THE HEALTH STATUS OF CHILDREN AND YOUNG PEOPLE

IN THE NORTHERN DISTRICT HEALTH BOARDS 2015

The Health Status of Children and Young People in the Northern District Health Boards 2015

New Zealand Child and Youth Epidemiology Service

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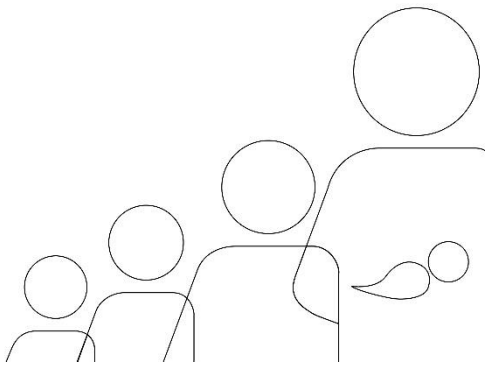

This report has been prepared for the Northern District Health Boards.

While every endeavour has been made to use accurate data in this report, there are currently variations in the way data are collected from DHBs and other agencies that may result in errors, omissions or inaccuracies in the information in this report. The NZCYES does not accept liability for any inaccuracies arising from the use of these data in the production of these reports, or for any losses arising as a consequence thereof.

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Butchard, Michael. Mental Health Issues in Youth and Young People. In: Simpson J, Duncanson M, Oben G, Adams J, Wicken A, Butchard M, Pierson M, Lilley R. and Gallagher S. The Health Status of Children and Young People in the Northern District Health Boards 2015. Dunedin: New Zealand Child and Youth Epidemiology Service, University of Otago; 2016.

Cover Artwork: Hector's dolphins (*Cephalorhynchus hectori*) - by Karen Davis

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INTRODUCTION

Introduction

This report is one of a series of three reports on the health of children and young people in New Zealand produced for the district health boards and the Ministry of Health, and it fits into the current reporting cycle as follows:

Year 1: The Determinants of Health for Children and Young People (prepared during 2014)

Year 2: The Health Status of Children and Young People (prepared during 2015)

Year 3: Children and Young People with Chronic Conditions and Disabilities (to be prepared during 2016)

It aims to provide an overview of the health status of children and young people in New Zealand, and to assist those working to improve child and youth health to use all of the available evidence when they are developing programmes and interventions to address child and youth health needs.

Report sections and indicators

This report is based on an *Indicator Framework* [1] developed in 2007 in which the indicators for each of the three reports in the series were identified. The indicators in this year's report were developed from Craig et al's indicators for the individual and whānau health and wellbeing stream. They are presented in the following sections:

- Issues in infancy
- Issues for all ages 0–24 year olds
- Conditions of the respiratory system
- Common communicable diseases
- Unintentional injury
- Reproductive health
- Mental health

Within each section, where possible, data are broken down by demographic factors such as age, gender, ethnicity, NZ Index of Deprivation decile, and district health board (DHB). When making comparisons between DHBs, readers should be aware that difference in disease rates may be the result of differences in DHB demographic characteristics (such as the age structure, ethnicity, and deprivation level of the population) and not assume that differences in disease rates represent differences in DHBs' performance.

In-depth topics

In addition to providing an overview of a range of important health conditions affecting children and young people, this report also considers two issues as in-depth topics. These are:

1. **Young people's sexual and reproductive health**: This in-depth topic by Dr Judith Adams addresses the sexual and reproductive health needs of New Zealand's young people. It does not include information relevant to the care of pregnant teenagers or teenage parents because a previous in-depth topic (in the 2012 report in this series of reports) entitled *Services and Interventions for Women Experiencing Multiple Adversities in Pregnancy* included a substantial section on services for teenage parents. It begins by reviewing the available data on the sexual health and behaviour of New Zealand's young people. It then reviews sexuality education and the research relevant to determining the best ways to provide young people with the knowledge and understanding to take care of their sexual and reproductive health. Subsequent sections review the literature on sexual and reproductive health care services for young people and newer contraceptive options for young people, particularly long-acting reversible contraceptive methods. The final section summarises key points and offers some suggestions for improving young people's sexual and reproductive health.

2. **Mental health issues in 15–24 year olds:** This in-depth topic by Dr Michael Butchard explores mental health issues and services for youth and young adults aged 15-24 years. Its general focus is on the mental health service structure and primary level care. After providing a brief historical context, the current mental health services and access are summarised, and barriers to access, transitioning from child to adult care, workforce issues, the role of primary care, and school-based health services are discussed. Literature on primary level mental health, alcohol and other drug interventions, including e-interventions, is reviewed and summarised. The final section explores issues relevant to high-risk groups within the youth and young adult population especially Māori and Pacific young people.

Evidence for good practice

Most sections in this year's report conclude with a brief overview of government documents, guidelines and reviews of evidence for good practice relevant to the prevention and management of the issue. **Appendix 1** provides an overview of the methodology used to develop these reviews. The quality and depth of evidence available varies considerably from indicator to indicator. When developing new approaches in areas where there is currently no sound evidence base, an evaluation arm should be built into any proposed programmes from the beginning. The learnings gained from these evaluations are essential for ensuring interventions developed enhance the wellbeing of children and young people and make best use of available resources.

Data quality, statistical significance, and demographic data

Tests of statistical significance: To assist the reader to determine whether tests of statistical significance have been used in a particular section, **Appendix 2**, outlines how the significance of the associations presented has been signalled in the text with the words *significant*, or *not significant* in italics. If the words *significant* or *not significant* do not appear in the text, then the associations described do not imply statistical significance or non-significance.

Appendix 3 contains information on the data sources used to develop each indicator. It is advisable to read the contents of these appendices when interpreting any information in this report. To ensure anonymity, where numbers are less than five, these and their associated rates have been suppressed.

Appendix 4 describes the use of ethnicity data in this report and **Appendix 5** outlines the New Zealand Deprivation Index and how it is used.

Overview of the health status of children and young people in New Zealand

Figure 1 to **Figure 4** on the following pages provide an overview of the indicators in this year's report, summarising the range of the DHB rates in relation to the New Zealand rates for each indicator.

Conclusions

This report provides an overview of the health status of children and young people in New Zealand, and an entry point to the policy and evidence-based review literature, to assist with addressing child and youth health needs in a systematic and evidence-based manner. It is suggested that the Ministry of Health, DHBs and others working in the health sector use the epidemiological data in this report as a complement to knowledge of existing services and key stakeholders' views. In addition, they should be mindful of existing Government policy, and that for any approaches developed to be effective, they need to be congruent with the evidence contained in the current literature. If there is no sound evidence base, planners should build an evaluation arm into their programmes to ensure the best use of available resources.

Figure 1. Summary of the indicators in the report Health Status of Children and Young People 2015, Northland compared to New Zealand

	Indicator	Northland number	Northland rate	NZ rate	Lowest DHB rate	Indicator range	Highest DHB rate
1	Fetal deaths	91	7.71	7.53	5.50		9.33
2	Preterm births	773	6.76	7.50	6.34		8.40
3	Infant mortality	86	7.35	5.14	2.40		8.07
4	Sudden unexpected death in infancy	26	2.22	1.01	0.43		2.47
5	Ambulatory sensitive hospitalisations in 0–4 year olds*	4,289	71.74	66.48	37.37		88.48
6	Acute upper respiratory tract infections in 0–14 year olds	970	5.35	6.49	4.27		10.71
7	Tonsillectomy ± adenoidectomy in 0–14 year olds	717	3.95	3.48	2.29		7.18
8	Otitis media in 0–14 year olds	145	0.80	0.58	0.22		0.99
9	Grommets in 0–14 year olds	780	4.30	5.08	2.41		8.56
10	Bronchiolitis in infants	1,345	117.70	84.58	37.88		130.83
11	Pneumonia in 0–24 year olds	852	3.07	2.32	1.00		3.35
12	Asthma in 0–24 year olds	1,329	4.78	4.68	1.94		6.19
13	Bronchiectasis in 0–24 year olds	158	56.87	25.50	7.39		56.87
14	Pertussis in under 1 year olds	29	2.54	2.40	0.90		7.36
15	Meningococcal disease in 0–24 year olds	34	12.24	4.52	2.81		12.24
16	Tuberculosis in 0–24 year olds	6	2.16	2.97	1.92		7.92
17	Acute rheumatic fever in 0–24 year olds	123	44.27	14.34	2.05		44.27
18	Rheumatic heart disease in 0–24 year olds	22	7.92	8.67	0.97		26.59
19	Any skin infections in 0–24 year olds	2,721	9.79	7.52	3.65		11.83
20	Gastroenteritis in 0–24 year olds	1,278	4.60	4.81	3.19		6.23
21	Unintentional injury hospitalisations of 0–24 year olds	3,969	1,428.47	1,180.40	977.70		1,582.58
22	Teenage births	1,179	44.32	24.40	13.50		46.51
23	Clients aged 0–24 year olds seen by mental health services	2,788	4,959.97	3,748.47	2,777.20		6,052.86
24	Mental health hospitalisations of 0–24 year olds	1,033	371.78	262.26	151.64		468.74
25	Suicide among 0–24 year olds	34	12.38	8.75	5.74		23.64
26	Intentional self-harm in 0–24 year olds	206	74.14	64.23	17.24		167.23

* ED cases included

Figure 2. Summary of the indicators in the report Health Status of Children and Young People 2015, Waitemata compared to New Zealand

	Indicator	Waitemata number	Waitemata rate	NZ rate	Lowest DHB rate	Indicator range	Highest DHB rate
1	Fetal deaths	299	7.50	7.53	5.50		9.33
2	Preterm births	2,837	7.21	7.50	6.34		8.40
3	Infant mortality	125	3.16	5.14	2.40		8.07
4	Sudden unexpected death in infancy	17	0.43	1.01	0.43		2.47
5	Ambulatory sensitive hospitalisations in 0–4 year olds*	11,720	60.20	66.48	37.37		88.48
6	Acute upper respiratory tract infections in 0–14 year olds	2,743	4.88	6.49	4.27		10.71
7	Tonsillectomy ± adenoidectomy in 0–14 year olds	1,482	2.64	3.48	2.29		7.18
8	Otitis media in 0–14 year olds	253	0.45	0.58	0.22		0.99
9	Grommets in 0–14 year olds	3,277	5.84	5.08	2.41		8.56
10	Bronchiolitis in infants	2,459	62.48	84.58	37.88		130.83
11	Pneumonia in 0–24 year olds	2,779	2.94	2.32	1.00		3.35
12	Asthma in 0–24 year olds	4,281	4.53	4.68	1.94		6.19
13	Bronchiectasis in 0–24 year olds	199	21.06	25.50	7.39		56.87
14	Pertussis in under 1 year olds	60	1.52	2.40	0.90		7.36
15	Meningococcal disease in 0–24 year olds	43	4.55	4.52	2.81		12.24
16	Tuberculosis in 0–24 year olds	21	2.22	2.97	1.92		7.92
17	Acute rheumatic fever in 0–24 year olds	91	9.63	14.34	2.05		44.27
18	Rheumatic heart disease in 0–24 year olds	47	4.97	8.67	0.97		26.59
19	Any skin infections in 0–24 year olds	7,525	7.96	7.52	3.65		11.83
20	Gastroenteritis in 0–24 year olds	4,916	5.20	4.81	3.19		6.23
21	Unintentional injury hospitalisations of 0–24 year olds	9,876	1,045.07	1,180.40	977.70		1,582.58
22	Teenage births	1,547	16.27	24.40	13.50		46.51
23	Clients aged 0–24 year olds seen by mental health services	5,694	2,965.34	3,748.47	2,777.20		6,052.86
24	Mental health hospitalisations of 0–24 year olds	2,141	226.56	262.26	151.64		468.74
25	Suicide among 0–24 year olds	56	6.02	8.75	5.74		23.64
26	Intentional self-harm in 0–24 year olds	669	70.79	64.23	17.24		167.23

* ED cases included

Figure 3. Summary of the indicators in the report Health Status of Children and Young People 2015, Auckland DHB compared to New Zealand

	Indicator	Auckland DHB number	Auckland DHB rate	NZ rate	Lowest DHB rate	Indicator range	Highest DHB rate
1	Fetal deaths	262	7.85	7.53	5.50		9.33
2	Preterm births	2,224	6.94	7.50	6.34		8.40
3	Infant mortality	155	4.68	5.14	2.40		8.07
4	Sudden unexpected death in infancy	28	0.85	1.01	0.43		2.47
5	Ambulatory sensitive hospitalisations in 0–4 year olds*	11,124	74.67	66.48	37.37		88.48
6	Acute upper respiratory tract infections in 0–14 year olds	2,424	5.88	6.49	4.27		10.71
7	Tonsillectomy ± adenoidectomy in 0–14 year olds	1,113	2.70	3.48	2.29		7.18
8	Otitis media in 0–14 year olds	196	0.48	0.58	0.22		0.99
9	Grommets in 0–14 year olds	2,162	5.24	5.08	2.41		8.56
10	Bronchiolitis in infants	2,371	73.93	84.58	37.88		130.83
11	Pneumonia in 0–24 year olds	2,380	3.04	2.32	1.00		3.35
12	Asthma in 0–24 year olds	4,848	6.19	4.68	1.94		6.19
13	Bronchiectasis in 0–24 year olds	171	21.83	25.50	7.39		56.87
14	Pertussis in under 1 year olds	53	1.65	2.40	0.90		7.36
15	Meningococcal disease in 0–24 year olds	22	2.81	4.52	2.81		12.24
16	Tuberculosis in 0–24 year olds	62	7.92	2.97	1.92		7.92
17	Acute rheumatic fever in 0–24 year olds	80	10.21	14.34	2.05		44.27
18	Rheumatic heart disease in 0–24 year olds	54	6.89	8.67	0.97		26.59
19	Any skin infections in 0–24 year olds	6,161	7.87	7.52	3.65		11.83
20	Gastroenteritis in 0–24 year olds	4,303	5.49	4.81	3.19		6.23
21	Unintentional injury hospitalisations of 0–24 year olds	7,784	993.83	1,180.40	977.70		1,582.58
22	Teenage births	1,050	13.69	24.40	13.50		46.51
23	Clients aged 0–24 year olds seen by mental health services	4,405	2,777.20	3,748.47	2,777.20		6,052.86
24	Mental health hospitalisations of 0–24 year olds	1,356	173.13	262.26	151.64		468.74
25	Suicide among 0–24 year olds	55	7.11	8.75	5.74		23.64
26	Intentional self-harm in 0–24 year olds	135	17.24	64.23	17.24		167.23

* ED cases included

Figure 4. Summary of the indicators in the report Health Status of Children and Young People 2015, Counties Manukau compared to New Zealand

	Indicator	Counties Manukau number	Counties Manukau rate	NZ rate	Lowest DHB rate	Indicator range	Highest DHB rate
1	Fetal deaths	389	8.79	7.53	5.50		9.33
2	Preterm births	3,278	7.69	7.50	6.34		8.40
3	Infant mortality	293	6.68	5.14	2.40		8.07
4	Sudden unexpected death in infancy	47	1.07	1.01	0.43		2.47
5	Ambulatory sensitive hospitalisations in 0–4 year olds*	14,527	71.14	66.48	37.37		88.48
6	Acute upper respiratory tract infections in 0–14 year olds	3,836	6.46	6.49	4.27		10.71
7	Tonsillectomy ± adenoidectomy in 0–14 year olds	1,717	2.89	3.48	2.29		7.18
8	Otitis media in 0–14 year olds	270	0.45	0.58	0.22		0.99
9	Grommets in 0–14 year olds	2,645	4.45	5.08	2.41		8.56
10	Bronchiolitis in infants	4,993	117.13	84.58	37.88		130.83
11	Pneumonia in 0–24 year olds	3,252	3.35	2.32	1.00		3.35
12	Asthma in 0–24 year olds	4,844	4.99	4.68	1.94		6.19
13	Bronchiectasis in 0–24 year olds	384	39.53	25.50	7.39		56.87
14	Pertussis in under 1 year olds	159	3.73	2.40	0.90		7.36
15	Meningococcal disease in 0–24 year olds	41	4.22	4.52	2.81		12.24
16	Tuberculosis in 0–24 year olds	47	4.84	2.97	1.92		7.92
17	Acute rheumatic fever in 0–24 year olds	406	41.80	14.34	2.05		44.27
18	Rheumatic heart disease in 0–24 year olds	250	25.74	8.67	0.97		26.59
19	Any skin infections in 0–24 year olds	10,295	10.60	7.52	3.65		11.83
20	Gastroenteritis in 0–24 year olds	5,046	5.19	4.81	3.19		6.23
21	Unintentional injury hospitalisations of 0–24 year olds	12,553	1,292.26	1,180.40	977.70		1,582.58
22	Teenage births	3,156	32.89	24.40	13.50		46.51
23	Clients aged 0–24 year olds seen by mental health services	6,565	3,330.46	3,748.47	2,777.20		6,052.86
24	Mental health hospitalisations of 0–24 year olds	1,473	151.64	262.26	151.64		468.74
25	Suicide among 0–24 year olds	90	9.40	8.75	5.74		23.64
26	Intentional self-harm in 0–24 year olds	173	17.81	64.23	17.24		167.23

* ED cases included

ISSUES IN INFANCY

BIRTHS AND PERINATAL DEATHS

Introduction

The following section briefly reviews the birth and perinatal period to provide a context for later sections. The following section uses the Birth Registration Dataset, the National Mortality Collection and the National Minimum Dataset to look at births and early deaths in New Zealand.

Data source and methods

Data sources

Livebirths: Birth registration dataset
Deaths: National Mortality Collection

Definitions

Total births are livebirths plus fetal deaths
Fetal death is when the infant is born deceased, weighing 400 grams or more, or is issued from its mother after the 20th week of pregnancy[2]

Fetal death rate = *number of fetal deaths per 1,000 total (live + still) births*
Perinatal death is fetal deaths and early neonatal deaths

Perinatal death rate = *number of fetal and early neonatal deaths per 1,000 total (live + still) births*
Neonatal death is the death of a live-born infant before 28 completed days after birth, and comprises:

- *Early neonatal death* is death of a live-born infant before seven days (168 completed hours) after birth
- *Late neonatal death* is death of a live-born infant after seven days and before 28 completed days after birth

Neonatal death rate = *number of early and late neonatal deaths per 1,000 livebirths*
Early neonatal death rate = *number of early neonatal deaths per 1,000 livebirths*
Late neonatal death rate = *number of late neonatal deaths per 1,000 livebirths*

Notes on interpretation

Note 1: An overview of the Birth Registration and National Minimum Datasets is provided in the **Appendix 3**.

National trends and distribution

Between 2008 and 2012 there were 319,934 births in New Zealand, an average of 63,987 per year. Of these, 317,526 (99.2%) were live births and 2,408 were fetal deaths (also known as stillbirths). The fetal death rate in this time period was 7.53 deaths per 1,000 total births **(Table 1)**.

Between 2008 and 2012 there were 1,010 deaths of live-born infants in the first 27 days of life (neonatal deaths), an average of 202 deaths per year. Of these neonatal deaths, 821 were before seven days after birth (early neonatal deaths) and 189 deaths occurred after seven days but before 28 completed days after birth (late neonatal deaths). The early neonatal death rate was 2.59 deaths per 1,000 live births and the late neonatal death rate was 0.6 deaths per 1,000 live births **(Table 1)**.

Table 1. Births and deaths during infancy, New Zealand 2008–2012

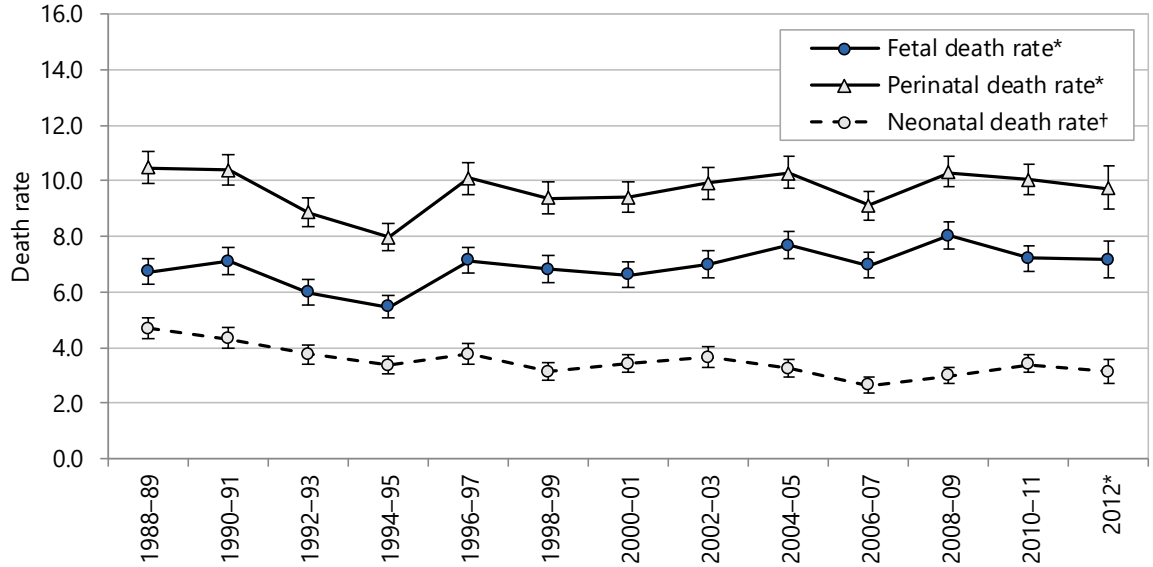
	Number: 2008–2012	Number: annual average	Rate per 1,000 births	95% CI
New Zealand				
Live births	317,526	63,505	..	..
Total births	319,934	63,987	..	..
Fetal deaths*	2,408	482	7.53	7.23–7.83
Perinatal deaths*	3,229	646	10.09	9.75–10.4
Neonatal deaths†	1,010	202	3.18	2.99–3.38
Early neonatal deaths†	821	164	2.59	2.41–2.77
Late neonatal deaths†	189	38	0.60	0.52–0.69

Live births: birth registration dataset; Deaths: National Mortality Collection; * Rate per 1,000 total births; † Rate per 1,000 live births

Deaths that occurred around the time of birth (perinatal deaths) include fetal deaths and early neonatal deaths. Between 2008 and 2012 there were 3,229 perinatal deaths in New Zealand, an average of 646 deaths per year **(Table 1)**.

The fetal death rate fell between 1988–89 and 1994–95, but then increased to above the 1988–89 level and has remained stable since then, with year to year fluctuations around an average of 7.2 deaths per 1,000 total births. The neonatal death rate showed a *significant fall* from 4.69 deaths per 1,000 live births in 1988–89 to 3.13 deaths per 1,000 live births in 2012. Between 1988–89 and 1994–95 the perinatal death rate followed a similar pattern to the fetal death rate and the rate of 9.73 deaths per 1,000 total births in 2012 is not significantly different from the rate of 10.48 deaths per 1,000 live births in 1988–89 **(Figure 5).**

Figure 5. Fetal, perinatal and neonatal death rates, New Zealand 1988–2012



Live births: birth registration dataset; Deaths: National Mortality Collection; * Rate per 1,000 total births; † Rate per 1,000 live births; *2012 is a single year

Northern region distribution and trends

The number of births occurring between 2008 and 2012 ranged from 11,796 in Northland to 44,248 in Counties Manukau. The majority of births in each DHB were live births (99.1–99.3%). The fetal death rate ranged from 7.50 fetal deaths per 1,000 total births in Waitemata to 8.79 in Counties Manukau, while neonatal deaths ranged from 2.05 neonatal deaths per 1,000 live births in Waitemata to 4.19 in Northland **(Table 2)**.

Table 2. Fetal, perinatal and neonatal death rates, Northern DHBs 2008–2012

	Number: 2008–2012	Number: annual average	Rate per 1,000 births	95% CI
Northland				
Live births	11,705	2,341	..	..
Total births	11,796	2,359	..	..
Fetal deaths*	91	18	7.71	6.29–9.46
Perinatal deaths*	133	27	11.28	9.52–13.35
Neonatal deaths†	49	10	4.19	3.17–5.53
Waitemata				
Live births	39,574	7,915	..	..
Total births	39,873	7,975	..	..
Fetal deaths*	299	60	7.50	6.70–8.39
Perinatal deaths*	362	72	9.08	8.19–10.06
Neonatal deaths†	81	16	2.05	1.65–2.54
Auckland DHB				
Live births	33,100	6,620	..	..
Total births	33,362	6,672	..	..
Fetal deaths*	262	52	7.85	6.96–8.86
Perinatal deaths*	342	68	10.25	9.23–11.39
Neonatal deaths†	101	20	3.05	2.51–3.70
Counties Manukau				
Live births	43,859	8,772	..	..
Total births	44,248	8,850	..	..
Fetal deaths*	389	78	8.79	7.96–9.70
Perinatal deaths*	544	109	12.29	11.31–13.36
Neonatal deaths†	181	36	4.13	3.57–4.77

Live births: Birth registration dataset; Deaths: National Mortality Collection; * Rate per 1,000 total births; † Rate per 1,000 live births

FETAL DEATHS

Introduction

A fetal death is defined by the World Health Organization as "death prior to the complete expulsion or extraction from its mother of a product of conception, irrespective of the duration of pregnancy; the death is indicated by the fact that after such separation the fetus does not breathe or show any other evidence of life, such as beating of the heart, pulsation of the umbilical cord or definite movement of voluntary muscles".[3] Most countries require registration of fetal deaths but the gestation beyond which a fetal death must be registered varies between countries.[3] In New Zealand, the Births, Deaths, Marriages, and Relationships Registration Act 1995 requires that all stillbirths are registered and it defines a stillbirth as "a dead fetus that weighed at least 400g when it issued from its mother or issued from its mother after the 20th week of pregnancy".[4] The Perinatal and Maternal Mortality Review Committee uses this definition to define a fetal death.[5] Fetal deaths include both spontaneous deaths (often referred to as stillbirths) and deaths due to termination of pregnancy (for example because of severe congenital malformations).

In high income countries around one in two hundred babies who reaches 22 weeks gestation or more is stillborn.[6] There are many possible reasons why a baby may be stillborn. In developed countries major contributors to stillbirth are factors related to placental dysfunction and very pre-term birth.[6] In a significant minority of cases (27% in New Zealand in 2012[5]) no cause is identified. The most significant potentially modifiable risk factors for stillbirth are maternal obesity and smoking.[5,6]

Data sources and methods

Indicator

Fetal deaths

Data sources

Numerator: National Mortality Collection
Denominator: Birth Registration Dataset (live births only) and National Mortality Collection

Definition

Fetal death is when the infant is born deceased, weighing 400 grams or more, or is issued from its mother after the 20th week of pregnancy.[2]

Fetal deaths are further defined into:

Intermediate: Fetal deaths occurring between 20 and 27 weeks gestation.
Late: Fetal deaths occurring 28+ weeks gestation.
Unspecified: Fetal deaths occurring from 20 weeks or more gestation where the main fetal cause of death was unspecified and no additional fetal or maternal causes of death were listed.

Fetal death rate = *number of fetal deaths per 1,000 total (live + still) births*

For gestational age specific rates, the denominator was those remaining in utero at the specified gestational age (e.g. the 22 week denominator excludes all births occurring at 20 and 21 weeks)

In this section, the main (fetal) underlying cause of death was categorised into the following: congenital anomalies (chromosomal, CNS, CVS, other), malnutrition or slow fetal growth, extreme immaturity or low birth weight, intrauterine hypoxia: pre labour onset, intrauterine hypoxia: in labour or unspecified, congenital pneumonia, infections specific to perinatal period, fetal blood loss, unspecified cause, other causes.

In addition, the first maternal cause of death (if present) was categorised into the following: incompetent cervix or premature rupture membranes, oligohydramnios, multiple pregnancy, placenta praevia or other placental separation or haemorrhage, other or unspecified placental anomalies, compression of umbilical cord, chorioamnionitis, maternal hypertensive disorders, placental transfusion syndrome, other causes.

Notes on interpretation

Note 1: Death registration data do not differentiate between spontaneous fetal deaths and late terminations of pregnancy. The admixture of spontaneous and induced fetal deaths is likely to be most prominent at earlier gestations (e.g. the high number of deaths attributed to congenital anomalies prior to 25 weeks gestation) and this must be taken into account when interpreting the data in this section.

Note 2: 95% confidence intervals have been provided for the rate ratios in this section and where appropriate, the terms *significant* or *not significant* have been used to communicate the significance of the observed associations. Tests of statistical significance have not been applied to other data in this section, and thus (unless the terms significant or non-significant are specifically used) the associations described do not imply statistical significance or non-significance (see **Appendix 2** for further discussion of this issue).

Note 3: An overview of the Birth Registration and National Minimum Datasets is provided in **Appendix 3**.

National trends and distribution

There were 2,390 fetal deaths in New Zealand from 2008 to 2012, an average of 478 deaths per year and a rate of 7.47 fetal deaths per 1,000 births. Just over half of the deaths (1,346 deaths, 56.3%) occurred between 20 and 27 weeks gestation (intermediate fetal deaths) and 1,044 deaths (43.7%) occurred from 28 weeks gestation (late fetal deaths) **(Table 3)**.

Table 3. Fetal deaths, by type and main cause of fetal death, New Zealand 2008–2012

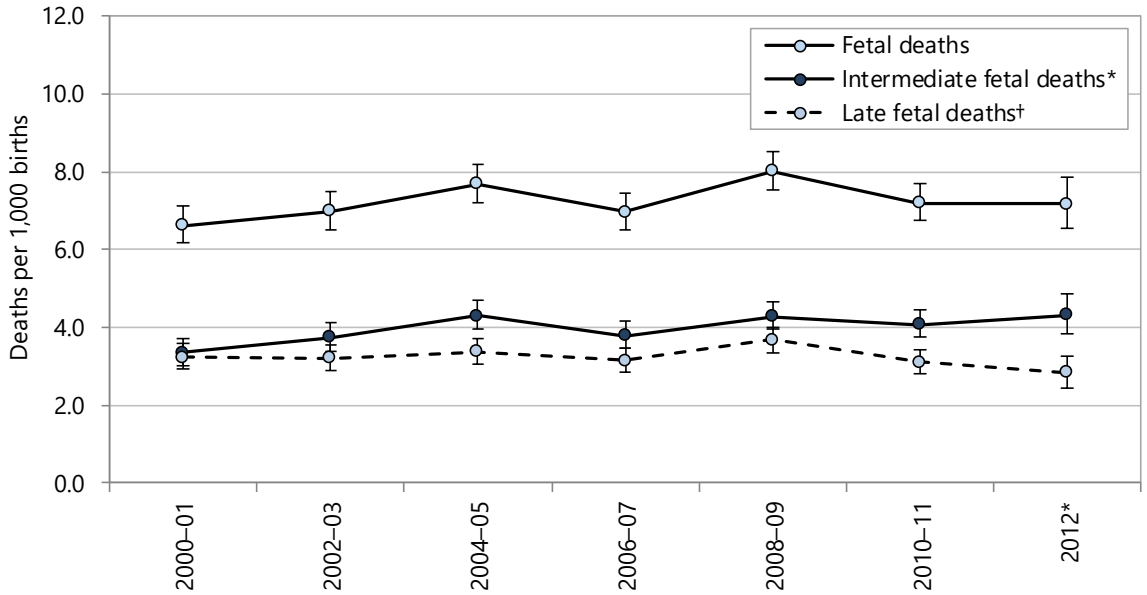
Main cause of fetal death	Number 2008–2012	Number: annual average	Rate per 1,000 births	95% CI	Per cent
Intermediate fetal deaths*					
Prematurity or low birth weight	173	35	0.54	0.47–0.63	12.9
Congenital anomalies: chromosomal	152	30	0.48	0.41–0.56	11.3
Congenital anomalies: CNS	115	23	0.36	0.30–0.43	8.5
Congenital anomalies: CVS	100	20	0.31	0.26–0.38	7.4
Congenital anomalies: other	147	29	0.46	0.39–0.54	10.9
Malnutrition or slow fetal growth	108	22	0.34	0.28–0.41	8.0
Congenital pneumonia	32	6	0.10	0.07–0.14	2.4
Fetal blood loss	23	5	0.07	0.05–0.11	1.7
Infections specific to perinatal period	22	4	0.07	0.05–0.10	1.6
Hydrops fetalis (non-haemolytic disease)	20	4	0.06	0.04–0.10	1.5
Intrauterine hypoxia	16	3	0.05	0.03–0.08	1.2
Polycythaemia neonatorum	13	3	0.04	0.02–0.07	1.0
Other causes	59	12	0.18	0.14–0.24	4.4
Unspecified cause of fetal death	366	73	1.14	1.03–1.27	27.2
Total	1,346	269	4.21	3.99–4.44	100.0
Late fetal deaths†					
Malnutrition or slow fetal growth	122	24	0.38	0.32–0.46	11.7
Intrauterine hypoxia	79	16	0.25	0.20–0.31	7.6
Fetal blood loss	50	10	0.16	0.12–0.21	4.8
Congenital anomalies: chromosomal	37	7	0.12	0.08–0.16	3.5
Congenital anomalies: CNS	42	8	0.13	0.10–0.18	4.0
Congenital anomalies: CVS	17	3	0.05	0.03–0.09	1.6
Congenital anomalies: other	29	6	0.09	0.06–0.13	2.8
Neonatal aspiration‡	30	6	0.09	0.07–0.13	2.9
Infections specific to perinatal period	25	5	0.08	0.05–0.12	2.4
Prematurity or low birth weight	12	2	0.04	0.02–0.07	1.1
Congenital pneumonia	8	2	0.03	0.01–0.05	0.8
Hydrops fetalis (non-haemolytic disease)	8	2	0.03	0.01–0.05	0.8
Other causes	64	13	0.20	0.16–0.26	6.1
Unspecified cause of fetal death	521	104	1.64	1.50–1.78	49.9
Total	1,044	209	3.28	3.08–3.48	100.0

Numerator: National Mortality Collection; Denominator: Birth Registration Dataset and National Mortality Collection; * rate per 1,000 births (live births and fetal deaths of 20 weeks gestation or more); † rate per 1,000 births (live births and fetal deaths of 28 weeks gestation or more); Neonatal aspiration‡ = Neonatal aspiration of meconium, amniotic fluid, or mucus

The overall fetal death rate was stable from 2000 to 2012 with year-to-year fluctuations around an average of 7.24 deaths per 1,000 births. Within this time period there was an overall decline in the rate of late fetal deaths from 3.23 to 2.83 deaths per 1,000 births of 28 weeks gestation or more and an increase in the rate of intermediate fetal deaths from 3.35 to 4.32 deaths per 1,000 births of 20 weeks gestation or more **(Figure 6)**.

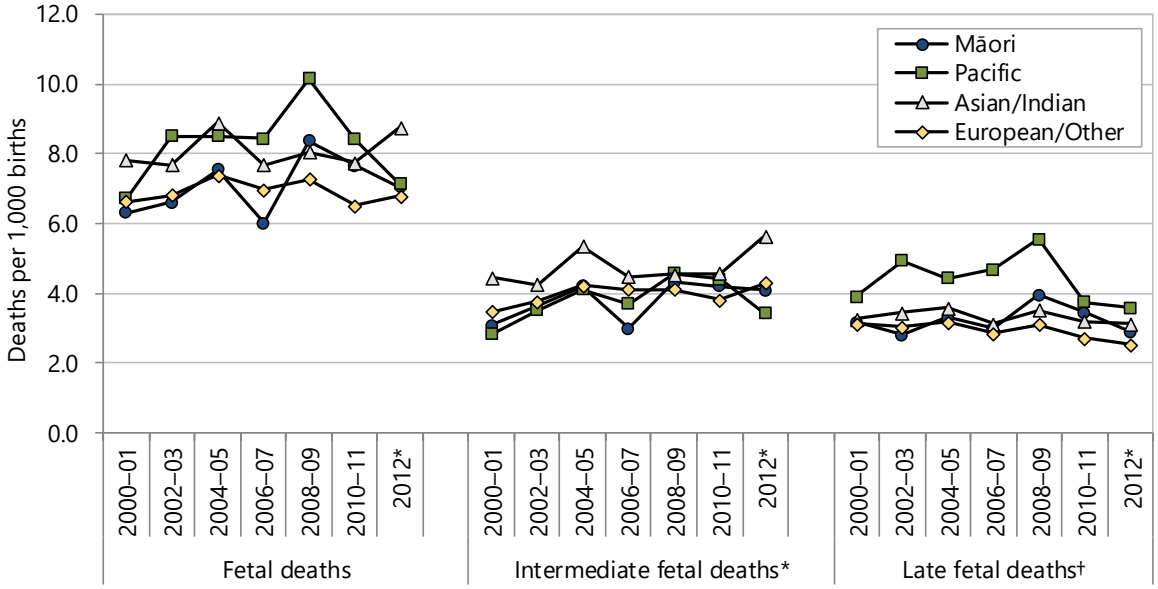
Similar patterns over time were observed for all ethnic groups. Intermediate fetal death rates were consistently highest for the Asian/Indian ethnic group and late fetal death rates were consistently highest for the Pacific ethnic group **(Figure 7)**.

Figure 6. Fetal deaths, by type, New Zealand 2000–2012



Numerator: National Mortality Collection; Denominator: Birth Registration Dataset and National Mortality Collection; * rate per 1,000 births (live births and fetal deaths of 20 weeks gestation or more); †rate per 1,000 births (live births and fetal deaths of 28 weeks gestation or more)

Figure 7. Fetal deaths, by type and ethnicity, New Zealand 2000–2012

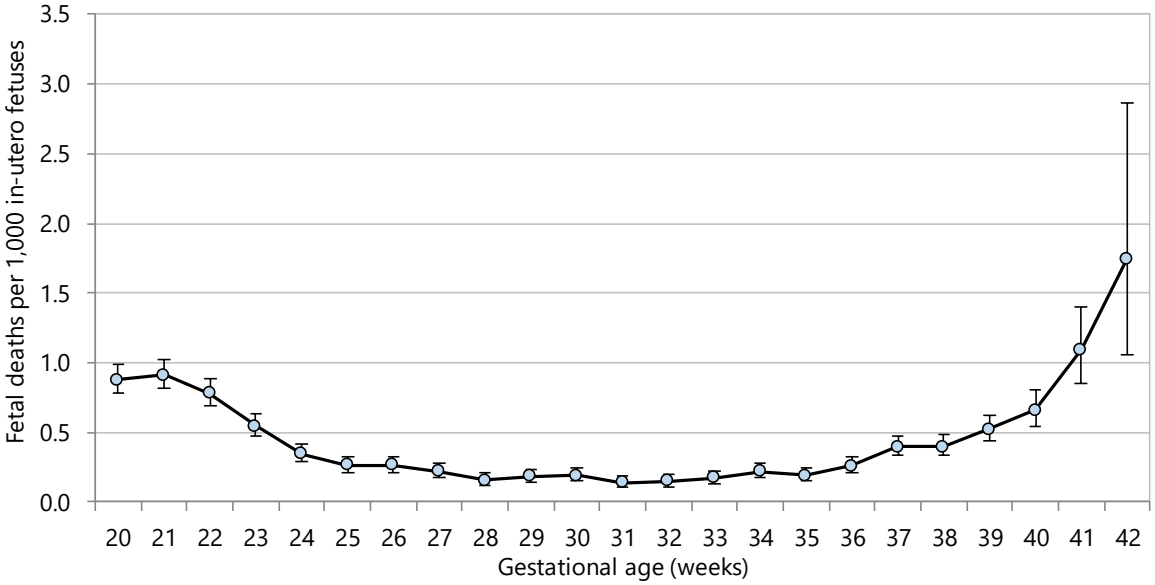


Numerator: National Mortality Collection; Denominator: Birth Registration Dataset and National Mortality Collection; * rate per 1,000 births (live births and fetal deaths of 20 weeks gestation or more); †rate per 1,000 births (live births and fetal deaths of 28 weeks gestation or more); Ethnicity is level 1 prioritised; 2012* is a single year

Distribution by gestational age

Between 2008 and 2012 fetal death rates were higher at gestational ages less than 25 weeks and more than 36 weeks, with the highest rates of all at over 40 weeks gestational age **(Figure 8)**. In interpreting these figures, note that the denominator was those fetuses remaining in utero at the specified gestational age. This means that the denominator at and beyond term is smaller than earlier in pregnancy and although the absolute number of fetal deaths is lower at later gestational ages, the risk is higher as fewer pregnancies continue past these gestational ages.

Figure 8. Fetal deaths, by gestational age, New Zealand 2008–2012



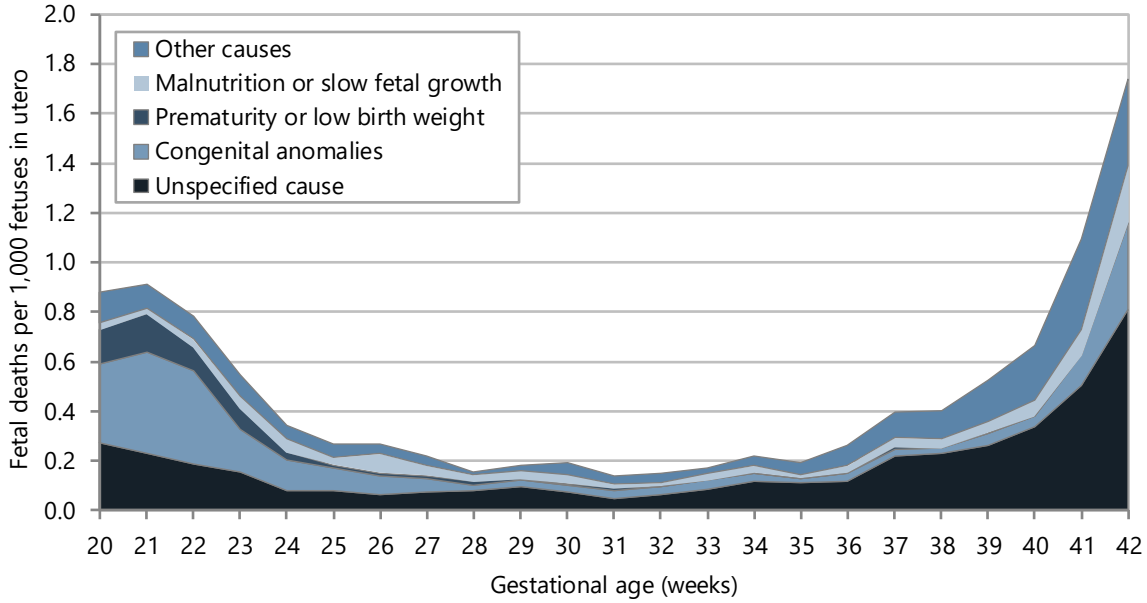
Numerator: National Mortality Collection; Denominator: Birth Registration Dataset and National Mortality Collection; rate per 1,000 (live and stillborn) fetuses remaining in-utero at each gestational age

Distribution by cause

Between 2008 and 2012 a fetal cause of death was unspecified for 27.2% of intermediate fetal deaths and 49.9% of late fetal deaths. Where specified, the most frequent causes of intermediate fetal death were congenital anomalies, prematurity or low birth weight, and malnutrition or slow fetal growth. The most frequent causes of late fetal death were congenital anomalies, malnutrition or slow fetal growth, and intrauterine hypoxia **(Figure 9)**.

Fetal death rates from prematurity or low birth weight were highest at 20–22 weeks gestation. Fetal death rates arising from congenital anomalies were highest at 20–22 weeks gestation and at 42 weeks gestation. The data did not distinguish between spontaneous fetal deaths and terminations of pregnancy and the higher fetal mortality rates at less than 25 weeks gestation must be interpreted with this in mind. Fetal death rates from malnutrition or slow fetal growth were highest at 41–42 weeks gestation **(Figure 9)**.

Figure 9. Fetal deaths, by gestational age and cause of death, New Zealand 2008–2012



Numerator: National Mortality Collection; Denominator: Birth Registration Dataset and National Mortality Collection; Rate per 1,000 (live and stillborn) fetuses remaining in-utero at each gestational age

There was no listed maternal cause for 45.7% of intermediate fetal deaths and 34.4% of late fetal deaths from 2008 to 2012. Where listed, the most common maternal causes of intermediate fetal deaths were incompetent cervix or premature rupture of membranes, placenta praevia or placental separation and haemorrhage, chorioamnionitis, and other abnormalities of the placenta. The most commonly listed maternal causes for late fetal deaths were placenta praevia or placental separation and haemorrhage, other abnormalities of the placenta, and compression of the umbilical cord **(Table 4)**.

Table 4. Fetal deaths, by type and main maternal cause of fetal death, New Zealand 2008–2012

Main maternal cause of fetal death	No. of deaths: 2008–2012	No. of deaths: annual average	Rate per 1,000 births	95% CI	Per cent
Intermediate fetal deaths*					
Incompetent cervix/premature rupture of membranes	114	23	0.36	0.30–0.43	8.5
Placenta praevia/placental separation and haemorrhage	113	23	0.35	0.29–0.42	8.4
Chorioamnionitis	81	16	0.25	0.20–0.31	6.0
Other abnormalities of placenta	62	12	0.19	0.15–0.25	4.6
Maternal hypertensive disorders	45	9	0.14	0.11–0.19	3.3
Multiple pregnancy	44	9	0.14	0.10–0.18	3.3
Placental transfusion syndromes	42	8	0.13	0.10–0.18	3.1
Oligohydramnios	38	8	0.12	0.09–0.16	2.8
Compression of umbilical cord	26	5	0.08	0.06–0.12	1.9
Other causes	166	33	0.52	0.45–0.60	12.3
No listed maternal cause	615	123	1.92	1.78–2.08	45.7
Total	1,346	269	4.21	3.99–4.44	100.0
Late fetal deaths†					
Placenta praevia/placental separation and haemorrhage	97	19	0.30	0.25–0.37	9.3
Other abnormalities of placenta	101	20	0.32	0.26–0.39	9.7
Compression of umbilical cord	94	19	0.30	0.24–0.36	9.0
Chorioamnionitis	51	10	0.16	0.12–0.21	4.9
Maternal hypertensive disorders	41	8	0.13	0.09–0.17	3.9
Multiple pregnancy	37	7	0.12	0.08–0.16	3.5
Placental transfusion syndromes	21	4	0.07	0.04–0.10	2.0
Oligohydramnios	20	4	0.06	0.04–0.10	1.9
Incompetent cervix/premature rupture of membranes	19	4	0.06	0.04–0.09	1.8
Other causes	204	41	0.64	0.56–0.73	19.5
No listed maternal cause	359	72	1.13	1.02–1.25	34.4
Total	1,044	209	3.28	3.08–3.48	100.0

Numerator: National Mortality Collection; Denominator: Birth Registration Dataset and National Mortality Collection; * rate per 1,000 births (live births and fetal deaths of 20 weeks gestation or more); † rate per 1,000 births (live births and fetal deaths of 28 weeks gestation or more)

Distribution by demographic factors

Between 2008 and 2012 there were disparities in rates of fetal death by the NZDep2013 Index of deprivation score, ethnicity, and maternal age with *significantly higher* rates in areas with the highest (deciles 9–10) NZDep2013 scores compared with deciles 1–8, *significantly higher* rates for Māori, Pacific and Asian/Indian ethnic groups compared with European/Other, and *significantly higher* rates for mothers aged under 25 and over 34 years compared with mothers aged 25–34 years **(Table 5)**.

These patterns differed when comparing intermediate and late fetal deaths. Rates of intermediate fetal death were *significantly higher* for the Asian/Indian ethnic group compared with European/Other and also *significantly higher* for mothers aged under 20 years and over 34 years compared with mothers aged 30–34 years. There were *no significant differences* in intermediate fetal death rates by NZDep2013 and *no significant difference* in rates between Māori, Pacific and European/Other ethnic groups. Rates of late fetal death were *significantly higher* in areas with the highest NZDep2013 scores (decile 9–10), *significantly higher* for Māori and Pacific ethnic groups compared with Asian/Indian and European/Other, and *significantly higher* for mothers

aged 20–24 years as well as mothers aged under 20 years and over 34 years compared with mothers aged 25–34 years **(Table 6)**.

Table 5. Fetal deaths, by demographic factor, New Zealand 2008–2012

Variable	Number	Rate per 1,000 births	Rate ratio	95% CI
Fetal deaths				
NZDep2013 Index of deprivation quintile				
Deciles 1–2	315	6.83	1.00	
Deciles 3–4	366	7.17	1.05	0.90–1.22
Deciles 5–6	412	7.04	1.03	0.89–1.19
Deciles 7–8	513	7.33	1.07	0.93–1.24
Deciles 9–10	791	8.51	1.25	1.09–1.42
Prioritised ethnicity				
Māori	732	7.83	1.14	1.04–1.25
Pacific	319	8.86	1.29	1.14–1.46
Asian/Indian	301	8.09	1.18	1.03–1.34
European/Other	1,053	6.88	1.00	
Maternal age group				
<20 years	222	9.90	1.48	1.27–1.72
20–24 years	456	7.74	1.16	1.02–1.31
25–29 years	525	6.61	0.99	0.88–1.11
30–34 years	596	6.69	1.00	
35+ years	609	8.68	1.30	1.16–1.45
Gender				
Female	1,164	7.48	1.00	
Male	1,219	7.42	0.99	0.92–1.08

Numerator: National Mortality Collection; Denominator: Birth Registration Dataset and National Mortality Collection; Rates are per 1,000 births; Rate ratios are unadjusted; Ethnicity is level 1 prioritised; Decile is NZDep2013

Table 6. Distribution of fetal deaths, by type and demographic factor, New Zealand 2008–2012

Variable	Number	Rate per 1,000 births	Rate ratio	95% CI
Intermediate fetal deaths*				
NZDep2013 Index of deprivation quintile				
Deciles 1–2	186	4.03	1.00	
Deciles 3–4	232	4.54	1.13	0.93–1.37
Deciles 5–6	244	4.17	1.03	0.86–1.25
Deciles 7–8	293	4.19	1.04	0.86–1.25
Deciles 9–10	383	4.12	1.02	0.86–1.22
Prioritised ethnicity				
Māori	395	4.22	1.05	0.92–1.19
Pacific	154	4.28	1.06	0.89–1.27
Asian/Indian	179	4.81	1.20	1.01–1.41
European/Other	616	4.03	1.00	
Maternal age group				
<20 years	129	5.75	1.51	1.23–1.84
20–24 years	235	3.99	1.04	0.88–1.23
25–29 years	286	3.60	0.94	0.81–1.10
30–34 years	340	3.82	1.00	
35+ years	356	5.08	1.33	1.15–1.54
Gender				
Female	645	4.14	1.00	
Male	684	4.17	1.01	0.90–1.12
Late fetal deaths†				
NZDep2013 Index of deprivation quintile				
Deciles 1–2	127	2.76	1.00	
Deciles 3–4	133	2.62	0.95	0.74–1.21
Deciles 5–6	166	2.85	1.03	0.82–1.30
Deciles 7–8	217	3.12	1.13	0.91–1.40
Deciles 9–10	398	4.30	1.56	1.27–1.90
Prioritised ethnicity				
Māori	330	3.54	1.25	1.08–1.44
Pacific	159	4.43	1.56	1.30–1.88
Asian/Indian	122	3.30	1.16	0.95–1.42
European/Other	432	2.83	1.00	
Maternal age group				
<20 years	89	3.99	1.39	1.09–1.77
20–24 years	217	3.70	1.29	1.07–1.54
25–29 years	235	2.97	1.03	0.87–1.23
30–34 years	255	2.88	1.00	
35+ years	248	3.55	1.24	1.04–1.47
Gender				
Female	514	3.32	1.00	
Male	523	3.20	0.96	0.85–1.09

Numerator: National Mortality Collection; Denominator: Birth Registration Dataset and National Mortality Collection; * Rate per 1,000 births (live births and fetal deaths of 20 weeks gestation or more); † Rate per 1,000 births (live births and fetal deaths of 28 weeks gestation or more); Rate ratios are unadjusted; Ethnicity is level 1 prioritised; Decile is NZDep2013

Distribution by region

Between 2008 and 2012 total fetal death rates were *significantly higher* than the national rate in Whanganui, Counties Manukau, MidCentral, Lakes, Hutt Valley and Auckland DHBs. Total fetal death rates were *significantly lower* than the national rate in West Coast, Bay of Plenty, Nelson Marlborough, South Canterbury, Capital & Coast, Taranaki, Hawke's Bay, Wairarapa and Southern DHBs **(Table 7)**.

Table 7. Fetal deaths, by district health board, New Zealand 2008–2012

DHB	No. of deaths: 2008–2012	No. of deaths: annual average	Rate per 1,000 births	Rate ratio	95% CI
Fetal deaths					
Northland	91	18	7.71	1.02	0.98–1.07
Waitemata	299	60	7.50	1.00	0.96–1.04
Auckland	262	52	7.85	1.04	1.00–1.09
Counties Manukau	389	78	8.79	1.17	1.12–1.22
Waikato	211	42	7.49	0.99	0.95–1.04
Bay of Plenty	84	17	5.61	0.75	0.71–0.78
Lakes	68	14	8.32	1.11	1.06–1.16
Tairawhiti	28	6	7.15	0.95	0.90–1.00
Taranaki	54	11	6.75	0.90	0.86–0.94
Hawke's Bay	82	16	6.96	0.92	0.89–0.97
MidCentral	98	20	8.39	1.11	1.07–1.16
Whanganui	42	8	9.33	1.24	1.18–1.30
Hutt Valley	89	18	8.25	1.10	1.05–1.15
Capital & Coast	131	26	6.56	0.87	0.84–0.91
Wairarapa	19	4	7.04	0.93	0.89–0.99
Nelson Marlborough	49	10	5.85	0.78	0.74–0.81
South Canterbury	20	4	6.34	0.84	0.80–0.89
Canterbury	237	47	7.35	0.98	0.94–1.02
West Coast	12	2	5.50	0.73	0.69–0.77
Southern	132	26	7.05	0.94	0.90–0.98
New Zealand	2,408	482	7.53	1.00	

Numerator: National Mortality Collection; Denominator: Birth Registration Dataset and National Mortality Collection; * Rate per 1,000 births (live births and fetal deaths of 20 weeks gestation or more); † Rate per 1,000 births (live births and fetal deaths of 28 weeks gestation or more); Rate ratios are unadjusted

Intermediate fetal death rates were *significantly higher* than the national rate in the Wairarapa, MidCentral, Whanganui, Auckland, Hutt Valley, Lakes, and Waitemata DHBs. Intermediate fetal death rates were *significantly lower* than the national rate in the Bay of Plenty, South Canterbury, Tairawhiti, Taranaki, Northland, and Nelson Marlborough DHBs **(Table 8)**.

Late fetal death rates were *significantly higher* than the national rate in Counties Manukau, Whanganui, Northland, Tairawhiti, Lakes and West Coast DHBs. Late fetal death rates were *significantly lower* than the national rate in the Nelson Marlborough, Capital & Coast, Hawke's Bay, Southern, Bay of Plenty, Waitemata, Auckland and Canterbury DHBs **(Table 9)**.

Table 8. Intermediate fetal deaths, by district health board, New Zealand 2008–2012

DHB	No. of deaths: 2008–2012	No. of deaths: annual average	Rate per 1,000 births*	Rate ratio	95% CI
Intermediate fetal deaths					
Northland	40	8	3.39	0.81	0.76–0.85
Waitemata	179	36	4.49	1.07	1.01–1.13
Auckland	161	32	4.83	1.15	1.09–1.21
Counties Manukau	187	37	4.23	1.00	0.95–1.06
Waikato	115	23	4.08	0.97	0.92–1.02
Bay of Plenty	39	8	2.61	0.62	0.59–0.65
Lakes	38	8	4.65	1.11	1.04–1.17
Tairawhiti	12	2	3.06	0.73	0.68–0.77
Taranaki	27	5	3.37	0.80	0.76–0.85
Hawke's Bay	52	10	4.41	1.05	0.99–1.11
MidCentral	58	12	4.97	1.18	1.12–1.25
Whanganui	22	4	4.89	1.16	1.09–1.23
Hutt Valley	52	10	4.82	1.15	1.08–1.21
Capital & Coast	81	16	4.06	0.96	0.91–1.02
Wairarapa	16	3	5.93	1.41	1.32–1.50
Nelson Marlborough	31	6	3.70	0.88	0.83–0.93
South Canterbury	9	2	2.85	0.68	0.64–0.72
Canterbury	137	27	4.25	1.01	0.96–1.07
West Coast	<5	s	s	s	s
Southern	78	16	4.17	0.99	0.94–1.05
New Zealand	1,346	269	4.21	1.00	

Numerator: National Mortality Collection; Denominator: Birth Registration Dataset and National Mortality Collection; * Rate per 1,000 births (live births and fetal deaths of 20 weeks gestation or more); Rate ratios are unadjusted

Table 9. Late fetal deaths, by district health board, New Zealand 2008–2012

DHB	No. of deaths: 2008–2012	No. of deaths: annual average	Rate per 1,000 births†	Rate ratio	95% CI
Late fetal deaths					
Northland	48	10	4.08	1.25	1.17–1.33
Waitemata	119	24	3.00	0.91	0.86–0.97
Auckland	100	20	3.01	0.92	0.86–0.98
Counties Manukau	199	40	4.52	1.38	1.30–1.47
Waikato	95	19	3.38	1.03	0.97–1.10
Bay of Plenty	44	9	2.95	0.90	0.84–0.96
Lakes	30	6	3.69	1.13	1.06–1.20
Tairawhiti	15	3	3.84	1.17	1.09–1.25
Taranaki	26	5	3.26	0.99	0.93–1.06
Hawke's Bay	30	6	2.56	0.78	0.73–0.83
MidCentral	39	8	3.36	1.02	0.96–1.09
Whanganui	20	4	4.46	1.36	1.27–1.46
Hutt Valley	35	7	3.26	1.00	0.93–1.06
Capital & Coast	49	10	2.47	0.75	0.71–0.80
Wairarapa	<5	s	s	s	s
Nelson Marlborough	18	4	2.16	0.66	0.62–0.70
South Canterbury	11	2	3.50	1.07	0.99–1.14
Canterbury	98	20	3.05	0.93	0.88–0.99
West Coast	8	2	3.67	1.12	1.04–1.21
Southern	54	11	2.90	0.88	0.83–0.94
New Zealand	1,044	209	3.28	1.00	

Numerator: National Mortality Collection; Denominator: Birth Registration Dataset and National Mortality Collection; † Rate per 1,000 births (live births and fetal deaths of 28 weeks gestation or more); Rate ratios are unadjusted

Northern region distribution and trends

Comparison with New Zealand

In the Northern DHBs between 2008 and 2012 the fetal death rate in Counties Manukau was *significantly higher* than the New Zealand rate with *no significant difference* in the other district health boards. Intermediate fetal death rates were *significantly higher* than the New Zealand rate in Waitemata and Auckland DHBs and *significantly lower* in Northland with *no significant difference* in Counties Manukau. Late fetal death rates in Northland and Counties Manukau were *significantly higher* than the New Zealand rate, while rates in Waitemata and Auckland DHB were *significantly lower* **(Table 10)**.

Table 10. Fetal deaths, Northern DHBs vs New Zealand 2008–2012

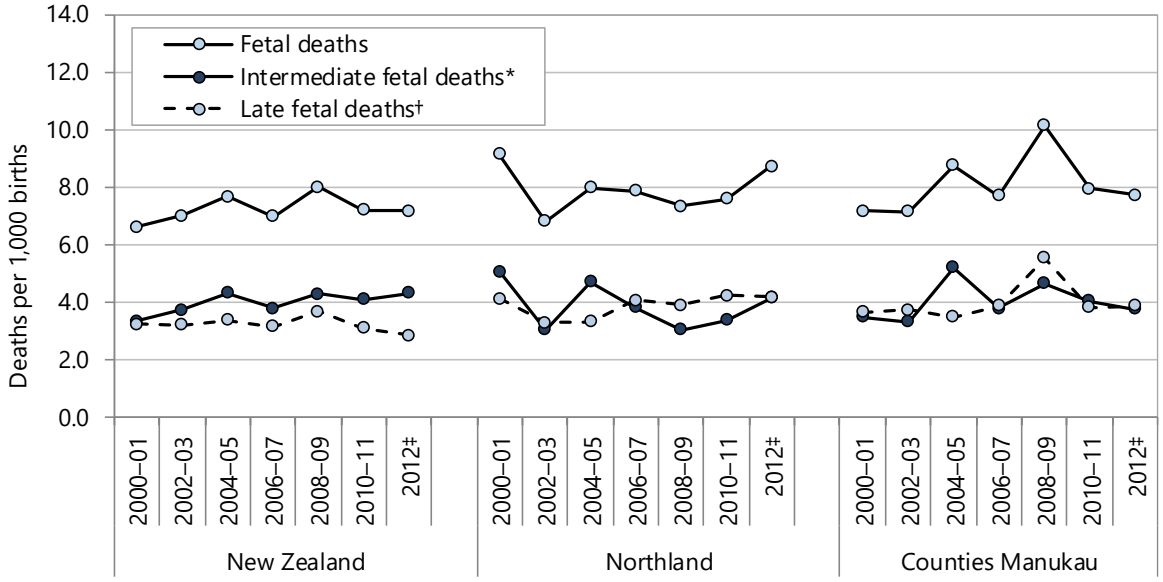
DHB	No. of deaths: 2008–2012	No. of deaths: annual average	Rate per 1,000 births	Rate ratio	95% CI
Fetal deaths					
Northland	91	18	7.71	1.02	0.98–1.07
Waitemata	299	60	7.50	1.00	0.96–1.04
Auckland	262	52	7.85	1.04	1.00–1.09
Counties Manukau	389	78	8.79	1.17	1.12–1.22
New Zealand	2408	482	7.53	1.00	
Intermediate fetal deaths*					
Northland	40	8	3.39	0.81	0.76–0.85
Waitemata	179	36	4.49	1.07	1.01–1.13
Auckland	161	32	4.83	1.15	1.09–1.21
Counties Manukau	187	37	4.23	1.00	0.95–1.06
New Zealand	1346	269	4.21	1.00	
Late fetal deaths†					
Northland	48	10	4.08	1.25	1.17–1.33
Waitemata	119	24	3.00	0.91	0.86–0.97
Auckland	100	20	3.01	0.92	0.86–0.98
Counties Manukau	199	40	4.52	1.38	1.30–1.47
New Zealand	1044	209	3.28	1.00	

Numerator: National Mortality Collection; Denominators: Birth Registration Dataset and National Mortality Collection. * Rate per 1,000 births (live births and fetal deaths of 20 weeks gestation or more); † Rate per 1,000 births (live births and fetal deaths of 28 weeks gestation or more)

Regional trends

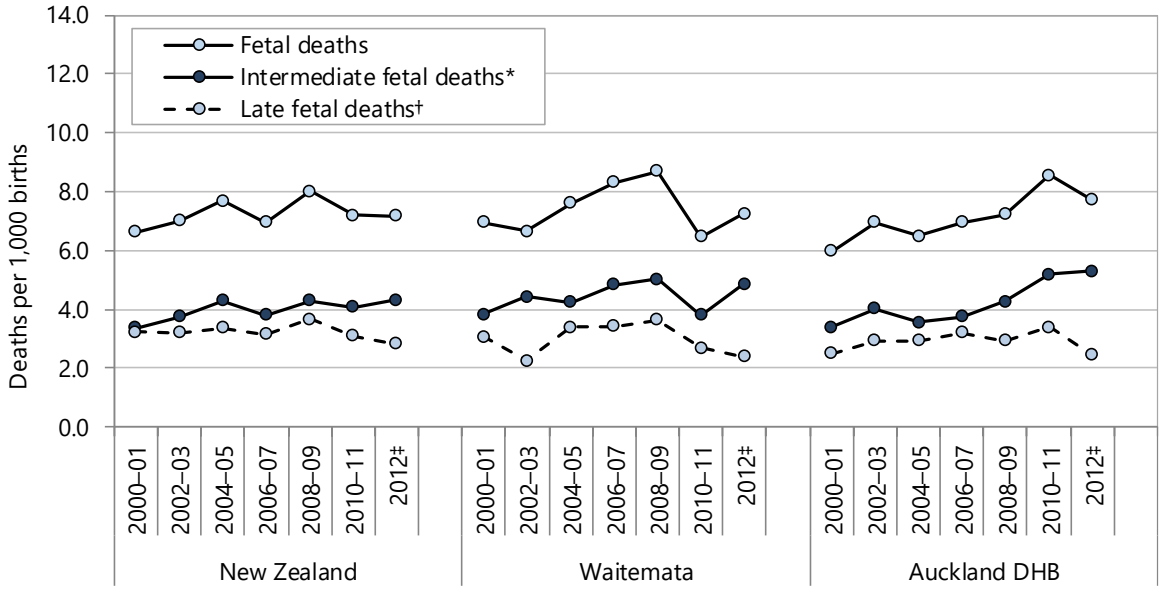
Fetal death rates increased from 2000 to 2012 in Auckland DHB, while rates in Northland, Waitemata and Counties Manukau were more stable with year to year variation. Intermediate fetal death rates increased over this period in Waitemata and Auckland, while rates in Northland and Counties Manukau were more stable with year to year variation. Late fetal death rates were stable in Northland, decreased slightly in Waitemata and Auckland DHB and increased slightly in Counties Manukau in this time period **(Figure 10**, **Figure 11)**.

Figure 10. Fetal deaths, by type, Northland and Counties Manukau DHBs vs New Zealand 2000–2012



Numerator: National Mortality Collection; Denominators: Birth Registration Dataset and National Mortality Collection. * Rate per 1,000 births (live births and fetal deaths of 20 weeks gestation or more); † Rate per 1,000 births (live births and fetal deaths of 28 weeks gestation or more); 2012* is a single year of data

Figure 11. Fetal deaths, by type, Waitemata and Auckland DHBs vs New Zealand 2000–2012



Numerator: National Mortality Collection; Denominators: Birth Registration Dataset and National Mortality Collection. * Rate per 1,000 births (live births and fetal deaths of 20 weeks gestation or more); † Rate per 1,000 births (live births and fetal deaths of 28 weeks gestation or more); 2012‡ is a single year of data

Regional distribution by cause

In the Northern region, congenital anomalies, prematurity or low birth weight, and malnutrition or slow fetal growth were the predominant causes of fetal deaths between 2008 and 2012 **(Table 11**, **Table 12)**. Of the fetal deaths with a maternal cause listed, placenta praevia or placental separation and haemorrhage were the predominant causes **(Table 13**, **Table 14)**.

Table 11. Fetal deaths, by cause of death, Northland and Counties Manukau DHBs 2008–2012

Main cause of fetal death	Number: 2008–2012	Number: annual average	Rate per 1,000 births	95% CI	Per cent
Fetal deaths					
Northland					
Congenital anomalies	18	3.6	1.53	0.97–2.41	19.8
Prematurity or low birth weight	8	1.6	0.68	0.34–1.34	8.8
Intrauterine hypoxia	5	1.0	0.42	0.18–0.99	5.5
Malnutrition or slow fetal growth	<5	s	s	s	s
Infections specific to perinatal period	<5	s	s	s	s
Other causes	9	1.8	0.76	0.40–1.45	9.9
Unspecified cause of fetal death	44	8.8	3.73	2.78–5.00	48.4
Northland total	91	18.2	7.71	6.29–9.46	100.0
Counties Manukau					
Congenital anomalies	88	17.6	1.99	1.61–2.45	22.6
Malnutrition or slow fetal growth	43	8.6	0.97	0.72–1.31	11.1
Prematurity or low birth weight	38	7.6	0.86	0.63–1.18	9.8
Intrauterine hypoxia	18	3.6	0.41	0.26–0.64	4.6
Fetal blood loss	10	2.0	0.23	0.12–0.42	2.6
Infections specific to perinatal period	7	1.4	0.16	0.08–0.33	1.8
Congenital pneumonia	7	1.4	0.16	0.08–0.33	1.8
Hydrops fetalis (non-haemolytic disease)	5	1.0	0.11	0.05–0.26	1.3
Neonatal aspiration*	<5	s	s	s	s
Polycythaemia neonatorum	<5	s	s	s	s
Other causes	21	4.2	0.47	0.31–0.73	5.4
Unspecified cause of fetal death	149	29.8	3.37	2.87–3.95	38.3
Counties Manukau total	389	77.8	8.79	7.96–9.70	100.0

Numerator: National Mortality Collection; Denominators: Birth Registration Dataset and National Mortality Collection.
* Neonatal aspiration of meconium, amniotic fluid, or mucus

Table 12. Fetal deaths, by cause of death, Waitemata and Auckland DHBs 2008–2012

Main cause of fetal death	Number: 2008–2012	Number: annual average	Rate per 1,000 births	95% CI	Per cent
Fetal deaths					
Waitemata					
Congenital anomalies	95	19.0	2.38	1.95–2.91	31.8
Malnutrition or slow fetal growth	19	3.8	0.48	0.31–0.74	6.4
Intrauterine hypoxia	11	2.2	0.28	0.15–0.49	3.7
Prematurity or low birth weight	9	1.8	0.23	0.12–0.43	3.0
Congenital pneumonia	7	1.4	0.18	0.09–0.36	2.3
Fetal blood loss	6	1.2	0.15	0.07–0.33	2.0
Infections specific to perinatal period	5	1.0	0.13	0.05–0.29	1.7
Neonatal aspiration*	<5	s	s	s	s
Hydrops fetalis (non-haemolytic disease)	<5	s	s	s	s
Other causes	11	2.2	0.28	0.15–0.49	3.7
Unspecified cause of fetal death	129	25.8	3.24	2.72–3.84	43.1
Waitemata total	299	59.8	7.50	6.70–8.39	100.0
Auckland DHB					
Congenital anomalies	65	13.0	1.95	1.53–2.48	24.8
Malnutrition or slow fetal growth	27	5.4	0.81	0.56–1.18	10.3
Prematurity or low birth weight	16	3.2	0.48	0.30–0.78	6.1
Infections specific to perinatal period	10	2.0	0.30	0.16–0.55	3.8
Fetal blood loss	6	1.2	0.18	0.08–0.39	2.3
Intrauterine hypoxia	5	1.0	0.15	0.06–0.35	1.9
Neonatal aspiration*	5	1.0	0.15	0.06–0.35	1.9
Hydrops fetalis (non-haemolytic disease)	5	1.0	0.15	0.06–0.35	1.9
Congenital pneumonia	<5	s	s	s	s
Polycythaemia neonatorum	<5	s	s	s	s
Other causes	20	4.0	0.60	0.39–0.93	7.6
Unspecified cause of fetal death	99	19.8	2.97	2.44–3.61	37.8
Auckland DHB total	262	52.4	7.85	6.96–8.86	100.0

Numerator: National Mortality Collection; Denominators: Birth Registration Dataset and National Mortality Collection.
* Neonatal aspiration of meconium, amniotic fluid, or mucus

Table 13. Fetal deaths, by maternal cause of fetal death, Northland and Counties Manukau DHBs 2008–2012

Main maternal cause of fetal death	Number: 2008–2012	Number: annual average	Rate per 1,000 births	95% CI	Per cent
Fetal deaths					
Northland					
Placenta praevia/placental separation and haemorrhage	6	1.2	0.51	0.23–1.11	6.6
Chorioamnionitis	6	1.2	0.51	0.23–1.11	6.6
Other abnormalities of placenta	<5	s	s	s	s
Compression of umbilical cord	<5	s	s	s	s
Multiple pregnancy	<5	s	s	s	s
Placental transfusion syndromes	<5	s	s	s	s
Oligohydramnios	<5	s	s	s	s
Other causes	17	3.4	1.44	0.90–2.31	18.7
No listed maternal cause	42	8.4	3.56	2.64–4.81	46.2
Northland total	91	18.2	7.71	6.29–9.46	100.0
Counties Manukau					
Placenta praevia/placental separation and haemorrhage	33	6.6	0.75	0.53–1.05	8.5
Other abnormalities of placenta	24	4.8	0.54	0.36–0.81	6.2
Chorioamnionitis	24	4.8	0.54	0.36–0.81	6.2
Compression of umbilical cord	22	4.4	0.50	0.33–0.75	5.7
Maternal hypertensive disorders	22	4.4	0.50	0.33–0.75	5.7
Incompetent cervix/premature rupture of membranes	19	3.8	0.43	0.27–0.67	4.9
Multiple pregnancy	11	2.2	0.25	0.14–0.45	2.8
Oligohydramnios	8	1.6	0.18	0.09–0.36	2.1
Other causes	73	14.6	1.65	1.31–2.07	18.8
No listed maternal cause	153	30.6	3.46	2.95–4.05	39.3
Counties Manukau total	389	77.8	8.79	7.96–9.70	100.0

Numerator: National Mortality Collection; Denominators: Birth Registration Dataset and National Mortality Collection

Table 14. Fetal deaths, by maternal cause of fetal death, Waitemata and Auckland DHBs 2008–2012

Main maternal cause of fetal death	Number: 2008–2012	Number: annual average	Rate per 1,000 births	95% CI	Per cent
Fetal deaths					
Waitemata					
Placenta praevia/placental separation and haemorrhage	18	3.6	0.45	0.29–0.71	6.0
Incompetent cervix/premature rupture of membranes	18	3.6	0.45	0.29–0.71	6.0
Other abnormalities of placenta	12	2.4	0.30	0.17–0.53	4.0
Chorioamnionitis	10	2.0	0.25	0.14–0.46	3.3
Maternal hypertensive disorders	10	2.0	0.25	0.14–0.46	3.3
Multiple pregnancy	10	2.0	0.25	0.14–0.46	3.3
Compression of umbilical cord	9	1.8	0.23	0.12–0.43	3.0
Placental transfusion syndromes	7	1.4	0.18	0.09–0.36	2.3
Oligohydramnios	6	1.2	0.15	0.07–0.33	2.0
Other causes	34	6.8	0.85	0.61–1.19	11.4
No listed maternal cause	165	33.0	4.14	3.55–4.82	55.2
Waitemata total	299	59.8	7.50	6.70–8.39	100.0
Auckland DHB					
Placenta praevia/placental separation and haemorrhage	24	4.8	0.72	0.48–1.07	9.2
Incompetent cervix/premature rupture of membranes	22	4.4	0.66	0.44–1.00	8.4
Other abnormalities of placenta	20	4.0	0.60	0.39–0.93	7.6
Chorioamnionitis	13	2.6	0.39	0.23–0.67	5.0
Maternal hypertensive disorders	11	2.2	0.33	0.18–0.59	4.2
Multiple pregnancy	8	1.6	0.24	0.12–0.47	3.1
Compression of umbilical cord	7	1.4	0.21	0.10–0.43	2.7
Placental transfusion syndromes	7	1.4	0.21	0.10–0.43	2.7
Oligohydramnios	6	1.2	0.18	0.08–0.39	2.3
Other causes	28	5.6	0.84	0.58–1.21	10.7
No listed maternal cause	116	23.2	3.48	2.90–4.17	44.3
Auckland DHB total	262	52.4	7.85	6.96–8.86	100.0

Numerator: National Mortality Collection; Denominators: Birth Registration Dataset and National Mortality Collection

Evidence for good practice for the prevention of fetal deaths

Ministry of Health publications
Ministry of Health. 2013. **Guidelines for Consultation with Obstetric and Related Medical Services (Referral Guidelines)**. Wellington: Ministry of Health. http://www.health.govt.nz/publication/guidelines-consultation-obstetric-and-related-medical-services-referral-guidelines These guidelines are intended for lead maternity carers. They outline criteria and processes for referral to primary care, referral for specialist consultation, referral for the transfer of clinical responsibility for care, transfer of clinical responsibility for care in an emergency, and emergency transport.
Ministry of Health. 2011. **New Zealand Maternity Standards: A set of standards to guide the planning, funding and monitoring of maternity services by the Ministry of Health and District Health Boards**. Wellington: Ministry of Health. http://www.health.govt.nz/publication/new-zealand-maternity-standards These standards provide guidance for the provision of safe, equitable and high quality maternity services throughout New Zealand. They consist of three high level strategic statements to guide the funding, planning, provision and monitoring of maternity services by the Ministry of Health, DHBs, service providers and health practitioners. The standards underpin the DHB maternity service specifications, the Primary Maternity Services Notice 2007, the Maternal Referral Guidelines, and other high-level guidelines and requirements.
International guidelines
Royal College of Obstetricians and Gynaecologists (RCOG). 2011. **Reduced fetal movements (Green-top guideline; no. 57)**. London (U.K.): Royal College of Obstetricians and Gynaecologists (RCOG). https://www.rcog.org.uk/globalassets/documents/guidelines/gtg_57.pdf The purpose of this guideline is to provide advice to clinicians, based on the best available evidence, on the management of women presenting with reduced fetal movements in pregnancy (excluding those with multiple pregnancy). The guidelines are structured as a series of clinical questions. The authors note that the available evidence is limited and that this is reflected in the low grading of some of the recommendations. Appendix 1 provides a care algorithm (flowchart) and Appendix 2 explains the grading scheme used for the evidence and recommendations. There is a comprehensive list of references.
National Collaborating Centre for Women's and Children's Health. 2010. **Pregnancy and complex social factors. A model for service provision for pregnant women with complex social factors** .London (UK): National Institute for Health and Clinical Excellence (NICE). https://www.nice.org.uk/guidance/cg110 This very comprehensive 300+ page guideline, which is complementary to the NICE guideline 'Antenatal care: routine care for the healthy pregnant woman' (NICE clinical guideline 62, https://www.nice.org.uk/guidance/cg62), applies to pregnant women with complex social factors, in particular women who misuse substances (alcohol and/or drugs); women who are recent migrants, asylum seekers or refugees, or who have difficulty speaking English; young women aged under 20 years; and women who experience domestic violence. It is intended for health professionals caring for pregnant women, those responsible for commissioning and planning health services and it may be of relevance to those working in social services and education. It is based on, and reports on, systematic reviews of the literature aiming to determine which interventions lead to improved pregnancy outcomes.
National Institute for Health and Clinical Excellence. 2010. **Weight management before, during and after pregnancy**. London: National Institute for Health and Clinical Excellence. https://www.nice.org.uk/guidance/ph27 Obese women who become pregnant are at increased risk of complications during pregnancy and childbirth and babies born to obese women face higher risks of a number of adverse outcomes: fetal death, stillbirth, congenital abnormality, shoulder dystocia, macrosomia (large body size) and subsequent obesity. Pregnant women are not encouraged to diet but they can be encouraged to take regular exercise and not to "eat for two". This guideline on dietary and physical activity interventions for weight management before, during and after pregnancy are intended for NHS and other commissioners, health service managers and health professionals. The evidence reviews on which the guideline was based, and some other relevant background publications can be found at: https://www.nice.org.uk/guidance/ph27/evidence
International guidelines relevant to induction of labour
Royal College of Obstetricians and Gynaecologists. 2013. **Induction of labour at term in older mothers**. London: Royal College of Obstetricians and Gynaecologists. https://www.rcog.org.uk/globalassets/documents/guidelines/scientific-impact-papers/sip_34.pdf This scientific impact paper states that epidemiological studies show that women aged 40+ years have a stillbirth risk at 39 weeks of pregnancy equal to the risk for 25–29 year old women at 41 weeks, and therefore is reasonable to question whether older mothers should be offered induction of labour. It also states that the impacts of offering induction on emergency caesarean rates needs to be considered as well as whether any reduction in pre-birth stillbirths would be obtained at the cost of an increase in intrapartum (during birth) and neonatal deaths. This paper considers the evidence and concludes that the evidence suggests that offering induction at 39–40 weeks to women ≥ 40 years would reduce late antenatal stillbirths and maternal risks of an on-going pregnancy such as pre-eclampsia, particularly in cases where there are concurrent medical co-morbidities, nulliparity or Afro Caribbean ethnicity. It also concludes that there is growing evidence that such a practice would not increase the number of operative vaginal deliveries or caesarean sections but insufficient evidence to assess the effect on surgical deliveries and perinatal mortality specifically in older mothers. The authors note that older mothers, particularly first time mothers, may request elective caesarean delivery rather than induction of labour and that, in such cases, a discussion comparing the risks and benefits of the two options is appropriate. They also noted that there is currently an on-going multicentre RCT comparing induction of labour at 39 weeks of gestation with expectant management in nulliparous women aged over 35 years of age (details can be found here: http://www.35-39trial.org/).
Leduc D, Biringer A, Lee L, et al. 2013. **Induction of labour**. J Obstet Gynaecol Can, 35(9), 840-60. http://sogc.org/guidelines/induction-labour-replaces-107-aug-2001/

This guideline was produced by the Society of Obstetricians and Gynaecologists of Canada. The literature search for published evidence used to produce the guideline concluded at the end of 2010. Recommendations in the guideline are accompanied by evidence statements regarding the quality of the evidence, and by a classification, according to criteria adapted from those of the Canadian Taskforce on Preventive Health Care.

National Guideline Clearinghouse. 2010 (revised 2014). **Guideline synthesis: induction of labour**. Rockville (MD): Agency for Healthcare Research and Quality (AHRQ). http://www.guideline.gov/syntheses/synthesis.aspx?id=47799&search=induction+of+labour

This website provides a comparison of the 2011 WHO guideline and the 2008 NICE guideline highlighting areas of agreement and difference. Compared guidelines can be found at http://whqlibdoc.who.int/publications/2011/9789241501156_eng.pdf and https://www.nice.org.uk/guidance/cg70

International guidelines relevant to the management of stillbirth

Queensland Maternity and Neonatal Clinical Guidelines Program. 2010. **Stillbirth Care**. Brisbane: Queensland Government. http://www.health.qld.gov.au/qcg/documents/g_still5-0.pdf

These guidelines are intended for health professionals in Queensland maternity services and they are consistent with the Perinatal Society of Australia and New Zealand (PSANZ) Clinical Practice Guideline for Perinatal Mortality. They cover clinical standards, diagnosis and birth, investigations, autopsy and subsequent pregnancy care. They are concise and well referenced but do not discuss the research evidence.

Royal College of Obstetricians and Gynaecologists (RCOG). 2010. **Late intrauterine fetal death and stillbirth**. London, U.K.: Royal College of Obstetricians and Gynaecologists (RCOG). https://www.rcog.org.uk/en/guidelines-research-services/guidelines/gtg55/

The purpose of this guideline, which is primarily for obstetricians and midwives, is to identify evidence-based options for women (and their families) who have a late intra-uterine death (after 24 weeks) and to provide guidance on general care before, during and after birth, and care in subsequent pregnancies. The levels of evidence and the grades of recommendations in this guideline follow the system used by the Scottish Intercollegiate Guidelines Network (SIGN). They cover diagnosis, investigations, labour and birth, the puerperium, psychological and social aspects of care, follow-up, pregnancy following unexplained stillbirth, clinical governance and recommendations for further research.

Flenady V, King J, Charles A, et al. 2009. **PSANZ Clinical Practice Guideline for Perinatal Mortality. Version 2.2**. Perinatal Society of Australia and New Zealand (PSANZ). http://www.stillbirthalliance.org.au/guideline1.htm

The purpose of this guideline is to assist clinicians in the audit of perinatal deaths, to enable a systematic approach to perinatal audit in Australia and New Zealand, and also to provide guidance on dealing with the psychological and social aspects of perinatal bereavement, peri-natal post-mortem examination, investigation of stillbirths and neonatal deaths and the use of perinatal mortality classifications.

Evidence-based medicine reviews

Alfirevic Z, Stampalija T, Medley N. 2015. **Fetal and umbilical Doppler ultrasound in normal pregnancy**. Cochrane Database of Systematic Reviews (4). http://onlinelibrary.wiley.com/doi/10.1002/14651858.CD001450.pub4/abstract

A key aim of routine antenatal care is to identify babies who are not thriving in the womb so that outcomes for these babies can be improved through medical intervention. This review aimed to assess the effect of routine fetal and umbilical Doppler ultrasound on pregnancy outcomes and obstetric practice in unselected and low risk pregnancies. The review authors identified five RCTs or quasi-RCTs of Doppler ultrasound vs. no Doppler ultrasound, all undertaken in the 1990s, with data from 14,185 women. There were no differences between the intervention and control groups for perinatal death (average risk ratio (RR) 0.80, 95% CI 0.35 to 1.83; four studies, 11,183 participants) or serious neonatal morbidity (RR 0.99, 95% CI 0.06 to 15.75; one study, 2016 participants). One trial compared a single Doppler assessment with no Doppler and found evidence for group differences in perinatal death: (RR 0.36, 95% CI 0.13 to 0.99; one study, 3891 participants). The review authors recommended caution in interpreting this finding. There was no evidence of differences between groups for the outcomes of caesarean section, neonatal intensive care admissions or preterm birth less than 37 weeks. The review authors used GRADE software to assess the quality of evidence for the main comparison of "All Doppler vs. no Doppler" and found that for the outcome of stillbirth the quality of evidence differed by regimen subgroups. The evidence for Doppler using fetal/umbilical vessels only was of moderate quality while the evidence for Doppler using fetal/umbilical vessels plus uterine artery vessels was of low quality. The review authors concluded that there was no conclusive evidence that the use of routine umbilical artery Doppler ultrasound, or combination of umbilical and uterine artery Doppler ultrasound, in low-risk or unselected populations benefits either mother or baby. They stated that future research should be designed to address small changes in perinatal outcome, and should focus on potentially preventable deaths.

Conde-Agudelo A, Bird S, Kennedy SH, et al. 2015. **First- and second-trimester tests to predict stillbirth in unselected pregnant women: a systematic review and meta-analysis**. BJOG, 122(1), 41-55

The aim of this review was to determine the accuracy of tests performed during the first and/or second trimester of pregnancy to predict stillbirth in unselected women with structurally and chromosomally normal singleton fetuses. The review did not include genetic markers or ante-partum surveillance tests such as assessment of fetal heart rate patterns, fetal and umbilical artery Doppler ultrasonography, and biophysical profile, which are routinely used to assess fetal wellbeing in pregnancies complicated by fetal or maternal conditions. The review included 71 studies (50 cohort and 21 case-control) of variable methodological quality assessing a total of 16 single and five combined tests. The pooled evidence indicated that there is no clinically useful first or second trimester test to predict stillbirth as a sole category, but a uterine artery pulsatility index greater than the 90th centile during the second trimester and low levels of pregnancy-associated plasma protein (PAPP-A) during the first trimester had a moderate to high predictive accuracy for stillbirth related to placental abruption, small-for-gestational-age or pre-eclampsia (positive and negative likelihood ratios from 6.3 to 14.1, and from 0.1 to 0.4, respectively).

Aune D, Saugstad OD, Henriksen T, et al. 2014. **Maternal body mass index and the risk of fetal death, stillbirth, and infant death: a systematic review and meta-analysis**. JAMA, 311(15), 1536-46

The aim of this systematic review and meta-analysis of cohort studies was to quantify the association between maternal body mass index (BMI) and the risk of fetal death, stillbirth, and infant death. Eighteen cohort studies were included in the analysis of maternal BMI and stillbirth risk. Stillbirth definitions varied between studies from 20 or more to 28 or more completed weeks of gestation. The 18 studies included more than 16,274 stillbirths among 3,288,688 participants. The summary relative risk per 5 BMI units was 1.24 (95% CI, 1.18 to 1.30). For BMI levels of 20, 25 and 30, the absolute risks per 10,000 pregnancies were 40 (reference standard), 48 (95% CI 46 to 61), and 59 (95% CI 55 to 63), respectively. The association was almost linear. Analysis of results from studies that reported antepartum and intrapartum stillbirths separately indicated summary RRs of 1.28 (95% CI 1.15 to 1.43) and 0.90 (95% CI 0.76 to 1.06) per 5 BMI units, respectively. There was some evidence of publication bias, but once one very large US study that contributed more than 51% of the total number of stillbirths was excluded there was no evidence of publication bias. This US study found a weaker association than the overall summary estimate.

Peters M, Riitano D, Lisy K, et al. 2014. **Providing care for families who have experienced stillbirth: a comprehensive systematic review**. Adelaide: The Joanna Briggs Institute (for the Stillbirth Foundation of Australia). http://www.stillbirthfoundation.org.au/wp-content/uploads/2014/03/Stillbirth-systematic-review-report.pdf

The aim of this review was to identify effective, meaningful and/or appropriate non-pharmacological, psychosocial supportive care interventions to improve the psychological well-being of families following stillbirth. The review included one quantitative study and 22 qualitative studies. It suggests numerous implications for practice. The review authors stated that the evidence indicates that parents need sensitive and supportive preparation from healthcare professionals to know what to expect at all stages of the stillbirth experience.

Likis F E, Andrews J C, Fonnesbeck C J, et al. 2014. **Smoking Cessation Interventions in Pregnancy and Postpartum Care. Evidence Report/Technology Assessment No.214. (Prepared by the Vanderbilt Evidence-based Practice Center under Contract No. 290-2007-10065-I.) AHRQ Publication No. 14-E001-EF**. Rockville, MD: Agency for Healthcare Research and Quality. http://effectivehealthcare.ahrq.gov/ehc/products/517/1871/smoking-pregnancy-infants-report-140226.pdf

This systematic review included 59 unique studies. Three were prospective cohort studies and 56 were RCTS. The review authors considered that 13 of the RCTs were good, 15 fair and 28 poor quality. The studies evaluated educational materials, counselling-based interventions, peer support, nicotine replacement therapy (NRT), multi component interventions, and other unique interventions. Overall, the reviewers considered that the strength of evidence regarding interventions for smoking cessation and relapse prevention in pregnant women was low. When assessed by meta-analysis, the strength of evidence was moderate for the effectiveness of incentives (odds ratio 3.23, 95% CI 1.98–4.59) and low for all other intervention components (odds ratios ranged from 1.32 down to 1.05 and all the associated confidence intervals all included 1, the value associated with no effect. The evidence for counselling was not assessed by meta-analysis as in most studies both the intervention and control arms included counselling (so it was not possible to compare counselling vs. no counselling). The reviewers found insufficient evidence to determine the effect of smoking cessation interventions on gestational age, birth weight, neonatal deaths, or long term or child outcomes, or to assess the harms of smoking interventions. They stated that their review indicated that approaches combining multiple components are most likely to be successful and that incentives were the component with the highest probability of success. Other components with a high probability of success were information, quit guides, feedback about biologic measures, NRT and personal follow up. The components that added little to the success of multi-component interventions were peer support, clinic reinforcement and prescriptions to quit.

Further publications on smoking cessation interventions for pregnant women can be found in the Smoking in Pregnancy chapter of the 2014 NZCYES report in this series, on determinants of health.

Nieuwenhuijsen MJ, Dadvand P, Grellier J, et al. 2013. **Environmental risk factors of pregnancy outcomes: a summary of recent meta-analyses of epidemiological studies**. Environ Health, 12, 6. http://www.ncbi.nlm.nih.gov/pmc/articles/PMC3582445/

The authors of this review aimed to describe the methodologies used in recent meta-analyses of environmental exposures and pregnancy outcomes, including stillbirth, and to report the main findings. They identified 16 meta-analyses, only a few of which reported having followed meta-analysis guidelines or having used a quality rating system, although most tested for heterogeneity and publication bias. One meta-analysis identified and increase in stillbirth risk associated with environmental tobacco smoke (OR 1.23, 95% CI 1.09 to 1.38, 4 studies) and another identified an increased risk associated with indoor air pollution from solid fuel use vs. cleaner fuel (OR 1.51, 95% CI 1.23 to 1.85, 4 studies). One meta-analysis considered the effects of disinfection by-products in drinking water and found a summary odds ratio for stillbirth of 1.09 (95% CI 1.02 to 1.17, number of studies not reported) when comparing the highest exposure group to the lowest.

Koopmans L, Wilson T, Cacciatore J, et al. 2013. **Support for mothers, fathers and families after perinatal death**. Cochrane Database of Systematic Reviews (6). http://onlinelibrary.wiley.com/doi/10.1002/14651858.CD000452.pub3/abstract

The authors of this review did not identify any RCTs of any form of support aimed at encouraging acceptance of loss, bereavement counselling, or specialised psychotherapy or counselling for mothers, fathers and families who have experienced perinatal death. They stated that therefore the true benefits of such interventions is unclear and that there was no evidence regarding the possible detrimental effects of some interventions such as seeing and holding the deceased baby. They noted, however, that some well-designed descriptive studies have shown that parents' experiences of seeing and holding their deceased baby can be very positive if they are supported by compassionate, sensitive and experienced staff. They also highlighted a variety of other interventions described in the literature that may be helpful to families.

Horey D, Flenady V, Heazell Alexander EP, et al. 2013. **Interventions for supporting parents' decisions about autopsy after stillbirth**. Cochrane Database of Systematic Reviews (2). http://onlinelibrary.wiley.com/doi/10.1002/14651858.CD009932.pub2/abstract

The authors of this review did not find any RCTs assessing interventions specifically designed to support parents of stillborn babies to make decisions about consenting to autopsy or other post-mortem investigations. They stated that those offering support to bereaved parents must rely on their own knowledge and experience.

Furber CM, McGowan L, Bower P, et al. 2013. **Antenatal interventions for reducing weight in obese women for improving pregnancy outcome**. Cochrane Database of Systematic Reviews (1). http://onlinelibrary.wiley.com/doi/10.1002/14651858.CD009334.pub2/abstract

Obese women are at increased risk of a number of adverse pregnancy outcomes including congenital anomalies, stillbirth, gestational diabetes, hypertension, pre-eclampsia, and pre-term birth, macrosomia and caesarean birth. Some observational studies have indicated that some obese women gain little weight in pregnancy and even lose weight whereas it is very unusual for non-obese women to do this. There is conflicting evidence from observational studies regarding whether weight loss during pregnancy in obese women is beneficial or harmful to the fetus but it appears that in heavier women (body mass index > 40 kg/m^2) weight loss can be beneficial. The authors of this review did not identify any RCTs designed to reduce maternal weight in obese pregnant women. They stated that it is unlikely that it would be considered ethical to conduct such a RCT given the current observational evidence.

Alfirevic Z, Stampalija T, Gyte MLG. 2013. **Fetal and umbilical Doppler ultrasound in high-risk pregnancies**. Cochrane Database of Systematic Reviews (11). http://onlinelibrary.wiley.com/enhanced/doi/10.1002/14651858.CD007529.pub3

Doppler ultrasound may be used to detect abnormal blood flow patterns in fetal circulation that may indicate poor fetal prognosis. This review aimed to assess the effects of Doppler ultrasound vs. no Doppler ultrasound in high-risk pregnancies. It included 18 RCTs and quasi RCTs involving a total of just over 10,000 women. The quality of the trials was unclear and there was some evidence of possible publication bias. Meta-analysis indicated that the use of Doppler ultrasound in high-risk pregnancy was associated with a reduction in perinatal deaths: Risk ratio (RR) 0.71, 95% CI 0.52 to 0.98, 6 studies, 10,225 babies, 1.2% versus 1.7%, number needed to treat (NNT) = 203; 95% CI 103 to 4352. It was also associated with fewer inductions of labour (average RR 0.89, 95% CI 0.80 to 0.99, 10 studies, 5633 women, random effects) and fewer caesarean sections (RR 0.90, 95% CI 0.84 to 0.97, 14 studies, 7918 women). It made no difference to the probability of operative vaginal birth (RR 0.95, 95% CI 0.80 to 1.14, four studies, 2813 women), nor to Apgar scores less than seven at five minutes (RR 0.92, 95% CI 0.69 to 1.24, seven studies, 6321 babies). The review authors concluded that current evidence suggests that the use of Doppler ultrasound in high-risk pregnancies leads to fewer perinatal deaths and obstetric interventions but, given that the evidence is not of high quality, the results of their review should be interpreted with caution.

Tan Kelvin H, Smyth Rebecca MD, Wei X. 2013. **Fetal vibroacoustic stimulation for facilitation of tests of fetal wellbeing**. Cochrane Database of Systematic Reviews(12) http://onlinelibrary.wiley.com/doi/10.1002/14651858.CD002963.pub2/abstract

It has been suggested that acoustic stimulation of the fetus (using an electronic device to send brief sounds through the mother's abdomen to her baby) improves the efficiency of pre-labour fetal heart rate testing by reducing the number of non-reactive cartiotocographs that are due to the baby being asleep (as opposed to being in distress). This review included 12 trials with a total of 6822 participants. Fetal vibroacoustic stimulation reduced the proportion of antenatal cardiotocography tests that were non-reactive (nine trials; average risk ratio (RR) 0.62, 95% confidence interval (CI) 0.48 to 0.81). Vibroacoustic stimulation compared with mock stimulation evoked significantly more fetal movements when used with fetal heart rate testing (one trial, RR 0.23, 95% CI 0.18 to 0.29). The review authors concluded that vibroacoustic stimulation is useful since it decreases the incidence of non-reactive cardiotocography and reduces the testing time.

Muktabhant B, Lumbiganon P, Ngamjarus C, et al. 2012. **Interventions for preventing excessive weight gain during pregnancy.** Cochrane Database of Systematic Reviews (4). http://onlinelibrary.wiley.com/doi/10.1002/14651858.CD007145.pub2/abstract

Excessive weight gain during pregnancy increases the risk of complications for both mother and baby. Some of these complications, including the development of diabetes and hypertension, increase the risk of stillbirth. This review aimed to evaluate the effectiveness of interventions for preventing excessive weight gain in pregnancy and associated pregnancy complications. It included 28 RCTs and quasi RCTs involving 3976 women; 27 of these studies (3964 women) contributed data to the analyses. The studies considered a broad range of interventions. For most of the outcomes it was not possible to combine data in a meta-analysis, and, where meta-analysis was possible, no more than two or three studies could be combined for a particular intervention and outcome measure. Most of the results from the review were not statistically significant, and where there did seem to be differences between the intervention and control groups, the results were not consistent. For women in a general clinic population, one of three interventions examined (behavioural counselling vs. standard care) was associated with a reduction in the rate of excessive weight gain (RR 0.72, 95% CI 0.54 to 0.95), but for women in high-risk groups, none of the interventions appeared to reduce excess weight gain. All but one of the included studies reported mean weight gain and the results were inconsistent. The review authors found a statistically significant effect on mean weight gain for five interventions in the general population and two interventions in high-risk groups. No study reported significant effects on adverse neonatal outcomes and most studies did not show statistically significant effects on maternal complications. The review authors concluded that there is insufficient evidence to recommend any intervention for preventing excessive weight gain in pregnancy.

Hofmeyr JG, Novikova N. 2012. **Management of reported decreased fetal movements for improving pregnancy outcomes**. Cochrane Database of Systematic Reviews (4). http://onlinelibrary.wiley.com/doi/10.1002/14651858.CD009148.pub2/abstract

Mothers who have a stillbirth commonly report perceiving a reduction in, or absence of, their baby's movements in the days preceding their baby's death. For this reason, monitoring of babies' movements is often advised by caregivers, and used by mothers to assess their baby's wellbeing. This review aimed to determine the effectiveness of various management strategies for decreased fetal movements (DFM). The review authors did not identify any RCTs of management of DFM. They did identify 13 randomised trials of management strategies for women whose babies are at risk of poor outcomes for various reasons, including DFM, but data on DFM sub-groups was only able to be provided by the authors of one trial and the numbers of cases of DFM (28) was too small for meaningful analysis. They concluded that there were insufficient data from RCTs to provide guidance on the management of DFM in clinical practice, but that, based on the findings from other systematic reviews, the following strategies show promise and should be prioritised for further research: Doppler ultrasound studies, computerised cardiotocography, and fetal arousal to facilitate cardiotocography.

Gulmezoglu MA, Crowther CA, Middleton P, et al. 2012. **Induction of labour for improving birth outcomes for women at or beyond term**. Cochrane Database of Systematic Reviews (6). http://onlinelibrary.wiley.com/doi/10.1002/14651858.CD004945.pub3/abstract

A pregnancy is considered to be "at term" at 37 weeks and "post-term" at 42 weeks. There is an increase in the risk of a baby dying in utero as pregnancy continues beyond term. Induction of labour is widely practiced to try to prevent stillbirth and other adverse outcomes for mother and baby. This review aimed to assess the benefits and harms of a policy of inducing labour at term compared with awaiting spontaneous onset of labour or later induction. It included 22 RCTs reporting on 9,382 women. The review authors considered them to be generally at moderate risk of bias. Compared with a policy of expectant management, a policy of induction of labour was associated with fewer all-cause perinatal deaths: risk ratio (RR) 0.31, 95% CI 0.12 to 0.88; 17 trials, 7407 women. (Perinatal deaths are stillbirths and deaths within the first week of life.) There was one perinatal death in the induction policy group, but 13 in the expectant management group. The number needed to treat to benefit with induction of labour to prevent one perinatal death was 410 (95% CI 322 to 1492). There was no difference between timing of induction subgroups for the primary outcome of perinatal death and for most other outcomes; the majority of trials had a policy of induction at 41 completed weeks (287 days) or more. There were fewer babies in the induction group (compared to the expectant management group) with meconium aspiration syndrome (RR 0.50, 95% CI 0.34 to 0.73; eight trials, 2371 infants), and fewer caesarean sections (RR 0.89, 95% CI 0.81 to 0.97, 21 trials 8749 women). Rates of neonatal intensive care unit (NICU) admission were not significantly different for induction compared to expectant management (RR 0.90, 95% CI 0.78 to 1.04; 10 trials, 6161 infants). The review authors concluded that a policy of labour induction compared with expectant management is associated with fewer perinatal deaths and caesarean sections, and fewer babies with meconium aspiration syndrome, but no significant difference in the rate of NICU admission.

The Cochrane library has a large number of reviews relating to induction of labour, which can be found at: http://www.cochranelibrary.com/app/content/browse/page/?context=topic/Pregnancy%20%26%20childbirth&paginationVal=1 . (Select "induction of labour" from the topic menu.)

Grivell Rosalie M, Wong L, Bhatia V. 2012. **Regimens of fetal surveillance for impaired fetal growth**. Cochrane Database of Systematic Reviews doi:10.1002/14651858.CD007113.pub3 http://onlinelibrary.wiley.com/doi/10.1002/14651858.CD007113.pub3/abstract

There is wide variation in policies and protocols for surveillance of pregnancies where impaired fetal growth is suspected. This review aimed to assess the effects of antenatal fetal surveillance on maternal and perinatal outcomes (including stillbirth). The review authors identified only one RCT (involving 167 women and their babies in Auckland) which compared a twice-weekly surveillance regimen (biophysical profile, nonstress tests, umbilical artery and middle cerebral artery Doppler and uterine artery Doppler) with the same regimen applied fortnightly (both groups had fetal growth assessed fortnightly). There was not sufficient data to assess the review's primary infant outcome (composite perinatal mortality and serious morbidity). There were no perinatal deaths in either group. There was no difference between the groups in the primary maternal outcome of emergency caesarean section for fetal distress (risk ratio (RR) 0.96; 95% CI 0.35 to 2.63). The babies in the twice-weekly surveillance group had a mean gestational age at birth that was four days less than the babies in the fortnightly surveillance group (mean difference (MD) −4.00; 95% CI −7.79 to −0.21). Compared to women in the fortnightly surveillance group, women in the twice-weekly surveillance group were 25% more likely to have induction of labour (RR 1.25; 95% CI 1.04 to 1.50). The review authors concluded that the evidence to inform best practice for fetal surveillance regimens for use when caring for women whose pregnancies had evidence of impaired fetal growth is limited and that more research is needed to evaluate the effects of currently used fetal surveillance regimens where there is impaired fetal growth.

Grivell RM, Alfirevic Z, Gyte GML, et al. 2012. **Antenatal cardiotocography for fetal assessment**. Cochrane Database of Systematic Reviews (12) http://onlinelibrary.wiley.com/doi/10.1002/14651858.CD007863.pub3/full

Cardiotocography (CTG) is widely used in pregnancy to assess fetal wellbeing, especially in pregnancies at increased risk of complications. It involves continuous recording of the fetal heart rate via an ultrasound transducer placed on the mother's abdomen. This review aimed to assess the effectiveness of antenatal CTG (both traditional and computerised) in improving outcomes for mothers and babies. The review authors searched for RCTs and quasi-RCTs that compared traditional antenatal CTG with no CTG or CTG with results concealed; computerised CTG with no CTG or CTG with results concealed; and computerised CTG with traditional CTG. They included six trials involving 2,105 women, the most recent of which was published in 1997. All of the trials include only women at increased risk of complications, and overall they were not of high quality. Comparison of traditional CTG versus no CTG showed no significant difference identified in perinatal mortality (risk ratio (RR) 2.05, 95% CI 0.95 to 4.42, 2.3% versus 1.1%, four studies, N = 1627) or potentially preventable deaths (RR 2.46, 95% CI 0.96 to 6.30, four studies, N = 1627), though the meta-analysis was underpowered for assessing this outcome. There was no significant difference identified in caesarean sections (RR 1.06, 95% CI 0.88 to 1.28, 19.7% versus 18.5%, three trials, N = 1279) nor in the secondary outcomes that were assessed. There were no eligible studies comparing computerised CTG with no CTG. Comparison of computerised CTG versus traditional CTG showed a significant reduction in perinatal mortality with computerised CTG (RR 0.20, 95% CI 0.04 to 0.88, two studies, 0.9% versus 4.2%, 469 women) but no significant difference in potentially preventable deaths (RR 0.23, 95% CI 0.04 to 1.29, two studies, N = 469), though the meta-analysis was underpowered to assess this outcome. There was no significant difference identified in caesarean sections (RR 0.87, 95% CI 0.61 to 1.24, 63% versus 72%, one study, N = 59) or in secondary outcomes. The review authors concluded that there is no clear evidence that antenatal CTG improves perinatal outcomes, but that additional studies focussing on the use of computerised CTG in specific populations of women at high risk of complications are warranted.

Flenady V, Middleton P, Smith GC, et al. 2011. **Stillbirths: the way forward in high-income countries**. The Lancet, 377(9778), 1703-17.

This paper, which is one of six in the Lancet's 2011 Stillbirth Series, notes that in developed countries, disparities in stillbirth rates between different population groups indicate that there is scope for further reductions in stillbirth rates. Overweight, obesity and smoking are important modifiable risk factors. Advanced maternal age is also a risk factor. A substantial proportion of stillbirths are linked to placental pathologies and infection associated with preterm birth. National perinatal mortality audit programmes aimed at improving the quality of care could reduce stillbirth rates and an international consensus on definitions and classifications related to stillbirth is necessary. All parents should be offered a thorough investigation including a high-quality autopsy and placental histopathology. Future research should focus on screening and interventions to reduce antepartum stillbirth as a result of placental dysfunction.

The other papers in the Lancet stillbirth series, which provide a global perspective on the issue of stillbirth, are:

Frøen JF, Cacciatore J, McClure EM, et al. 2011. **Stillbirths: why they matter**. The Lancet, 377(9774), 1353-66.

Lawn JE, Blencowe H, Pattinson R, et al. 2011. **Stillbirths: Where? When? Why? How to make the data count?** The Lancet, 377(9775), 1448-63.

Bhutta ZA, Yakoob MY, Lawn JE, et al. 2011. **Stillbirths: what difference can we make and at what cost?** The Lancet, 377(9776), 1523-38.

Pattinson R, Kerber K, Buchmann E, et al. **Stillbirths: how can health systems deliver for mothers and babies?** The Lancet, 377(9777), 1610-23.

Goldenberg RL, McClure EM, Bhutta ZA, et al. 2011. **Stillbirths: the vision for 2020**. Lancet, 377(9779), 1798-805.

Flenady V, Koopmans L, Middleton P, et al. 2011. **Major risk factors for stillbirth in high-income countries: a systematic review and meta-analysis.** Lancet, 377(9774), 1331-40.

This systematic review included 96 population-based studies. The highest ranking modifiable risk factor for stillbirth was found to be maternal obesity with a population attributable risk (PAR) calculated to be 8 -18% across five countries (Australia, Canada, Netherlands, UK, and USA). Advanced maternal age (>35 years) had a PAR of 7–11% and maternal smoking had a PAR of 4–7%. In disadvantaged populations the PAR for smoking could be as high as 20%. Primiparity contributes to about 15% of stillbirths. Placental pathology has an important role in stillbirth, as indicated by the PARs for small-for-gestational-age (23%) and placental abruption (15%). Pre-existing maternal diabetes and hypertension still contribute to stillbirth in high income countries. Priority areas for stillbirth prevention are raising awareness and implementing interventions to address obesity, maternal age and smoking.

Other relevant publications

PMMRC. 2014. **Eighth Annual Report of the Perinatal and Maternal Mortality Review Committee: Reporting mortality 2012.** Wellington: Health Quality & Safety Commission. http://www.hqsc.govt.nz/assets/PMMRC/Publications/eighth-PMMRC-report-June-2014.pdf

The Perinatal and Maternal Mortality Review Committee (PMMRC) reviews all perinatal and maternal deaths in New Zealand with the aim of identifying areas for improvement in maternal and newborn care. This report is based on the data collected by the Mortality Review Data Group. A perinatal death is defined as one occurring after 20 weeks gestation (or of a baby weighing at least 400g if gestation is unknown) and up to and including the 28th day of life. Besides reporting statistics, the report also makes recommendations for future work by the PMMRC, the Ministry of Health, lead maternity cares, DHBs and others. Key findings regarding stillbirth were:

- There was a significant reduction in stillbirth rates from 2007 to 2012, which was independent of demographic changes. The rates (per 1,000 total babies born at 20 weeks or beyond, or weighing at least 400g if gestation was unknown) were 5.6, 5.8, 6.1, 5.3, 5.3 and 5.1 in 2007–2012 respectively
- There was a significant reduction in unexplained antepartum stillbirth and hypoxic peripartum stillbirth, which contributed to the observed reduction

Multivariate analysis of data for women booked with a lead maternity carer indicated that the following women are at increased risk of stillbirth: women with a high body mass index (the risk increase as the BMI increases beyond 25 kg/m^2), women who smoke during pregnancy, women of Indian ethnicity, and women having their first birth. Each of these risk factors is independent of the others and of age and socio-economic deprivation.

The most commonly reported classification of fetal deaths was unexplained (27% of all stillbirths and 37% of stillbirths at term) and other classifications which each accounted for 10–15% of stillbirths were congenital abnormalities, antepartum haemorrhage, specific perinatal conditions, fetal growth restriction and spontaneous preterm birth.

Redshaw M, Rowe R, Henderson J. 2014. **Listening to Parents after stillbirth or the death of their baby after birth**. Oxford, UK: National Perinatal Epidemiology Unit, University of Oxford. https://www.npeu.ox.ac.uk/downloads/files/listeningtoparents/report/Listening%20to%20Parents%20Report%20-%20March%202014%20-%20FINAL%20-%20PROTECTED.pdf

This is the report of national survey of women who registered a stillbirth or a neonatal death in two three-month periods in 2012–2013 in England. In all, 720 women were included, a response rate of 30%. The questions addressed in this report were focussed on the recent experiences of the parents, their maternity care and key areas of concern. The findings are presented separately for women who had a stillborn baby and those who had a baby who died in the neonatal period. Just over half the women who had a stillbirth had problems in their pregnancies and most of these women had additional specialist care. These women were most positive about their care in labour and most critical of their care in pregnancy. Around two thirds of women whose babies were stillborn before labour felt that something was wrong, mostly commonly because of decreased fetal movements (72%).

Edmunds SF, Silver RM. 2013. **Stillbirth reduction efforts and impact on early births**. Clin Perinatol, 40(4), 611-28

This article discusses the pros and cons of intentional delivery before 39 weeks gestation in order to reduce the risk of stillbirth. Infants born before 39 weeks are at increased risk for neonatal death and morbidity due to complications of prematurity, therefore it is critical to identify in which circumstances the fetus is at high enough risk for stillbirth to justify late preterm or early term birth. Examples of conditions where early delivery may be justified are hypertensive disorders of pregnancy, diabetes, intra-uterine growth restriction, placental abnormalities, some birth defects, multiple gestation, and abnormal fetal testing. It is stated that the optimal gestational age for delivery in many of these conditions is uncertain. It is also stated that there is no evidence that delivery before 39 weeks gestation reduces the risk of recurrent stillbirth but acknowledges that obstetricians caring for women who have had a previous stillbirth, and the women themselves, tend to desire early delivery. This paper summarises the guidance regarding timing of delivery for particular conditions complicating pregnancy contained in the following paper:

Spong CY, Mercer BM, D'Alton M, et al. **Timing of indicated late-preterm and early-term birth**. Obstet Gynecolol 2011;118:326–7.

Moewaka Barnes H, Moewaka Barnes A, Baxter J, et al. 2013. **Hapū Ora: Wellbeing in the Early Stages of Life**. Auckland: Whāriki Research Group, Massey University. http://www.massey.ac.nz/massey/learning/departments/centres-research/shore/projects/hapu-ora.cfm

This is the report of a project funded by the partnership programme of the Health Research Council of New Zealand and the Ministry of Health. The project aimed to identify Māori life course research priorities, with a specific focus on wellbeing at the early stage of life, hapū ora (the fetal/gestational and neonatal periods). While the report does not specifically consider the prevention of fetal death, it does

contain much information relevant to those who are involved in providing maternity care for Māori, particularly in Chapter 4, which reviews literature on antenatal, labour and delivery care for Māori, and in Chapter 5, which outlines views from the health sector gathered from both individuals and groups.

Stacey T, Thompson JM, Mitchell EA, et al. 2012. **Antenatal care, identification of suboptimal fetal growth and risk of late stillbirth: findings from the Auckland Stillbirth Study**. Australian & New Zealand Journal of Obstetrics & Gynaecology, 52(3), 242-7. http://onlinelibrary.wiley.com/doi/10.1111/j.1479-828X.2011.01406.x/abstract

This paper reports findings from the Auckland Stillbirth Study, a case control study which included 155 cases (out of 215 invited) cases and 310 controls (out of 429 invited). Increased risk of late stillbirth was found to be associated with accessing <50% of recommended antenatal visits compared to accessing the recommended number of visits (adjusted odds ratio, aOR, 2.68; 95% CI, 1.04–6.90) and with having a small-for-gestational-age (SGA) baby that had not been identified as being SGA prior to birth (aOR, 9.46; 95% CI, 1.98–45.13), compared to having a SGA baby that was identified as such antenatally. There was no association found between the type or model of maternity care provider at booking and late stillbirth risk. The authors stated that their findings reinforced the importance of regular antenatal care attendance, which may identify babies that are SGA and thus reduce the chances of them being stillborn.

Peat AM, Stacey T, Cronin R, et al. 2012. **Maternal knowledge of fetal movements in late pregnancy**. Australian & New Zealand Journal of Obstetrics & Gynaecology, 52(5), 445-9

This paper reports on a study which involved interviewing a convenience sample of 100 women attending two antenatal clinics in Auckland in November and December 2011 to determine what information women in their third trimester of pregnancy receive about fetal movements, both from their lead maternity carer and from other sources. The study results indicated that 97% of women reported that their lead maternity carer regularly asked about fetal movements. Sixty-two percent recalled receiving information from their LMC about what to expect regarding fetal movements in the last three months of pregnancy. Thirty-three percent reported that the information they received from their LMC was that their baby's movements should increase or stay the same, and 20% that their baby's movements may decrease in late pregnancy. Forty per cent were advised to contact their LMC if they had any concerns about their baby's movements, and one-quarter were told to seek advice if they had fewer than 10 movements in a day. The study authors concluded that their results suggested that some pregnant women in Auckland lack optimum information about fetal movements. They stated that strategies to enhance maternal knowledge, such as pamphlet provision, could be helpful.

Websites

Ministry of Health. 2014. **Fetal and Infant Deaths 2011.** http://www.health.govt.nz/publication/fetal-and-infant-deaths-2011

This website presents key findings regarding fetal and infant deaths in 2011. It has downloadable tables which present a summary of fetal and infant deaths with a focus on deaths and stillbirths registered in 2011 with the Births, Deaths, Marriages and Citizenship Registry (BDM). The tables include information on demographic characteristics (such as ethnicity and sex), cause of death, gestation and birthweight, and also information on deaths classified as sudden infant death syndrome (SIDS) and sudden unexpected death in infancy (SUDI).

PRETERM BIRTH

Introduction

A preterm birth is defined by the World Health Organization as a baby born alive before 37 completed weeks of pregnancy.[7] Spontaneous preterm birth is the leading cause of neonatal death worldwide (death occurring before 28 days of age).[7] The risk of death is inversely proportional to gestational age. In New Zealand in 2012, 32% of all neonatal deaths were reported to be due to spontaneous preterm birth.[5] Rates of preterm birth are increasing in almost all countries with reliable data.[7] There are three main reasons given for this elsewhere.[8] Firstly, rates of multiple pregnancy are increasing due to increasing average maternal age and the use of fertility treatments. (Multiple pregnancy is associated with a much higher likelihood of preterm birth and older mothers are more likely to have twins than younger mothers.) Secondly, the numbers of planned early deliveries has increased because, as outcomes for preterm infants have improved due to advances in medical care, the risk associated with iatrogenic early delivery has become lower than the risk associated with the baby remaining in utero in cases of pregnancy complications such as placenta praevia, hypertension and diabetes.[9] Thirdly, a number of risk factors for preterm birth have become more common, including in-vitro fertilisation, older maternal age, and high body mass index. However, this is not so in New Zealand where rates have stayed fairly constant for the last fifteen years. In New Zealand in 2012, 7.6% of babies were born preterm: 1.3% at less than 32 weeks gestation and 6.3% at 32–36 weeks gestation.[10]

Babies born prematurely, especially those born very prematurely, are at risk of severe morbidity in their early life from conditions including bronchopulmonary dysplasia, respiratory distress syndrome, necrotising enterocolitis, intraventricular haemorrhage, retinopathy of prematurity, and sepsis.[8] They are also at risk of lifelong neurodevelopmental problems including cerebral palsy and learning disorders.[8] The causes of spontaneous preterm birth are currently not well understood and the available interventions are of limited effectiveness.[11] An important function of antenatal care is to identify women at risk of preterm birth. The most significant risk factor by far is a previous history of preterm delivery.[8] At the population level, interventions to reduce smoking and intimate partner violence, improve access to family planning to reduce the number of closely spaced pregnancies, and provide support to socially disadvantaged women could help reduce preterm birth rates.[12]

The following section reports on preterm birth rates using information from the Birth Registration Dataset.

Data sources and methods

Indicator

Proportion of live babies born prematurely

Data sources

Birth registration dataset

Numerator: Live births between 20–36 weeks gestation

Denominator: Live births

National Minimum Dataset

Numerator: In-hospital live births between 20–36 weeks gestation

Denominator: In-hospital live births

Definition

Preterm birth per 100 live births

Notes on interpretation

Note 1: Year is year of registration, rather than year of birth.

Note 2: In this analysis, stillborn infants have been excluded due to advice from the Ministry of Health that the Birth Registration dataset provides less reliable information on stillborn infants than the National Mortality Collection. Stillbirth rates, however, are reviewed in the Fetal Deaths section.

Note 3: Preterm births were classified according to the criteria of WHO into groups of 20–27, 28–31, and 32–36 completed weeks (http://www.who.int/mediacentre/factsheets/fs363/en/)

Note 4: In the length of stay analyses (LOS), the set is limited to babies born in-hospital as identified by an event type code of 'BT'. Plurality was assigned using the 'Z38' code.

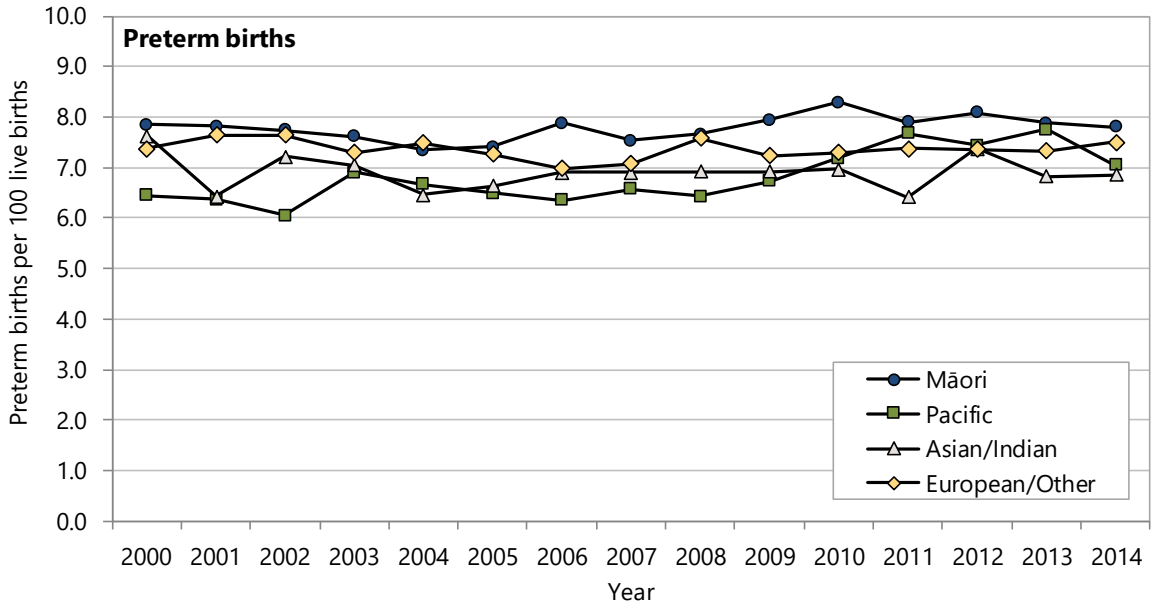
Note 5: An overview of the Birth Registration and National Minimum Datasets are provided in **Appendix 3**.

National trends and distribution

From 2000 to 2014 the pre-term birth rate in New Zealand was stable at around 7.4% of live births. Over the same time period around 0.5% of all live births occurred at 20–27 weeks gestation, 0.8% at 28–31 weeks and around 6.1% at 32–36 weeks.

This stable pattern over time was observed for all ethnic groups, with Māori pre-term birth rates generally higher than rates for other ethnic groups. Since 2010 the pre-term birth rates for Asian/Indian infants have been generally lower than for other ethnic groups **(Figure 12)**.

Figure 12. Preterm live births, by ethnicity, New Zealand 2000–2014

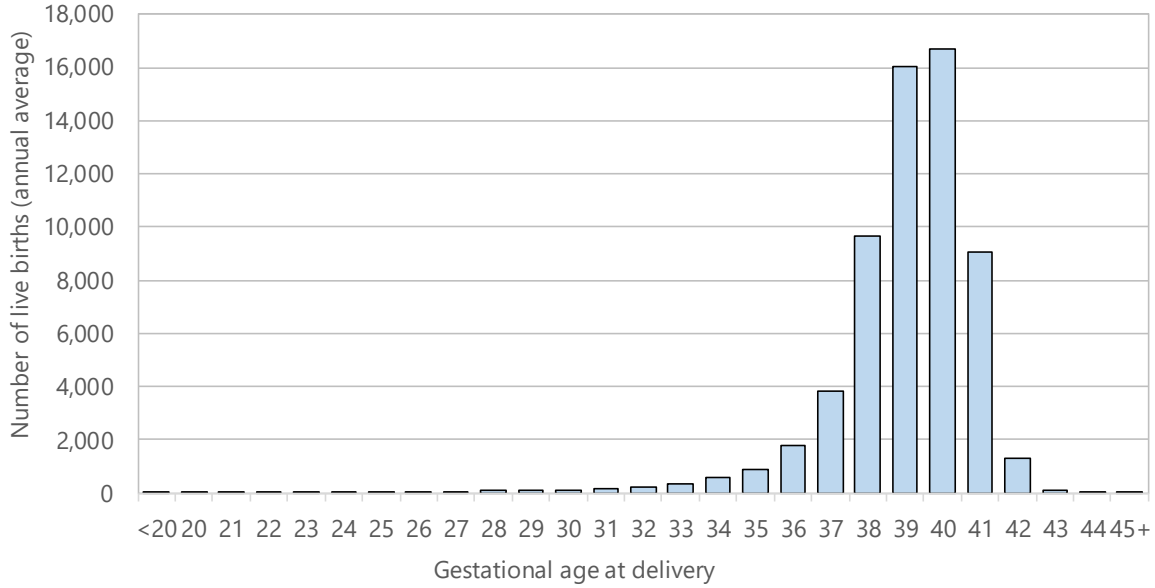


Birth Registration Dataset; Numerator: live births between 20–36 weeks gestation. Denominator: live births; Preterm live birth rate is per 100 live births; Ethnicity is level 1 prioritised

Distribution by demographic factors

Between 2010 and 2014 there were *small but significant* disparities in pre-term birth rates by NZDep2013 score, ethnicity, maternal age, and infant sex. The greatest disparity was observed with plurality which is also discussed on **page 40**. Rates of pre-term birth were *significantly higher* for infants living in areas with higher scores on NZDep2013 (deciles 7–10) compared with deciles 1–6 and for Māori infants compared with Pacific, MELAA and European/Other infants. Pre-term birth rates were *significantly lower* for Asian/Indian infants than for other ethnic groups. There was an association with maternal age with *significantly higher* pre-term birth rates for infants born to mothers aged under 20 years and aged over 35 years, compared with mothers aged 25–34 years. Pre-term birth rates were *significantly higher* for male compared with female infants. There was a strong association between plurality and pre-term birth with *significantly higher* rates for multiple compared with singleton pregnancies. Pre-term birth was over nine times more likely for twins compared with singletons, and over 16 times more likely for other multiple births **(Table 15)**. Between 2010 and 2014 most live births occurred after 36 weeks gestation with an average of 4,611 pre-term births each year **(Figure 13)**.

Figure 13. Distribution of live births, by gestational age at delivery, New Zealand 2010–2014



Birth Registration Dataset. Numerator: All live births (annual average); Gestational age is in week

Table 15. Preterm live births, by demographic factors, New Zealand 2010–2014

Variable	Number: 2010–2014	Number: annual average	Rate per 100 live births	Rate ratio	95% CI
Preterm births					
NZDep2013 Index of deprivation quintile					
Deciles 1–2	3,233	647	7.17	1.00	
Deciles 3–4	3,552	710	7.17	1.00	0.96–1.05
Deciles 5–6	4,096	819	7.27	1.01	0.97–1.06
Deciles 7–8	5,133	1,027	7.61	1.06	1.02–1.11
Deciles 9–10	6,892	1,378	7.89	1.10	1.06–1.14
Prioritised ethnicity					
Māori	7,085	1,417	8.01	1.08	1.05–1.11
Pacific	2,523	505	7.42	1.00	0.96–1.05
Asian/Indian	2,869	574	6.90	0.93	0.90–0.97
MELAA	362	72	6.67	0.90	0.81–1.00
European/Other	10,159	2,032	7.40	1.00	
Maternal age					
<20 years	1,570	314	8.43	1.19	1.13–1.26
20–24 years	4,108	822	7.31	1.03	0.99–1.07
25–29 years	5,491	1,098	7.00	0.99	0.95–1.02
30–34 years	6,182	1,236	7.08	1.00	
35+ years	5,655	1,131	8.53	1.20	1.16–1.25
Gender					
Female	10,568	2,114	7.08	1.00	
Male	12,438	2,488	7.89	1.11	1.09–1.14
Plurality					
Singleton	17,954	3,591	6.02	1.00	
Twins	4,847	969	57.17	9.50	9.28–9.72
Multiple	205	41	97.16	16.14	15.7–16.6

Birth Registration Dataset; Numerator: live births between 20–36 weeks gestation; Denominator: live births; Preterm live birth rate is per 100 live births; Rate ratios are unadjusted; Infant ethnicity is level 1 prioritised; Decile is NZDep2013

Plurality and gestational age

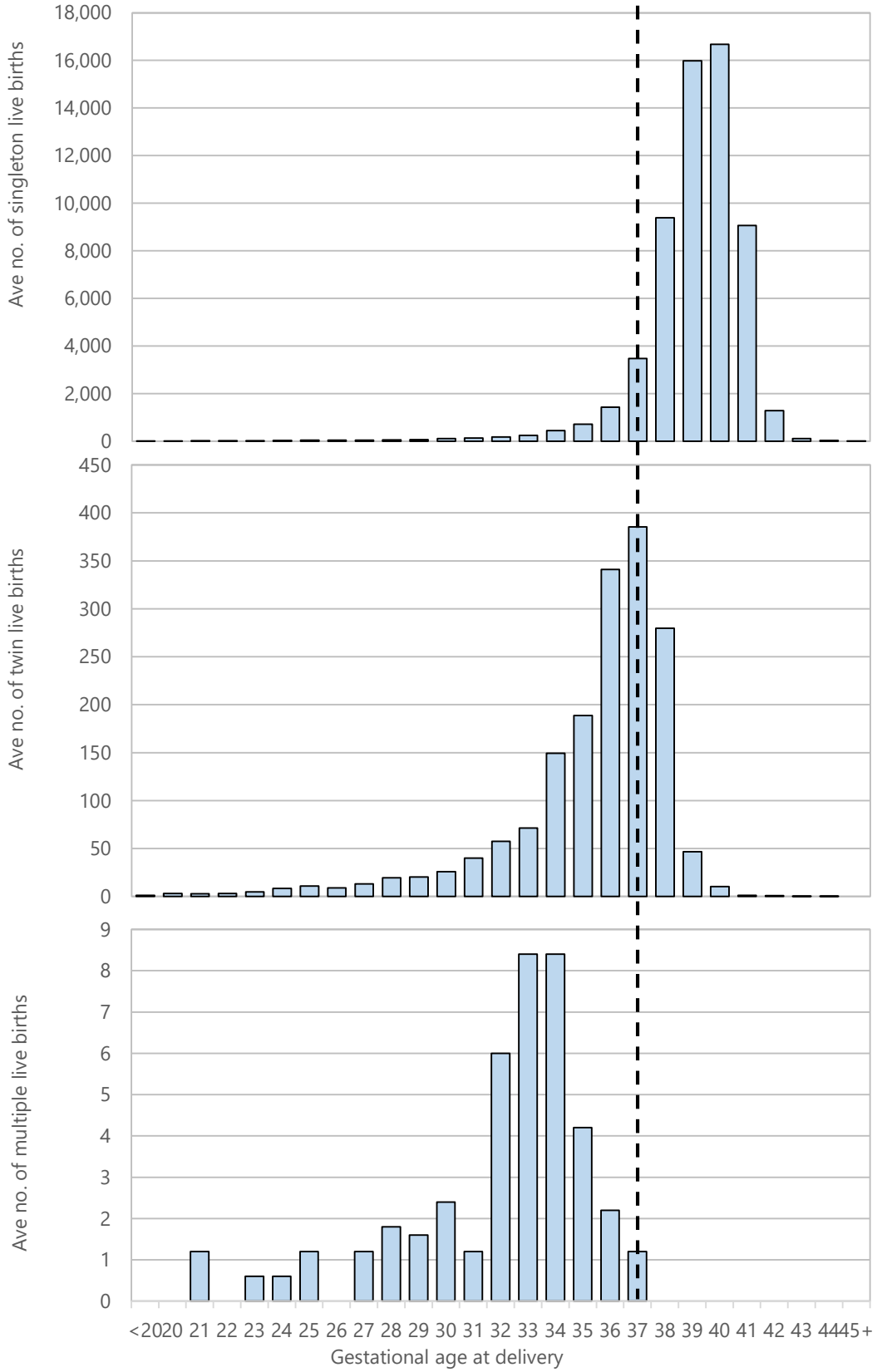
Between 2010 and 2014 there were 17,954 live pre-term births of singleton infants, 4,847 twins and 205 other multiple births. The distribution by gestational age differed by plurality, with pre-term birth rates of 6.0% of live singleton births, 57.2% of live twin births and 97.2% of other live multiple births **(Table 16)**. The peak gestational age at birth for singleton infants was 40 weeks, for twins 37 weeks and for other multiple births 33–34 weeks **(Figure 14)**.

Table 16. Preterm live births, by plurality, New Zealand 2010–2014

Gestational age (weeks)	Number: 2010–2014	Rate 100 live births	95% CI	Gestational age (weeks)	Number: 2010–2014	Rate 100 live births	95% CI
Preterm births							
Total				Singleton			
20–27	1,440	0.47	0.45–0.49	20–27	1,140	0.38	0.36–0.41
28–31	2,358	0.77	0.74–0.80	28–31	1,793	0.60	0.57–0.63
32–36	19,208	6.26	6.17–6.35	32–36	15,021	5.04	4.96–5.12
37+ weeks	283,745	92.46	92.4–92.6	37+ weeks	280,114	93.93	93.9–94.0
20–36	23,006	7.50	7.40–7.59	20–36	17,954	6.02	5.94–6.11
Twins				Other multiple birth			
20–27	276	3.26	2.90–3.65	20–27	24	11.37	7.76–16.4
28–31	530	6.25	5.76–6.79	28–31	35	16.59	12.2–22.2
32–36	4,041	47.66	46.6–48.7	32–36	146	69.19	62.7–75.0
37+ weeks	3,625	42.76	41.7–43.8	37+ weeks	6	2.84	1.31–6.06
20–36	4,847	57.17	56.1–58.2	20–36	205	97.16	93.9–98.7

Birth Registration Dataset. Numerator: live births between 20–36 weeks gestation; Denominator: live births by plurality; Preterm live birth rate is per 100 live births; Rate ratios are unadjusted

Figure 14. Distribution of live births, by plurality and gestational age at delivery, New Zealand 2010–2014



Birth Registration Dataset; Rate is per 100 live births. Note that the numbers are very different at each level of plurality and accordingly the scales on the y-axes differ considerably

Plurality: Distribution by demographic factors

Between 2010 and 2014 there was *no significant difference* in the pre-term birth rates of twins by NZDep2013 score or infant sex. Pre-term birth rates were *slightly but significantly lower* for Māori twins compared with

European/Other and *slightly but significantly higher* for Asian/Indian compared with European/Other. Pre-term birth rates were *significantly higher* for twins born to mothers aged under 20 years and aged 25–29 years compared with mothers aged 30–34 years (**Table 17**).

In the same time period pre-term birth rates were *significantly higher* for other multiple births of infants in areas with mid-range to high NZDep2013 scores (deciles 3–10) compared with multiple birth infants in areas with the lowest NZDep2013 scores (deciles 1–2). There were no pre-term other multiple births to mothers aged under 20 years. Pre-term birth rates were *significantly higher* for infants born to mothers aged 20–29 and over 35 years compared with mothers aged 30–34 years and for male multiple birth infants compared with female infants (**Table 18**).

Table 17. Distribution of preterm live births among twins, by demographic factor, New Zealand 2010–2014

Variable	Number: 2010–2014	Number: annual average	Rate per 100 live births	Rate ratio	95% CI
Preterm births					
Twins					
NZDep2013 Index of deprivation quintile					
Deciles 1–2	828	166	58.4	1.00	
Deciles 3–4	853	171	60.5	1.04	0.97–1.10
Deciles 5–6	928	186	57.4	0.98	0.92–1.04
Deciles 7–8	1,008	202	56.2	0.96	0.91–1.02
Deciles 9–10	1,220	244	55.2	0.95	0.89–1.00
Prioritised ethnicity					
Māori	1,346	269	55.1	0.95	0.91–0.99
Pacific	484	97	54.9	0.95	0.89–1.01
Asian/Indian	500	100	63.2	1.09	1.03–1.16
MELAA	88	18	52.1	0.90	0.78–1.04
European/Other	2,429	486	57.9	1.00	
Maternal age					
<20 years	191	38	64.1	1.16	1.06–1.27
20–24 years	669	134	55.8	1.01	0.95–1.07
25–29 years	1,120	224	59.1	1.07	1.02–1.13
30–34 years	1,414	283	55.2	1.00	
35+ years	1,453	291	57.5	1.04	0.99–1.09
Gender					
Female	2,467	493	57.8	1.00	
Male	2,380	476	56.5	0.98	0.94–1.01

Birth Registration Dataset; Numerator: live births between 20–36 weeks gestation; Denominator: live births; Preterm live birth rate is per 100 live births; Rate ratios are unadjusted; Infant ethnicity is level 1 prioritised; Decile is NZDep2013

Table 18. Distribution of preterm live births among multiple births, by demographic factor, New Zealand 2010–2014

Variable	Number: total 2010–2014	Number: annual average	Rate per 100 live births	Rate ratio	95% CI
Preterm births					
Multiple births					
NZDep2013 Index of deprivation quintile					
Deciles 1–2	32	6	91.4	1.00	
Deciles 3–4	42	8	97.7	1.07	0.96–1.19
Deciles 5–6	18	4	100.0	1.09	0.99–1.21
Deciles 7–8	62	12	100.0	1.09	0.99–1.21
Deciles 9–10	48	10	96.0	1.05	0.93–1.18
Prioritised ethnicity					
Māori	48	10	100.0	1.03	1.00–1.07
Pacific	24	5	92.3	0.95	0.85–1.07
Asian/Indian	18	4	94.7	0.98	0.87–1.09
MELAA	15	3	100.0	1.03	1.00–1.07
European/Other	100	20	97.1	1.00	
Maternal age					
<20 years	0	..	..	..	..
20–24 years	27	5	100.0	1.06	0.99–1.14
25–29 years	51	10	96.2	1.02	0.94–1.12
30–34 years	47	9	94.0	1.00	
35+ years	80	16	98.8	1.05	0.98–1.13
Gender					
Female	117	23	98.3	1.00	
Male	88	18	95.7	0.97	0.93–1.02

Birth Registration Dataset. Numerator: live births between 20–36 weeks gestation; Denominator: live births; Preterm live birth rate is per 100 live births; Rate ratios are unadjusted; Infant ethnicity is level 1 prioritised; Decile is NZDep2013

Length of stay by plurality and gestational age

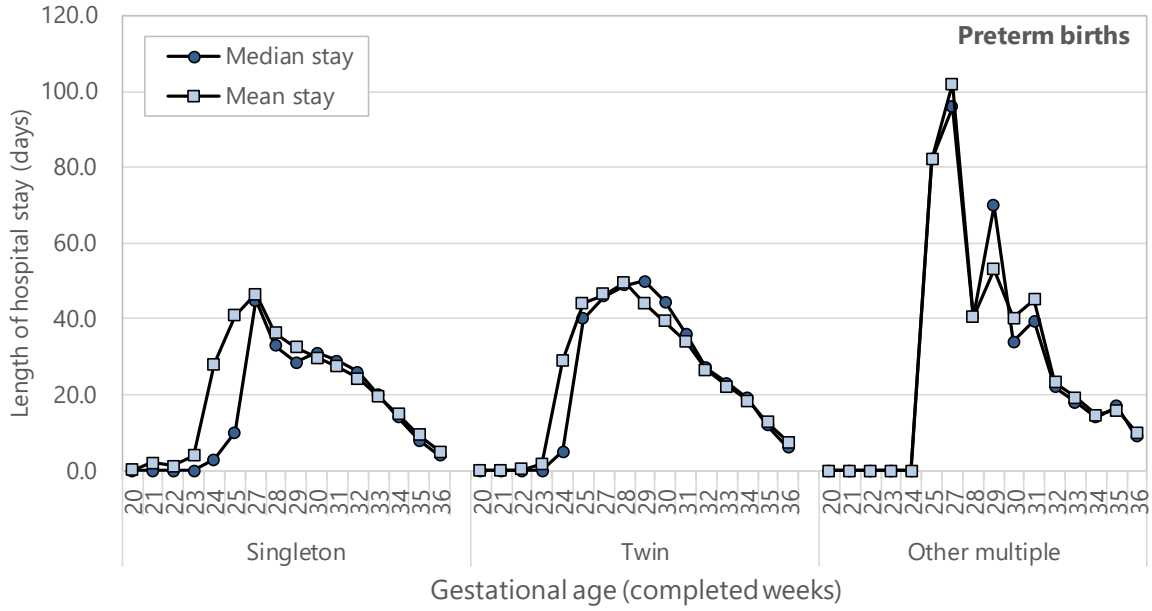
The mean and median length of stay for pre-term twins were longer than for singleton infants, and were higher still for other multiple births **(Table 19).** The increased length of stay was more noticeable for twins and other multiple births at less than 32 weeks gestational age compared with 32–36 weeks gestational age **(Figure 15).**

Table 19. Length of hospital stay of preterm babies, by plurality, New Zealand 2010–2014

Variable	Number: total 2010–2014	Length of hospital stay (days)	
		Mean	Median
Preterm births			
Singleton	16,184	12	7
Twins	4,473	16	11
Multiple	184	23	18

National Minimum Dataset (hospital live births between 20–36 weeks gestation)

Figure 15. Length of hospital stay of preterm babies, by plurality and gestation, New Zealand 2010–2014

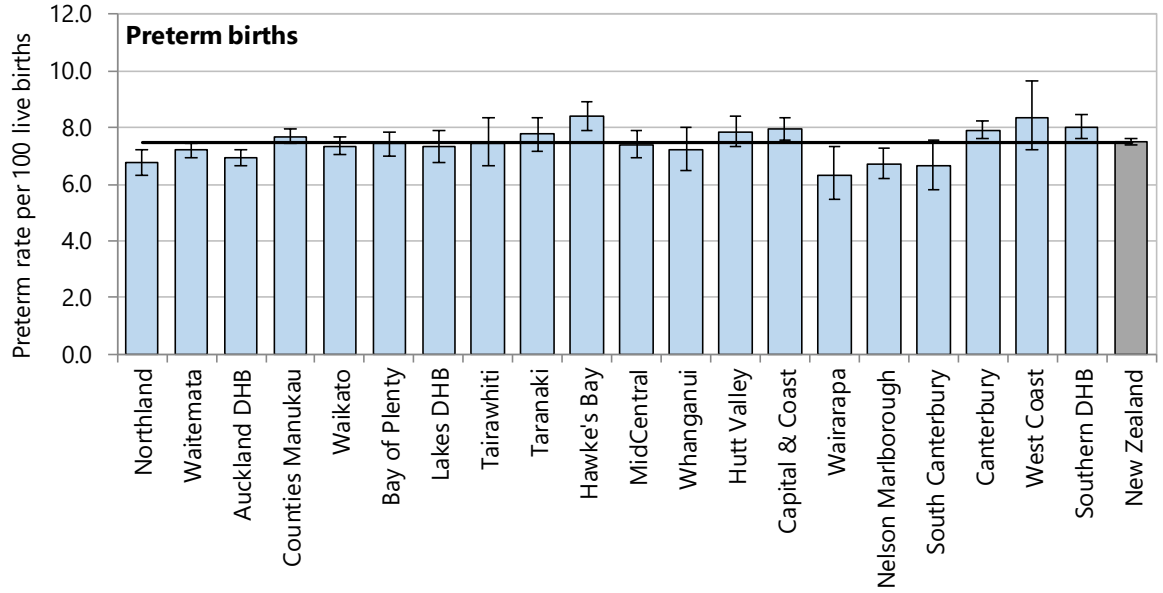


National Minimum Dataset (hospital live births between 20–36 weeks gestation)

Distribution by region

Pre-term birth rates were close to the New Zealand rate in all DHBs but were *significantly higher* in Counties Manukau, Taranaki, Hawke's Bay, Hutt Valley, Capital & Coast, Canterbury, West Coast, and Southern DHBs, and *significantly lower* in Northland, Auckland, Waitemata, Whanganui, Wairarapa, Nelson Marlborough and South Canterbury DHBs **(Figure 16**, **Table 20)**.

Figure 16. Preterm live births, by district health board, New Zealand 2010–2014



Birth Registration Dataset; Numerator: live births between 20–36 weeks gestation; Denominator: live births; Preterm live birth rate is per 100 live births

Table 20. Distribution of preterm live births, by district health board, New Zealand 2010–2014

DHB	Number: 2010–2014	Number: annual average	Rate per 100 live births	Rate ratio	95% CI
Preterm births					
Northland	773	155	6.76	0.90	0.84–0.97
Waitemata	2,837	567	7.21	0.96	0.93–1.00
Auckland	2,224	445	6.94	0.93	0.89–0.96
Counties Manukau	3,278	656	7.69	1.03	0.99–1.06
Waikato	1,995	399	7.36	0.98	0.94–1.03
Bay of Plenty	1,071	214	7.42	0.99	0.93–1.05
Lakes	551	110	7.31	0.98	0.90–1.06
Tairawhiti	274	55	7.47	1.00	0.89–1.12
Taranaki	604	121	7.76	1.04	0.96–1.12
Hawke's Bay	941	188	8.40	1.12	1.05–1.19
MidCentral	824	165	7.39	0.99	0.92–1.05
Whanganui	307	61	7.22	0.96	0.86–1.07
Hutt Valley	782	156	7.85	1.05	0.98–1.12
Capital & Coast	1,502	300	7.94	1.06	1.01–1.11
Wairarapa	164	33	6.34	0.85	0.73–0.98
Nelson Marlborough	532	106	6.72	0.90	0.82–0.97
South Canterbury	205	41	6.63	0.88	0.77–1.01
Canterbury	2,437	487	7.92	1.06	1.02–1.10
West Coast	172	34	8.35	1.11	0.97–1.29
Southern	1,433	287	8.03	1.07	1.02–1.13
New Zealand	23,006	4,601	7.50	1.00	0.00

Birth Registration Dataset; Numerator: live births between 20–36 weeks gestation; Denominator: live births; Preterm live birth rate is per 100 live births

Northern region distribution and trends

Comparison with New Zealand

Between 2010 and 2014 the preterm birth rates in Counties Manukau were similar to the New Zealand rate, while rates in Northland, Waitemata, and Auckland DHBs were *significantly lower* (**Table 21**).

Table 21. Preterm live births, Northern DHBs vs New Zealand 2010–2014

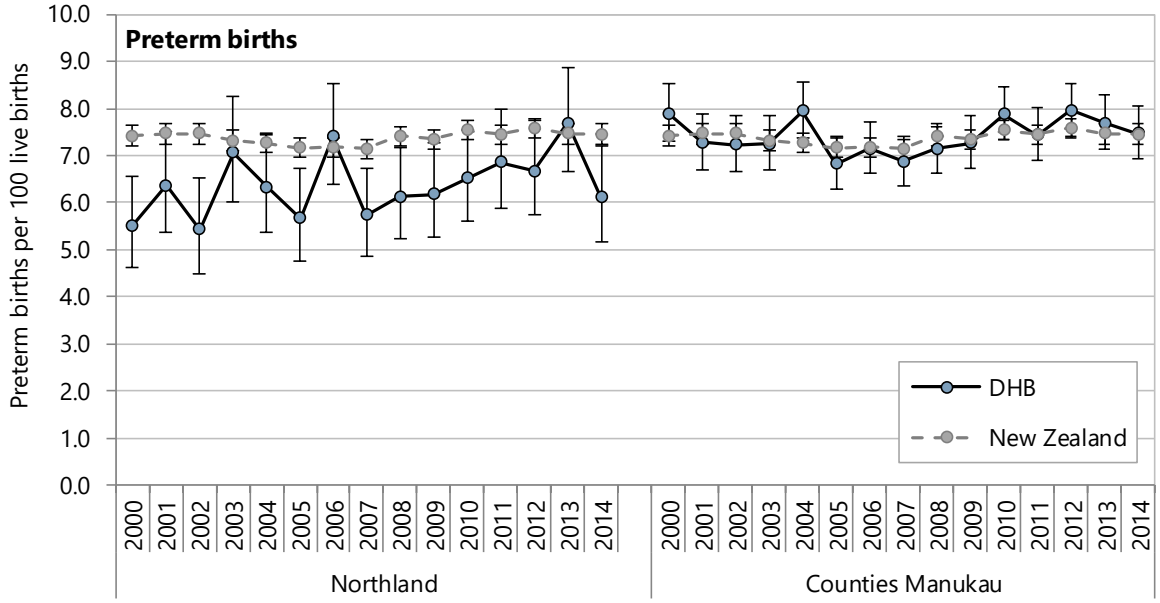
DHB	Number: 2010–2014	Number: annual average	Rate per 100 live births	Rate ratio	95% CI
Preterm births					
Northland	773	155	6.76	0.90	0.84–0.97
Waitemata	2,837	567	7.21	0.96	0.93–1.00
Auckland	2,224	445	6.94	0.93	0.89–0.96
Counties Manukau	3,278	656	7.69	1.03	0.99–1.06
New Zealand	23,006	4,601	7.50	1.00	

Birth Registration Dataset. Numerator: live births between 20–36 weeks gestation; Denominator: live births. Preterm live birth rate is per 100 live births

Regional trends

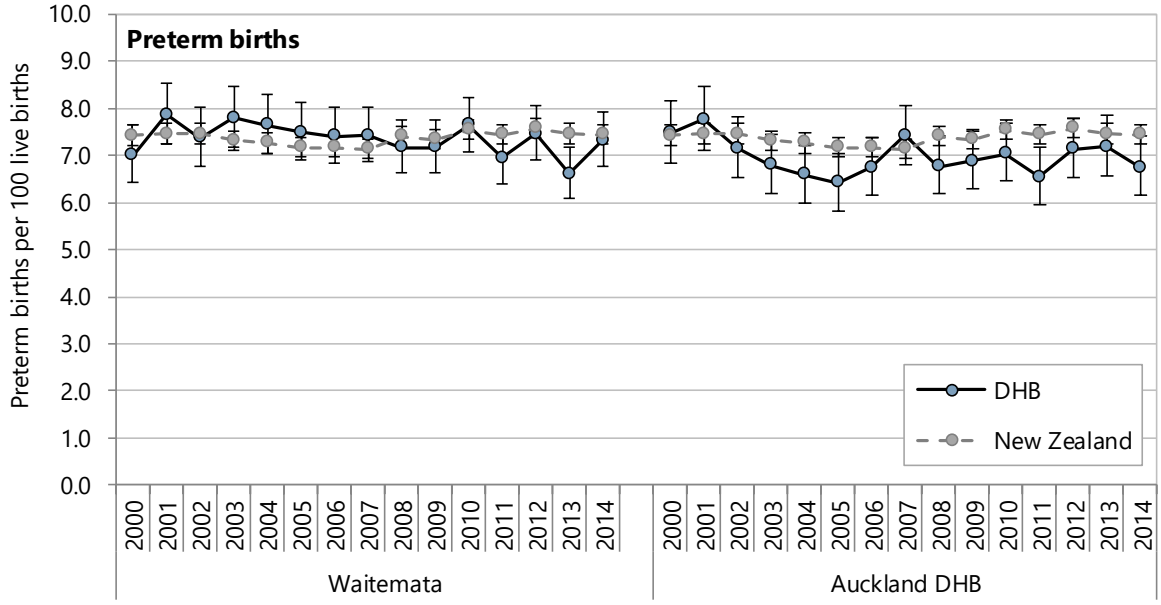
The preterm birth rate in Northland has fluctuated since 2000, and has generally been lower than the New Zealand rate. In Counties Manukau and Waitemata the preterm birth rates remained relatively stable between 2000 and 2014, while rates in Auckland DHB gradually decreased **(Figure 17**, **Figure 18)**.

Figure 17. Preterm live births, Northland and Counties Manukau DHBs vs New Zealand 2000–2014



Birth Registration Dataset. Numerator: live births between 20–36 weeks gestation; Denominator: live births

Figure 18. Preterm live births, Waitemata and Auckland DHBs vs New Zealand 2000–2014

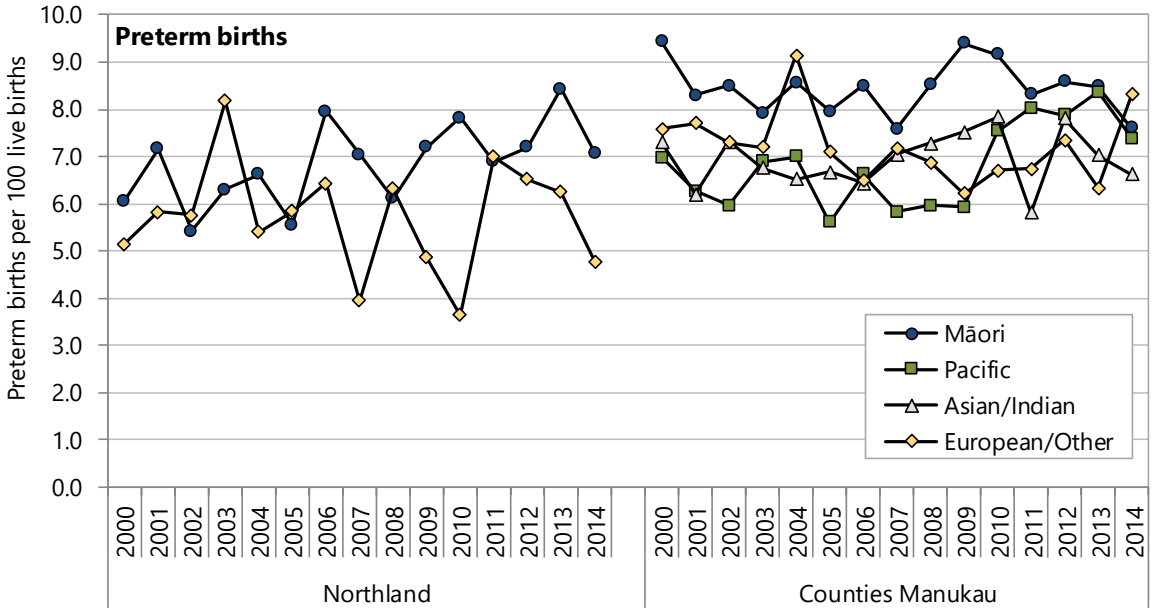


Birth Registration Dataset. Numerator: live births between 20–36 weeks gestation; Denominator: live births

Regional trends by ethnicity

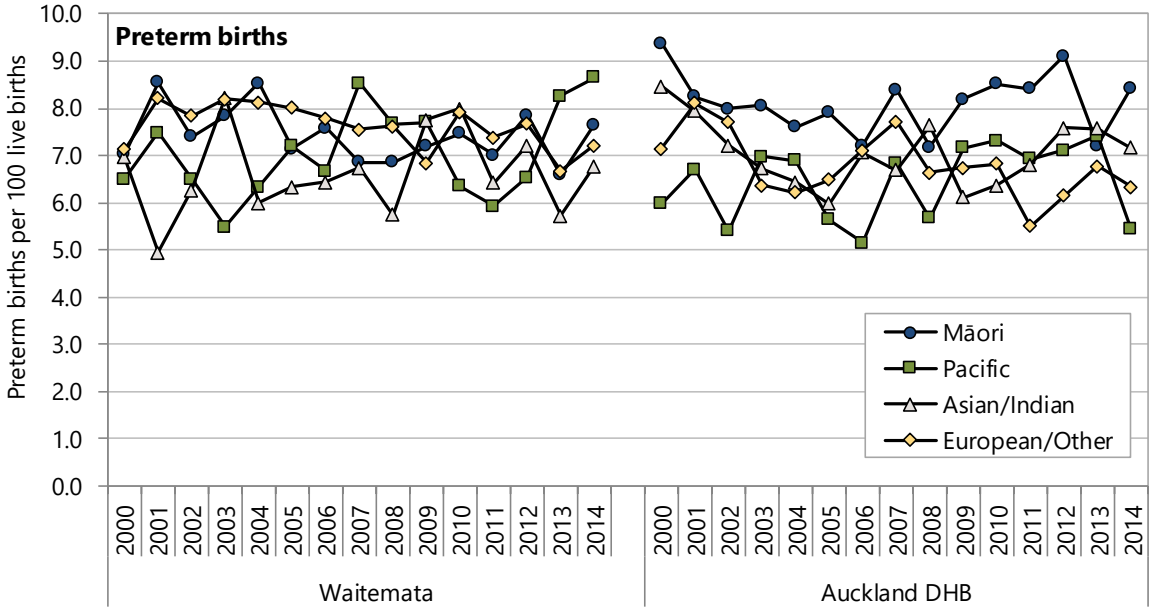
In Northland, Auckland DHB and Counties Manukau from 2000 to2014 preterm birth rates were higher for Māori than for European infants, although in Waitemata ethnic differences were less consistent **(Figure 12**, **Figure 20)**.

Figure 19. Preterm live births, by ethnicity, Northland and Counties Manukau DHBs 2000–2014



Birth Registration Dataset. Numerator: live births between 20–36 weeks gestation; Denominator: live births; Ethnicity is level 1 prioritised

Figure 20. Preterm live births, by ethnicity, Waitemata and Auckland DHBs 2000–2014



Birth Registration Dataset. Numerator: live births between 20–36 weeks gestation; Denominator: live births; Ethnicity is level 1 prioritised

Evidence for good practice for the prevention of spontaneous preterm birth

International guidelines
Roelens K, Roberfroid D, Ahmadzai N, et al. 2014. **Prevention of preterm birth in women at risk: Selected topics**. Brussels: Belgian Health Care Knowledge Centre (KCE). http://kce.fgov.be/sites/default/files/page_documents/KCE_228_Preterm%20birth_Report.pdf This Belgian guideline provides recommendations based on current scientific evidence for the secondary and tertiary prevention of spontaneous preterm birth. Secondary prevention applies to asymptomatic women at risk with: a history of preterm birth or surgery to the uterine cervix; short cervix measured by ultrasound; asymptomatic changes of cervix (e.g. funnelling, effacement or dilation). Tertiary prevention applies to women in preterm labour. Recommendations in the guideline are graded according to the GRADE approach.
National Collaborating Centre for Women's and Children's Health. 2011. **Multiple pregnancy: the management of twin and triplet pregnancies in the antenatal period**. London: National Institute for Health and Clinical Excellence. https://www.nice.org.uk/guidance/cg129 Women with twin and triplet pregnancies have a higher risk of preterm birth. This guideline is complementary to the NICE guideline 'Antenatal care: routine care for the healthy pregnant woman' (NICE clinical guideline 62) and it specifies the additional or different care that women with twin or triplet pregnancies should receive. Chapter 8 deals specifically with preterm birth. Following discussion of the research evidence, the following recommendations are made regarding the prevention of preterm birth and its associated risks: • Be aware that women who have had a previous premature singleton birth are at increased risk • Do not use fibronectin testing alone, home uterine activity monitoring, or routine cervical length measuring (with or without fetal fibronectin) to predict the risk of spontaneous preterm birth in twin and triplet pregnancies. • Do not use the following interventions (either alone or in combination) routinely to prevent spontaneous preterm birth in twin and triplet pregnancies: bed rest (either at home or in hospital), intramuscular or vaginal progesterone, cervical cerclage or oral tocolytics • Inform women with twin and triplet pregnancies about the benefits of targeted (when birth is imminent) corticosteroids • Do not use single or multiple untargeted (routine) courses of corticosteroids and inform women that there is no benefit from using untargeted corticosteroids. The full guideline, a 2012 evidence update, and the guideline appendices which include the details of the evidence review on which the guidance is based (including the evidence tables) can be found at: https://www.nice.org.uk/guidance/cg129/evidence
Systematic and other reviews from the international literature
The reviews in this section deal with interventions that may prevent preterm births in general, not interventions for treating women in preterm labour or with preterm rupture of membranes. The Cochrane library now contains a large number of reviews relevant to the treatment of such women. It is suggested that readers interested in these reviews consult the Cochrane library's pregnancy and childbirth reviews that are listed under the headings: Pre-labour rupture of membranes, and Preterm labour, at: http://www.cochranelibrary.com/app/content/browse/page/?context=topic/Pregnancy%20%26%20childbirth In addition, the following review, which provides an overview and summary of Cochrane reviews relevant to reducing the risk of preterm birth, may be useful.
Piso B, Zechmeister-Koss I, Winkler R. 2014. **Antenatal interventions to reduce preterm birth: an overview of Cochrane Systematic Reviews**. BMC Res Notes 7 265 http://www.ncbi.nlm.nih.gov/pubmed/24758148 This review of Cochrane reviews includes 56 Cochrane reviews. Three interventions have been shown in Cochrane reviews to increase the incidence of preterm birth (PTB): metronidazole treatment in pregnant women with asymptomatic trichomoniasis, vitamin C, and oestrogen supplementation. The latter is no longer in use due to its other negative effects. Regarding interventions shown to have positive effects in preventing PTB, the strongest evidence is for smoking cessation programmes, which have been shown to reduce low birthweight as well as PTB, and the treatment of clinical hypothyroidism in pregnancy with levothyroxine, which is standard practice. Cervical cerclage has been shown to reduce PTBs in women at high risk of PTB and progestogen reduces PTB in women with a previous history of PTB, but not in women with multiple pregnancies or at risk of PTB for other reasons. For women with a high risk of developing pre-eclampsia, two interventions reduced PTB risk, and also had a positive effect on other pregnancy outcomes: low dose aspirin after 12 weeks' gestation and calcium supplementation, although the latter also led to a small increase in the risk of HELLP syndrome. Calcium supplementation also seems to be beneficial for women with low dietary calcium intake, but not for the general population of pregnant women. For women in developing countries and undernourished women, rates of PTB could be reduced through advice to increase protein and energy intake and zinc supplementation.
Sosa Claudio G, Althabe F, Belizán José M, et al. 2015. **Bed rest in singleton pregnancies for preventing preterm birth**. Cochrane Database of Systematic Reviews (3) http://onlinelibrary.wiley.com/doi/10.1002/14651858.CD003581.pub3/abstract It is common for bed rest, either at home or in hospital, to be recommended for the prevention of preterm birth in women at high risk (for example because of a previous preterm birth or because of a short cervical length as measured by ultrasound). This review aimed to evaluate the effectiveness of prescription of bed rest for preventing preterm birth, using data from randomised, cluster-randomised, and quasi-randomised controlled trials that assessed clinical outcomes for women and their babies. There were two studies that met the review's inclusion criteria. One was unsuitable or meta-analysis as its data combined single and multiple pregnancies. This study, considered to be at low risk of selection, performance, detection and attrition bias, reported no differences in any maternal or perinatal outcomes. The other study, which provided the data that were included in the meta-analysis, involved 1266 women. There were 432 women who were prescribed bed rest at home and 834 women who received either a placebo (412 women) or no intervention (422 women). There was little difference between the intervention and control groups in preterm birth before 37 weeks: 7.9% in the intervention group vs. 8.5% in the control group; risk ratio 0.92, 95% CI 0.62 to 1.37. There were no other results reported for any of the other primary

or secondary outcomes. The review authors concluded that there is no evidence to either support or refute the use of bed rest, at home or in hospital, to prevent preterm birth. They stated that bed rest could have adverse effects on women and their families (such as deep vein thrombosis or the cost of care for other children) and increase health system costs so clinicians need to discuss the pros and cons of bed rest with women at increased risk of preterm birth.

Sangkomkamhang Ussanee S, Lumbiganon P, Prasertcharoensuk W, et al. 2015. **Antenatal lower genital tract infection screening and treatment programs for preventing preterm delivery**. Cochrane Database of Systematic Reviews (2). http://onlinelibrary.wiley.com/doi/10.1002/14651858.CD006178.pub3/abstract

Genital tract infection is associated with preterm birth; therefore it is possible that screening women for infection during pregnancy and treating identified infections could reduce the numbers of babies born prematurely. The authors of this review searched for all published and unpublished RCTs in any language that compared methods of antenatal lower genital tract infection screening with no screening, to assess the effectiveness of antenatal lower genital tract infection screening and treatment programs for reducing preterm birth and subsequent morbidity. They identified one study meeting their inclusion criteria (4155 women at <20 weeks' gestation). The 2058 women in the intervention group received infection screening and treatment for bacterial vaginosis, trichomonas vaginalis and candidiasis while the 2097 women in the control group also received screening but were not informed of the results and received only routine antenatal care. The women in the intervention group had a significantly lower rate of preterm birth: 3% vs. 5%, risk ratio (RR) of 0.55, 95% CI 0.41 to 0.75. The evidence for this outcome was graded as of moderate quality. There was a significantly lower incidence of preterm low birthweight (≤ 2500g) infants, and very low birthweight (≤ 1500g) infants, in the intervention group compared to the control group: RR 0.48, 95% CI 0.34 to 0.66 and RR 0.34; 95% CI 0.15 to 0.75, respectively; both graded as moderate quality evidence. The authors of this study reported that, based on a subset of costs for preterm births <1900g, for each of those preterm births prevented, EUR 60,262 would be saved. The review authors concluded that there was evidence from one trial that infection screening and treatment programs for pregnant women at <20 weeks' gestation reduce rates of preterm birth and preterm low birthweight and that such programs are cost saving when used to prevent preterm birth. They stated that future trials should evaluate the effects of different types of infection screening programs.

Urquhart C, Currell R, Harlow F, et al. 2015. **Home uterine monitoring for detecting preterm labour**. Cochrane Database of Systematic Reviews (1) http://onlinelibrary.wiley.com/doi/10.1002/14651858.CD006172.pub3/abstract

Home uterine activity monitoring (HUAM) is intended to permit early detection of increased contraction frequency, and early intervention with tocolytic drugs to inhibit labour and prolong pregnancy. This review aimed to assess the effectiveness of HUAM for improving outcomes for women at high risk of preterm birth, and their babies. It included 15 RCTs, 13 of which contributed data. Women using HUAM were less likely to experience preterm birth at less than 34 weeks (risk ratio (RR) 0.78; 95% CI 0.62 to 0.99; three studies, n = 1596, fixed-effect analysis, GRADE high) but a significant difference was not evident in a sensitivity analysis which restricted analysis to studies at low risk of bias based on study quality (RR 0.75, 95% CI 0.57 to 1.00, one study, 1292 women). There was no significant difference in the rate of perinatal mortality (RR 1.22, 95% CI 0.86 to 1.72, two studies, n = 2589, quality of evidence GRADE low). There was no significant difference in the number of preterm births at less than 37 weeks (average RR 0.85, CI 0.72 to 1.01, eight studies, n = 4834, random-effects, $T^2 = 0.03$, $I^2 = 68\%$, GRADE very low). Infants born to women using HUAM were less likely to be admitted to neonatal intensive care unit. Women using HUAM made more unscheduled antenatal visits and were more likely to have prophylactic tocolytic drug therapy (low to moderate evidence). The review authors concluded that HUAM has no impact on maternal and perinatal outcomes such as incidence of preterm birth or perinatal mortality but it may result in fewer admissions to neonatal intensive care, more unscheduled antenatal visits and more tocolytic treatment.

Rafael Timothy J, Berghella V, Alfirevic Z. 2014. **Cervical stitch (cerclage) for preventing preterm birth in multiple pregnancy**. Cochrane Database of Systematic Reviews (9) http://onlinelibrary.wiley.com/doi/10.1002/14651858.CD009166.pub2/abstract

Cervical cerclage is a surgical procedure involving placing a stitch round the uterine cervix with the aim of preventing cervical shortening and opening thereby reducing the risk of preterm birth. This review included five RCTs comparing cervical cerclage with other preventive therapy (such as progesterone) in both single and multiple pregnancies (1577 women in total). The final analysis included 128 women (122 with twins and six with triplets). Two trials (73 women) assessed history-indicated cerclage and three assessed ultrasound-indicated cerclage. These five trials were considered to be of average to above-average quality. Three of them were at unclear risk regarding selection and detection biases. When outcomes for cerclage were pooled together for all indications and compared with no cerclage, there was no statistically significant differences in perinatal deaths (19.2% versus 9.5%, risk ratio (RR) 1.74, 95% CI 0.92 to 3.28, five trials, n = 262), serious neonatal morbidity (15.8% versus 13.6%; average RR 0.96, 95% CI 0.13 to 7.10, three trials, n = 116), or composite perinatal death and neonatal morbidity (40.4% versus 20.3%; average RR 1.54, 95% CI 0.58 to 4.11, three trials, n = 116). There were also no significant differences between the cerclage and no cerclage groups for preterm birth <34 weeks (average RR 1.16, 95% CI 0.44 to 3.06, four trials, n = 83), preterm birth <35 weeks (average RR 1.11, 95% CI 0.58 to 2.14, four trials, n = 83), low birthweight < 2500 g (average RR 1.10, 95% CI 0.82 to 1.48, four trials, n = 172), very low birthweight <1500 g (average RR 1.42, 95% CI 0.52 to 3.85, four trials, n = 172), and respiratory distress syndrome (average RR 1.70, 95% CI 0.15 to 18.77, three trials, n = 116), caesarean section (elective and emergency) (RR 1.24, 95% CI 0.65 to 2.35, three trials, n = 77) and maternal side-effects (RR 3.92, 95% CI 0.17 to 88.67, one trial, n = 28). The review authors concluded that there is no evidence that cervical cerclage in women with multiple gestations is effective for preventing preterm birth, reducing perinatal deaths or reducing neonatal morbidity.

Dodd Jodie M, Jones L, Flenady V, et al. 2013. **Prenatal administration of progesterone for preventing preterm birth in women considered to be at risk of preterm birth**. Cochrane Database of Systematic Reviews (7) http://onlinelibrary.wiley.com/doi/10.1002/14651858.CD004947.pub3/abstract

This review aimed to assess the benefits and harms of progesterone for the prevention of preterm birth in women considered to be at increased risk, and their infants. It included 36 RCTs (8523 women and 12,515 infants).

Progesterone versus placebo for women with a past history of spontaneous preterm birth

Progesterone was associated with a statistically significant reduction in the risk of perinatal mortality (six studies; 1453 women; risk ratio (RR) 0.50, 95% CI 0.33 to 0.75), preterm birth <34 weeks (five studies; 602 women; average RR 0.31, 95% CI 0.14 to 0.69), infant birthweight <2500 g (four studies; 692 infants; RR 0.58, 95% CI 0.42 to 0.79), use of assisted ventilation (three studies; 633 women; RR 0.40, 95% CI 0.18 to 0.90), necrotising enterocolitis (three studies; 1170 women; RR 0.30, 95% CI 0.10 to 0.89), neonatal death (six studies; 1453 women; RR 0.45, 95% CI 0.27 to 0.76), admission to neonatal intensive care unit (three studies; 389 women; RR 0.24, 95% CI 0.14 to 0.40), preterm

birth < 37 weeks (10 studies; 1750 women; average RR 0.55, 95% CI 0.42 to 0.74) and a statistically significant increase in pregnancy prolongation in weeks (one study; 148 women; mean difference (MD) 4.47, 95% CI 2.15 to 6.79). For most of the outcomes examined there were no differential effects seen in terms of route of administration, time of commencing therapy and dose of progesterone.

Progesterone versus placebo for women with a short cervix identified on ultrasound

Progesterone was associated with a statistically significant reduction in the risk of preterm birth <34 weeks (two studies; 438 women; RR 0.64, 95% CI 0.45 to 0.90), preterm birth <28 weeks' gestation (two studies; 1115 women; RR 0.59, 95% CI 0.37 to 0.93) and increased risk of urticaria in women when compared with placebo (one study; 654 women; RR 5.03, 95% CI 1.11 to 22.78). It was not possible to assess the effect of route of progesterone administration, gestational age at commencing therapy, or total cumulative dose of medication.

Progesterone versus placebo for women with a multiple pregnancy

Progesterone was associated with no statistically significant differences for any of the reported outcomes.

Progesterone versus no treatment/placebo for women following presentation with threatened preterm labour

Progesterone, was associated with a statistically significant reduction in the risk of infant birthweight <2500 g (one study; 70 infants; RR 0.52, 95% CI 0.28 to 0.98).

Progesterone versus placebo for women with 'other' risk factors for preterm birth

Progesterone, was associated with a statistically significant reduction in the risk of infant birthweight <2500 g (three studies; 482 infants; RR 0.48, 95% CI 0.25 to 0.91).

The review authors concluded that the use of progesterone is associated with infant health benefits when it is administered to women considered to be at increased risk of preterm birth because of either a previous preterm delivery or a short cervix identified on ultrasound, but there is little information available on longer-term infant and child outcomes, the assessment of which is continues to be a priority. They stated that further trials are needed to determine the optimal timing, mode of administration and dose of progesterone for women at increased risk of preterm birth.

Abdel-Aleem H, Shaaban OM, Abdel-Aleem MA. 2013. **Cervical pessary for preventing preterm birth**. Cochrane Database of Systematic Reviews 5 http://onlinelibrary.wiley.com/doi/10.1002/14651858.CD007873.pub3/abstract

Among the risk factors for preterm birth are cervical incompetence and multiple pregnancy. The use of a cervical pessary has been tried as a simple non-invasive alternative to cervical cerclage (an invasive cervical stitch procedure necessitating anaesthesia). This review included one RCT of cervical pessary vs. expectant management in women with a short cervix (≤ 25mm) who were between 18 to 22 weeks of pregnancy. This trial involved a total of 385 women. The use of cervical pessary (192 women) was associated with a statistically significantly decrease in the incidence of spontaneous preterm birth <37 weeks' gestation compared with expectant management (22% versus 59%; respectively, risk ratio (RR) 0.36, 95% CI 0.27 to 0.49) and <34 weeks' gestation (6% and 27% respectively, RR 0.24; 95% CI 0.13 to 0.43). Mean gestational age at delivery was 37.7±2 weeks in the pessary group and 34.9±4 weeks in the expectant group. Women in the pessary group used less tocolytics (RR 0.63; 95% CI 0.50 to 0.81) and corticosteroids (RR 0.66; 95% CI 0.54 to 0.81) than the expectant group. Vaginal discharge was more common in the pessary group (RR 2.18; 95% CI 1.87 to 2.54). Among the pessary group, 27 women needed pessary repositioning without removal and there was one case of pessary removal. Ninety-five per cent of women in the pessary group would recommend this intervention to other people. Neonatal paediatric care admission was reduced in the pessary group compared to the expectant group (RR 0.17; 95% CI 0.07 to 0.42). The review authors concluded that one well-designed RCT had showed a beneficial effect of cervical pessary in reducing preterm birth in women with a short cervix, but that more research in women with different risk factors (e.g. multiple pregnancy) and in different settings is needed.

Brocklehurst P, Gordon A, Heatley E, et al. 2013. **Antibiotics for treating bacterial vaginosis in pregnancy**. Cochrane Database of Systematic Reviews 1 http://onlinelibrary.wiley.com/doi/10.1002/14651858.CD000262.pub4/abstract

Bacterial vaginosis is an overgrowth of anaerobic bacteria in the vagina and a lack of the normal lactobacillary flora. Having this condition in pregnancy has been associated with adverse perinatal outcomes, particularly preterm birth (PTB). This review sought to assess the effects of antibiotic treatment of bacterial vaginosis in pregnancy. It included 21 good quality trials involving 7847 women diagnosed with bacterial vaginosis or intermediate vaginal flora. Antibiotic treatment given to women with bacterial vaginosis in pregnancy was found to be effective at eradicating bacterial vaginosis (average risk ratio (RR) 0.42; 95% CI 0.31 to 0.56; 10 trials, 4403 women; random-effects, $T^2 = 0.19$, $I^2 = 91\%$) and it also reduced the risk of late miscarriage (RR 0.20; 95% CI 0.05 to 0.76; two trials, 1270 women, fixed-effect, $I^2 = 0\%$). It did not reduce the risk of PTB at <37 weeks (average RR 0.88; 95% CI 0.71 to 1.09; 13 trials, 6491 women; random-effects, $T^2 = 0.06$, $I^2 = 48\%$), or the risk of preterm pre labour rupture of membranes (RR 0.74; 95% CI 0.30 to 1.84; two trials, 493 women). It did increase the risk of side-effects sufficient to stop or change treatment (RR 1.66; 95% CI 1.02 to 2.68; four trials, 2323 women, fixed-effect, $I^2 = 0\%$). New evidence for this updated review indicated that treatment before 20 weeks' gestation did not reduce the risk of PTB at <37 weeks (average RR 0.85; 95% CI 0.62 to 1.17; five trials, 4088 women; random-effects, $T^2 = 0.06$, $I^2 = 49\%$). In women with previous PTB, treatment did not change the risk of PTB in the current pregnancy (average RR 0.78; 95% CI 0.42 to 1.48; three trials, 421 women; random-effects, $T^2 = 0.19$, $I^2 = 72\%$). In women with abnormal vaginal flora (intermediate flora or bacterial vaginosis) evidence from two trials (894 women) suggested that treatment may reduce the risk of PTB at < 37 weeks (RR 0.53; 95% CI 0.34 to 0.84). A few trials compared different antibiotics, different routes of administration, or different antibiotic doses. The differences found were either not statistically significant, or statistically significant but not clinically significant. The review authors concluded that while antibiotic treatment can eradicate bacterial vaginosis in pregnancy, there is little evidence that screening and treating all pregnant women with bacterial vaginosis will prevent PTB or its consequences. They noted that limited evidence from two studies indicated that treatment of women with abnormal flora was associated with a 47% reduction in preterm births.

Berghella V, Baxter JK, Hendrix NW. 2013. **Cervical assessment by ultrasound for preventing preterm delivery**. Cochrane Database of Systematic Reviews 1 http://onlinelibrary.wiley.com/doi/10.1002/14651858.CD007235.pub3/abstract

This review aimed to assess the effectiveness of antenatal management based on transvaginal ultrasound measurement of cervical length (TVU CL) screening. A short cervical length is associated with a higher risk of preterm birth. There were five RCTs deemed eligible for inclusion in the review (507 women). There were three including singleton gestations with preterm labor (PTL); one including singleton gestations with preterm premature rupture of membranes (PPROM); and one including twin gestations with or without PTL. The three trials of singleton gestations with PTL included 290 women, randomised to either knowledge of TVU CL results (147 women) or no knowledge (143 women). Knowledge of TVU CL results was associated with a non-significant decrease in PTB at <37 weeks (22.3% vs.

34.7%, respectively; average risk ratio 0.59, 95% CI 0.26 to 1.32; two trials, 242 women) and at <34 weeks (6.9% vs. 12.6%; RR 0.55, 95% CI 0.25 to 1.20; three trials, 256 women). Delivery occurred at a later gestational age in the knowledge versus no knowledge groups (mean difference (MD) 0.64 weeks, 95% CI 0.03 to 1.25; three trials, 290 women). For all other outcomes with available data (PTB at <34 or <28 weeks; birthweight <2500 grams; perinatal death; maternal hospitalization; tocolysis; and steroids for fetal lung maturity), there was no evidence of a difference between groups. The trial of singleton gestations with PPROM (n = 92) had as its primary outcome measure TVU CL safety in this population, rather than its effect on management. There was no evidence of a difference between the TVU CL and no TVU CL groups in incidence of maternal and neonatal infections. In the trial of twin gestations with or without PTL (n = 125), there was no evidence of a difference in PTB at less than 36, 34, or 30 weeks, gestational age at delivery, and other perinatal and maternal outcomes between the TVU CL and the no TVU CL groups. Life-table analysis showed significantly less PTB at <35 weeks in the TVU CL group compared with the no TVU CL group (P = 0.02). the review authors concluded that there is insufficient evidence to recommend routine screening of either symptomatic or asymptomatic pregnant women with TVU CL. They offered some suggestions for further research.

Likis FE, Andrews JC, Woodworth AL, et al. 2012. **Progestogens for prevention of preterm birth. Comparative effectiveness review No. 74. (Prepared by the Vanderbilt Evidence-based Practice Center under Contract no. 290-2007-10065-I). AHRQ Publication No. 12-EHC105-EF.** Rockville MD: Agency for Healthcare Research and Quality. http://www.ncbi.nlm.nih.gov/pubmedhealth/PMH0068098/

This comprehensive systematic review addressed six key questions related to the use of progestogens for the prevention of preterm birth. The review included 70 publications published from January 1996 to October 2010, plus eight RCTs published through to October 2011. Sixteen RCTs contributed data for meta-analyses. Results from meta-analyses are presented as odds ratios from Bayesian models. In women with a previous preterm birth and a singleton pregnancy, progestogen treatment decreased the risk of preterm birth: 4 RCTs, odds ratio (OR) 0.66, Bayesian credible interval (BCI) 0.53 to 0.82, corresponding to an absolute risk reduction of between 0 and 26% across studies. In this population, progestogen also reduced rates of neonatal death: OR 0.52, 95% BCI 0.25 to 0.96. Results of two trials of progestogen administration in women with short cervical length indicated an absolute risk reduction for preterm birth of between 8.8 and 15.2%. There was inconsistent, or absence of, evidence for the benefit of progestogen for other maternal, fetal or neonatal outcomes. For multiple gestations, there was no evidence that progestogen prevents prematurity (preterm birth OR 1.18, 95% BCI 0.79 to 1.39), enhances birthweight, or improves other outcomes. There was no definitive evidence that maternal factors, such as number or severity of previous preterm births, modify the effects of progestogen treatment. No reducing the effects of preterm birth, but no RCTs directly compared routes of administration or doses, but across 15 RCTs, all formulations were effective at reducing the risk of preterm birth, but not the risk of neonatal mortality. There was insufficient evidence to assess whether time of initiation or adherence to treatment affected outcomes. Research has not assessed factors associated with adherence to treatment, nor long term maternal and infant effects. The main conclusions of this review were that progestogens prevent preterm birth when used in singleton pregnancy where the mother has had a previous preterm birth or has a short cervical length (moderate to low quality evidence), but that there is insufficient evidence to determine whether this intervention has the ultimately desired outcome of preventing morbidity and promoting normal childhood development. There was moderate quality evidence suggesting that progestogens are not effective for preventing preterm birth in multiple gestations.

Khanprakob T, Laopaiboon M, Lumbiganon P, et al. 2012. **Cyclo-oxygenase (COX) inhibitors for preventing preterm labour**. Cochrane Database of Systematic Reviews (10) http://onlinelibrary.wiley.com/doi/10.1002/14651858.CD007748.pub2/abstract

Prostaglandins are believed to play an important role in the birth process through their action on the smooth muscle of the uterus. Cyclo-oxygenase (COX) is an enzyme in the pathway of prostaglandin synthesis. COX inhibitors hinder prostaglandin production by inhibiting the action of COX. This review aimed to assess the effectiveness and safety of COX inhibitors for preventing preterm labour in high risk pregnant women. It included one small RCT evaluating Rofecoxib, involving 98 women. This trial did not report on the outcome of preterm labour. Rofecoxib use was associated with an increased risk of preterm birth and preterm premature rupture of membranes. It was associated with a greater risk of oligohydramnios (deficiency of amniotic fluid) and low fetal urine production but these effects were reversible with cessation of treatment. There were no differences between the intervention and control groups in the number of women who discontinued treatment before 32 weeks' gestation and no differences in neonatal morbidities or admission to a neonatal intensive care unit. There were no perinatal deaths or maternal adverse effects in either group. The review authors concluded that there was little evidence regarding the use of COX inhibitors to prevent preterm labour and stated that the existing data was insufficient to make any recommendations about the use of COX inhibitors in practice for the prevention of preterm labour, and that further research is needed.

Khianman B, Pattanittum P, Thinkhamrop J, et al. 2012. **Relaxation therapy for preventing and treating preterm labour**. Cochrane Database of Systematic Reviews (8) http://onlinelibrary.wiley.com/doi/10.1002/14651858.CD007426.pub2/abstract

Maternal psychological stress is associated with adverse pregnancy outcomes and may play a role in causing preterm labour (PTL). This review aimed to assess the effectiveness of relaxation therapies for preventing or treating PTL and preventing preterm birth (PTB). The review authors identified 11 RCTs with a total of 833 women, but the results of the review are based on single studies with small numbers of participants. Most of the studies were of limited quality and did not report adequately on sequence generation, allocation concealment or blinding. No studies assessed PTL or PTB as the primary outcome. For women not in PTL, one study found benefits of relaxation for maternal stress (Anxiety Stress Scale) at 26 to 29 weeks gestation (mean difference (MD) −7.04; 95% CI −13.91 to −0.17).There were also other beneficial effects of relaxation including baby birthweight (MD 285.00 g; 95% CI 76.94 to 493.06); type of delivery; (vaginal delivery; risk ratio (RR) 1.52; 95% CI 1.13 to 2.04), (caesarean section; RR 0.38; 95% CI 0.19 to 0.78); maternal anxiety (MD −15.79; 95% CI −18.33 to −13.25); and stress (MD −13.08; 95% CI −15.29 to −10.87) when relaxation therapy was used together with standard treatment. For women not in PTL, a single study found no difference between the intervention and control groups in the main outcome of PTB (RR 0.95; 95% CI 0.57 to 1.59). A fixed-effect model from two included studies found a non-significant mean difference in birthweight in grams: MD −5.68; (95% CI −174.09 to 162.74). The review authors concluded that there was some evidence that relaxation during pregnancy reduces anxiety and stress but no evidence that it reduces PTL or PTB. They stated that the results of the review should be interpreted with caution due to the limited quality of the studies included.

Alfirevic Z, Stampalija T, Roberts D, et al. 2012. **Cervical stitch (cerclage) for preventing preterm birth in singleton pregnancy**. Cochrane Database of Systematic Reviews 4 http://onlinelibrary.wiley.com/doi/10.1002/14651858.CD008991.pub2/abstract

Cervical cerclage involves placing a suture (stitch) around the neck of the womb (the cervix) to provide mechanical support to the cervix and keep it closed, thereby reducing the risk of preterm birth. This review aimed to determine whether the use of cervical stitch in singleton pregnancy at high risk of pregnancy loss because of a woman's history and/or a finding of a short cervix on ultrasound and/or physical examination improves subsequent obstetric care and fetal outcome. Trials were eligible for inclusion in the review if they compared cerclage with either no treatment or an alternative intervention. Twelve trials, involving 3328 women, were included. When cerclage was compared to no treatment, there was a significant difference in preterm births (average RR 0.80; 95% CI 0.69 to 0.95; nine trials, 2898 women) but no statistically significant difference in perinatal deaths (8.4% versus 10.7%) (risk ratio (RR) 0.78; 95% CI 0.61 to 1.00; eight trials, 2391 women) or neonatal morbidity (9.6% versus 10.2%) (RR 0.95; 95% CI 0.63 to 1.43; four trials, 818 women). Cervical cerclage was associated with higher rates of maternal side effects (vaginal discharge and bleeding, pyrexia) (average RR 2.25; 95% CI 0.89 to 5.69; three trials, 953 women) and significantly higher caesarean section rates (RR 1.19; 95% CI 1.01 to 1.40; 8 trials, 2817 women). There were no important differences seen across all pre-specified clinical subgroups (history-indicated, ultrasound indicated). One study that compared cerclage with weekly intramuscular injections of 17 α-hydroxyprogesterone caproate in women with a short cervix (detected via ultrasound) didn't find any differences in obstetrical and neonatal outcomes between the two strategies. Two studies comparing cerclage based on previous history with cerclage only if the cervix was found to be short on transvaginal ultrasound found no differences in any of the primary or secondary outcomes. The authors concluded that, compared to no treatment, cervical cerclage reduces the incidence of preterm birth in women at risk of recurrent preterm birth but doesn't produce statistically significant reductions in perinatal mortality or neonatal morbidity and does increase the likelihood of caesarean section. They stated that decisions on how best to minimise recurrent preterm birth should be personalised based on the clinical team's skill and expertise and the woman's informed choice.

Davey M, Watson L, Rayner J, et al. 2011. **Risk scoring systems for predicting preterm birth with the aim of reducing associated adverse outcomes**. Cochrane Database of Systematic Reviews (11)
http://onlinelibrary.wiley.com/doi/10.1002/14651858.CD004902.pub4/abstract

A fundamental aim of antenatal care is to identify pregnancies at higher than average risk of adverse outcomes. Many scoring systems have been devised to try and classify the risk of poor pregnancy outcomes, including preterm birth. Preterm birth risk assessment tools have included items such as maternal age, weight, height, marital status, smoking, plurality, previous low birthweight baby, threatened miscarriage and previous stillbirth. This review aimed to determine whether the use of a risk screening tool designed to predict preterm birth (together with appropriate interventions as indicated) reduces the incidence of preterm birth and very preterm birth, and the associated adverse outcomes. Despite extensive searching the review authors did not identify any trials of risk scoring systems to prevent preterm birth so they concluded that the role of scoring systems in the prevention of preterm birth is unknown.

Whitworth M, Quenby S, Cockerill R, et al. 2011. **Specialised antenatal clinics for women with a pregnancy at high risk of preterm birth (excluding multiple pregnancy) to improve maternal and infant outcomes**.
http://onlinelibrary.wiley.com/doi/10.1002/14651858.CD006760.pub2/abstract

Having had a previous preterm delivery is a strong predictor of preterm birth. For this reason, specialised clinics for pregnant women with a history of previous preterm birth have been advocated as means of improving outcomes for these women and their babies. This review aimed to assess the evidence regarding the value of such clinics compared to standard antenatal clinics for pregnant women at high risk of preterm delivery. It included three trials involving 3400 women, all carried out in the US. All of them were focussed on specialised clinics for high-risk women and had primary outcomes of gestational age at delivery, preterm delivery, or both, but the interventions offered differed between the trials. There was little data on the pre-specified outcomes for the review. For most outcomes only a single study provided data and there was insufficient statistical power to detect differences between groups. Therefore there was no clear evidence that specialised antenatal clinics reduce rates of preterm births. The review authors noted that specialised clinics are now an accepted part of care in many settings and so it may not now be possible to carry out further RCTs. They suggested that future research should include psychological outcomes and aim to determine which aspects of service provision women prefer.

INFANT MORTALITY AND SUDDEN UNEXPECTED DEATH IN INFANCY

Introduction

Infant mortality, the number of deaths of infants aged less than 365 days per 1,000 live births, is often used as a barometer of the social wellbeing of a country.[13] New Zealand's infant mortality rates are higher than the OECD average and in 2011 New Zealand's rate was ranked fifth highest out of 36 OECD countries.[14] Mortality rates in the first year of life are much higher than at any other time during childhood or adolescence.[15] During 2012, a total of 256 New Zealand infants were registered as having died prior to their first birthday, which equates to an infant mortality rate of 4.2 per 1,000 the lowest ever recorded in New Zealand.[16]

New Zealand's infant mortality rates have declined during the past 40 years, although the rate of decline has been slower in more recent years, with rates falling from 28.4 per 1,000 in 1952, to 15.6 in 1972, 7.2 in 1992, 5.5 in 2002 and 4.2 in 2012.[16] Infant mortality rates are generally higher for Pacific and Māori than European/Other, for males, for babies of very young mothers, and for babies from the most deprived areas.[17] However total infant mortality rates are of limited utility in guiding population health interventions, as the most common causes of mortality differ markedly according to the age of the infant. Interventions aimed at reducing New Zealand's infant mortality rates therefore need to be based on an understanding of these component causes. It is noteworthy that the number of deaths from sudden unexpected death in infancy (SUDI) has fallen from 2009 (n= 60) to 2013 (n= 38).[18] The following section uses information from the National Mortality Collection to review neonatal, post neonatal and total infant mortality, as well as SUDI rates since 1990. The latest year for which data are available from the Ministry of Health's Mortality Collection is 2012.

Data source and methods

Indicators

Infant mortality
Neonatal mortality
Post neonatal mortality
Sudden Unexpected Death in Infancy (SUDI)

Data sources

Numerator: National Mortality Collection
Denominator: Birth Registration Dataset (live births only)

Definition

All deaths in the first year of life. Cause of death was the main underlying cause of death. Refer to **Appendix 6** for the corresponding codes.

Infant mortality: Death of a live born infant prior to 365 days of life per 1,000 live births
Neonatal mortality: Death of a live-born infant before 28 completed days after birth per 1,000 live births
Post neonatal mortality: Death of a live-born infant from 28 completed days and before the first year of life is completed per 1,000 live births
Sudden Unexpected Death in Infancy (SUDI): Death of a live born infant before the first year of life is completed (<365 days of life) where the cause of death is Sudden Infant Death Syndrome (SIDS), accidental suffocation or strangulation in bed, inhalation of gastric contents or food, or ill-defined or unspecified causes. Rate is per 1,000 live births

Notes on interpretation

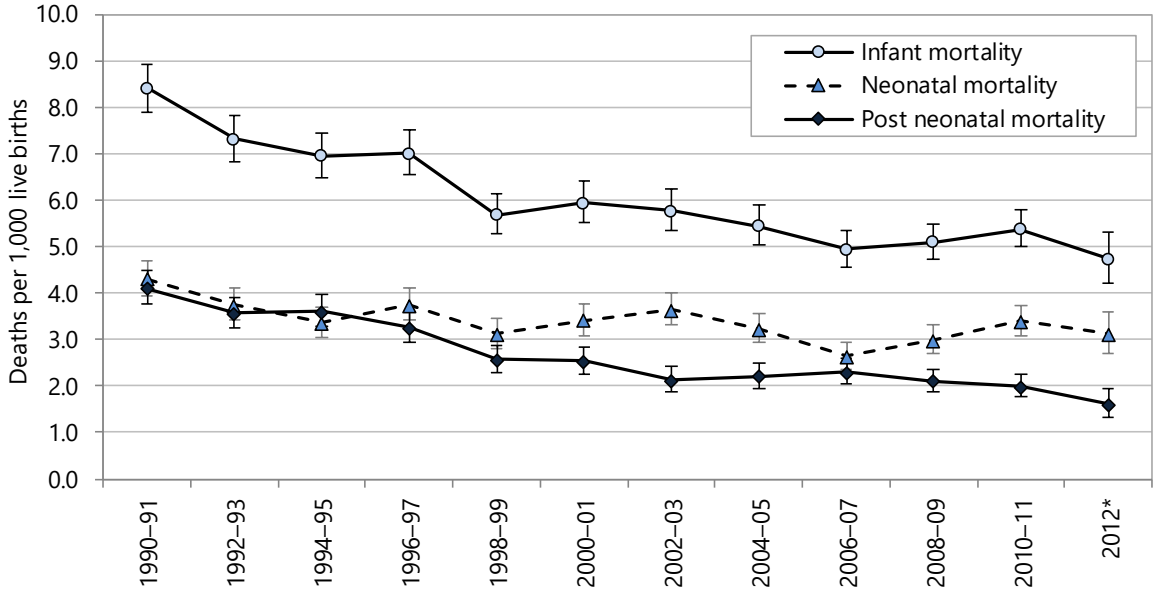
Note 1: SUDI and SIDS: SIDS is defined as "the sudden unexpected death of an infant <1 year of age, with onset of the fatal episode apparently occurring during sleep, and that remains unexplained after a thorough investigation, including performance of a complete autopsy and review of the circumstances of death and the clinical history".[19] Issues have emerged with defining SIDS, possibly as the result of pathologists and coroners becoming increasingly reluctant to label a death as SIDS in the context of equivocal death scene findings (e.g. death of an infant who had been co-sleeping with a parent who had recently consumed alcohol[19]). This has resulted in a fall in the number of SIDS deaths, and a rise in the number of deaths attributed to "suffocation/strangulation in bed" or "unspecified causes".
Note 2: Two additional codes were added to the SUDI indicator in 2013 (W78: Inhalation of gastric contents; and W79: Inhalation and ingestion of food causing obstruction of the respiratory tract) to ensure consistency with the Child and Youth Mortality Review Committee's SUDI reporting. As a result, the rates in this section are not directly comparable with those presented in NZCYES reports prior to 2013.
Note 3: See Appendix 3 for an overview of the National Mortality Collection.

National trends and distribution

The number of infant deaths in New Zealand declined from 507 in 1990 to 294 deaths in 2012. From 1990 to 2012 there was an overall fall in infant mortality rates from 8.43 deaths per 1,000 live births in 1990 to 4.74 deaths per 1,000 live births in 2012 (the lowest recorded rate). Most of the fall in infant mortality rates occurred between 1990 and 1998, with a further slight fall to 2005, and there has been no significant difference in rates from year to year since 2005. From 1996 this fall was more marked for post-neonatal than for neonatal mortality rates **(Figure 21)**.

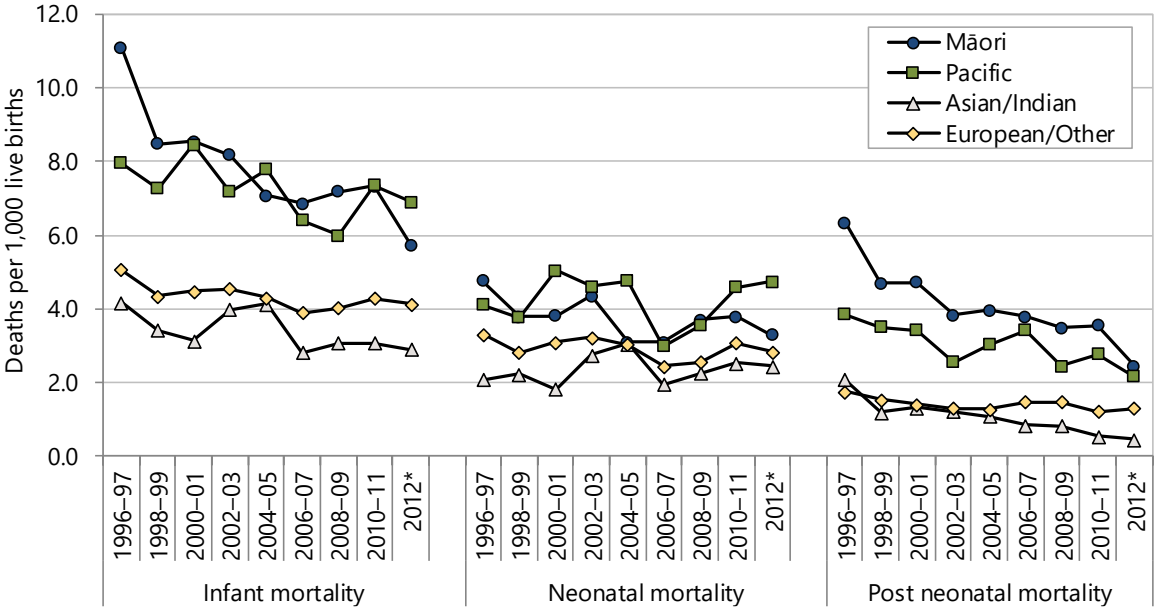
The fall in infant mortality rates was observed in all ethnic groups and was more marked for Māori, Pacific and Asian/Indian infants than for European/Other. Infant mortality rates remain higher for Māori and Pacific infants compared with European/Other and Asian/Indian infants, however the disparity in rates has lessened over time. The fall in rates for all ethnic groups was more marked for post-neonatal than for neonatal mortality **(Figure 22)**.

Figure 21. Infant deaths, by type, New Zealand 1990–2012



Numerator: National Mortality Collection; Denominator: Birth Registration Dataset; * 2012 is a single year of data

Figure 22. Total infant, neonatal, and post neonatal mortality, by ethnicity, New Zealand 1996–2012



Numerator: National Mortality Collection; Denominator: Birth Registration Dataset; Ethnicity is level 1 prioritised

Distribution by cause

Between 2008 and 2012 most infant deaths and most neonatal deaths were the result of congenital anomalies, extreme prematurity and other perinatal conditions including intrauterine or birth asphyxia. The most common underlying cause of post-neonatal death was sudden unexpected death in infancy (SUDI) which is discussed further on **page 63 (Table 22, Table 23)**.

Table 22. Infant mortality, by main underlying cause of death, New Zealand 2008–2012

Cause of death	Number: 2008–2012	Number: annual average	Rate per 1,000 live births	Per cent
New Zealand				
Infant mortality				
Congenital anomalies	373	75	1.17	22.8
Extreme prematurity	264	53	0.83	16.2
Intrauterine hypoxia or birth asphyxia	26	5	0.08	1.6
Other perinatal conditions	464	93	1.46	28.4
SUDI: SIDS	140	28	0.44	8.6
SUDI: suffocation or strangulation in bed	125	25	0.39	7.7
SUDI: all other types	17	3	0.05	1.0
Injury or poisoning	32	6	0.10	2.0
Other causes	192	38	0.60	11.8
Total	1,633	327	5.14	100.0

Numerator: National Mortality Collection; Denominator: Birth Registration Dataset

Table 23. Neonatal and post neonatal mortality by main underlying cause of death, New Zealand 2008–2012

Cause of death	Number: 2008–2012	Number: annual average	Rate per 1,000 live births	Per cent
New Zealand				
Neonatal mortality				
Extreme prematurity	264	53	0.83	26.1
Congenital anomalies: chromosomal	39	8	0.12	3.9
Congenital anomalies: CNS	50	10	0.16	5.0
Congenital anomalies: CVS	60	12	0.19	5.9
Congenital anomalies: other	110	22	0.35	10.9
Intrauterine hypoxia or birth asphyxia	26	5	0.08	2.6
Other perinatal conditions	388	78	1.22	38.4
SUDI: SIDS	10	2	0.03	1.0
SUDI: All other types	20	4	0.06	2.0
Injury or poisoning	5	1	0.02	0.5
Other causes	38	8	0.12	3.8
Total	1,010	202	3.18	100.0
Post neonatal mortality				
SUDI: SIDS	130	26	0.41	20.9
SUDI: suffocation or strangulation in bed	106	21	0.33	17.0
SUDI: All other types	16	3	0.05	2.6
Congenital anomalies: chromosomal	26	5	0.08	4.2
Congenital anomalies: CNS	7	1	0.02	1.1
Congenital anomalies: CVS	47	9	0.15	7.5
Congenital anomalies: other	34	7	0.11	5.5
Other perinatal conditions	76	15	0.24	12.2
Injury or poisoning	27	5	0.09	4.3
Other causes	154	31	0.48	24.7
Total	623	125	1.96	100.0
Infant mortality total	1,633	327	5.14	

Numerator: National Mortality Collection; Denominator: Birth Registration Dataset

Distribution by demographic factors

There were disparities in infant mortality rates by NZDep2013 score, ethnicity, maternal age, infant gender and gestational age at birth. Between 2008 and 2012 there was a clear social gradient in infant mortality rates, with *significantly higher* rates in areas with higher NZDep2013 scores (deciles 5–10) compared with the lowest NZDep scores (deciles 1–2). Mortality rates were *significantly higher* for Māori and Pacific infants, and *significantly lower* for Asian/Indian infants, compared with European/Other infants. Mortality rates for infants born to mothers aged under 30 years and over 35 years were *significantly higher* than for infants born to mothers aged 30–34 years. The highest difference was observed for mothers aged under 20 years. Mortality rates were *significantly higher* for male compared with female infants. The greatest disparity was observed by gestational age. The mortality rate for infants born before 37 weeks gestation was 18 times higher than the rate for infants born at or after 37 weeks and this difference was *statistically significant* **(Table 24)**. Similar disparities were observed for neonatal mortality rates, although the higher rate for mothers aged 20–24 years and the lower rate for Asian/Indian infants were *not significant*. The significance of disparities in post-neonatal infant mortality rates by NZDep2013 score, ethnicity, infant gender and gestational age at birth were the same as for overall infant mortality. Post-neonatal mortality rates for infants born to mothers aged under 30 years were *significantly higher* than for infants born to mothers aged 30–34 years but were *not significantly different* for mothers aged over 35 years **(Table 25)**.

Table 24. Infant mortality, by demorgraphic factor, New Zealand 2008–2012

Variable	Rate per 1,000 live births	Rate ratio	95% CI	Variable	Rate per 1,000 live births	Rate ratio	95% CI
Infant mortality							
NZDep2013 Index of deprivation quintile				Prioritised ethnicity			
Deciles 1–2	2.77	1.00		Māori	6.96	1.68	1.51–1.87
Deciles 3–4	3.35	1.21	0.96–1.52	Pacific	6.72	1.62	1.40–1.88
Deciles 5–6	4.25	1.53	1.24–1.90	Asian/Indian	3.04	0.73	0.60–0.89
Deciles 7–8	5.00	1.80	1.47–2.21	European/Other	4.15	1.00	
Deciles 9–10	7.93	2.86	2.37–3.45	Gender			
Maternal age group				Female	4.54	1.00	
<20 years	10.2	2.88	2.43–3.42	Male	5.72	1.26	1.14–1.39
20–24 years	7.06	2.00	1.73–2.32	Gestation at birth			
25–29 years	4.44	1.26	1.08–1.47	20–36 weeks	37.94	18.08	16.3–20.0
30–34 years	3.53	1.00		37+ weeks	2.10	1.00	
35+ years	4.34	1.23	1.05–1.44				

Numerator: National Mortality Collection; Denominator: Birth Registration Dataset; Rates are per 1,000 live births; Rate ratios are unadjusted; Ethnicity is level 1 prioritised; Decile is NZDep2013

Table 25. Neonatal and post neonatal mortality, by demographic factor, New Zealand 2008–2012

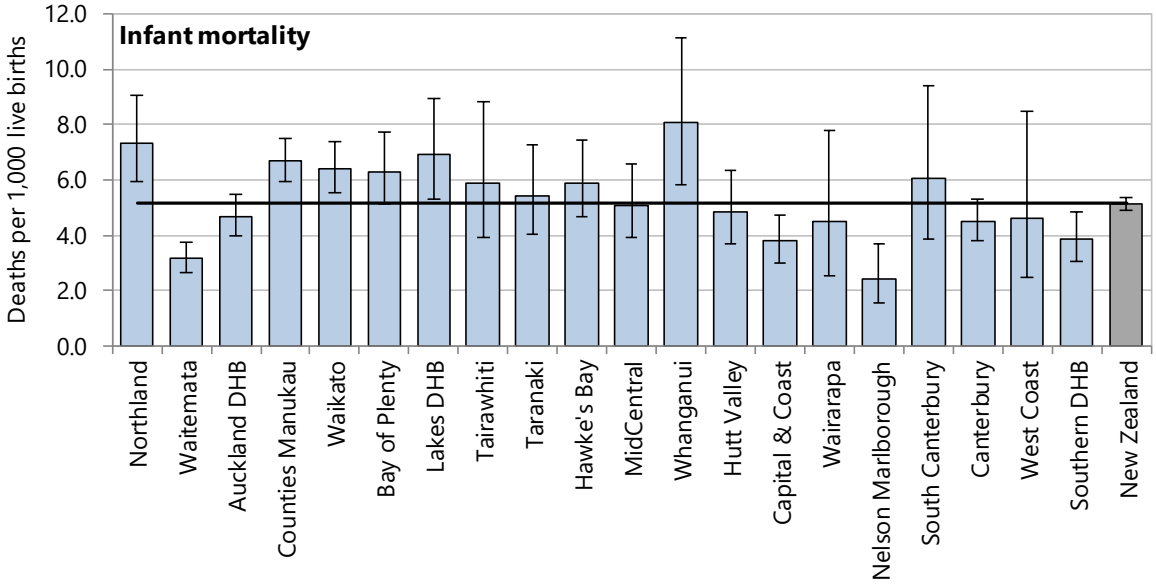
Variable	Rate per 1,000 live births	Rate ratio	95% CI	Variable	Rate per 1,000 live births	Rate ratio	95% CI
Neonatal mortality							
NZDep2013 Index of deprivation quintile				Prioritised ethnicity			
Deciles 1–2	1.79	1.00		Māori	3.65	1.30	1.13–1.50
Deciles 3–4	2.27	1.27	0.96–1.68	Pacific	4.20	1.50	1.24–1.80
Deciles 5–6	2.77	1.55	1.19–2.02	Asian/Indian	2.41	0.86	0.68–1.08
Deciles 7–8	3.36	1.87	1.46–2.41	European/Other	2.81	1.00	
Deciles 9–10	4.50	2.52	1.99–3.19	Gender			
Maternal age group				Female	2.87	1.00	
<20 years	5.76	2.46	1.98–3.07	Male	3.48	1.21	1.07–1.37
20–24 years	3.81	1.63	1.35–1.97	Gestation at birth			
25–29 years	2.79	1.19	0.99–1.44	20–36 weeks	29.92	37.71	32.5–43.7
30–34 years	2.34	1.00		37+ weeks	0.79	1.00	
35+ years	3.18	1.36	1.12–1.64				
Post neonatal mortality							
NZDep2013 Index of deprivation quintile				Prioritised ethnicity			
Deciles 1–2	0.98	1.00		Māori	3.31	2.48	1.13–1.50
Deciles 3–4	1.08	1.10	0.75–1.64	Pacific	2.52	1.89	1.47–2.42
Deciles 5–6	1.48	1.51	1.05–2.16	Asian/Indian	0.62	0.47	0.30–0.72
Deciles 7–8	1.64	1.67	1.18–2.36	European/Other	1.34	1.00	
Deciles 9–10	3.43	3.49	2.55–4.77	Gender			
Maternal age group				Female	1.67	1.00	
<20 years	4.41	3.72	2.82–4.89	Male	2.24	1.34	1.14–1.57
20–24 years	3.25	2.74	2.16–3.47	Gestation at birth			
25–29 years	1.65	1.39	1.07–1.80	20–36 weeks	8.02	6.15	5.17–7.31
30–34 years	1.19	1.00		37+ weeks	1.30	1.00	
35+ years	1.16	0.98	0.73–1.31				

Numerator: National Mortality Collection; Denominator: Birth Registration Dataset; Rates are per 1,000 live births; Rate ratios are unadjusted; Ethnicity is level 1 prioritised; Decile is NZDep2013

Distribution by region

Between 2008 and 2012 infant mortality rates were *significantly higher* than the national rate in the Northland, Counties Manukau, Waikato, Lakes and Whanganui DHBs and *significantly lower* than the national rate in the Waitemata, Capital & Coast, Nelson Marlborough and Southern DHBs. In the remaining district health boards there were no significant differences from the national rate. **(Figure 23**, **Table 26)**.

Figure 23. Infant mortality, by district health board, New Zealand 2008–2012



Numerator: National Mortality Collection; Denominator: Birth Registration Dataset

Table 26. Infant mortality, by district health board, New Zealand 2008–2012

DHB	Number: 2008–2012	Number: Annual average	Rate per 1,000 live births	Rate ratio	95% CI
Infant mortality					
Northland	86	17	7.35	1.43	1.15–1.77
Waitemata	125	25	3.16	0.61	0.51–0.74
Auckland	155	31	4.68	0.91	0.77–1.07
Counties Manukau	293	59	6.68	1.30	1.15–1.47
Waikato	179	36	6.40	1.24	1.07–1.45
Bay of Plenty	94	19	6.31	1.23	1.00–1.51
Lakes	56	11	6.91	1.34	1.03–1.75
Tairawhiti	23	5	5.91	1.15	0.76–1.73
Taranaki	43	9	5.41	1.05	0.78–1.42
Hawke's Bay	69	14	5.90	1.15	0.90–1.46
MidCentral	59	12	5.09	0.99	0.76–1.28
Whanganui	36	7	8.07	1.57	1.13–2.18
Hutt Valley	52	10	4.86	0.95	0.72–1.25
Capital & Coast	75	15	3.78	0.74	0.58–0.93
Wairarapa	12	2	4.48	0.87	0.49–1.53
Nelson Marlborough	20	4	2.40	0.47	0.30–0.73
South Canterbury	19	4	6.06	1.18	0.75–1.85
Canterbury	144	29	4.50	0.87	0.74–1.04
West Coast	10	2	4.61	0.90	0.48–1.67
Southern	72	14	3.87	0.75	0.60–0.95
New Zealand	1,633	327	5.14	1.00	

Numerator: National Mortality Collection; Denominator: Birth Registration Dataset

Northern region distribution and trends

Comparison with New Zealand

Between 2008 and 2012 infant mortality rates were *significantly higher* than the national rate in Northland and Counties Manukau DHBs, and *significantly lower* in Waitemata DHB. Auckland DHB's rate was *not significantly different* from the national rate. Similar patterns were observed for neonatal and post neonatal mortality rates **(Table 27)**.

Table 27. Infant mortality, by type, Northern DHBs vs New Zealand 2008–2012

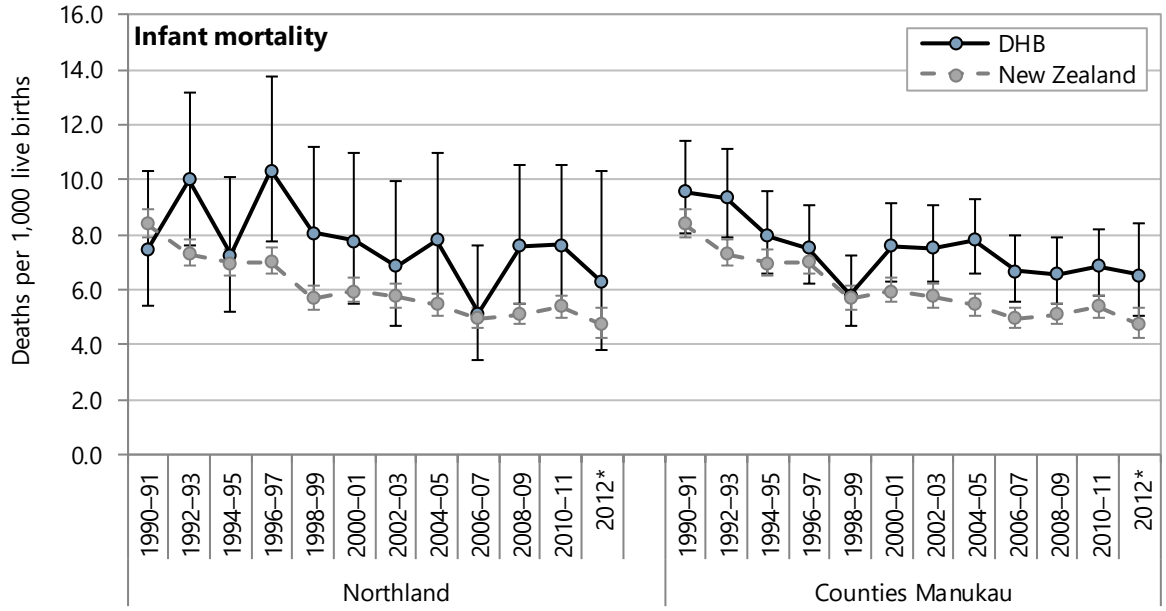
DHB	Number: 2008–2012	Number: annual average	Rate per 1,000 live births	Rate ratio	95% CI
Infant mortality					
Northland	86	17	7.35	1.43	1.15–1.77
Waitemata	125	25	3.16	0.61	0.51–0.74
Auckland	155	31	4.68	0.91	0.77–1.07
Counties Manukau	293	59	6.68	1.30	1.15–1.47
New Zealand	1,633	327	5.14	1.00	
Neonatal mortality					
Northland	49	10	4.19	1.32	0.99–1.75
Waitemata	81	16	2.05	0.64	0.51–0.81
Auckland	101	20	3.05	0.96	0.78–1.18
Counties Manukau	181	36	4.13	1.30	1.11–1.52
New Zealand	1,010	202	3.18	1.00	
Post neonatal mortality					
Northland	37	7	3.16	1.61	1.16–2.24
Waitemata	44	9	1.11	0.57	0.42–0.77
Auckland	54	11	1.63	0.83	0.63–1.10
Counties Manukau	112	22	2.55	1.30	1.06–1.59
New Zealand	623	125	1.96	1.00	

Numerator: National Mortality Collection; Denominator: Birth Registration Dataset

Regional trends

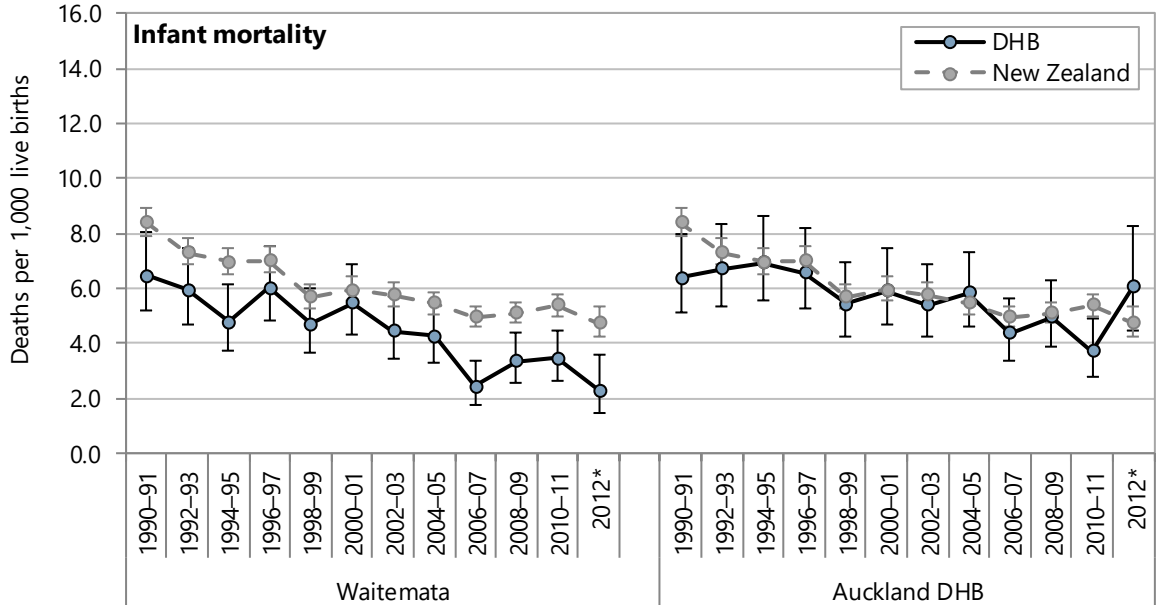
In the Northern DHBs there was an overall fall in infant mortality rates from 1990 to 2012 **(Figure 24, Figure 25)**. Falling rates of post neonatal mortality were observed during this period, and a fall in neonatal mortality rate was observed in Waitemata while neonatal mortality rates were more variable for the other DHBs **(Figure 26, Figure 27)**.

Figure 24. Infant mortality, Northland and Counties Manukau DHBs vs New Zealand 1990–2012



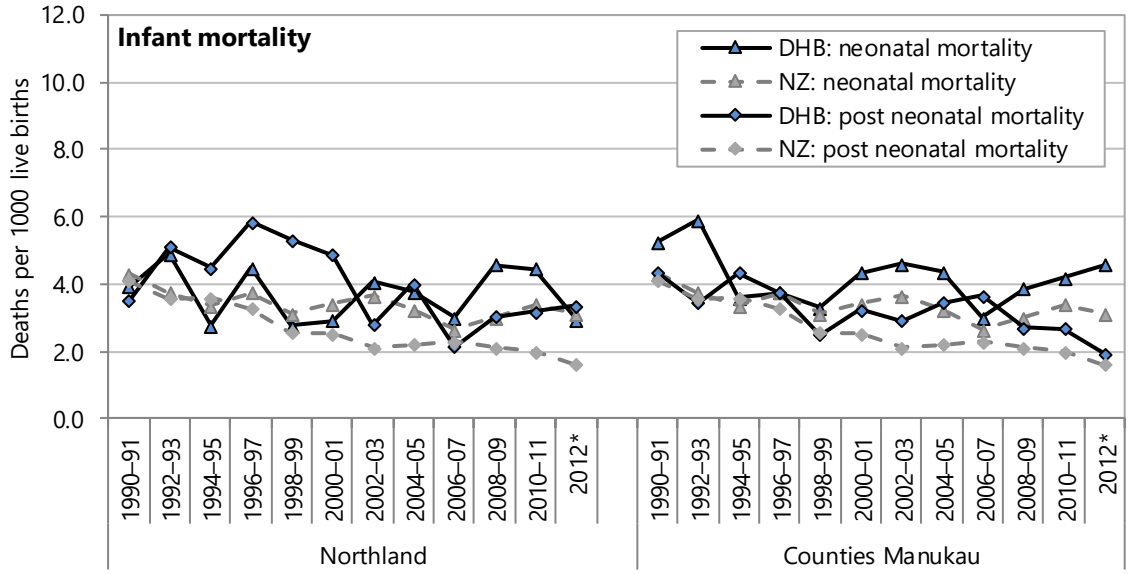
Numerator: National Mortality Collection; Denominator: Birth Registration Dataset; *2012 is a single year of data

Figure 25. Infant mortality, Waitemata and Auckland DHBs vs New Zealand 1990–2012



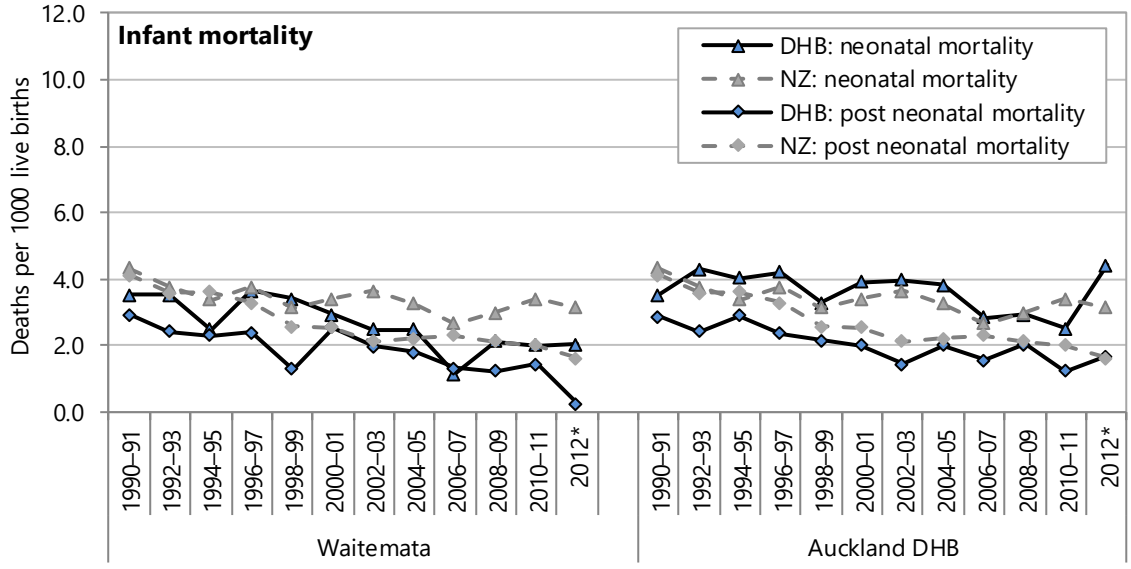
Numerator: National Mortality Collection; Denominator: Birth Registration Dataset; *2012 is a single year of data

Figure 26. Neonatal and post neonatal mortality, Northland and Counties Manukau DHBs vs New Zealand 1990–2012



Numerator: National Mortality Collection; Denominator: Birth Registration Dataset; *2012 is a single year of data

Figure 27. Neonatal and post neonatal mortality, Waitemata and Auckland DHBs vs New Zealand 1990–2012



Numerator: National Mortality Collection; Denominator: Birth Registration Dataset; *2012 is a single year of data

Regional distribution by cause

In the Northern DHBs, congenital anomalies, extreme prematurity and other perinatal conditions were the most frequent causes of infant mortality between 2008 and 2012 **(Table 28)**.

Table 28. Infant mortality by cause, Northern DHBs 2008–2012

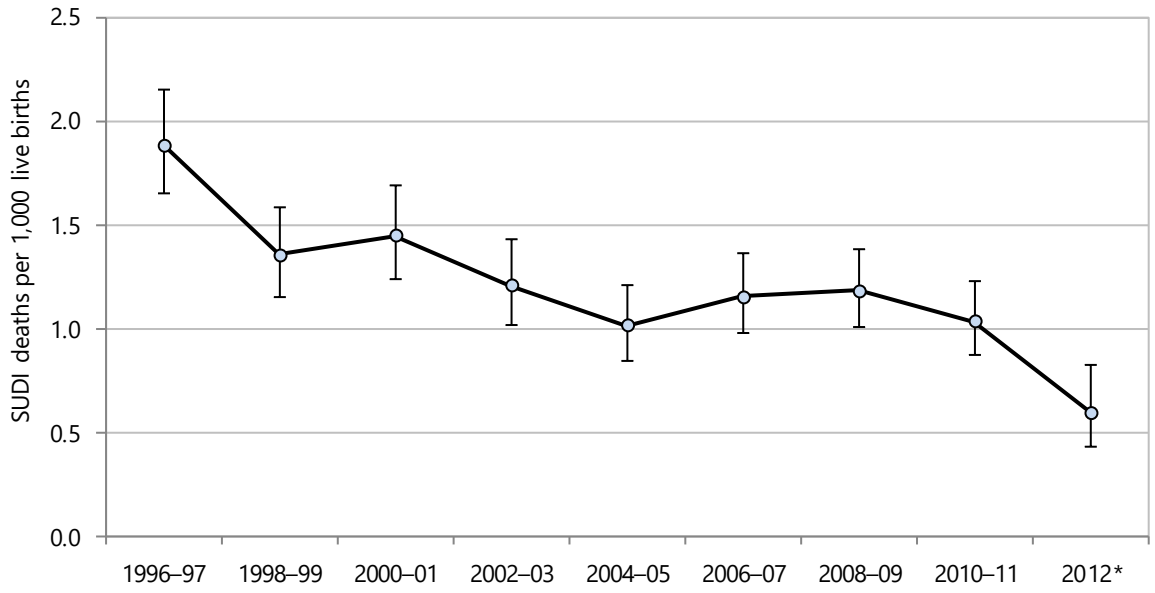
Cause of death	Number: 2008–2012	Number: annual average	Rate per 1,000 live births	Per cent
Infant mortality				
Northland				
Extreme prematurity	16	3.2	1.37	18.6
Congenital anomalies	14	2.8	1.20	16.3
Intrauterine hypoxia or birth asphyxia	<5	s	s	s
Other perinatal conditions	15	3.0	1.28	17.4
SUDI: SIDS	11	2.2	0.94	12.8
SUDI: suffocation or strangulation in bed	11	2.2	0.94	12.8
SUDI: All other types	<5	s	s	s
Injury or poisoning	<5	s	s	s
Other causes	12	2.4	1.03	14.0
Northland total	86	17.2	7.35	100.0
Waitemata				
Congenital anomalies	30	6.0	0.76	24.0
Extreme prematurity	16	3.2	0.40	12.8
Other perinatal conditions	44	8.8	1.11	35.2
SUDI: SIDS	8	1.6	0.20	6.4
SUDI: suffocation or strangulation in bed	6	1.2	0.15	4.8
SUDI: All other types	<5	s	s	s
Injury or poisoning	<5	s	s	s
Other causes	15	3.0	0.38	12.0
Waitemata total	125	25.0	3.16	100.0
Auckland DHB				
Congenital anomalies	41	8.2	1.24	26.5
Extreme prematurity	29	5.8	0.88	18.7
Other perinatal conditions	41	8.2	1.24	26.5
SUDI: SIDS	12	2.4	0.36	7.7
SUDI: suffocation or strangulation in bed	9	1.8	0.27	5.8
Other causes	23	4.6	0.69	14.8
Auckland DHB total	155	31.0	4.68	100.0
Counties Manukau				
Congenital anomalies	66	13.2	1.50	22.5
Extreme prematurity	64	12.8	1.46	21.8
Intrauterine hypoxia or birth asphyxia	<5	s	s	s
Other perinatal conditions	84	16.8	1.92	28.7
SUDI: SIDS	24	4.8	0.55	8.2
SUDI: suffocation or strangulation in bed	13	2.6	0.30	4.4
SUDI: All other types	7	1.4	0.16	2.4
Injury or poisoning	<5	s	s	s
Other causes	30	6.0	0.68	10.2
Counties Manukau total	293	58.6	6.68	100.0

Numerator: National Mortality Collection; Denominator: Birth Registration Dataset; SUDI = Sudden Unexpected Death in Infancy; SIDS = Sudden Infant Death Syndrome

Sudden unexpected death in infancy (SUDI)

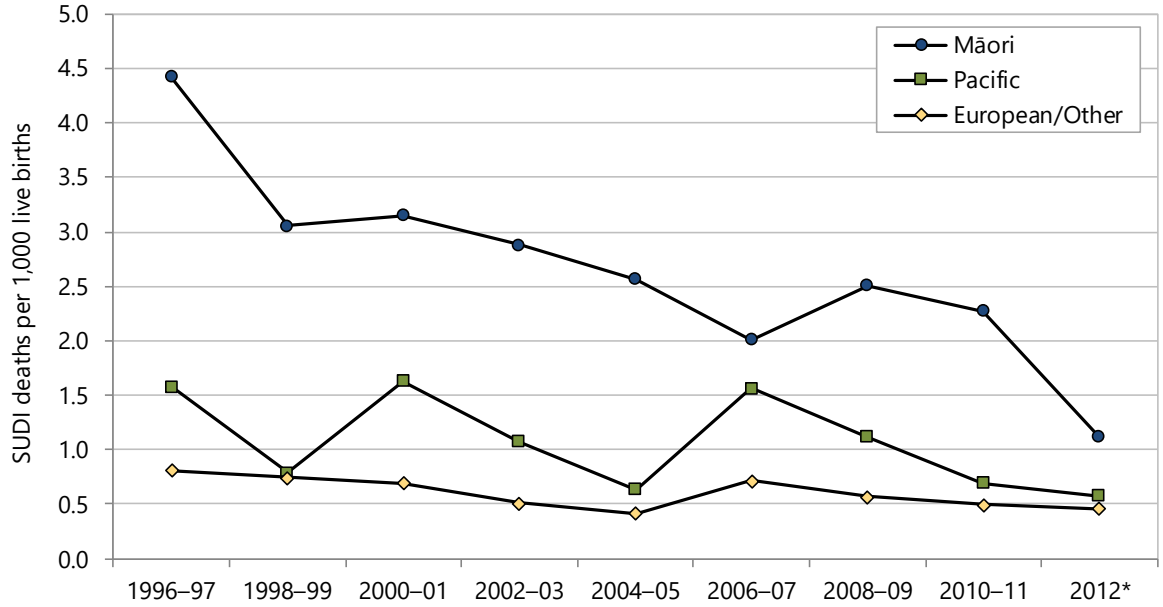
From 1996 to 2012 there was an overall *significant fall* in SUDI rates from 1.88 to 0.6 deaths per 1,000 live births **(Figure 28)**. The fall in SUDI rates from 1996–2012 was greatest for Māori infants, with lesser falls for Pacific and European/Other ethnic groups. Asian/Indian analyses were suppressed due to small numbers. Māori rates were consistently highest and European/Other consistently lowest, however, the gap between ethnic groups was closing by 2012 **(Figure 29)**.

Figure 28. Sudden Unexpected Death in Infancy (SUDI), New Zealand 1996–2012



Numerator: National Mortality Collection; Denominator: Birth Registration Dataset; * 2012 is a single year of data

Figure 29. Sudden unexpected death in infancy (SUDI), by ethnicity, New Zealand 1996–2012



Numerator: National Mortality Collection; Denominator: Birth Registration Dataset; Ethnicity is level 1 prioritised; * 2012 is a single year of data

Distribution by cause

From 1996–97 to 2012 the rate of sudden infant death syndrome (SIDS) deaths fell consistently. The diagnosis of unspecified SUDI was used from 2000–01 for between 0.05 and 0.20 deaths per 1,000 live births. Between 2002–03 and 2008–09 there was a rise in the death rate for suffocation or strangulation in bed which has since fallen. Death rates from inhalation of food or gastric contents have been relatively stable since 1998–99 with

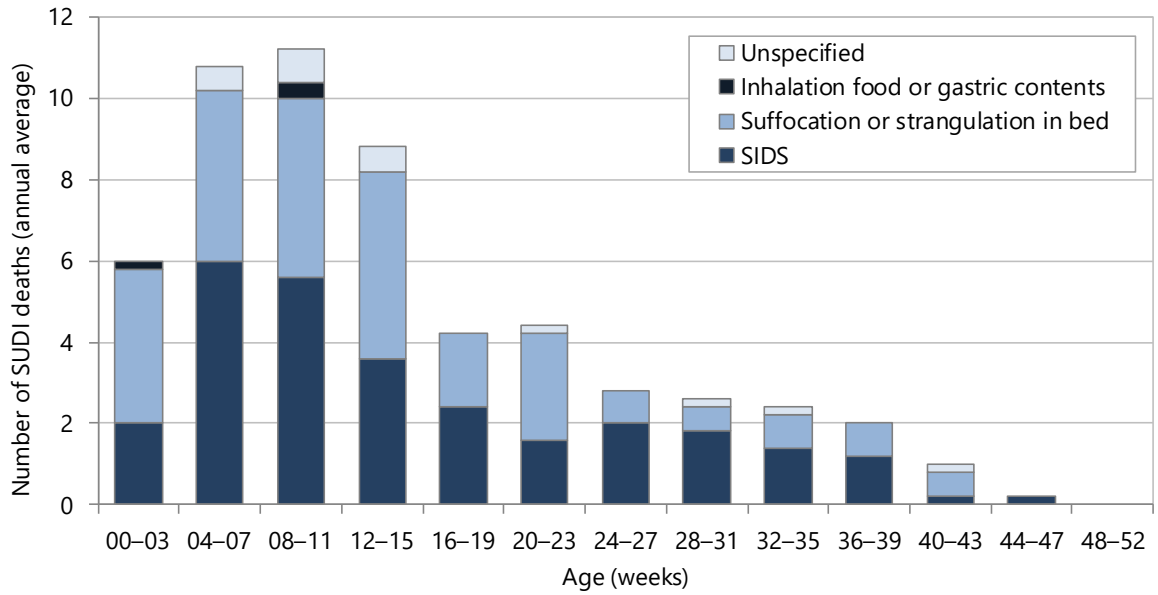
some year to year variation. These changes occurred in the context of falling SUDI rates overall and will have been influenced by changes in coding.

Distribution by demographic factors

Between 2008 and 2012 SUDI was most common from 4–15 weeks of age, with the highest numbers from 4 to 15 weeks of age, followed by deaths in the first three weeks and at 16–23 weeks. Numbers reduced with increasing age from 24–47 weeks and there were no deaths from 48–52 weeks. Suffocation or strangulation in bed was the predominant cause of death for 0–3 week olds and remained a common diagnosis until 23 weeks, while SIDS was the most common diagnosis for 4 to 11 weeks and again after 24 weeks of age. Inhalation of food or gastric contents was not noted as an underlying cause of death after age 11 weeks **(Figure 30)**.

There were disparities in SUDI rates by NZDep2013 index of deprivation score, ethnicity, gender, gestational age at birth and maternal age between 2008 and 2012. In areas with the highest NZDep2013 scores (deciles 7–10) SUDI rates were *significantly higher* compared with areas with lower scores (deciles 1–6) where there was *no significant difference* between deciles. Māori and Pacific SUDI rates were *significantly higher* compared with Asian/Indian and European/Other ethnic groups. Male rates were *significantly higher* than female rates. Infants born at 20–26 weeks gestation had *significantly higher* SUDI rates than infants born at more than 37 weeks gestation. SUDI rates were *significantly higher* for infants born to mothers aged under 30 years compared with infants born to mothers aged 30 years or older, with the increasing risk of SUDI with decreasing maternal age **(Table 29)**.

Figure 30. Sudden unexpected death in infancy (SUDI), by type and age in weeks, New Zealand 2008–2012



National Mortality Collection; Numbers are annual average

Table 29. Sudden unexpected death in infancy (SUDI), by demographic factor, New Zealand 2008–2012

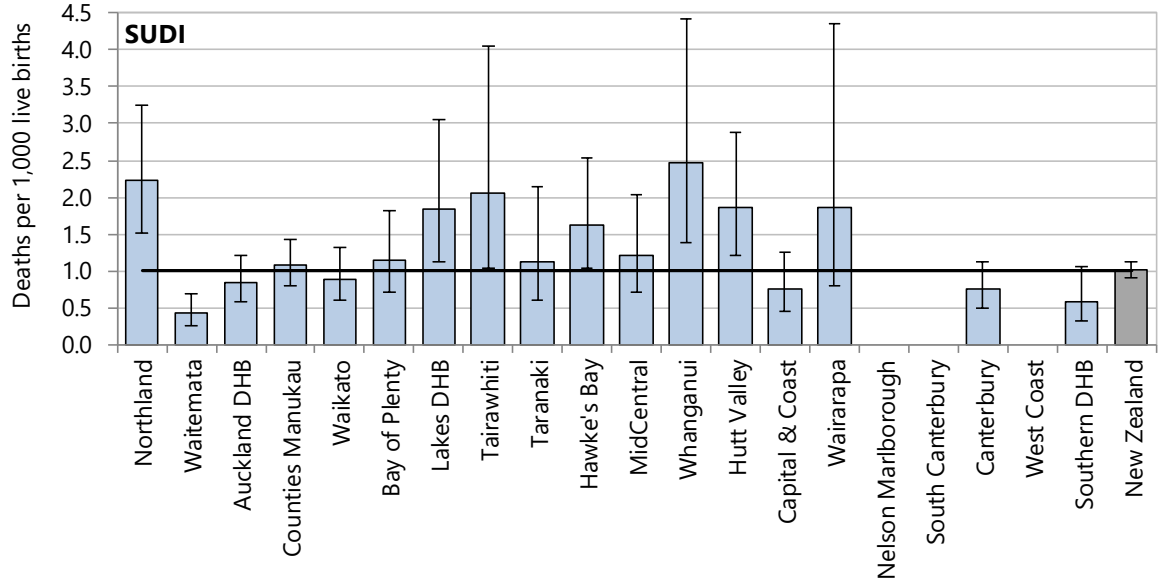
Variable	Rate per 1,000 live births	Rate ratio	95% CI	Variable	Rate per 1,000 live births	Rate ratio	95% CI
Sudden unexpected death in infancy (SUDI)							
NZDep2013 Index of deprivation quintile				Prioritised ethnicity			
Deciles 1–2	0.31	1.00		Māori	2.14	4.13	3.18–5.35
Deciles 3–4	0.49	1.61	0.84–3.10	Pacific	0.84	1.62	1.06–2.46
Deciles 5–6	0.57	1.86	1.00–3.47	Asian/Indian	0.33	0.63	0.34–1.15
Deciles 7–8	1.11	3.63	2.05–6.41	European/Other	0.52	1.00	
Deciles 9–10	1.84	6.04	3.50–10.4	Gender			
Maternal age group				Female	0.79	1.00	
<20 years	2.75	7.36	4.82–11.2	Male	1.21	1.54	1.23–1.93
20–24 years	1.73	4.63	3.12–6.86	Gestation at birth			
25–29 years	0.71	1.90	1.24–2.93	20–36 weeks	2.24	3.17	2.35–4.29
30–34 years	0.37	1.00		37+ weeks	0.70	1.00	
35+ years	0.35	0.93	0.55–1.56				

Numerator: National Mortality Collection; Denominator: Birth Registration Dataset; Rates are per 1,000 live births, Rate ratios are unadjusted; Ethnicity is level 1 prioritised; Decile is NZDep2013

Distribution by region

Between 2008 and 2012 SUDI rates were *significantly higher* than the national rate in the Northland, Lakes, Tairawhiti, Hawke's Bay, Whanganui and Hutt Valley DHBs and *significantly lower* in the Waitemata DHB. In remaining district health boards there was no significant difference from the national rate. **(Figure 31**, **Table 30)**.

Figure 31. Sudden unexpected death in infancy (SUDI), by district health board, New Zealand 2008–2012



Numerator: National Mortality Collection; Denominator: Birth Registration Dataset; Rates suppressed for Nelson Marlborough, South Canterbury, and West Coast DHBs due to numbers less than five

Table 30. Sudden unexpected death in infancy (SUDI), by district health board, New Zealand 2008–2012

DHB	Number: 2008–2012	Number: annual average	Rate per 1,000 live births	Rate ratio	95% CI
Sudden unexpected death in infancy					
Northland	26	5	2.22	2.20	1.48–3.29
Waitemata	17	3	0.43	0.43	0.26–0.69
Auckland	28	6	0.85	0.84	0.57–1.23
Counties Manukau	47	9	1.07	1.06	0.78–1.44
Waikato	25	5	0.89	0.89	0.59–1.33
Bay of Plenty	17	3	1.14	1.13	0.70–1.84
Lakes	15	3	1.85	1.84	1.09–3.08
Tairawhiti	8	2	2.06	2.04	1.01–4.11
Taranaki	9	2	1.13	1.12	0.58–2.18
Hawke's Bay	19	4	1.62	1.61	1.01–2.56
MidCentral	14	3	1.21	1.20	0.70–2.05
Whanganui	11	2	2.47	2.45	1.34–4.46
Hutt Valley	20	4	1.87	1.86	1.18–2.91
Capital & Coast	15	3	0.76	0.75	0.45–1.26
Wairarapa	5	1	1.86	1.85	0.77–4.47
Nelson Marlborough	<5	s	s	s	s
South Canterbury	<5	s	s	s	s
Canterbury	24	5	0.75	0.74	0.49–1.13
West Coast	<5	s	s	s	s
Southern	11	2	0.59	0.59	0.32–1.07
New Zealand	320	64	1.01	1.00	

Numerator: National Mortality Collection; Denominator: Birth Registration Dataset

Northern region distribution and trends

Comparison with New Zealand

Between 2008 and 2012 SUDI rates were *significantly higher* than the national rate in Northland, and *significantly lower* in Waitemata while rates in Auckland DHB and Counties Manukau were *not significantly different* from the national rate **(Table 31)**.

Table 31. Sudden unexpected death in infancy, Northern DHBs vs New Zealand 2008–2012

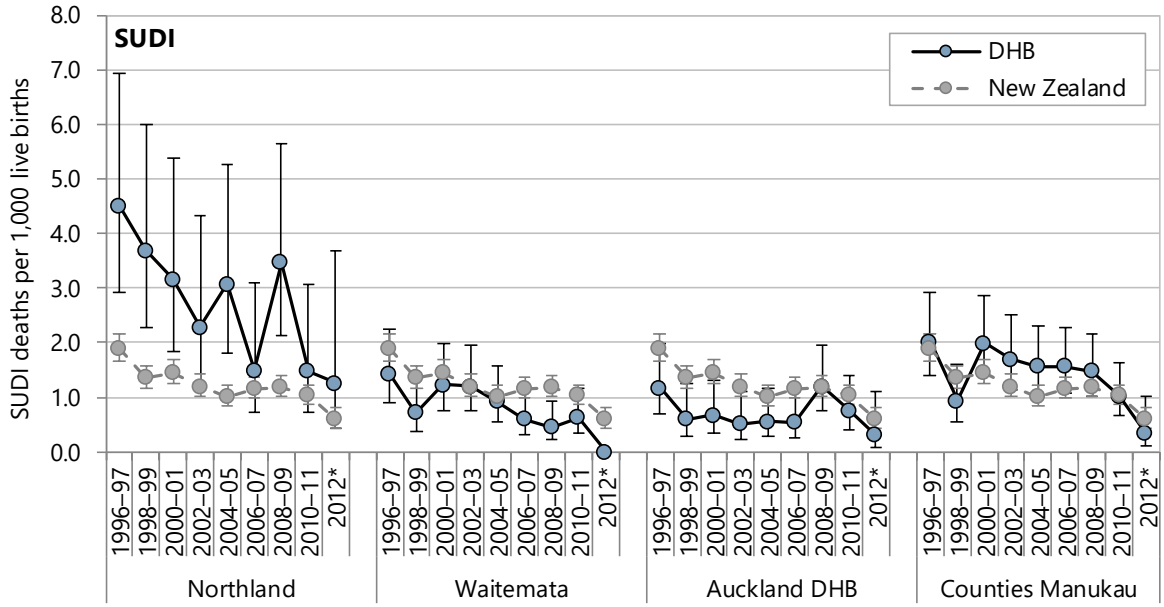
DHB	Number: 2008–2012	Number: annual average	Rate per 1,000 live births	Rate ratio	95% CI
Sudden unexpected death in infancy					
Northland	26	5	2.22	2.20	1.48–3.29
Waitemata	17	3	0.43	0.43	0.26–0.69
Auckland	28	6	0.85	0.84	0.57–1.23
Counties Manukau	47	9	1.07	1.06	0.78–1.44
New Zealand	320	64	1.01	1.00	

Numerator: National Mortality Collection; Denominator: Birth Registration Dataset

Regional trends

In the Northern DHBs, the rate of SUDI fell consistently from 1996–97 to 2012. Care should be applied when interpreting these rates due to the small numbers of SUDI deaths in each DHB **(Figure 32)**.

Figure 32. Sudden unexpected death in infancy, Northern DHBs vs New Zealand, 1996–2012



Numerator: National Mortality Collection; Denominator: Birth Registration Dataset; * 2012 is a single year of data; Care should be taken when interpreting these data as rates based on small numbers

Evidence for good practice relevant to infant mortality and SUDI prevention

Ministry of Health web pages
Ministry of Health. 2014. **Keeping baby safe and warm in bed**. http://www.health.govt.nz/your-health/healthy-living/babies-and-toddlers/keeping-baby-safe-and-warm-bed This web page contains advice for parents on putting their baby to sleep in a safe place to reduce the risk of suffocation during sleep. A pamphlet containing this information can be ordered or downloaded from the webpage.
New Zealand guidelines
Ministry of Health. 2012. **Observation of mother and baby in the immediate postnatal period: consensus statements guiding practice**. Wellington: Ministry of Health http://www.health.govt.nz/system/files/documents/publications/observation-mother-baby-immediate-postnatal-period-consensus-statements.pdf This guidance is intended to address the prevention of sudden unexpected early neonatal death, risk factors for which include unsupervised skin-to-skin contact, inexperienced mothers, and mothers being left unsupervised in the immediate postnatal period. The guidance was developed by members of the New Zealand College of Midwives and the Royal Australian and New Zealand College of Obstetricians and Gynaecologists – New Zealand Committee, with the support of the Ministry of Health. It is endorsed by the Ministry of Health and it is expected that all practitioners supporting mothers and babies in the immediate postnatal period will use this document to guide their practice.
International guidelines
National Institute for Health and Care Excellence. 2014. **Addendum to Clinical Guideline 37, Postnatal Care**. London: National Institute for Health and Care Excellence. http://www.nice.org.uk/guidance/cg37/evidence/cg37-postnatal-care-full-guideline-addendum2 This addendum to the NICE guideline on routine postnatal care updates the guideline section on reducing the risk of sudden infant death syndrome (SIDS). The update was considered necessary because of the publication of new information on the association between co-sleeping and SIDS. Unlike the original guideline which only reviewed evidence for the first 6–8 weeks after birth, this update considered evidence relevant to the first year of life. The review on which the recommendations were based included 11 individual studies and two individual patient data meta-analysis studies. All of the studies were observational (case control) rather than experimental therefore observed relationships between co-sleeping and SIDS could not definitively confirm that co-sleeping is a risk factor for SIDS. In summary, the new recommendations made are: 1. Recognise that co-sleeping can be intentional or unintentional. Discuss this with parents and carers and inform them that there is an association between co-sleeping (parents or carers sleeping on a bed or sofa or chair with an infant) and SIDS. 2. Inform parents and carers that the association between co-sleeping (sleeping on a bed or sofa or chair with an infant) and SIDS is likely to be greater when they, or their partner, smoke. 3. Inform parents and carers that the association between co-sleeping (sleeping on a bed or sofa or chair with an infant) and SIDS may be greater with: parental or carer recent alcohol consumption, or parental or carer drug use, or low birthweight or premature infants.
Task Force on Sudden Infant Death Syndrome. 2011. **SIDS and Other Sleep-Related Infant Deaths: Expansion of SIDS and Other Sleep-Related Infant Deaths**. Pediatrics, 128(5), 1030-39. http://pediatrics.aappublications.org/content/128/5/1030 This policy statement from the American Academy of Pediatrics is an expansion of previous AAP recommendations. It was reaffirmed in October 2014. The new recommendations not only focus on SIDS prevention but also on safe sleep environments that can reduce the risk of all sleep-related infant deaths including suffocation, asphyxia and entrapment. The recommendations described in this publication include placing the baby in a supine position to sleep, using a firm sleeping surface, breastfeeding, sharing a room (but not a bed), routine immunisations, considering the use of a pacifier, and avoiding soft bedding, overheating and exposure to tobacco smoke, alcohol and illicit drugs. The evidence base for these recommendations is published as: Task Force on Sudden Infant Death Syndrome. 2011. **Technical Report: SIDS and Other Sleep-Related Infant Deaths: Expansion of Recommendations for a Safe Infant Sleeping Environment**. Pediatrics, 128(5), e1341-e67.
Evidence-based medicine reviews
Horne RSC, Hauck FR, Moon RY, et al. 2014. **Dummy (pacifier) use and sudden infant death syndrome: Potential advantages and disadvantages**. Journal of Paediatrics and Child Health 50(3) 170-74. http://dx.doi.org/10.1111/jpc.12402 There has been some controversy over whether parents should be advised that the use of a pacifier (dummy) may reduce the risk of sudden infant death syndrome (SIDS). Several systematic reviews have shown a strong association between the lack of pacifier use in the final sleep and SIDS, but it is uncertain by what mechanism pacifier use is protective and whether pacifier use is a marker for some other factor that influences SIDS risk. This article describes the evidence, discussion and conclusions from the Epidemiology and Physiology Working Groups of the International Society for the Study and Prevention of Perinatal and Infant Death (ISPID) on this issue. It discusses potential disadvantages of dummy use and states that, while the current evidence regarding the effect of dummy use on breastfeeding duration and frequency has some methodological limitations, it reinforces the importance of introducing a dummy to breastfed infants only after breastfeeding has become well established, generally after 3–4 weeks. It also states that the evidence suggests that there is an association between otitis media and dummy use, although this has largely been observed in later infancy rather than in early infancy when most SIDS deaths occur. The ISPID found itself unable to provide a definitive recommendation regarding the use of dummies (pacifiers) for reducing SIDS risk, but members were agreed that parents of newborns should be educated about the evidence and potential benefits and risks to using dummies, so that they can make informed choices regarding their own infants.

Ball HL, Volpe LE. 2013. **Sudden Infant Death Syndrome (SIDS) risk reduction and infant sleep location – Moving the discussion forward**. Social Science & Medicine 79(0) 84-91.

The authors of this paper argue that SIDS reduction campaigns have assumed that parents who are appropriately instructed will choose to place their baby to sleep in an approved location such as a crib, but that public health practitioners have failed to recognise the importance of infant sleep location to ethnic and sub-cultural identity and therefore their messages advising parents not to bed share with their baby have been rejected by target populations. They argue that more detailed research about bed sharing is needed so that more sophisticated and focussed infant sleep safety measures that are culturally embedded can be developed.

Strehle E-M, Gray WK, Gopisetti S, et al. 2012**. Can home monitoring reduce mortality in infants at increased risk of sudden infant death syndrome? A systematic review**. Acta Paediatrica 101(1) 8-13. http://dx.doi.org/10.1111/j.1651-2227.2011.02464.x

This systematic review aimed to evaluate the effectiveness of home monitoring devices for the prevention of sudden infant death syndrome (SIDS). The review authors identified 11 relevant studies meeting their inclusion criteria: 10 cohort studies and one RCT. The RCT was a small study (100 infants in total) designed to assess the feasibility of a larger scale RCT. Across all 11 studies, 2210 infants were monitored for a total of 12,160 months, fiving a mean monitoring time of 5.5 months. During monitoring there were 11 deaths described as SIDS deaths, a rate of 5.9 per 1,000 (95% CI 1.4 to 11.0). Several studies reported deaths in infants who were not monitored or for whom monitoring had ceased. The review authors concluded that there is no high level evidence that home monitoring may be useful for preventing SIDS and that the wide variety of monitoring devices used makes comparisons between studies difficult. They noted that a methodologically rigorous controlled study to provide a more definitive evaluation of home monitoring may not be possible due to ethical concerns.

Mitchell EA, Freemantle J, Young J, et al. 2012. **Scientific consensus forum to review the evidence underpinning the recommendations of the Australian SIDS and Kids Safe Sleeping Health Promotion Programme--October 2010**. Journal of Paediatrics & Child Health 48(8) 626-33. http://onlinelibrary.wiley.com/doi/10.1111/j.1440-1754.2011.02215.x/abstract

This paper is a summary from a 1-day scientific consensus forum that reviewed the evidence underpinning the Australian SIDS and Safe Sleeping Health Promotion Programme. The Consensus forum recommended that future "Reducing the Risk" campaigns should focus on back to sleep, face uncovered, avoidance of cigarette smoking both before and after birth, safe sleeping environment (avoiding letting babies sleep on sofas, in strollers etc.), and sleeping baby in own cot in parents' room.

Hauck FR, Thompson JMD, Tanabe KO, et al. 2011. **Breastfeeding and Reduced Risk of Sudden Infant Death Syndrome: A Meta-analysis**. Pediatrics 128(1) 103-10. http://pediatrics.aappublications.org/content/128/1/103.abstract

The authors of this review identified 24 original case-control studies that provided data on the relationship between breastfeeding and SIDS risk. Eighteen studies met the review's quality criteria and contribute data to the meta-analyses. The number of cases in each study ranged from 23 to 591. For infants who received any amount of breast milk for any duration, the univariable summary odds ratio (SOR) was 0.40 (95% CI 0.35–0.44), and the multivariable SOR was 0.55 (95% CI 0.44–0.69). For any breastfeeding at two months of age or older, the univariable SOR was 0.38 (95% CI 0.27–0.54). The univariable SOR for exclusive breastfeeding of any duration was 0.27 (95% CI 0.24–0.31). The review authors concluded that breastfeeding is protective against SIDS, more so when breastfeeding is exclusive. They stated that breastfeeding recommendations should be included with other SIDS prevention messages, both to reduce the risk of SIDS and also for the many other child and maternal health benefits breastfeeding provides.

Other relevant publications

Horne RSC, Hauck FR, Moon RY. 2015. **Sudden infant death syndrome and advice for safe sleeping.** BMJ 350: h1989 http://www.bmj.com/content/350/bmj.h1989

This recent clinical review aims to provide healthcare professionals with the most up to date information for parents and caregivers about SIDS and infant safety while sleeping. It discusses the major risk factors for SIDS: prone sleeping position, smoking in pregnancy, being born preterm and using bedding which may cover the baby's head. It states that breastfeeding, sharing a room with parents and use of a dummy (pacifier) are protective. There is a detailed discussion of the risk associated with bed sharing and it is noted that although earlier studies found a risk associated with bed sharing only if the mother smoked, more recent studies have found an increased risk for infants <3 months even if neither parent is a smoker. While apnoea monitors are popular with parents who have lost a previous baby to SIDS, there is a lack of evidence for their efficacy.

Fleming P J, Blair P S, Pease A. 2015. **Sudden unexpected death in infancy: aetiology, pathophysiology, epidemiology and prevention in 2015**. Archives of Disease in Childhood. Published online first February 19, 2015. DOI: 10.1136/archdischild-2014-306424 http://adc.bmj.com/content/early/2015/02/19/archdischild-2014-306424.full.pdf+html

This paper notes that changes in the way sudden infant deaths are classified by pathologists and coroners, and a reluctance to use the term 'sudden infant death syndrome' have made it difficult to assess and compare national and international data on incidence. It reviews current understanding of the epidemiology and aetiology of SUDI, and current hypotheses regarding the pathophysiology of the processes which may lead to death. It also reviews interventions to reduce SUDI, and their variable effectiveness, before discussing new approaches that may offer the possibility of prevention in the future.

Hutchison LB, Thompson JMD, Mitchell EA. 2015. **Infant care practices related to sudden unexpected death in infancy: a 2013 survey**. NZMJ, Volume 128, Number 1408

This paper reports on a postal survey of women recently delivered at National Women's Health which aimed to evaluate mothers' knowledge of, and practices related to, risk factors for sudden unexpected death in infancy (SUDI) and to compare results with a similar survey conducted in 2005. Compared to the earlier survey, significantly more mothers in the 2013 survey cited advice to avoid bed sharing, keep the face clear, use a firm sleep surface, avoid soft bedding, and sleep in the same room as the parent. There was a marked increase in reported sources of this information. Significantly more mothers than previously reported that their babies were usually placed to sleep on their backs, and that their baby slept in their own bed in the parents' room. Fewer reported bed sharing and smoking in pregnancy.

Abel S, Stockdale-Frost , Rolls R, Tipene-Leach D 2015. **The wahakura: a qualitative study of the flax bassinet as a sleep location for New Zealand Māori infants**. NZMJ, Volume 128 Number 1413

This paper reports on a qualitative study in which 12 Māori mothers in the Hawke's Bay and Tairawhiti were interviewed about their impressions and experience of the wahakura (a hand woven flax basket which allows a baby to sleep in their own space in the parents' bed). The study also interviewed 10 key informants from the same region who were selected because of their knowledge and expertise about various aspects of wahakura production or use. The mothers were participants in the Kahungunu Infant Safe Sleep (KISS) study, a three-year RCT using a standard bassinette as a control which is currently underway. The mothers appreciated the practical advantages of the wahakura, especially its portability and convenience, and its cultural and spiritual values. The health professional key informants reported that the wahakura facilitated engaging with Māori women to impart safe sleep messages.

Child and Youth Mortality Review Committee, Te Rōpū Arotake Auau Mate o te Hunga Tamariki, Taiohi. 2013**. Special Report: Unintentional suffocation, foreign body inhalation and strangulation**. Wellington. http://www.hqsc.govt.nz/assets/CYMRC/Publications/CMYRC-special-report-March-2013.pdf

This report points out that suffocation in the place of sleep is increasingly being recognised as an important cause of SUDI and that some of these deaths occur when there has been a break from normal sleep routine, for example because of a social gathering or being away from home. In 2002–2009 48 infants under the age of 12 months died from suffocation in the place of sleep. Of the 50 children of all ages who died from suffocation in the place of sleep, 30 (60%) died due to overlaying by a parent or sibling, and 20 (30%) due to wedging (e.g. becoming trapped between a sleeping surface and bedding, or between cushions and the couch). The report includes issues identified and recommendations made by guest authors, by local Mortality Review Groups and by the CYMRC, and also national policy and practice recommendations, best practice for DHBs, PHOs and NGOs, and best practice in community messaging.

Abel S, Tipene-Leach D. 2013. **SUDI prevention: a review of Māori safe sleep innovations for infants**. New Zealand Medical Journal 126(1379) 86-94. https://www.nzma.org.nz/journal/read-the-journal/all-issues/2010-2019/2013/vol-126-no-1379/view-abel

Māori have disproportionately high rates of SUDI and of smoking in pregnancy. Māori health workers have found it difficult to reduce smoking in pregnancy among Māori women so attention has been focussed on how to improve the safety of infant sleeping situations without necessarily banning bed sharing which is both a culturally valued behaviour and a practice that is common in resource-poor homes. This paper describes the wahakura project which involved the distribution of 85 wahakura to vulnerable Māori mothers through a Māori midwifery service in the Gisborne area. A wahakura is a woven flax bassinet-like basket which can be placed in the parents' bed for the baby to sleep in (at the head of the bed). A second project was later initiated in the Hawke's Bay. The high degree of weaving skill and the time required to make wahakura led to a search for a cheaper alternative. The pepi-pod is based on a plastic box and has been found to be acceptable to parents. It is the subject of randomised controlled trial comparing outcomes from an enhanced safe sleep education programme that uses pēpi-pods with those from a standard safe sleep education programme.

Cowan S, Pease A, Bennett S. 2013**. Usage and impact of an online education tool for preventing sudden unexpected death in infancy**. Journal of Paediatrics & Child Health 49(3) 228-32.

This paper reports on the evaluation of an online educational tool for mainstream health professionals, and the wider community, intended to equip them with the knowledge, attitudes and actions needed for providing developmentally appropriate sleeping conditions for babies in New Zealand. The 24 slide presentation, with voiceover, cost $3000 to develop. There were 3286 completed online sessions between 18 November 2009 and 31 December 2011. Users had diverse locations, ethnicities and roles. On completing the course, 69% gave a high rating to their "increased confidence" to discuss infant sleep safety with others. The study authors stated that the online tool achieved its aims of high usage and broad participation and had a cost-effective impact on increasing people's confidence to discuss infant sleep safety with others.

Mitchell EA, Blair PS. 2012. SIDS prevention: **3000 lives saved but we can do better**. New Zealand Medical Journal 125(1359) 50-7. https://www.nzma.org.nz/journal/read-the-journal/all-issues/2010-2019/2012/vol-125-no-1359/view-mitchell

This viewpoint article outlines the history of SIDS research and the success of subsequent SIDS prevention efforts involving the promotion of supine (on the back) sleeping in dramatically reducing rates of SIDS, both in New Zealand and elsewhere. It notes that there is considerable ongoing effort by the Ministry of Health, and many other organisations, to discourage maternal smoking and promote breastfeeding, to reduce SIDS risk. It highlights the fact that bed sharing is a significant risk factor, and that many parents are unaware of this. It lists the ISPID recommendations for reducing the risk of Sudden Infant Death Syndrome.

International Society for the Study and Prevention of Perinatal and Infant Death (ISPID). 2012. **To swaddle or not to swaddle?** http://www.ispid.org/swaddling.html

This brief article on the ISPID website discusses the evidence regarding swaddling (firmly wrapping a baby before putting it down to sleep) and SIDS. It makes the following recommendations: Parents should be aware of the potential risks of swaddling their infant, particularly of the use of heavy materials for swaddling; Infants must NEVER be placed prone (on their stomach) when swaddled; Current research suggests that it is safest to swaddle infants from birth and not to change infant care practices by beginning to swaddle their infant at 3 months of age when SIDS risk is greatest; Secondary caregivers should be made aware of their infant's usual sleeping environment and practices.

Tipene-Leach D, Hutchison L, Tangiora A, et al. 2010. **SIDS-related knowledge and infant care practices among Māori mothers**. New Zealand Medical Journal 123(1326) 88-96. https://www.nzma.org.nz/journal/read-the-journal/all-issues/2010-2019/2010/vol-123-no-1326/article-tipene-leach

This paper reports on a survey of Māori mothers who had given Counties Manukau DHB area from 21 July to 31 December 2008. There were 299 mothers who participated, out of 734 who were eligible. Mothers were asked to list all the factors they thought might help reduce the risk of SIDS, and from where and from whom they had received their information. They were also asked about current practices of maternal smoking, breastfeeding and both 'last night' and 'usual practice' infant sleep position and bed sharing, room sharing, pacifier use, plastic mattress wrapping, head shape concerns and positioning devices, and their reasons for using these practices (or not). The survey indicated that there was a high prevalence of Māori infant co-sleeping where there had been smoking in pregnancy (21%), which is an extremely high-risk practice, and that 13% of infants habitually slept prone and 36% with soft objects present in their sleeping environment.

The authors concluded that their research had highlighted important information regarding the current state of Māori mothers' knowledge and usage of child care practices and they stated that the challenge now is to develop appropriate health promotion tools for use in this community that might improve knowledge and so change behaviour, especially in regard to smoking cessation, safe sleeping environments, safe sleeping position and duration of breastfeeding.

New Zealand College of Midwives. 2010. **Consensus Statement: Safe sleeping for Baby**. Christchurch: New Zealand College of Midwives. http://www.midwife.org.nz/pdf/resources/20%20Safe%20Sleeping%20for%20Baby.pdf

This consensus statement sets out the recommendations on safe sleeping for babies that midwives should inform mothers/families/whānau about.

McManus V, Abel S, McCreanor T, et al. 2010. Narratives of deprivation: **Women's life stories around Māori sudden infant death syndrome**. Social Science & Medicine, 71(3), 643-9.

This paper reports on life story interviews conducted between 2002 and 2004 with nineteen Māori mothers whose infants died of SIDS. These mothers' stories have common themes of alienation, marginalisation and exclusion and lives lived with serious deprivation within an affluent society. The authors state that is unhelpful to view some risk factors as non-modifiable and argue that new approaches that build on the WHO Social determinants of health framework are needed to stem the tide of deaths of Māori babies from SIDS.

Child and Youth Mortality Review Committee, Te Rōpū Arotake Auau Mate o te Hunga Tamariki, Taiohi. 2009**. Fifth Report to the Minister of Health: Reporting mortality 2002–2008**. Wellington: Child and Youth Mortality Review Committee. http://www.hqsc.govt.nz/assets/CYMRC/Publications/cymrc-5th-report-chp1-sudi.pdf

Chapter one of this report provides quantitative data on mortality from SUDI during 2002–2008, and qualitative information obtained from local mortality review. It also contains recommendations from the CYMRC on reducing the incidence of SUDI in New Zealand.

A full page quick reference guide on SUDI prevention, from the CYMRC, can be found here: http://www.hqsc.govt.nz/assets/CYMRC/Publications/Protecting-Infants-from-SUDI.pdf

Websites

Child and Youth Mortality Review Committee. **SUDI**. http://www.hqsc.govt.nz/our-programmes/mrc/cymrc/publications-and-resources/sudi/

This web page, by the Child and Youth Mortality Review Committee, has a range of resources and links related to SUDI.

Safe sleep videos from the Northland DHB http://www.hqsc.govt.nz/our-programmes/mrc/cymrc/publications-and-resources/publication/1907/

In conjunction with the regional Child Health Network and Whakawhetu, the Northland DHB produced four television commercials to promote SUDI prevention. The videos were launched for Safe Sleep Day in December 2013. The four videos, entitled: PLACE baby in his or her own baby bed; ELIMINATE smoking in pregnancy, in the whānau and the home; POSITION baby on his or her back to sleep; and ENCOURGE and support mum, so baby is breastfed, can be viewed on YouTube by following the links on the webpage.

Whakawhetu: National SUDI Prevention for Māori http://www.whakawhetu.co.nz/

Whakawhetū National SUDI Prevention for Māori is a national kaupapa Māori programme dedicated to reducing the rate of SUDI (Sudden Unexpected Death in Infancy) for Māori. They provide policy advice, disseminate evidence-based information, resources, training and education to the health sector and Māori communities, facilitate an annual Safe Sleep Day in December of every year, work with communities to develop local solution, and work with DHBs to support their work to reduce SUDI.

TAHA Well Pacific Mother and Infant Service (www.taha.co.nz)

The Pacific Health Programme, in the Department of Māori and Pacific Health at the University of Auckland, has developed a SUDI prevention programme for Pacific families in Auckland.

Change for Our Children (www.changeforourchildren.co.nz)

Change for our Children is on a mission to build a strong culture of respect for children that is visible in our country's systems and services, conversations and communities, hearts and homes. This site contains, among other useful resources, information on the pepi-pod project which provides a means of enabling babies to be close to a parent but have their own safe sleeping space, and some useful publications both from the organisation and elsewhere. There is a link to The Pepi Shop which is an initiative allowing parents to buy their own Pepi-Pod® sleep space online via Trademe.

ISSUES FOR ALL AGES

CAUSES OF DEATH AND HOSPITALISATION

Introduction

This section provides a brief review of the causes of death and hospitalisation for New Zealand children and young people for the last five years thereby giving the context for the subsequent sections of this report where the descriptions are of specific conditions. Infant mortality has been considered in the previous section and is not repeated here. The following sections use the National Mortality Collection and the National Minimum Dataset to describe the most common causes of death for children aged 1–14 years and young people aged 15–24 years, and for hospitalisation of children aged 0–14 years and young people aged 15–24 years.

Data source and methods

Indicators

Causes of deaths in 1–24 year olds
Causes of hospitalisations in 0–24 year olds

Data sources

Numerator:
Deaths: National Mortality Collection
Hospitalisations: National Minimum Dataset
Denominator: Statistics NZ Estimated Resident Population (with linear extrapolation being used to calculate denominators between Census years)

Definition

Numerator:
Deaths: Deaths in 1–24 year olds by the main underlying cause of death (deaths per 100,000 population)
Hospitalisations: Hospitalisations for 0–24 year olds by primary diagnosis (acute and arranged admissions; excluding neonates) or primary procedure (waiting list admissions; hospitalisations per 1,000 population). Refer to **Appendix 6** for the codes included.
Denominator: 1–14 DHB age range was calculated using Estimated Resident Population extrapolations for 0–14 range and subtracting the number of live births in that period.

Notes on interpretation

Note 1: Because hospitalisations during the neonatal period are likely to be heavily influenced by perinatal factors and/or result from preterm infants transitioning through different levels of neonatal care (e.g. from neonatal intensive care, to Level 1–3 special care baby units), neonatal hospitalisations have been excluded from this analysis. Similarly, infant mortality is also likely to be heavily influenced by perinatal factors, and thus this section is restricted to an analysis of mortality aged 1–24 years (see Infant mortality and sudden unexpected death in infancy section beginning on **page 53** for a review of the causes of mortality in those aged less than one year).
Note 2: An acute admission is an unplanned hospitalisation occurring on the day of presentation, while an arranged admission (sometimes referred to as semi-acute) is a non-acute hospitalisation with an admission date less than seven days after the date the decision was made that the hospitalisation was necessary. A waiting list admission is a planned hospitalisation, where the admission date is seven or more days after the date the decision was made that the hospitalisation was necessary.
Note 3: In order to maintain consistency with the injury section, all injury hospitalisations with an Emergency Medicine Specialty Code on discharge have been excluded (see **Appendix 3** for rationale).
Note 4: **Appendix 3** outlines the limitations of the data utilised from the National Minimum Dataset. The reader is advised to review this information before interpreting any trends.

National distribution

Causes of death

Between 2008 and 2012 there were 718 deaths of children aged 1–14 years, an average of 144 deaths per year. The most common underlying causes of death were cancers (neoplasms), congenital anomalies, transport-related injuries, and other injuries including self-harm **(Table 32)**. From 2008–2012 there were 1,965 deaths of young

people aged 15–24 years, an average of 393 deaths per year. Suicide (intentional self-harm) was the most common cause of death in this age group followed by transport-related injury **(Table 33)**.

Table 32. Deaths in 1–14 year olds, by main underlying cause, New Zealand 2008–2012

Main underlying cause of death	Number: 2008–2012	Number: annual average	Rate per 100,000 1–14 year olds	95% CI	Per cent
New Zealand					
1–14 year olds					
Unintentional injury	227	45	5.43	4.77–6.18	31.6
Neoplasm	112	22	2.68	2.23–3.22	15.6
Congenital anomalies	65	13	1.55	1.22–1.98	9.1
Suicide	39	8	0.93	0.68–1.27	5.4
Metabolic disorders	25	5	0.60	0.40–0.88	3.5
Assault	24	5	0.57	0.39–0.85	3.3
Pneumonia	18	4	0.43	0.27–0.68	2.5
Meningococcal disease	13	3	0.31	0.18–0.53	1.8
SUDI: SIDS & unspecified	12	2	0.29	0.16–0.50	1.7
Other medical	173	35	4.14	3.56–4.80	24.1
Undetermined intent	5	1	0.12	0.05–0.28	0.7
Other causes	5	1	0.12	0.05–0.28	0.7
New Zealand total	718	144	17.17	15.96–18.47	100.0

Numerator: National Mortality Collection; Denominator: Statistics NZ Estimated Resident Population; Excludes infants (age less than one year)

Table 33. Deaths in 15–24 year olds, by main underlying cause, New Zealand 2008–2012

Main underlying cause of death	Number: 2008–2012	Number: annual average	Rate per 100,000 15–24 year olds	95% CI	Per cent
New Zealand					
15–24 year olds					
Unintentional injury	773	155	25.03	23.32–26.86	39.3
Suicide	625	125	20.24	18.71–21.89	31.8
Neoplasm	141	28	4.57	3.87–5.38	7.2
Assault	54	11	1.75	1.34–2.28	2.7
Congenital anomalies	48	10	1.55	1.17–2.06	2.4
Metabolic disorders	22	4	0.71	0.47–1.08	1.1
Other medical	266	53	8.61	7.64–9.71	13.5
Unspecified	12	2	0.39	0.22–0.68	0.6
Undetermined intent of injury	14	3	0.45	0.27–0.76	0.7
Other causes	10	2	0.32	0.18–0.60	0.5
New Zealand total	1,965	393	63.62	60.87–66.50	100.0

Numerator: National Mortality Collection; Denominator: Statistics NZ Estimated Resident Population

Causes of hospitalisation

0-14 year olds

Between 2010 and 2014 there were 380,650 acute hospitalisations of children aged 0–14 years, 60,000 arranged admissions and 140,860 waiting list admissions. In total there were 581,510 hospitalisations of children in this age group. The most common reasons for acute hospitalisation in this age group were injury or poisoning, bronchiolitis, acute upper respiratory tract infections and gastroenteritis. The most common reasons for arranged admissions were cancer or cancer treatment (neoplasm, chemotherapy or radiotherapy), injury or poisoning and congenital anomalies. The most common procedures for waiting list admissions were gastrointestinal procedures, grommets and tonsillectomy **(Table 34)**.

15–24 year olds

Between 2010 and 2014 there were 265,498 acute hospitalisations of young people aged 15–24 years, 54,140 arranged hospitalisations, 139,389 reproductive admissions and 59,390 waiting list admissions. In total there were 518,417 hospitalisations of young people in this age group, an average of 103,683 hospitalisations per year. The most common reasons for acute hospitalisation in this age group were injury or poisoning, pregnancy, delivery or postnatal-related conditions, mental health, and abdominal or pelvic pain. The most common reasons for arranged admissions were injury or poisoning, cancer or cancer treatment (neoplasm, chemotherapy or radiotherapy), mental health and dialysis. Most of the reproductive admissions (79.5%) were for pregnancy, delivery or postnatal-related conditions with smaller numbers for termination of pregnancy and spontaneous or other early pregnancy loss. The most common procedures for waiting list admissions were gastrointestinal procedures, dental procedures and tonsillectomy **(Table 35)**.

Table 34. Causes of hospitalisations in 0–14 year olds, by admission type, New Zealand 2010–2014

	Number: 2010–2014	Number: annual average	Rate per 1,000 0–14 year olds	95% CI	Per cent
New Zealand 0–14 year olds					
Acute admissions by primary diagnosis					
Injury or poisoning	46,537	9,307	10.27	10.18–10.37	12.2
Asthma and wheeze	31,260	6,252	6.90	6.83–6.98	8.2
Bronchiolitis	28,377	5,675	6.27	6.19–6.34	7.5
Acute upper respiratory tract infection	28,060	5,612	6.20	6.12–6.27	7.4
Gastroenteritis	27,033	5,407	5.97	5.90–6.04	7.1
Viral infection NOS	20,915	4,183	4.62	4.56–4.68	5.5
Skin infections	15,375	3,075	3.39	3.34–3.45	4.0
Pneumonia	14,712	2,942	3.25	3.20–3.30	3.9
Abdominal or pelvic pain	10,461	2,092	2.31	2.27–2.35	2.7
Urinary tract infection	7,171	1,434	1.58	1.55–1.62	1.9
Appendicitis	5,242	1,048	1.16	1.13–1.19	1.4
Constipation	4,378	876	0.97	0.94–1.00	1.2
Other diagnoses	141,129	28,226	31.16	31.00–31.32	37.1
Total	380,650	76,130	84.04	83.79–84.30	100.0
Arranged admissions by primary diagnosis					
Neoplasm, chemotherapy, or radiotherapy	13,371	2,674	2.95	2.90–3.00	22.3
Injury or poisoning	4,767	953	1.05	1.02–1.08	7.9
Congenital anomalies	3,109	622	0.69	0.66–0.71	5.2
Metabolic disorders	1,362	272	0.30	0.29–0.32	2.3
Perinatal-related conditions	1,117	223	0.25	0.23–0.26	1.9
Haemolytic anaemias	853	171	0.19	0.18–0.20	1.4
Constipation	828	166	0.18	0.17–0.20	1.4
Mental health	771	154	0.17	0.16–0.18	1.3
Dialysis	701	140	0.15	0.14–0.17	1.2
Removal of internal fixation device	700	140	0.15	0.14–0.17	1.2
Dental conditions	700	140	0.15	0.14–0.17	1.2
Other diagnoses	31,721	6,344	7.00	6.93–7.08	52.9
Total	60,000	12,000	13.25	13.14–13.35	100.0
Waiting list admissions by primary procedure					
Dental procedures	36,014	7,203	7.95	7.87–8.03	24.0
Grommets	22,743	4,549	5.02	4.96–5.09	15.1
Tonsillectomy ± adenoidectomy	15,653	3,131	3.46	3.40–3.51	10.4
Musculoskeletal procedures	13,448	2,690	2.97	2.92–3.02	9.0
Gastrointestinal procedures	7,381	1,476	1.63	1.59–1.67	4.9
Procedures on skin or subcutaneous tissue	4,767	953	1.05	1.02–1.08	3.2
Inguinal hernia repair	3,300	660	0.73	0.70–0.75	2.2
Adenoidectomy without tonsillectomy	2,999	600	0.66	0.64–0.69	2.0
Other procedures	37,072	7,414	8.19	8.10–8.27	24.7
No procedure listed	6,751	1,350	1.49	1.46–1.53	4.5
Total	150,128	30,026	33.15	32.98–33.31	100.0
New Zealand total	590,778	118,156	130.44	130.13–130.75	

Numerator: National Minimum Dataset; Denominator: Statistics NZ Estimated Resident Population; NOS = not otherwise specified

Table 35. Causes of hospitalisations in 15–24 year olds, by primary diagnosis, New Zealand 2010–2014

	Number: 2010–2014	Number: annual average	Rate per 1,000 15–24 year olds	95% CI	Per cent
New Zealand 15–24 year olds					
Acute admissions by primary diagnosis					
Injury or poisoning	42,049	8,410	13.47	13.35–13.60	15.9
Mental health	21,475	4,295	6.88	6.79–6.97	8.1
Abdominal or pelvic pain	20,981	4,196	6.72	6.63–6.81	7.9
Skin infections	11,100	2,220	3.56	3.49–3.62	4.2
Gastroenteritis	8,745	1,749	2.80	2.74–2.86	3.3
Appendicitis	7,994	1,599	2.56	2.51–2.62	3.0
Urinary tract infection	6,932	1,386	2.22	2.17–2.27	2.6
Acute upper respiratory tract infection	5,206	1,041	1.67	1.62–1.71	2.0
Asthma and wheeze	4,071	814	1.30	1.26–1.35	1.5
Viral infection NOS	3,975	795	1.27	1.23–1.31	1.5
STI or pelvic inflammatory disease	3,936	787	1.26	1.22–1.30	1.5
Other diagnoses	127,663	25,533	40.91	40.69–41.13	48.3
Acute total	264,127	52,825	84.63	84.32–84.94	100.0
Arranged admissions by primary diagnosis					
Injury or poisoning	5,575	1,115	1.79	1.74–1.83	10.3
Neoplasm, chemotherapy, or radiotherapy	3,668	734	1.18	1.14–1.21	6.8
Mental health	2,448	490	0.78	0.75–0.82	4.5
Dialysis	2,167	433	0.69	0.67–0.72	4.0
Immune disorders	1,552	310	0.50	0.47–0.52	2.9
Metabolic disorders	891	178	0.29	0.27–0.30	1.6
Removal of internal fixation device	833	167	0.27	0.25–0.29	1.5
Other diagnoses	37,006	7,401	11.86	11.74–11.98	68.4
Arranged total	54,140	10,828	17.35	17.20–17.49	100.0
Reproductive hospitalisations by primary diagnosis					
Pregnancy, delivery, or postnatal-related conditions	112,923	22,585	73.60	73.19–74.02	78.7
Termination of pregnancy*: therapeutic, other, or unspecified	22,915	4,583	14.94	14.75–15.13	16.0
Spontaneous or other early pregnancy loss	7,687	1,537	5.01	4.90–5.12	5.4
reproductive total	143,525	28,705	93.55	93.09–94.01	100.0
Waiting list admissions by primary procedure					
Musculoskeletal procedures	9,395	1,879	3.01	2.95–3.07	16.6
Gastrointestinal procedures	8,688	1,738	2.78	2.73–2.84	15.3
Dental procedures	4,911	982	1.57	1.53–1.62	8.7
Procedures on skin or subcutaneous tissue	4,650	930	1.49	1.45–1.53	8.2
Tonsillectomy ± adenoidectomy	4,585	917	1.47	1.43–1.51	8.1
Other procedures	21,841	4,368	7.00	6.91–7.09	38.6
no procedure listed	2,555	511	0.82	0.79–0.85	4.5
Waiting list total	56,625	11,325	18.14	18.00–18.29	100.0
New Zealand total	518,417	103,683			

Numerator: National Minimum Dataset; Denominator: Statistics NZ Estimated Resident Population; Injury ED cases excluded; NOS = not otherwise specified; reproductive hospitalisations are presented as rates per 1,000 females aged 15–24 years;
* Termination of pregnancy includes therapeutic, other, or unspecified terminations performed in hospital, and may be an underestimate; overall rate not provided due to use of gender-specific denominator for reproductive hospitalisations

Northern region distribution

Causes of death

Between 2008 and 2012 the most common underlying causes of death for 0–14 year olds in all Northern DHBs were medical conditions, particularly cancer and congenital anomalies, drowning and transport-related injuries.

The order of these diagnoses varied between the DHBs. For each specific cause there were fewer than five deaths per year on average in each DHB. In Northland suicide was among the common causes of death for 1–14 year olds with an average of one death per year **(Table 36)**. Among 15–24 year olds the most common underlying causes of death were suicide and transport-related injuries **(Table 37).**

Table 36. Deaths in 1–14 year olds, by main underlying cause of death, Northern DHBs 2008–2012

Main underlying cause of death	Number: 2008–2012	Number: annual average	Rate per 100,000 1–14 year olds	95% CI	Per cent
1–14 year olds					
Northland					
Unintentional injury	18	4	10.71	6.78–16.93	40.9
Suicide	5	1	2.98	1.27–6.97	11.4
Other causes	21	4	12.50	8.17–19.10	47.7
Northland total	44	9	26.18	19.51–35.14	100.0
Waitemata					
Neoplasm	16	3	3.11	1.92–5.06	25.8
Unintentional injury	16	3	3.11	1.92–5.06	25.8
Congenital anomalies	7	1	1.36	0.66–2.81	11.3
Other medical	15	3	2.92	1.77–4.82	24.2
Other causes	8	2	1.56	0.79–3.07	12.9
Waitemata total	62	12	12.06	9.41–15.46	100.0
Auckland DHB					
Neoplasm	15	3	4.02	2.43–6.63	28.3
Congenital anomalies	7	1	1.87	0.91–3.87	13.2
Other medical	19	4	5.09	3.26–7.95	35.8
Other causes	12	2	3.21	1.84–5.62	22.6
Auckland total	53	11	14.19	10.85–18.56	100.0
Counties Manukau					
Unintentional injury	31	6	5.69	4.01–8.08	29.5
Neoplasm	11	2	2.02	1.13–3.62	10.5
Congenital anomalies	11	2	2.02	1.13–3.62	10.5
Suicide	5	1	0.92	0.39–2.15	4.8
Pneumonia	5	1	0.92	0.39–2.15	4.8
Other causes	42	8	7.71	5.71–10.42	40.0
Counties Manukau total	105	21	19.28	15.93–23.34	100.0

Numerator: National Mortality Collection; Denominator: Statistics NZ Estimated Resident Population

Table 37. Deaths in 15–24 year olds, by main underlying cause of death, Northern DHBs 2008–2012

Main underlying cause of death	Number: 2008–2012	Number: annual average	Rate per 100,000 15–24 year olds	95% CI	Per cent
15–24 year olds					
Northland					
Unintentional injury	38	8	40.05	29.18–54.96	42.2
Suicide	29	6	30.56	21.28–43.89	32.2
Neoplasm	5	1	5.27	2.25–12.34	5.6
Other causes	18	4	18.97	12.00–29.98	20.0
Northland total	90	18	94.84	77.17–116.55	100.0
Waitemata					
Unintentional injury	57	11	15.14	11.69–19.62	36.1
Suicide	53	11	14.08	10.77–18.42	33.5
Neoplasm	10	2	2.66	1.44–4.89	6.3
Assault	5	1	1.33	0.57–3.11	3.2
Other causes	33	7	8.77	6.24–12.31	20.9
Waitemata total	158	32	41.98	35.92–49.05	100.0
Auckland DHB					
Suicide	52	10	14.17	10.81–18.58	36.4
Unintentional injury	48	10	13.08	9.87–17.34	33.6
Neoplasm	13	3	3.54	2.07–6.06	9.1
Other medical	22	4	6.00	3.96–9.08	15.4
Other causes	8	2	2.18	1.10–4.30	5.6
Auckland total	143	29	38.98	33.09–45.91	100.0
Counties Manukau					
Suicide	85	17	23.05	18.64–28.49	37.4
Unintentional injury	66	13	17.90	14.07–22.76	29.1
Neoplasm	17	3	4.61	2.88–7.38	7.5
Assault	10	2	2.71	1.47–4.99	4.4
Congenital anomalies	7	1	1.90	0.92–3.92	3.1
Other medical	37	7	10.03	7.28–13.83	16.3
Other causes	5	1	1.36	0.58–3.17	2.2
Counties Manukau total	227	45	61.55	54.05–70.09	100.0

Numerator: National Mortality Collection; Denominator: Statistics NZ Estimated Resident Population

Causes of hospitalisation

In the Northern DHBs between 2010 and 2014 the most frequent cause of acute hospitalisation for 0–14 year olds was injury or poisoning. Other common causes were gastroenteritis, upper respiratory tract and other viral infections, bronchiolitis and gastroenteritis although the order of these diagnoses varied between the DHBs. Skin infections were an additional frequent cause in Counties Manukau. Cancer (neoplasms) and injury or poisoning were the most common reasons for arranged admissions in all Northern DHBs, with the addition of congenital anomalies in Northland and Counties Manukau and dialysis in Counties Manukau. The most frequent waiting list admissions were for gastrointestional procedures, insertion of grommets, dental treatment and tonsillectomy +/− adenoidectomy, although the order of these diagnoses varied between DHBs **(Table 38–Table 41)**.

Table 38. Causes of hospitalisations of 0–14 year olds, by admission type, Northland 2010–2014

	Number: 2010–2014	Number: annual average	Rate per 1,000 0–14 year olds	95% CI	Per cent
Northland 0–14 year olds					
Acute admissions by primary diagnosis					
Injury or poisoning	2,122	424	11.70	11.21–12.20	13.3
Bronchiolitis	1,517	303	8.36	7.95–8.79	9.5
Asthma and wheeze	1,146	229	6.32	5.96–6.69	7.2
Gastroenteritis	910	182	5.02	4.70–5.35	5.7
Acute upper respiratory tract infection	907	181	5.00	4.69–5.34	5.7
Viral infection NOS	813	163	4.48	4.19–4.80	5.1
Other diagnoses	8,585	1,717	47.33	46.36–48.32	53.7
Acute total	16,000	3,200	88.21	86.91–89.52	100.0
Arranged admissions by primary diagnosis					
Neoplasm, chemotherapy, or radiotherapy	449	90	2.48	2.26–2.71	14.7
Congenital anomalies	228	46	1.26	1.10–1.43	7.5
Injury or poisoning	219	44	1.21	1.06–1.38	7.2
Other diagnoses	2,156	431	11.89	11.40–12.40	70.6
Arranged total	3,052	610	16.83	16.24–17.43	100.0
Waiting list admissions by primary procedure					
Dental procedures	2,143	429	11.81	11.33–12.32	32.9
Grommets	775	155	4.27	3.98–4.58	11.9
Tonsillectomy ± adenoidectomy	709	142	3.91	3.63–4.21	10.9
Other procedures	2,649	530	14.60	14.06–15.17	40.7
No procedure listed	238	48	1.31	1.16–1.49	3.7
Waiting list total	6,514	1,303	35.91	35.07–36.78	100.0
Northland total	25,566	5,113	140.95	139.35–142.56	

Numerator: National Minimum Dataset; Denominator: Statistics NZ Estimated Resident Population; excludes neonates; URTI = upper respiratory tract infection; NOS = not otherwise specified

Table 39. Causes of hospitalisations of 0–14 year olds, by admission type, Waitemata 2010–2014

	Number: 2010–2014	Number: annual average	Rate per 1,000 0–14 year olds	95% CI	Per cent
Waitemata 0–14 year olds					
Acute admissions by primary diagnosis					
Injury or poisoning	4,583	917	8.16	7.93–8.40	9.4
Asthma and wheeze	3,523	705	6.27	6.07–6.48	7.2
Gastroenteritis	3,498	700	6.23	6.03–6.44	7.1
Viral infection NOS	3,032	606	5.40	5.21–5.59	6.2
Bronchiolitis	2,644	529	4.71	4.53–4.89	5.4
Acute upper respiratory tract infection	2,526	505	4.50	4.33–4.68	5.2
Other diagnoses	29,153	5,831	51.91	51.33–52.49	59.5
Acute total	48,959	9,792	87.18	86.44–87.92	100.0
Arranged admissions by primary diagnosis					
Neoplasm, chemotherapy, or radiotherapy	1,653	331	2.94	2.81–3.09	19.3
Injury or poisoning	764	153	1.36	1.27–1.46	8.9
Other diagnoses	6,134	1,227	10.92	10.65–11.20	71.7
Arranged total	8,551	1,710	15.23	14.91–15.55	100.0
Waiting list admissions by primary procedure					
Grommets	3,241	648	5.77	5.58–5.97	19.1
Dental procedures	2,766	553	4.93	4.75–5.11	16.3
Musculoskeletal procedures	2,295	459	4.09	3.92–4.26	13.5
Tonsillectomy ± adenoidectomy	1,475	295	2.63	2.50–2.76	8.7
Other procedures	6,423	1,285	11.44	11.16–11.72	37.8
No procedure listed	771	154	1.37	1.28–1.47	4.5
Waiting list total	16,971	3,394	30.22	29.77–30.67	100.0
Waitemata total	74,481	14,896	132.62	131.74–133.51	

Numerator: National Minimum Dataset; Denominator: Statistics NZ Estimated Resident Population; excludes neonates; URTI = upper respiratory tract infection; NOS = not otherwise specified

Table 40. Causes of hospitalisations of 0–14 year olds, by admission type, Auckland DHB 2010–2014

	Number: 2010–2014	Number: annual average	Rate per 1,000 0–14 year olds	95% CI	Per cent
Auckland DHB 0–14 year olds					
Acute admissions by primary diagnosis					
Asthma and wheeze	4,402	880	10.67	10.36–10.99	10.79
Injury or poisoning	3,516	703	8.52	8.25–8.81	8.62
Gastroenteritis	3,218	644	7.80	7.54–8.07	7.89
Viral infection NOS	2,885	577	6.99	6.74–7.25	7.07
Bronchiolitis	2,646	529	6.41	6.18–6.66	6.49
Acute upper respiratory tract infection	2,325	465	5.64	5.41–5.87	5.70
Pneumonia	2,115	423	5.13	4.91–5.35	5.19
Other diagnoses	19,679	3,936	47.71	47.06–48.36	48.25
Acute total	40,786	8,157	98.87	97.97–99.79	100.00
Arranged admissions by primary diagnosis					
Neoplasm, chemotherapy, or radiotherapy	1,316	263	3.19	3.02–3.37	23.19
Injury or poisoning	637	127	1.54	1.43–1.67	11.22
Other diagnoses	3,723	745	9.03	8.74–9.32	65.59
Arranged total	5,676	1,135	13.76	13.41–14.12	100.00
Waiting list admissions by primary procedure					
Grommets	2,121	424	5.14	4.93–5.36	16.43
Dental procedures	2,048	410	4.96	4.75–5.18	15.87
Musculoskeletal procedures	1,668	334	4.04	3.85–4.24	12.92
Tonsillectomy ± adenoidectomy	1,104	221	2.68	2.52–2.84	8.55
Other procedures	5,324	1,065	12.91	12.57–13.26	41.25
No procedure listed	641	128	1.55	1.44–1.68	4.97
Waiting list total	12,906	2,581	31.29	30.76–31.82	100.00
Auckland DHB total	59,368	11,874	143.92	142.85–144.99	

Numerator: National Minimum Dataset; Denominator: Statistics NZ Estimated Resident Population; excludes neonates; URTI = upper respiratory tract infection; NOS = not otherwise specified

Table 41. Causes of hospitalisations of 0–14 year olds, by admission type, Counties Manukau 2010–2014

	Number: 2010–2014	Number: annual average	Rate per 1,000 0–14 year olds	95% CI	Per cent
Counties Manukau 0–14 year olds					
Acute admissions by primary diagnosis					
Injury or poisoning	6,464	1,293	10.89	10.63–11.15	11.77
Bronchiolitis	5,526	1,105	9.31	9.07–9.55	10.06
Asthma and wheeze	4,111	822	6.92	6.72–7.14	7.48
Gastroenteritis	3,988	798	6.72	6.51–6.93	7.26
Acute upper respiratory tract infection	3,627	725	6.11	5.91–6.31	6.60
Other diagnoses	31,218	6,244	52.58	52.01–53.15	56.83
Acute total	54,934	10,987	92.52	91.79–93.26	100.00
Arranged admissions by primary diagnosis					
Neoplasm, chemotherapy, or radiotherapy	1,499	300	2.52	2.40–2.66	19.16
Injury or poisoning	1,107	221	1.86	1.76–1.98	14.15
Congenital anomalies	437	87	0.74	0.67–0.81	5.59
Dialysis	427	85	0.72	0.65–0.79	5.46
Other diagnoses	4,352	870	7.33	7.12–7.55	55.64
Arranged total	7,822	1,564	13.17	12.89–13.47	100.00
Waiting list admissions by primary procedure					
Dental procedures	3,826	765	6.44	6.24–6.65	21.74
Grommets	2,617	523	4.41	4.24–4.58	14.87
Musculoskeletal procedures	2,164	433	3.64	3.49–3.80	12.30
Tonsillectomy ± adenoidectomy	1,684	337	2.84	2.70–2.97	9.57
Other procedures	6,456	1,291	10.87	10.61–11.14	36.69
No procedure listed	849	170	1.43	1.34–1.53	4.82
Waiting list total	17,596	3,519	29.64	29.21–30.07	100.00
Counties Manukau total	80,352	16,070	135.33	134.47–136.21	

Numerator: National Minimum Dataset; Denominator: Statistics NZ Estimated Resident Population; excludes neonates; URTI = upper respiratory tract infection; NOS = not otherwise specified

In all Northern DHBs from 2010 to 2014 the most frequent causes of acute hospitalisations in 15–24 year olds were injury or poisoning, abdominal or pelvic pain and mental health conditions, with the addition of skin infections in Counties Manukau. The most frequent causes of arranged hospitalisations in this age group were dialysis and mental health conditions in Northland, and injury or poisoning in Waitemata, Auckland and Counties Manukau DHBs. Cancer was also a frequent cause in Waitemata and Auckland DHBs. Gastrointestinal procedures, tonsillectomy +/− adenoidectomy and dental procedures were the most frequent causes of waiting list admissions although the order of these diagnoses varied between DHBs. All Northern DHBs had a substantial number of reproductive hospitalisations, the majority were for pregnancy, delivery, or postnatal-related conditions **(Table 42–Table 45)**.

Table 42. Causes of hospitalisations of 15–24 year olds, by admission type, Northland 2010–2014

	Number: 2010–2014	Number: annual average	Rate per 1,000 15–24 year olds	95% CI	Per cent
Northland 15–24 year olds					
Acute admissions by primary diagnosis					
Injury or poisoning	1,838	368	19.05	18.21–19.94	18.7
Abdominal or pelvic pain	720	144	7.46	6.94–8.03	7.3
Mental health	703	141	7.29	6.77–7.84	7.2
Other diagnoses	6,571	1,314	68.12	66.55–69.73	66.8
Acute total	9,832	1,966	101.92	100.03–103.85	100.0
Arranged admissions by primary diagnosis					
Dialysis	1,728	346	17.91	17.10–18.77	39.6
Mental health	396	79	4.11	3.72–4.53	9.1
Injury or poisoning	270	54	2.80	2.48–3.15	6.2
Other diagnoses	1,975	395	20.47	19.60–21.39	45.2
Arranged total	4,369	874	45.29	44.00–46.62	100.0
Reproductive hospitalisations by primary diagnosis					
Pregnancy, delivery, or postnatal-related conditions	5,894	1,179	125.35	122.38–128.37	79.4
Termination of pregnancy*: therapeutic, other, or unspecified	1,214	243	25.82	24.42–27.29	16.4
Other diagnoses	314	63	6.68	5.98–7.46	4.2
Reproductive total	7,422	1,484	157.84	154.58–161.17	100.0
Waiting list admissions by primary procedure					
Gastrointestinal procedures	378	76	3.92	3.54–4.33	19.7
Tonsillectomy ± adenoidectomy	214	43	2.22	1.94–2.54	11.2
Procedures on skin or subcutaneous tissue	203	41	2.10	1.83–2.41	10.6
Other procedures	1,056	211	10.95	10.31–11.62	55.1
No procedure listed	65	13	0.67	0.53–0.86	3.4
Waiting list total	1,916	383	19.86	19.00–20.76	100.0
Northland total	23,539	4,708			

Numerator: National Minimum Dataset; Denominator: Statistics NZ Estimated Resident Population; injury ED cases excluded; reproductive hospitalisations are presented as rates per 1,000 females aged 15–24 years; *therapeutic abortions performed in hospital may be an underestimate

Table 43. Causes of hospitalisations of 15−24 year olds, by admission type, Waitemata 2010−2014

	Number: 2010−2014	Number: annual average	Rate per 1,000 15–24 year olds	95% CI	Per cent
Waitemata 15–24 year olds					
Acute admissions by primary diagnosis					
Injury or poisoning	5,015	1,003	13.08	12.73–13.44	14.3
Abdominal or pelvic pain	2,882	576	7.52	7.25–7.80	8.2
Mental health	2,748	550	7.17	6.91–7.44	7.8
Other diagnoses	24,463	4,893	63.81	63.04–64.58	69.7
Acute total	35,108	7,022	91.57	90.66–92.49	100.0
Arranged admissions by primary diagnosis					
Injury or poisoning	550	110	1.43	1.32–1.56	10.5
Neoplasm, chemotherapy, or radiotherapy	352	70	0.92	0.83–1.02	6.7
Other diagnoses	4,355	871	11.36	11.03–11.70	82.8
Arranged total	5,257	1,051	13.71	13.35–14.08	100.0
Reproductive hospitalisations by primary diagnosis					
Pregnancy, delivery, or postnatal-related conditions	10,151	2,030	54.20	53.19–55.24	89.9
Spontaneous or other early pregnancy loss	791	158	4.22	3.94–4.53	7.0
Other diagnoses	355	71	1.90	1.71–2.10	3.1
Reproductive total	11,297	2,259	60.32	59.25–61.41	100.0
Waiting list admissions by primary procedure					
Gastrointestinal procedures	1,111	222	2.90	2.73–3.07	20.0
Musculoskeletal procedures	847	169	2.21	2.07–2.36	15.2
Tonsillectomy ± adenoidectomy	479	96	1.25	1.14–1.37	8.6
Other procedures	2,931	586	7.64	7.37–7.93	52.7
No procedure listed	196	39	0.51	0.44–0.59	3.5
Waiting list total	5,564	1,113	14.51	14.14–14.90	100.0
Waitemata total	57,226	11,445			

Numerator: National Minimum Dataset; Denominator: Statistics NZ Estimated Resident Population; injury ED cases excluded; reproductive hospitalisations are presented as rates are per 1,000 females aged 15–24 years; *therapeutic abortions performed in hospital may be an underestimate

Table 44. Causes of hospitalisations of 15–24 year olds, by admission type, Auckland DHB 2010–2014

	Number: 2010–2014	Number: annual average	Rate per 1,000 15–24 year olds	95% CI	Per cent
Auckland DHB 15–24 year olds					
Acute admissions by primary diagnosis					
Injury or poisoning	3,417	683	9.22	8.91–9.53	12.65
Abdominal or pelvic pain	2,061	412	5.56	5.33–5.80	7.63
Mental health	1,785	357	4.81	4.60–5.04	6.61
Other diagnoses	19,750	3,950	53.27	52.56–54.00	73.11
Acute total	27,013	5,403	72.86	72.03–73.71	100.00
Arranged admissions by primary diagnosis					
Injury or poisoning	596	119	1.61	1.48–1.74	13.12
Neoplasm, chemotherapy, or radiotherapy	316	63	0.85	0.76–0.95	6.95
Other diagnoses	3,632	726	9.80	9.48–10.12	79.93
Arranged total	4,544	909	12.26	11.91–12.62	100.00
Reproductive hospitalisations by primary diagnosis					
Pregnancy, delivery, or postnatal-related conditions	8,269	1,654	44.73	43.80–45.68	88.42
Spontaneous or other early pregnancy loss	663	133	3.59	3.32–3.87	7.09
Termination of pregnancy*: therapeutic, other, or unspecified	420	84	2.27	2.06–2.50	4.49
Reproductive total	9,352	1,870	50.59	49.60–51.60	100.00
Waiting list admissions by primary procedure					
Musculoskeletal procedures	635	127	1.71	1.58–1.85	15.55
Gastrointestinal procedures	374	75	1.01	0.91–1.12	9.16
Procedures on skin or subcutaneous tissue	357	71	0.96	0.87–1.07	8.74
Other procedures	2,544	509	6.86	6.60–7.13	62.29
No procedure listed	174	35	0.47	0.40–0.54	4.26
Waiting list total	4,084	817	11.02	10.69–11.36	100.00
Auckland DHB total	44,993	8,999			

Numerator: National Minimum Dataset; Denominator: Statistics NZ Estimated Resident Population; injury ED cases excluded; reproductive hospitalisations are presented as rates are per 1,000 females aged 15–24 years; *therapeutic abortions performed in hospital may be an underestimate

Table 45. Causes of hospitalisations of 15−24 year olds, by admission type, Counties Manukau 2010−2014

	Number: 2010−2014	Number: annual average	Rate per 1,000 15–24 year olds	95% CI	Per cent
Counties Manukau 15–24 year olds					
Acute admissions by primary diagnosis					
Injury or poisoning	4,619	924	12.23	11.88–12.59	14.22
Abdominal or pelvic pain	2,256	451	5.97	5.73–6.22	6.94
Skin infections	1,926	385	5.10	4.88–5.33	5.93
Mental health	1,919	384	5.08	4.86–5.31	5.91
Other diagnoses	21,765	4,353	57.63	56.89–58.38	67.00
Acute total	32,485	6,497	86.01	85.12–86.91	100.00
Arranged admissions by primary diagnosis					
Injury or poisoning	1,111	222	2.94	2.77–3.12	12.34
Neoplasm, chemotherapy, or radiotherapy	342	68	0.91	0.81–1.01	3.80
Immune disorders	314	63	0.83	0.74–0.93	3.49
Other diagnoses	7,238	1,448	19.16	18.73–19.61	80.38
Arranged total	9,005	1,801	23.84	23.36–24.33	100.00
Reproductive hospitalisations by primary diagnosis					
Pregnancy, delivery, or postnatal-related conditions	20,171	4,034	108.19	106.79–109.61	93.51
Spontaneous or other early pregnancy loss	1,082	216	5.80	5.47–6.16	5.02
Termination of pregnancy*: therapeutic, other, or unspecified	318	64	1.71	1.53–1.90	1.47
Reproductive total	21,571	4,314	115.70	114.26–117.16	100.00
Waiting list admissions by primary procedure					
Gastrointestinal procedures	1,107	221	2.93	2.76–3.11	18.52
Musculoskeletal procedures	1,068	214	2.83	2.66–3.00	17.87
Procedures on skin or subcutaneous tissue	608	122	1.61	1.49–1.74	10.17
Other procedures	2,969	594	7.86	7.58–8.15	49.68
No procedure listed	224	45	0.59	0.52–0.68	3.75
Waiting list total	5,976	1,195	15.82	15.43–16.23	100.00
Counties Manukau total	69,037	13,807			

Numerator: National Minimum Dataset; Denominator: Statistics NZ Estimated Resident Population; injury ED cases excluded; reproductive hospitalisations are presented as rates are per 1,000 females aged 15–24 years; *therapeutic abortions performed in hospital may be an underestimate

AMBULATORY SENSITIVE HOSPITALISATIONS

Introduction

Ambulatory sensitive hospitalisations (ASH) are a range of conditions for which hospitalisation could potentially be avoided.[20] At a community level, high ASH rates may indicate difficulty in accessing primary care in a timely fashion, poor care coordination or care continuity, or structural constraints such as limited supply of primary care workers. However ASH rates are also determined by other factors including hospital size and service configuration, capacity for emergency department management, admission policies and practices, as well as health literacy and overall social determinants of health in the community. It is important to note the deliberate use of the word 'sensitive' in the title of ASH. Not all these hospitalisations would be avoidable even in a perfect health system; for example, children who are found to have relatively minor ASH conditions may have come in to hospital for investigations to exclude more serious illness such as meningococcal disease.[21]

There are currently two different ASH algorithms in use in New Zealand: the NZCYES uses paediatric ASH codes developed by Anderson et al[22] with analysis restricted to age 0–4 years and a population-based denominator. The Health Quality and Safety Commission use a similar but not identical list in 0–14 year olds with a PHO enrolment denominator.[21] Both provide analyses including and excluding ED cases.

In New Zealand children, ASH accounts for approximately 30% of all acute and arranged medical and surgical discharges each year.[21] Pathways to prevent ASH will vary by condition. For asthma it may be the use of preventative medicine, whilst for gastroenteritis it may be about access to early oral rehydration fluids.[21] Vaccine-preventable disease can be prevented almost entirely with good immunisation coverage and diseases or conditions that can lead to rapid onset of problems, such as dehydration and gastroenteritis, can be treated in primary care.[20]

The following section reports on ambulatory sensitive hospitalisations for children aged 0–4 years using the ASH conditions, as defined by NZCYES, applied to information from the National Mortality Collection and the National Minimum Dataset. Guidelines and reviews of literature which consider the most effective interventions for preventing or managing the specific conditions included in ASH can be found in the relevant indicator chapter.

Data sources and methods

Indicator

Ambulatory sensitive hospitalisations (ASH) in 0–4 year olds

Data sources

Numerator: National Minimum Dataset
Denominator: Statistics NZ Estimated Resident Population (with linear extrapolation being used to calculate denominators between Census years)

Definition

Acute and arranged hospitalisations for ambulatory sensitive conditions in 0–4 year olds
The conditions in this section are based on primary diagnosis, and include:
Asthma and wheeze, bronchiectasis, skin infections, constipation, dental caries and other dental conditions, dermatitis and eczema, gastroenteritis, gastro-oesophageal reflux, nutritional deficiency, bacterial or non-viral pneumonia, rheumatic fever/rheumatic heart disease, otitis media, acute upper respiratory tract infections (excluding croup), vaccine preventable diseases: (neonatal/other tetanus, congenital rubella; pertussis age ≥6 months, diphtheria, hepatitis B, measles, mumps, rubella age ≥16 months, urinary tract infections age >4 years).

Notes on interpretation

Note 1: *Age filters*: The 0–4 year age group has been selected for this analysis as it aligns with the Ministry of Health's previous paediatric ASH Target (0–4 years). Neonatal hospitalisations (0–27 days) have been excluded on the basis that issues arising in the neonatal period are likely to be heavily influenced by antenatal/perinatal factors, and as a consequence are likely to require different care pathways from conditions arising in the community (e.g. pneumonia in a very preterm infant). The only exceptions are neonatal tetanus and congenital rubella, which are potentially preventable by timely (maternal) access to immunisation. Further, age filters have also been applied to some vaccine preventable diseases (e.g. measles ≥16 months) on the basis that these conditions may not be (primary care) preventable, prior to the age at which immunisation for the relevant condition is due. Similarly, a >4 year age criteria has been applied to urinary tract infections, on the basis that younger children may require hospitalisation for further investigation.

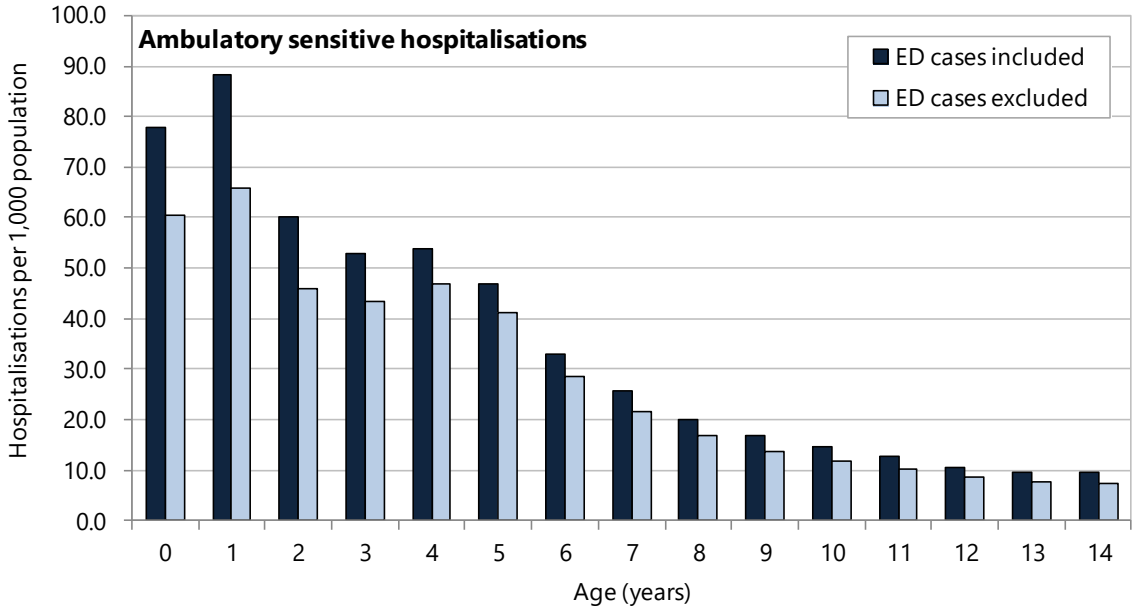
Note 2: *Admission type filters*: An acute hospitalisation is an unplanned hospitalisation occurring on the day of presentation, while an arranged admission is a non-acute hospitalisation with an admission date less than seven days after the decision was made that the admission was required. A waiting list admission is a planned hospitalisation, where the admission date is equal to or greater than seven days after the decision was made that the admission was necessary. In this section, all analyses include acute and arranged admissions only, with the exception of dental conditions, which also include waiting list admissions (as some DHBs routinely admit dental conditions from the waiting list, while others admit the majority as arranged admissions, potentially creating artefactual DHB differences if the entire burden of dental morbidity is not captured). This restriction was applied in order to eliminate the large number of cases where the primary diagnosis was, for example, otitis media, but where the main reason for admission was for the insertion of grommets. It was considered that the role primary care played in preventing acute admissions (e.g. for acute otitis media), was likely to differ from the one it played in ensuring children had access to waiting list procedures (e.g. for the insertion of grommets).
Note 3: *Emergency Department Filters*: In order to deal with the issue of inconsistent uploading of Emergency Department (ED) cases to the National Minimum Dataset (see **Appendix 3**), the Ministry of Health has traditionally applied a number of filters to its ASH analyses.[23,24] These filters exclude Accident and Emergency cases which meet the following criteria:

- The admission and discharge dates are the same AND,
- The patient was not discharged dead (i.e., discharge type not in 'DD') AND,
- The health specialty code is in ('M05', 'M06', 'M07', or 'M08').

While the NZ Child and Youth Epidemiology service does not recommend the use of such filters in the paediatric population, in order to allow DHBs to assess the impact ED cases have on their ASH rates, all the analyses in this section are presented with both ED cases included and excluded. In contrast to the Ministry of Health filters described above however, all ED cases have either been totally included or excluded, not just those admitted and discharged on the same day (as in the paediatric population many presentations occur late in the evening, with children then being discharged in the early hours of the following day, potentially making their total length of stay similar to that of ED day cases).
For those DHBs without a dedicated paediatric emergency department, who assess the majority of their cases in a Paediatric Assessment Unit or on the Paediatric Ward, the ED included and excluded analyses may be identical. Local variations in the way health specialty codes are assigned to such cases may seriously influence the differences seen between the ED included and excluded rates.

As shown in **Figure 33**, ASH rates were highest for children aged under two years and declined rapidly with increasing age from age five years whether ED cases were included or excluded. The remainder of this section is restricted to 0–4 year olds **(Figure 33)**.

Figure 33. Ambulatory sensitive hospitalisations in 0–14 year olds, by age New Zealand 2010–2014



Numerator: National Minimum Dataset (acute and arranged admissions, neonates excluded); Denominator: Statistics NZ Estimated Resident Population

Causes of ambulatory sensitive hospitalisations

Between 2010 and 2014 there were 102,454 ASH when ED cases were included and 88,831 ASH when ED cases were excluded. The most frequent ASH diagnoses with ED cases included were gastroenteritis and asthma and wheeze. With ED cases excluded the most common ASH diagnosis was asthma and wheeze, followed by dental conditions and gastroenteritis **(Table 46)**.

Table 46. Ambulatory sensitive hospitalisations in 0–4 year olds, by ED status and primary diagnosis, New Zealand 2010–2014

Primary diagnosis	Number: 2010–2014	Number: annual average	Rate per 1,000 0–4 year olds	95% CI	Per cent
Ambulatory sensitive hospitalisations in 0–4 year olds					
Emergency Department cases included					
Gastroenteritis	21,691	4,338	14.07	13.89–14.26	21.2
Asthma and wheeze	21,603	4,321	14.02	13.83–14.20	21.1
Acute upper respiratory infections (excl croup)	17,937	3,587	11.64	11.47–11.81	17.5
Dental	14,629	2,926	9.49	9.34–9.65	14.3
Pneumonia: bacterial, non-viral	9,162	1,832	5.94	5.82–6.07	8.9
Skin infections	8,219	1,644	5.33	5.22–5.45	8.0
Dermatitis and eczema	2,681	536	1.74	1.68–1.81	2.6
Otitis media	2,480	496	1.61	1.55–1.67	2.4
Constipation	2,030	406	1.32	1.26–1.38	2.0
Gastro-oesophageal reflux	1,353	271	0.88	0.83–0.93	1.3
Bronchiectasis	263	53	0.17	0.15–0.19	0.3
Nutritional deficiencies or anaemias	211	42	0.14	0.12–0.16	0.2
VPD ≥ 6 months: DTP, Polio, HepB	156	31	0.10	0.09–0.12	0.2
VPD ≥ 16 months: MMR	28	6	0.02	0.01–0.03	0.0
Rheumatic fever or rheumatic heart disease	11	2	0.01	s	0.0
Total	102,454	20,491	66.48	66.09–66.87	100.0
Emergency Department cases excluded					
Asthma and wheeze	16,230	3,246	10.53	10.37–10.69	20.1
Dental	14,596	2,919	9.47	9.32–9.62	18.1
Gastroenteritis	14,580	2,916	9.46	9.31–9.61	18.0
Acute upper respiratory infections (excl croup)	12,598	2,520	8.17	8.03–8.32	15.6
Skin infections	7,686	1,537	4.99	4.88–5.10	9.5
Pneumonia: bacterial, non-viral	7,677	1,535	4.98	4.87–5.09	9.5
Dermatitis and eczema	2,457	491	1.59	1.53–1.66	3.0
Otitis media	1,713	343	1.11	1.06–1.17	2.1
Constipation	1,493	299	0.97	0.92–1.02	1.8
Gastro-oesophageal reflux	1,185	237	0.77	0.73–0.81	1.5
Bronchiectasis	257	51	0.17	0.15–0.19	0.3
Nutritional deficiencies or anaemias	198	40	0.13	0.11–0.15	0.2
VPD ≥ 6 months: DTP, Polio, HepB	133	27	0.09	0.07–0.10	0.2
VPD ≥ 16 months: MMR	17	3	0.01	0.01–0.02	0.0
Rheumatic fever or rheumatic heart disease	11	2	0.01	s	0.0
Total	80,831	16,166	52.45	52.10–52.80	100.0

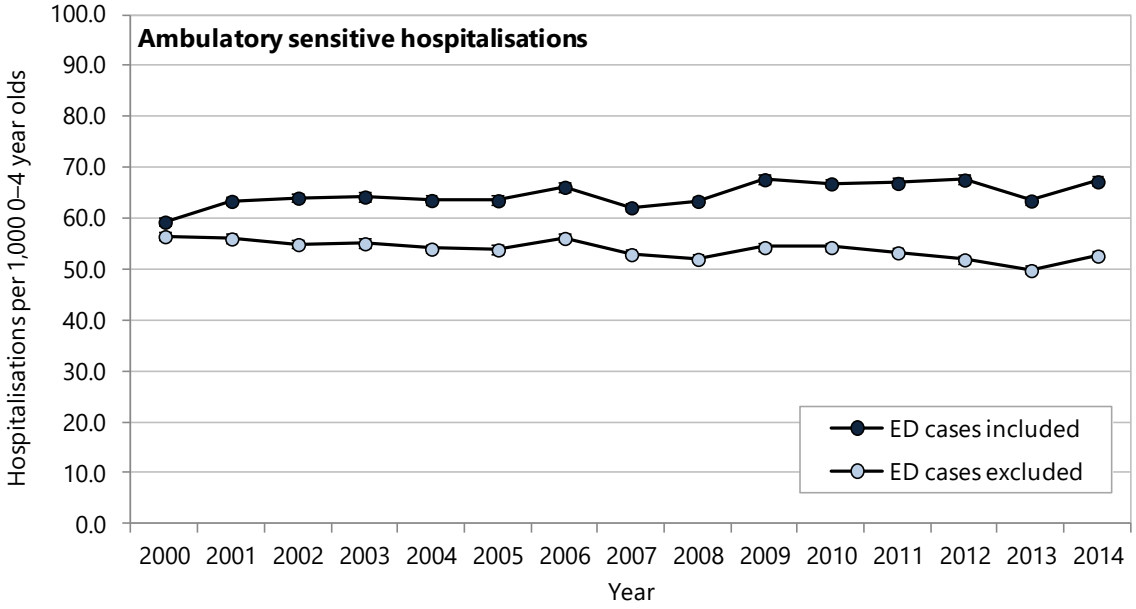
Numerator: National Minimum Dataset (acute and arranged admissions, neonates excluded); Denominator: Statistics NZ Estimated Resident Population; * Acute upper respiratory tract infections excludes croup; s: suppressed due to small numbers; VPD: Vaccine preventable diseases; DTP: diphtheria, tetanus, pertussis; HepB: hepatitis B; MMR: measles, mumps, rubella

National trends and distribution

From 2000 to 2014 the hospitalisation rate for ambulatory-care sensitive conditions rose when ED cases were included and fell when ED cases were excluded **(Figure 34)**.

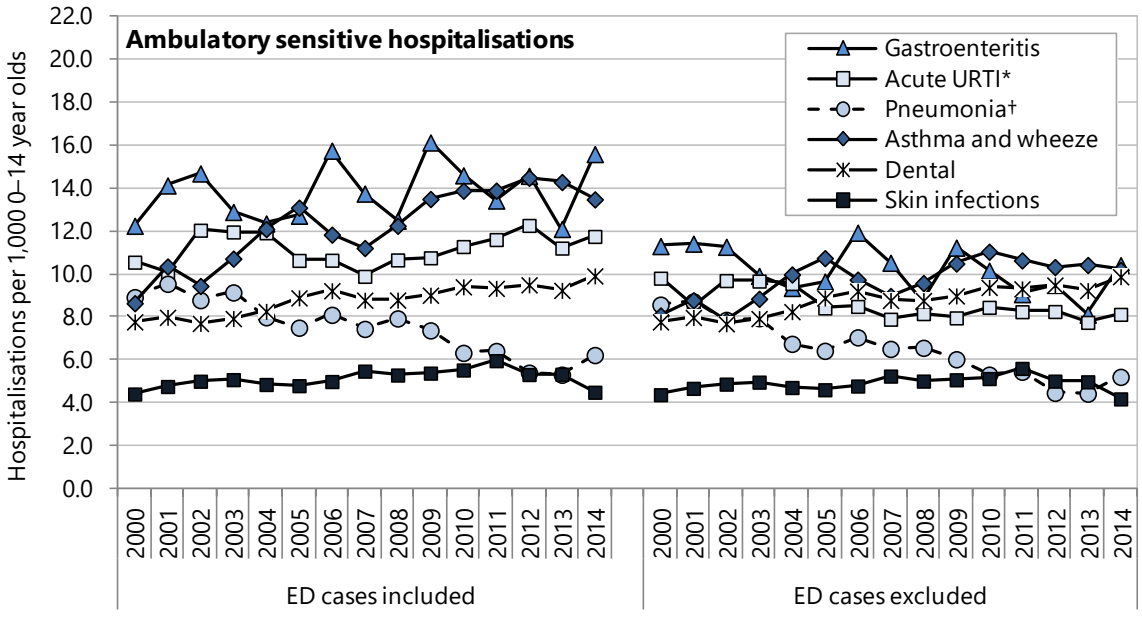
When considered by primary diagnosis ASH rates rose from 2000 to 2014 for asthma and wheeze and dental conditions and fell for pneumonia with ED cases included or excluded. Hospitalisation rates for URTI and gastroenteritis and skin infections were more variable over time **(Figure 35)**.

Figure 34. Ambulatory sensitive hospitalisations in 0–4 year olds, New Zealand 2000–2014



Numerator: National Minimum Dataset (acute and arranged admissions, neonates excluded); Denominator: Statistics NZ Estimated Resident Population

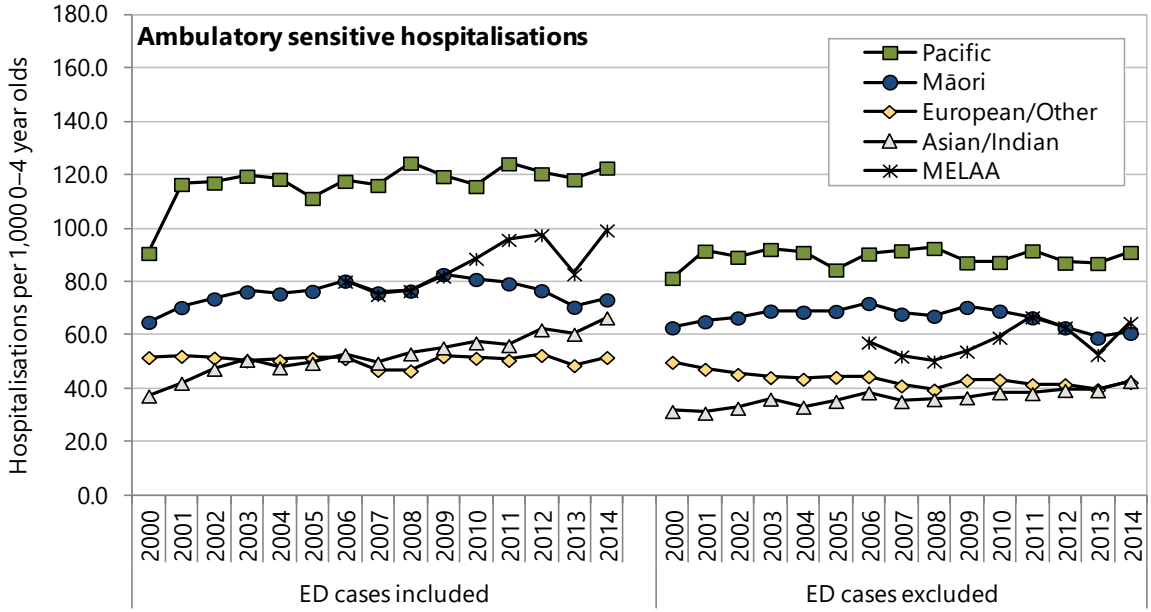
Figure 35. Ambulatory sensitive hospitalisations in 0–4 year olds, by primary diagnosis, New Zealand 2010–2014



Numerator: National Minimum Dataset (acute and arranged admissions, neonates excluded); Denominator: Statistics NZ Estimated Resident Population; * Acute URTI = Acute upper respiratory infections (excl croup); Pneumonia† = Bacterial and non-viral pneumonia

From 2000 to 2014 hospitalisation rates for ambulatory-care sensitive conditions were stable for European/Other 0–4 year olds and increased for other ethnic groups when ED cases were included. When ED cases were excluded ASH rates rose for Asian/Indian children, fell for European/Other children and were stable with year-to-year variability for Māori and Pacific children. ASH rates from 2000–2014, with or without ED cases, were consistently highest for Pacific children, followed by Māori, European/Other and Asian/Indian children. Data for MELAA children were available from 2006; the MELAA rate rose when ED cases were included and was stable with year-to-year variability with ED cases excluded **(Figure 36)**.

Figure 36. Ambulatory sensitive hospitalisations in 0–4 year olds, by ethnicity, New Zealand, 2000–2014



Numerator: National Minimum Dataset (acute and arranged admissions, neonates excluded); Denominator: Statistics NZ Estimated Resident Population

Distribution by demographic factors

From 2010 to 2014 for children aged 0–4 years there were disparities in ASH rates by NZDep2013 decile, ethnicity and gender. With ED cases included a social gradient was evident with a *significant increase* in ASH rates between each quintile of NZDep2013 scores compared with the quintile below. ASH rates for Māori, Pacific, Asian/Indian and MELAA were *significantly higher* than rates for European/Other children. Male ASH rates were *significantly higher* than female rates. Similar relationships with demographic factors were observed when ED cases were excluded except that rates for Asian/Indian 0–14 years olds were *significantly lower* than European/Other rates **(Table 47, Table 48)**.

Table 47. Ambulatory sensitive hospitalisations in 0–4 year olds (ED cases included), by demographic variables New Zealand 2010–2014

Variable	Number: 2010–2014	Rate per 1,000 0–4 year olds	Rate ratio	95% CI
Ambulatory sensitive hospitalisations in 0–4 year olds				
Emergency Department cases included				
NZDep2013 Index of deprivation quintile				
Deciles 1–2	10,977	42.16	1.00	
Deciles 3–4	12,717	48.56	1.15	1.12–1.18
Deciles 5–6	15,981	54.24	1.29	1.26–1.32
Deciles 7–8	23,417	68.13	1.62	1.58–1.65
Deciles 9–10	38,901	102.24	2.42	2.38–2.48
Prioritised ethnicity				
Māori	31,438	76.24	1.49	1.47–1.51
Pacific	18,322	120.54	2.36	2.32–2.40
Asian/Indian	10,750	60.89	1.19	1.17–1.22
MELAA	1,977	93.10	1.82	1.74–1.90
European/Other	39,820	51.12	1.00	
Gender				
Female	45,443	60.56	1.00	
Male	57,009	72.09	1.19	1.18–1.20

Numerator: National Minimum Dataset (acute and arranged admissions, neonates excluded, ED included); Denominator: Statistics NZ Estimated Resident Population; Rate ratios are unadjusted; Ethnicity is level 1 prioritised; Decile is NZDep2013

Table 48. Ambulatory sensitive hospitalisations in 0–4 year olds (ED cases excluded), demographic variables New Zealand 2010–2014

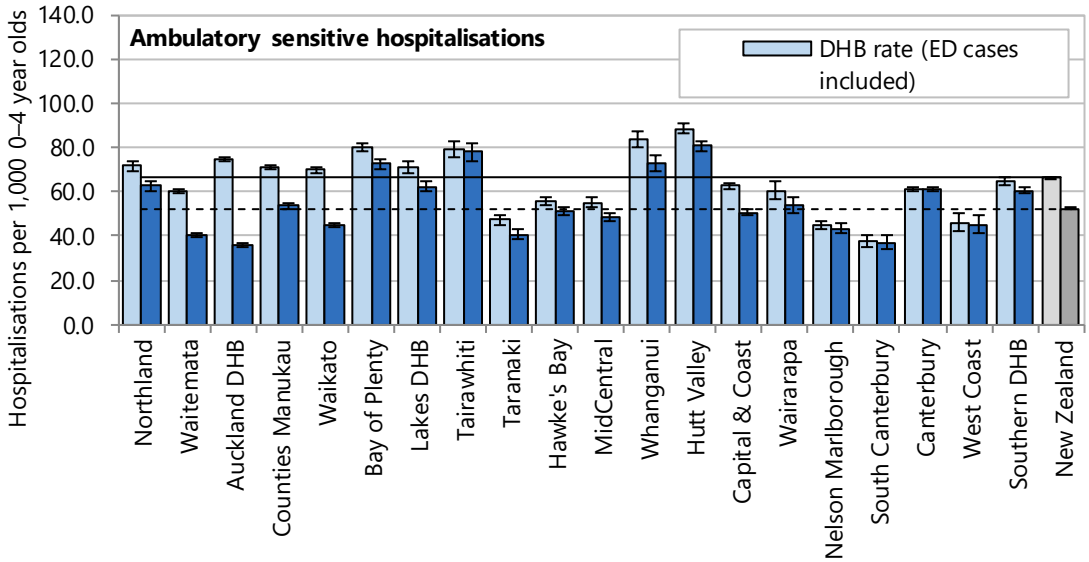
Variable	Number: 2010–2014	Rate per 1,000 0–4 year olds	Rate ratio	95% CI
Ambulatory sensitive hospitalisations in 0–4 year olds				
Emergency Department cases excluded				
NZDep2013 Index of deprivation quintile				
Deciles 1–2	8,614	33.09	1.00	
Deciles 3–4	9,777	37.34	1.13	1.10–1.16
Deciles 5–6	12,221	41.48	1.25	1.22–1.29
Deciles 7–8	18,996	55.27	1.67	1.63–1.71
Deciles 9–10	30,896	81.20	2.45	2.40–2.51
Prioritised ethnicity				
Māori	26,274	63.72	1.52	1.50–1.55
Pacific	13,528	89.00	2.13	2.09–2.17
Asian/Indian	7,035	39.85	0.95	0.93–0.98
MELAA	1,303	61.36	1.47	1.39–1.55
European/Other	32,560	41.80	1.00	
Gender				
Female	35,839	47.76	1.00	
Male	44,990	56.89	1.19	1.18–1.21

Numerator: National Minimum Dataset (acute and arranged admissions, neonates excluded, ED included); Denominator: Statistics NZ Estimated Resident Population; Rate ratios are unadjusted; Ethnicity is level 1 prioritised; Decile is NZDep2013

Distribution by region

Hospitalisation rates for ambulatory-sensitive conditions, with ED cases included were *significantly higher* than the New Zealand rate in the Northland, Auckland, Counties Manukau, Waikato, Bay of Plenty, Lakes, Tairawhiti, Whanganui and Hutt Valley DHBs between 2010 and 2014. In contrast rates were *significantly lower* than the New Zealand rate in the Waitemata, Taranaki, Hawke's Bay, MidCentral, Capital & Coast, Wairarapa, Nelson Marlborough, South Canterbury, Canterbury and West Coast DHBs. Excluding ED cases made a difference for the Canterbury and Southern DHBs were rates became *significantly higher* and the Auckland and Waikato DHBs where rates became *significantly lower* than the New Zealand rate **(Figure 37**, **Table 49)**.

Figure 37. Ambulatory sensitive hospitalisations in 0–4 year olds, by ED status and district health board, New Zealand 2010–2014



Numerator: National Minimum Dataset; Denominator: Statistics NZ Estimated Resident Population

Table 49. Ambulatory sensitive hospitalisations in 0–4 year olds, by ED status and district health board, New Zealand 2010–2014

DHB	Number: 2010–2014	Number: annual average	Rate per 1,000 0–4 year olds	Rate ratio	95% CI
Ambulatory sensitive hospitalisations in 0–4 year olds					
Emergency Department cases included					
Northland	4,289	858	71.74	1.08	1.05–1.11
Waitemata	11,720	2,344	60.20	0.91	0.89–0.92
Auckland	11,124	2,225	74.67	1.12	1.10–1.14
Counties Manukau	14,527	2,905	71.14	1.07	1.05–1.09
Waikato	9,723	1,945	70.01	1.05	1.03–1.07
Bay of Plenty	5,931	1,186	80.30	1.21	1.18–1.24
Lakes	2,795	559	71.18	1.07	1.03–1.11
Tairawhiti	1,524	305	79.11	1.19	1.13–1.25
Taranaki	1,921	384	47.24	0.71	0.68–0.74
Hawke's Bay	3,216	643	55.90	0.84	0.81–0.87
MidCentral	3,154	631	55.28	0.83	0.80–0.86
Whanganui	1,829	366	83.30	1.25	1.20–1.31
Hutt Valley	4,556	911	88.48	1.33	1.29–1.37
Capital & Coast	5,976	1,195	62.61	0.94	0.92–0.97
Wairarapa	824	165	60.68	0.91	0.85–0.98
Nelson Marlborough	1,935	387	45.16	0.68	0.65–0.71
South Canterbury	635	127	37.37	0.56	0.52–0.61
Canterbury	9,764	1,953	61.19	0.92	0.90–0.94
West Coast	495	99	45.95	0.69	0.63–0.75
Southern	6,093	1,219	64.57	0.97	0.95–1.00
New Zealand	102,454	20,491	66.48	1.00	
Emergency Department cases excluded					
Northland	3,742	748	62.59	1.19	1.16–1.23
Waitemata	7,866	1,573	40.40	0.77	0.75–0.79
Auckland	5,335	1,067	35.81	0.68	0.66–0.70
Counties Manukau	10,936	2,187	53.55	1.02	1.00–1.04
Waikato	6,265	1,253	45.11	0.86	0.84–0.88
Bay of Plenty	5,349	1,070	72.42	1.38	1.34–1.42
Lakes	2,453	491	62.47	1.19	1.15–1.24
Tairawhiti	1,500	300	77.86	1.48	1.41–1.56
Taranaki	1,660	332	40.82	0.78	0.74–0.82
Hawke's Bay	2,947	589	51.23	0.98	0.94–1.01
MidCentral	2,765	553	48.47	0.92	0.89–0.96
Whanganui	1,598	320	72.78	1.39	1.32–1.46
Hutt Valley	4,153	831	80.65	1.54	1.49–1.58
Capital & Coast	4,814	963	50.43	0.96	0.93–0.99
Wairarapa	733	147	53.98	1.03	0.96–1.10
Nelson Marlborough	1,860	372	43.41	0.83	0.79–0.87
South Canterbury	630	126	37.07	0.71	0.65–0.76
Canterbury	9,727	1,945	60.96	1.16	1.14–1.19
West Coast	485	97	45.03	0.86	0.79–0.94
Southern	5,719	1,144	60.61	1.16	1.13–1.19
New Zealand	80,831	16,166	52.45	1.00	

Numerator: National Minimum Dataset (acute and arranged admissions, neonates excluded, ED excluded); Denominator: Statistics NZ Estimated Resident Population

Northern region distribution and trends

Comparison with New Zealand

Between 2010 and 2014 hospitalisation rates for ambulatory sensitive conditions, with ED cases included or excluded, were *significantly higher* than the national rate in Northland and *significantly lower* in Waitemata. Rates in Auckland DHB and Counties Manukau were *significantly higher* than the national rate when ED cases were included. In Auckland DHB ASH rates were *significantly lower* when ED cases were excluded, whereas in Counties Manukau ASH rates were *not significantly different* when ED cases were excluded **(Table 50)**.

Table 50. Ambulatory sensitive hospitalisations in 0–4 year olds, by ED status, Northern DHBs vs New Zealand 2010–2014

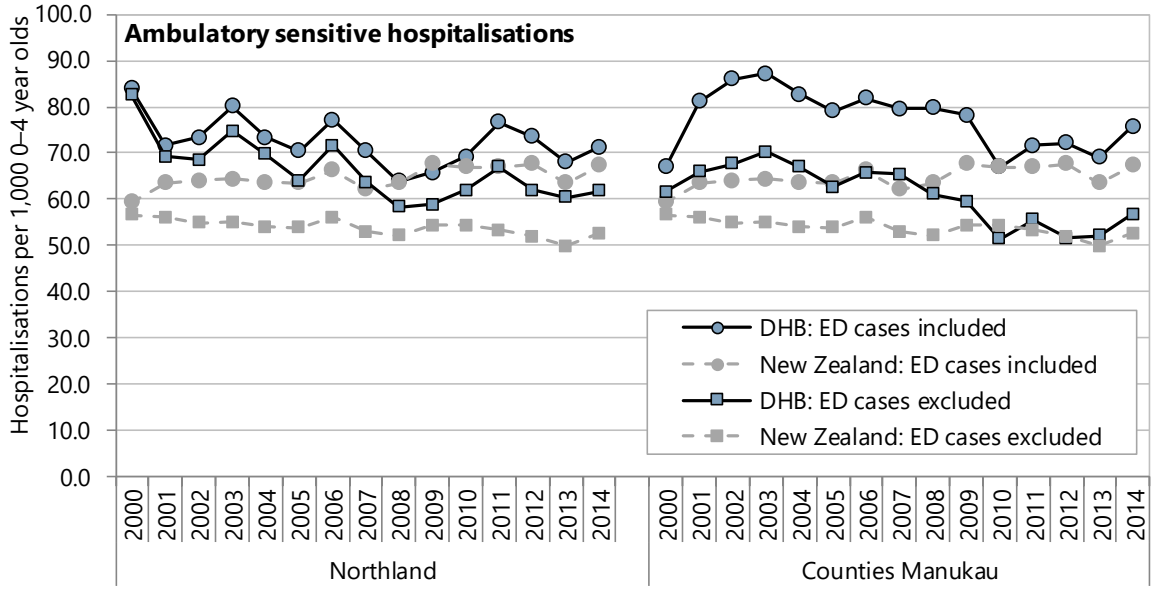
DHB	Number: 2010–2014	Number: annual average	Rate per 1,000 0–4 year olds	Rate ratio	95% CI
Ambulatory sensitive hospitalisations in 0–4 year olds					
Emergency Department cases included					
Northland	4,289	858	71.74	1.08	1.05–1.11
Waitemata	11,720	2,344	60.20	0.91	0.89–0.92
Auckland	11,124	2,225	74.67	1.12	1.10–1.14
Counties Manukau	14,527	2,905	71.14	1.07	1.05–1.09
New Zealand	102,454	20,491	66.48	1.00	
Emergency Department cases excluded					
Northland	3,742	748	62.59	1.19	1.16–1.23
Waitemata	7,866	1,573	40.40	0.77	0.75–0.79
Auckland	5,335	1,067	35.81	0.68	0.66–0.70
Counties Manukau	10,936	2,187	53.55	1.02	1.00–1.04
New Zealand	80,831	16,166	52.45	1.00	0.0

Numerator: National Minimum Dataset (acute and arranged admissions; neonates excluded); Denominator: Statistics NZ Estimated Resident Population

Regional trends

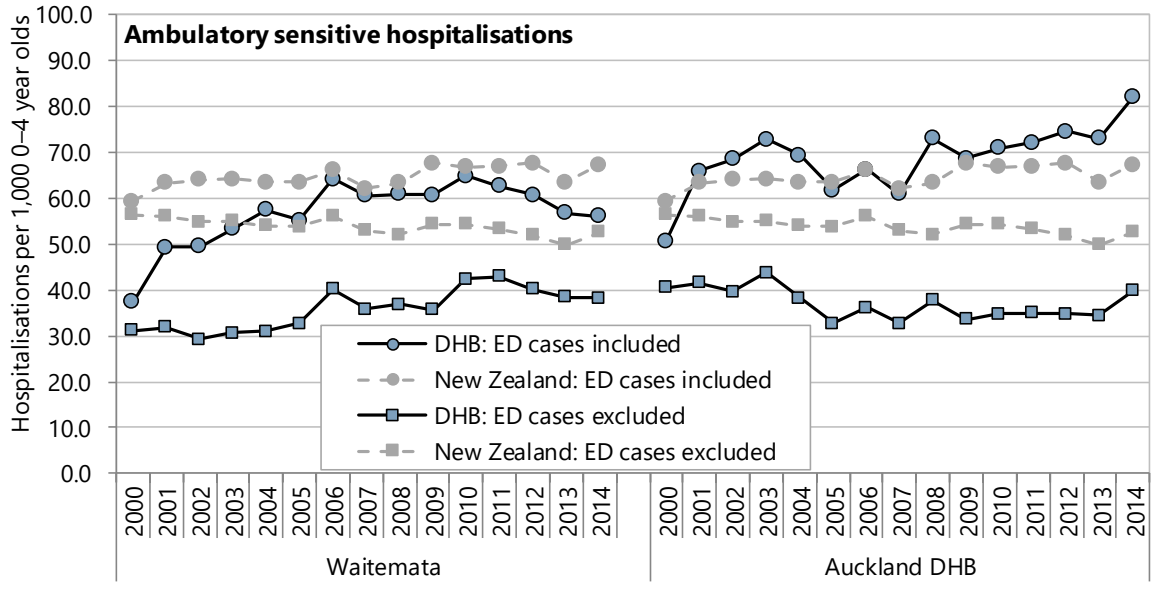
Hospitalisation rates of 0–4 year olds for ambulatory sensitive conditions declined between 2000 and 2014 in Northland and Counties Manukau. Hospitalisation rates excluding ED cases decreased in Auckland and remained relatively stable in Waitemata during this period; however, when ED cases were included rates increased in both DHBs, although only marginally for Waitemata **(Figure 38, Figure 39)**.

Figure 38. Ambulatory sensitive hospitalisations in children aged 0–4 years, by ED status, Northland and Counties Manukau DHBs vs New Zealand 2000–2014



Numerator: National Minimum Dataset (acute and arranged admissions; neonates excluded); Denominator: Statistics NZ Estimated Resident Population

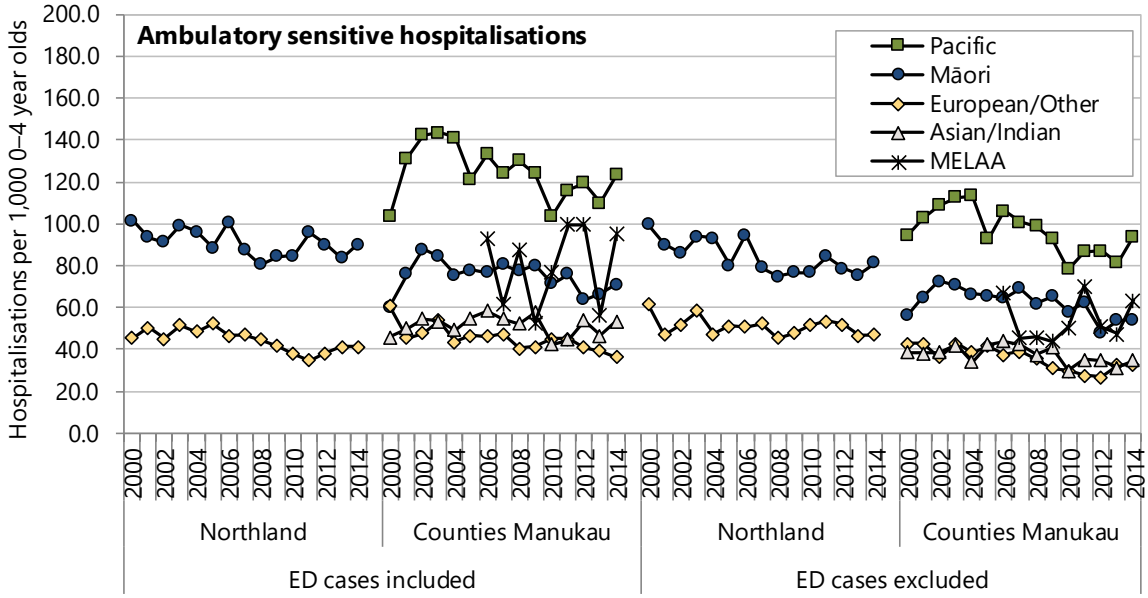
Figure 39. Ambulatory sensitive hospitalisations in children aged 0–4 years, by ED status, Waitemata and Auckland DHBs vs New Zealand 2000–2014



Numerator: National Minimum Dataset (acute and arranged admissions; neonates excluded); Denominator: Statistics NZ Estimated Resident Population

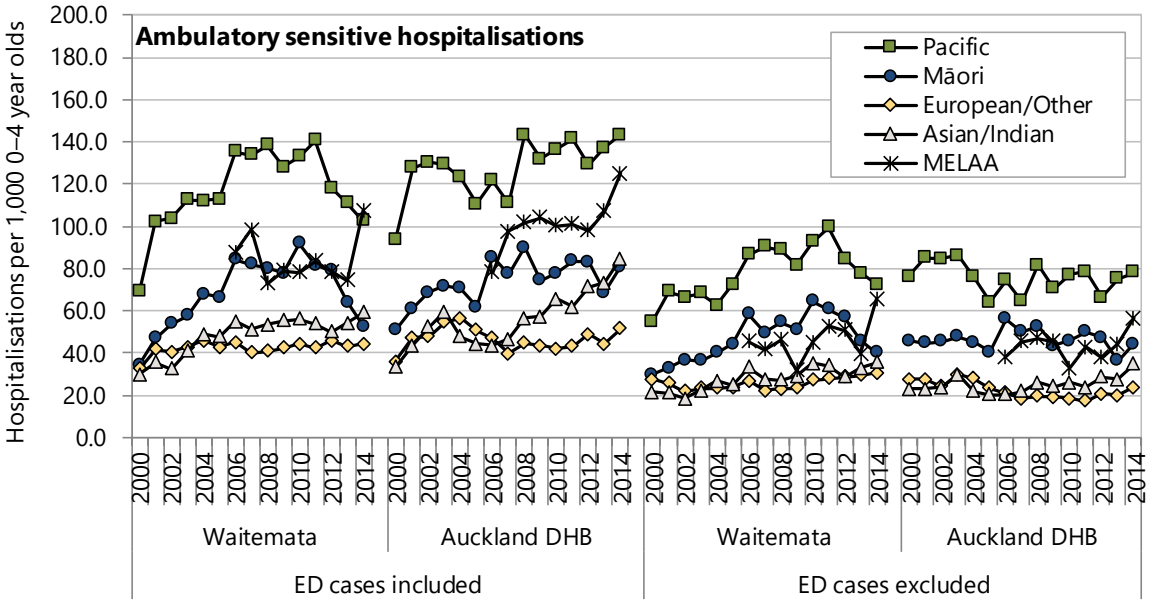
The hospitalisation rates of Pacific and Māori 0–4 year olds for ambulatory sensitive conditions were consistently higher than European/Other in Waitemata, Auckland DHB and Counties Manukau from 2000 to 2014, while in Northland rates were consistently higher for Māori than for European/Other. In Counties Manukau, Waitemata and Auckland DHBs MELAA ASH rates were generally higher than European/Other rates **(Figure 40, Figure 41)**.

Figure 40. Ambulatory sensitive hospitalisations in 0–4 year olds, by ED status and ethnicity, Northern DHBs vs New Zealand 2000–2014



Numerator: National Minimum Dataset (acute and arranged admissions; neonates excluded); Denominator: Statistics NZ Estimated Resident Population; Ethnicity is level 1 prioritised

Figure 41. Ambulatory sensitive hospitalisations in 0–4 year olds, by ED status and ethnicity, Northern DHBs vs New Zealand 2000–2014



Numerator: National Minimum Dataset (acute and arranged admissions; neonates excluded); Denominator: Statistics NZ Estimated Resident Population; Ethnicity is level 1 prioritised

Regional distribution by cause

Between 2010 and 2014 0–4 year olds hospitalised with ambulatory sensitive conditions in the Northern DHBs were most frequently diagnosed with gastroenteritis, asthma and wheeze, dental conditions, acute upper respiratory tract infections, pneumonia or skin infections although the order of these diagnoses varied between the DHBs **(Table 51–Table 54)**.

Table 51. Ambulatory sensitive hospitalisations in 0–4 year olds, by ED status and primary diagnosis, Northland 2010–2014

Primary diagnosis	Number: 2010–2014	Number: annual average	Rate per 1,000 0–4 year olds	95% CI	Per cent
Ambulatory sensitive hospitalisations in Northland 0–4 year olds					
Emergency Department cases included					
Dental	979	196	16.38	15.39–17.42	22.8
Asthma and wheeze	760	152	12.71	11.84–13.64	17.7
Gastroenteritis	741	148	12.39	11.54–13.31	17.3
Acute upper respiratory infections (excluding croup)	540	108	9.03	8.30–9.82	12.6
Pneumonia: bacterial, non-viral	471	94	7.88	7.20–8.62	11.0
Skin infections	398	80	6.66	6.04–7.34	9.3
Otitis media	135	27	2.26	1.91–2.67	3.1
Dermatitis and eczema	120	24	2.01	1.68–2.40	2.8
Constipation	65	13	1.09	0.85–1.39	1.5
Gastro-oesophageal reflux	38	8	0.64	0.46–0.87	0.9
Bronchiectasis	28	6	0.47	0.32–0.68	0.7
VPD ≥6 months: DTP, Polio, HepB	7	1	0.12	0.06–0.24	0.2
Nutritional deficiencies or anaemias	6	1	0.10	0.05–0.22	0.1
VPD ≥16 months: MMR	<5	s	s	s	s
Rheumatic fever or rheumatic heart disease	0	..	..	..	..
Total	4,289	858	71.74	69.70–73.84	100.0
Emergency Department cases excluded					
Dental	977	195	16.34	15.36–17.39	26.1
Asthma and wheeze	619	124	10.35	9.57–11.20	16.5
Gastroenteritis	602	120	10.07	9.30–10.90	16.1
Pneumonia: bacterial, non-viral	447	89	7.48	6.82–8.20	11.9
Skin infections	378	76	6.32	5.72–6.99	10.1
Acute upper respiratory infections (excluding croup)	376	75	6.29	5.69–6.96	10.0
Dermatitis and eczema	114	23	1.91	1.59–2.29	3.0
Otitis media	100	20	1.67	1.38–2.03	2.7
Constipation	53	11	0.89	0.68–1.16	1.4
Gastro-oesophageal reflux	35	7	0.59	0.42–0.81	0.9
Bronchiectasis	28	6	0.47	0.32–0.68	0.7
Nutritional deficiencies or anaemias	6	1	0.10	0.05–0.22	0.2
VPD ≥6 months: DTP, Polio, HepB	6	1	0.10	0.05–0.22	0.2
VPD ≥16 months: MMR	<5	s	s	s	s
Rheumatic fever or rheumatic heart disease	0	..	..	..	..
Total	3,742	748	62.59	60.68–64.56	100.0

Numerator: National Minimum Dataset (acute and arranged admissions; neonates excluded); Denominator: Statistics NZ Estimated Resident Population; s= suppressed due to small numbers; VPD: Vaccine preventable diseases; DTP: diphtheria, tetanus, pertussis; HepB: hepatitis B; MMR: measles, mumps, rubella

Table 52. Ambulatory sensitive hospitalisations in 0–4 year olds, by ED status and primary diagnosis, Waitemata 2010–2014

Primary diagnosis	Number: 2010–2014	Number: annual average	Rate per 1,000 0–4 year olds	95% CI	Per cent
Ambulatory sensitive hospitalisations in Waitemata 0–4 year olds					
Emergency Department cases included					
Gastroenteritis	2,839	568	14.58	14.06–15.12	24.2
Asthma and wheeze	2,487	497	12.77	12.29–13.28	21.2
Pneumonia: bacterial, non-viral	1,675	335	8.60	8.20–9.02	14.3
Acute upper respiratory infections (excluding croup)	1,470	294	7.55	7.18–7.95	12.5
Dental	1,146	229	5.89	5.56–6.24	9.8
Skin infections	1,142	228	5.87	5.54–6.21	9.7
Constipation	258	52	1.33	1.17–1.50	2.2
Otitis media	245	49	1.26	1.11–1.43	2.1
Dermatitis and eczema	231	46	1.19	1.04–1.35	2.0
Gastro-oesophageal reflux	131	26	0.67	0.57–0.80	1.1
Bronchiectasis	41	8	0.21	0.16–0.29	0.3
Nutritional deficiencies or anaemias	28	6	0.14	0.10–0.21	0.2
VPD ≥6 months: DTP, Polio, HepB	17	3	0.09	0.05–0.14	0.1
VPD ≥16 months: MMR	8	2	0.04	0.02–0.08	0.1
Rheumatic fever or rheumatic heart disease	<5	s	s	s	s
Total	11,720	2,344	60.20	59.15–61.26	100.0
Emergency Department cases excluded					
Asthma and wheeze	1,549	310	7.96	7.57–8.36	19.7
Gastroenteritis	1,508	302	7.75	7.37–8.15	19.2
Pneumonia: bacterial, non-viral	1,316	263	6.76	6.41–7.13	16.7
Dental	1,140	228	5.86	5.53–6.20	14.5
Skin infections	971	194	4.99	4.68–5.31	12.3
Acute upper respiratory infections (excluding croup)	760	152	3.90	3.64–4.19	9.7
Dermatitis and eczema	187	37	0.96	0.83–1.11	2.4
Otitis media	132	26	0.68	0.57–0.80	1.7
Constipation	125	25	0.64	0.54–0.76	1.6
Gastro-oesophageal reflux	100	20	0.51	0.42–0.62	1.3
Bronchiectasis	38	8	0.20	0.14–0.27	0.5
Nutritional deficiencies or anaemias	24	5	0.12	0.08–0.18	0.3
VPD ≥6 months: DTP, Polio, HepB	10	2	0.05	0.03–0.09	0.1
VPD ≥16 months: MMR	<5	s	s	s	s
Rheumatic fever or rheumatic heart disease	<5	s	s	s	s
Total	7,866	1,573	40.40	39.54–41.29	100.0

Numerator: National Minimum Dataset (acute and arranged admissions; neonates excluded); Denominator: Statistics NZ Estimated Resident Population; VPD: Vaccine preventable diseases; DTP: diphtheria, tetanus, pertussis; HepB: hepatitis B; MMR: measles, mumps, rubella

Table 53. Ambulatory sensitive hospitalisations in 0–4 year olds, by ED status and primary diagnosis, Auckland DHB 2010–2014

Primary diagnosis	Number: 2010–2014	Number: annual average	Rate per 1,000 0–4 year olds	95% CI	Per cent
Ambulatory sensitive hospitalisations in Auckland DHB 0–4 year olds					
Emergency Department cases included					
Asthma and wheeze	3,173	635	21.30	20.58–22.04	28.5
Gastroenteritis	2,516	503	16.89	16.25–17.56	22.6
Acute upper respiratory infections (excluding croup)	1,413	283	9.48	9.00–9.99	12.7
Pneumonia: bacterial, non-viral	1,361	272	9.14	8.66–9.63	12.2
Skin infections	976	195	6.55	6.15–6.97	8.8
Dental	930	186	6.24	5.86–6.66	8.4
Dermatitis and eczema	215	43	1.44	1.26–1.65	1.9
Constipation	188	38	1.26	1.09–1.46	1.7
Otitis media	184	37	1.24	1.07–1.43	1.7
Gastro-oesophageal reflux	93	19	0.62	0.51–0.76	0.8
Bronchiectasis	30	6	0.20	0.14–0.29	0.3
Nutritional deficiencies or anaemias	27	5	0.18	0.12–0.26	0.2
VPD ≥6 months: DTP, Polio, HepB	12	2	0.08	0.05–0.14	0.1
VPD ≥16 months: MMR	<5	s	s	s	s
Rheumatic fever or rheumatic heart disease	<5	s	s	s	s
Total	11,124	2,225	74.67	73.34–76.01	100.0
Emergency Department cases excluded					
Asthma and wheeze	1,122	224	7.53	7.10–7.98	21.0
Dental	925	185	6.21	5.82–6.62	17.3
Skin infections	877	175	5.89	5.51–6.29	16.4
Pneumonia: bacterial, non-viral	830	166	5.57	5.21–5.96	15.6
Gastroenteritis	737	147	4.95	4.60–5.32	13.8
Acute upper respiratory infections (excluding croup)	424	85	2.85	2.59–3.13	7.9
Dermatitis and eczema	182	36	1.22	1.06–1.41	3.4
Constipation	69	14	0.46	0.37–0.59	1.3
Otitis media	57	11	0.38	0.30–0.50	1.1
Gastro-oesophageal reflux	51	10	0.34	0.26–0.45	1.0
Bronchiectasis	29	6	0.19	0.14–0.28	0.5
Nutritional deficiencies or anaemias	22	4	0.15	0.10–0.22	0.4
VPD ≥6 months: DTP, Polio, HepB	6	1	0.04	0.02–0.09	0.1
Rheumatic fever or rheumatic heart disease	<5	s	s	s	s
VPD ≥16 months: MMR	<5	s	s	s	s
Total	5,335	1,067	35.81	34.88–36.77	100.0

Numerator: National Minimum Dataset (acute and arranged admissions; neonates excluded); Denominator: Statistics NZ Estimated Resident Population; VPD: Vaccine preventable diseases; DTP: diphtheria, tetanus, pertussis; HepB: hepatitis B; MMR: measles, mumps, rubella

Table 54. Ambulatory sensitive hospitalisations in 0–4 year olds, by ED status and primary diagnosis, Counties Manukau 2010–2014

Primary diagnosis	Number: 2010–2014	Number: annual average	Rate per 1,000 0–4 year olds	95% CI	Per cent
Ambulatory sensitive hospitalisations in Counties Manukau 0–4 year olds					
Emergency Department cases included					
Gastroenteritis	3,261	652	15.97	15.43–16.52	22.4
Asthma and wheeze	2,740	548	13.42	12.93–13.93	18.9
Acute upper respiratory infections (excluding croup)	2,303	461	11.28	10.83–11.74	15.9
Dental	1,880	376	9.21	8.80–9.63	12.9
Skin infections	1,819	364	8.91	8.51–9.32	12.5
Pneumonia: bacterial, non-viral	1,532	306	7.50	7.14–7.89	10.5
Dermatitis and eczema	352	70	1.72	1.55–1.91	2.4
Otitis media	249	50	1.22	1.08–1.38	1.7
Constipation	170	34	0.83	0.72–0.97	1.2
Gastro-oesophageal reflux	98	20	0.48	0.39–0.58	0.7
Bronchiectasis	69	14	0.34	0.27–0.43	0.5
Nutritional deficiencies or anaemias	36	7	0.18	0.13–0.24	0.2
VPD ≥6 months: DTP, Polio, HepB	14	3	0.07	0.04–0.12	0.1
VPD ≥16 months: MMR	<5	s	s	s	s
Rheumatic fever or rheumatic heart disease	<5	s	s	s	s
Total	14,527	2,905	71.14	70.03–72.26	100.0
Emergency Department cases excluded					
Asthma and wheeze	1,954	391	9.57	9.16–10.00	17.9
Gastroenteritis	1,907	381	9.34	8.93–9.76	17.4
Dental	1,869	374	9.15	8.75–9.57	17.1
Skin infections	1,717	343	8.41	8.02–8.81	15.7
Acute upper respiratory infections (excluding croup)	1,483	297	7.26	6.90–7.64	13.6
Pneumonia: bacterial, non-viral	1,232	246	6.03	5.71–6.38	11.3
Dermatitis and eczema	316	63	1.55	1.39–1.73	2.9
Otitis media	165	33	0.81	0.69–0.94	1.5
Constipation	95	19	0.47	0.38–0.57	0.9
Gastro-oesophageal reflux	77	15	0.38	0.30–0.47	0.7
Bronchiectasis	69	14	0.34	0.27–0.43	0.6
Nutritional deficiencies or anaemias	35	7	0.17	0.12–0.24	0.3
VPD ≥6 months: DTP, Polio, HepB	13	3	0.06	0.04–0.11	0.1
VPD ≥16 months: MMR	<5	s	s	s	s
Rheumatic fever or rheumatic heart disease	<5	s	s	s	s
Total	10,936	2,187	53.55	52.58–54.54	100.0

Numerator: National Minimum Dataset (acute and arranged admissions; neonates excluded); Denominator: Statistics NZ Estimated Resident Population; VPD: Vaccine preventable diseases; DTP: diphtheria, tetanus, pertussis; HepB: hepatitis B; MMR: measles, mumps, rubella

CONDITIONS OF THE RESPIRATORY SYSTEM

UPPER RESPIRATORY TRACT INFECTIONS

Introduction

Acute upper respiratory tract infections (URTIs) are a common cause of illness in childhood and responsible for a considerable proportion of children's visits to primary care each year.[25] Although URTIs are generally of short duration and limited severity, they place a significant burden on secondary care services.[26] In New Zealand, a number of acute URTIs are considered to be ambulatory sensitive on the basis that early and appropriate management of these conditions in primary care can significantly reduce the need for hospitalisation.[26]

Upper respiratory conditions particularly relevant for children are non-specific URTIs, acute pharyngitis and tonsillitis. Non-specific URTIs, including the common cold, produce a variety of symptoms including cough, sore throat, runny nose, fever and malaise. They are usually of viral origin.[27] The available evidence indicates that antibiotic treatment does not alter the course of these illnesses,[27] which are self-limiting in the vast majority of cases, nor is it an effective strategy for preventing complications such as lower respiratory conditions like pneumonia.[28] A minority of cases of pharyngitis and tonsillitis are due to group A streptococci and may, if untreated, result in acute rheumatic fever.[29] Given their multi-factorial aetiology (for example, exposure to infectious agents, cigarette smoke, poor nutrition, sub-standard housing, overcrowding), approaches to the prevention of respiratory and infectious diseases take a variety of forms. Poverty is linked to higher rates of respiratory and infectious disease through its associations with poor housing, poor nutrition, smoking, air pollution, and difficulties with accessing healthcare.[30]

The following section uses data from the National Minimum Dataset to review acute and arranged admissions for acute upper respiratory infections in 0–14 year olds. Guidelines and evidence-based reviews, which consider how these conditions might best be prevented or managed, are summarised at the end of the section.

Data sources and methods

Indicator

Hospitalisations for acute upper respiratory tract infections in 0–14 year olds

Data sources

Numerator: National Minimum Dataset
Denominator: Statistics NZ Estimated Resident Population (with linear extrapolation being used to calculate denominators between Census years)

Definition

Acute and arranged hospitalisations for 0–14 year olds with a primary diagnosis of acute upper respiratory tract infection (URTI). Acute URTIs comprise: acute nasopharyngitis (common cold); acute sinusitis; acute pharyngitis; acute tonsillitis; croup, acute laryngitis, or tracheitis; acute URTI multiple or unspecified sites; epiglottitis. Refer to **Appendix 6** for the codes included.

Notes on interpretation

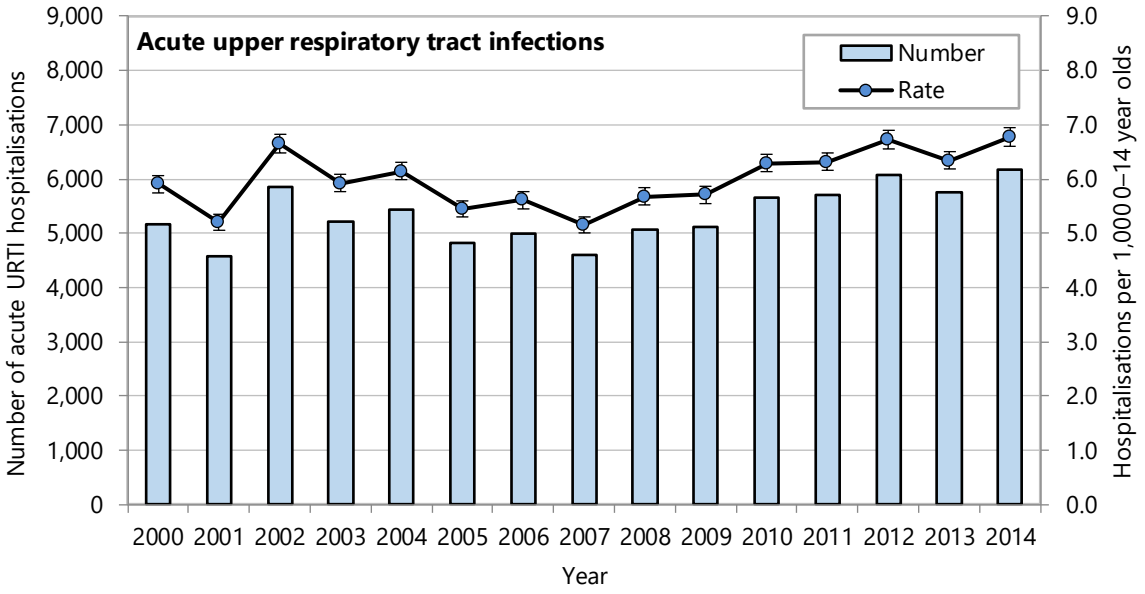
Note 1: All of the acute upper respiratory tract infections listed above are considered ambulatory sensitive, with the exception of croup/acute laryngitis/tracheitis, where early access to primary care may not prevent a hospitalisation (e.g. children with croup may require hospitalisation for the management of respiratory distress).
Note 2: An acute admission is an unplanned hospitalisation occurring on the day of presentation, while an arranged admission (also referred to as a semi-acute admission) is a non-acute hospitalisation with an admission date less than seven days after the date the decision was made that hospitalisation was necessary. Because arranged hospitalisations comprise a mix of patients being admitted semi-acutely for the management of medical conditions, and semi-urgently for operative procedures, in this section, arranged hospitalisations have been included.
Note 4: **Appendix 3** outlines the limitations of the data utilised from the National Minimum Dataset. The reader is advised to review this appendix before interpreting any trends.

National trends and distribution

From 2000 to 2014 there were 80,273 hospitalisations of 0–14 year olds with acute URTI, an average of 5352 hospitalisations per year. The hospitalisation rate for acute URTI was stable with year-to-year fluctuations from 2000 to 2009 and then rose *significantly* from 2009 to 2014 **(Figure 42)**. The rise in hospitalisation rates for acute URTI was particularly marked for Pacific, MELAA and Asian/Indian ethnic groups, whereas rates for Māori and European/Other were more stable over time. Hospitalisation rates for Pacific, MELAA and Māori

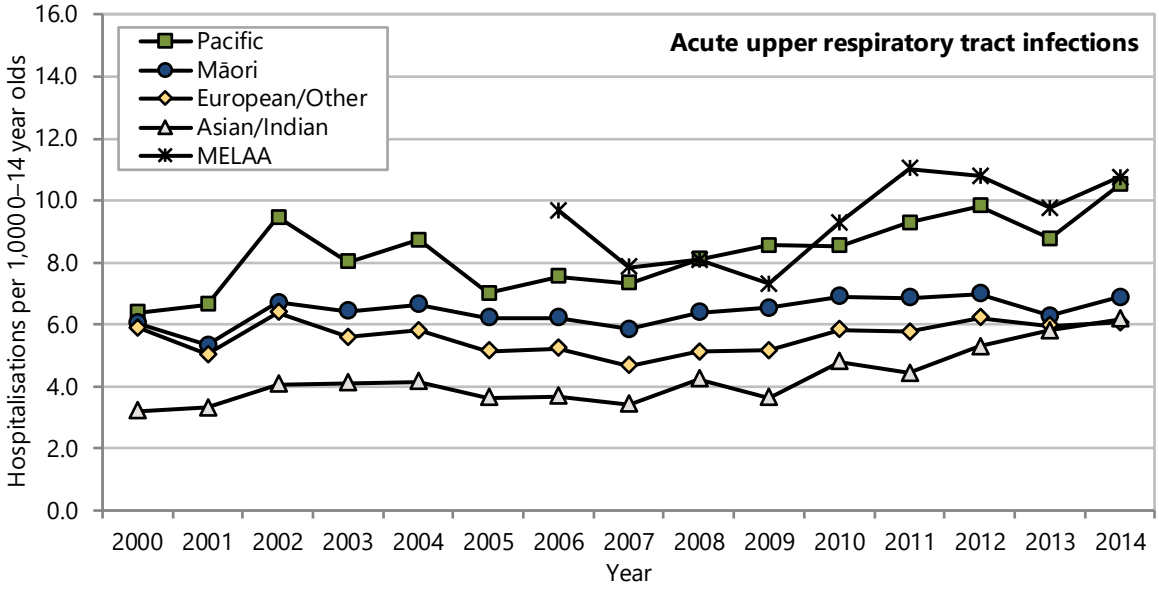
were consistently higher than European/Other rates; Asian/Indian rates were lower than European/Other rates until 2013 when they rose to become similar to European/Other **(Figure 43)**.

Figure 42. Hospitalisations for acute upper respiratory tract infections in 0–14 year olds, New Zealand 2000–2014



Numerator: National Minimum Dataset (acute and arranged admissions); Denominator: Statistics NZ Estimated Resident Population

Figure 43. Hospitalisations for acute upper respiratory tract infections (URTIs) in 0–14 year olds, by ethnicity, New Zealand 2000–2014



Numerator: National Minimum Dataset (acute and arranged admissions); Denominator: Statistics NZ Estimated Resident Population; Ethnicity is level 1 prioritised

Distribution by primary diagnosis

Between 2010 and 2014 the primary diagnosis for the majority of acute URTI hospitalisations was unspecified or involved multiple acute URTI sites. Of the remainder, the most frequent diagnoses were croup, acute laryngitis or tracheitis and acute tonsillitis **(Table 55)**.

Table 55. Hospitalisations for acute upper respiratory tract infections in 0–14 year olds, by primary diagnosis, New Zealand 2010–2014

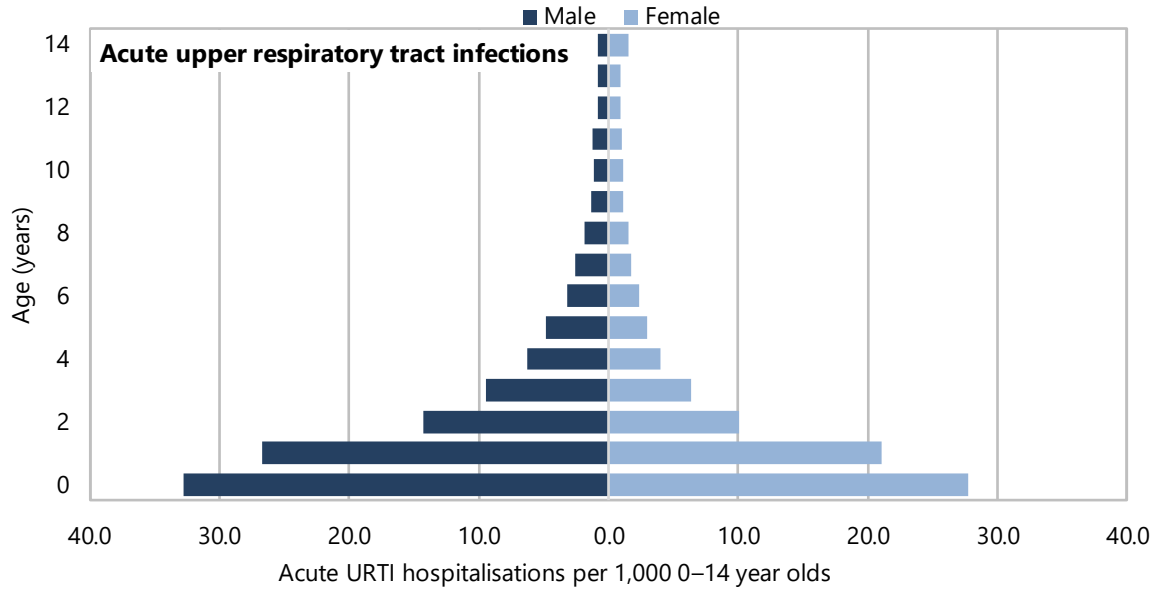
Primary diagnosis	Number: 2010–2014	Number: annual average	Rate per 1,000 0–14 year olds	95% CI	Per cent
Acute upper respiratory tract infections in 0–14 year olds					
New Zealand					
Croup, acute laryngitis, or tracheitis	6,628	1,326	1.46	1.43–1.50	22.54
Acute tonsillitis	3,657	731	0.81	0.78–0.83	12.44
Acute pharyngitis	1,579	316	0.35	0.33–0.37	5.37
Acute nasopharyngitis (common cold)	191	38	0.04	0.04–0.05	0.65
Acute sinusitis	102	20	0.02	0.02–0.03	0.35
Epiglottitis	9	2	<0.01	...	<0.1
Acute URTI multiple or unspecified sites	17,242	3,448	3.81	3.75–3.86	58.63
Total	29,408	5,882	6.49	6.42–6.57	100.00

Numerator: National Minimum Dataset (acute and arranged admissions); Denominator: Statistics NZ Estimated Resident Population

Distribution by demographic factors

For 0–14 year olds between 2010 and 2014 acute URTI hospitalisation rates were highest for 0–2 year olds and then decreased rapidly with increasing age. Male hospitalisation rates were higher than female children to age eight years **(Figure 44)**. A similar age pattern was seen in all ethnic groups with Pacific rates higher than other ethnic groups for 0–2 year olds.

Figure 44. Hospitalisations for acute upper respiratory tract infections (URTIs) in 0–14 year olds, by age and sex, New Zealand 2010–2014



Numerator: National Minimum Dataset (acute and arranged admissions); Denominator: Statistics NZ Estimated Resident Population

Between 2010 and 2014 there was disparity in rates of acute URTI by NZDep2013 index of deprivation score, ethnicity and gender. There was an evident social gradient with a *significant* increase in acute URTI rates between each quintile (using the NZDep2013 scores) compared with the quintile below, *significantly higher* rates for Māori, Pacific and MELAA ethnic groups and *significantly lower* rates for Asian/Indian compared with European/Other **(Table 56)**.

Table 56. Hospitalisations for acute upper respiratory tract infections in 0–14 year olds, by demographic factor, New Zealand 2010–2014

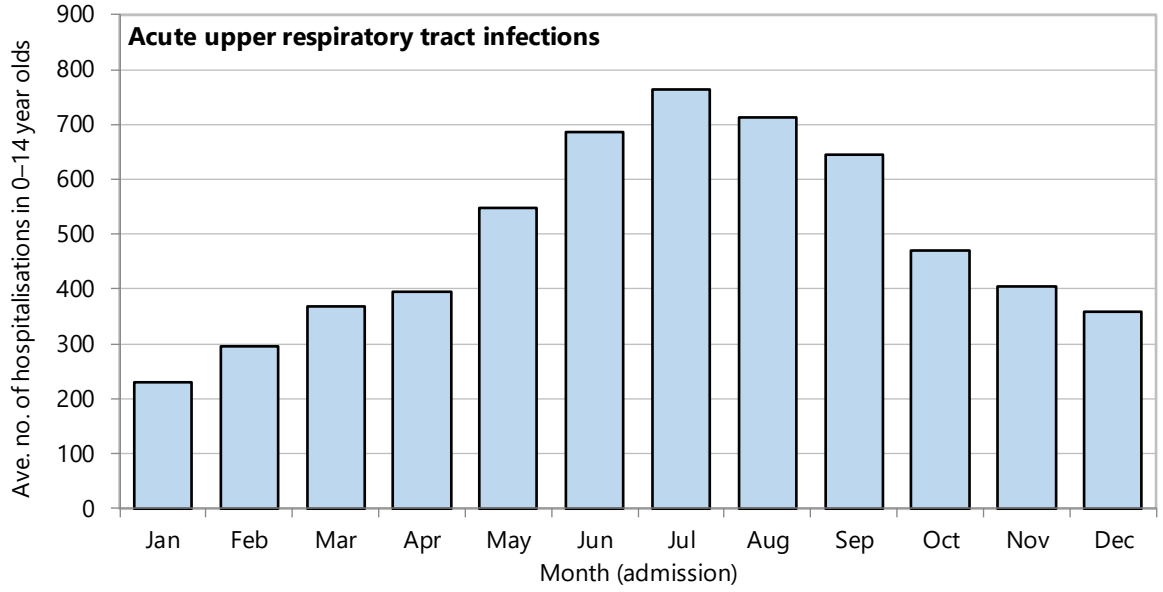
Variable	Number: 2010–2014	Rate per 1,000 0–14 year olds	Rate ratio	95% CI
Acute upper respiratory tract infections in 0–14 year olds				
New Zealand				
NZDep2013 Index of deprivation quintile				
Deciles 1–2	3,646	4.18	1.00	
Deciles 3–4	4,009	4.97	1.19	1.14–1.24
Deciles 5–6	4,889	5.72	1.37	1.31–1.43
Deciles 7–8	6,641	7.07	1.69	1.62–1.76
Deciles 9–10	10,076	9.55	2.28	2.20–2.37
Prioritised ethnicity				
Māori	7,806	6.77	1.14	1.11–1.17
Pacific	4,085	9.39	1.58	1.52–1.63
Asian/Indian	2,534	5.32	0.89	0.86–0.93
MELAA	575	10.33	1.73	1.60–1.88
European/Other	14,359	5.96	1.00	
Gender				
Female	12,511	5.67	1.00	
Male	16,897	7.28	1.28	1.25–1.31

Numerator: National Minimum Dataset (acute and arranged admissions); Denominator: Statistics NZ Estimated Resident Population; Rates are per 1,000 0–14 year olds; Rate ratios are unadjusted; Ethnicity is level 1 prioritised; Decile is NZDep2013.

Distribution by season

There was seasonal variation in acute URTI hospitalisations. The highest numbers of hospitalisations were in June to September and the lowest numbers in December to February **(Figure 45)**.

Figure 45. Hospitalisations for acute upper respiratory tract infections (URTIs) in 0–14 year olds, by month, New Zealand 2010–2014



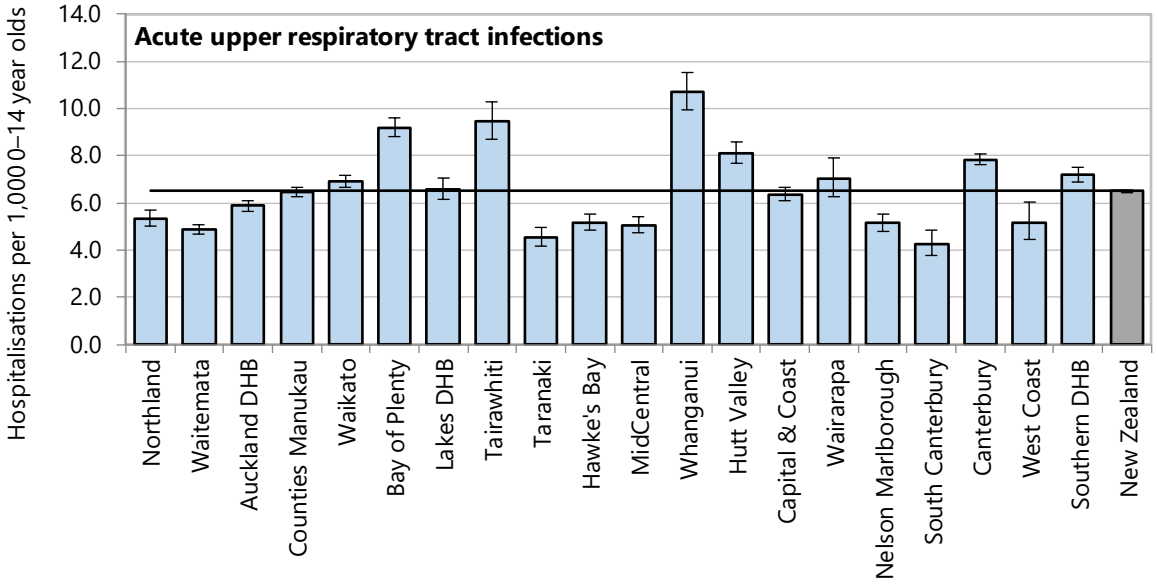
Numerator: National Minimum Dataset (acute and arranged admissions)

Distribution by region

Between 2010 and 2014 the hospitalisation rates for acute URTI were *significantly higher* than the national rate in the Waikato, Bay of Plenty, Tairawhiti, Whanganui, Hutt Valley, Canterbury and Southern DHBs. Total acute URTI hospitalisation rates were *significantly lower* than the national rate in the Northland, Waitemata, Auckland, Taranaki, Hawke's Bay, MidCentral, Nelson Marlborough, South Canterbury and West Coast DHBs.

In remaining district health boards there was *no significant difference* from the national rate **(Figure 46**, **Table 57)**.

Figure 46. Hospitalisations for acute upper respiratory tract infections in 0–14 year olds, by district health board, New Zealand 2010–2014



Numerator: National Minimum Dataset (acute and arranged admissions); Denominator: Statistics NZ Estimated Resident Population

Table 57. Hospitalisations for acute upper respiratory tract infections in 0–14 year olds, by district health board, New Zealand 2010–2014

DHB	Number: 2010–2014	Number: annual average	Rate per 1,000 0–14 year olds	Rate ratio	95% CI
Acute upper respiratory tract infections in 0–14 year olds					
Northland	970	194	5.35	0.82	0.77–0.88
Waitemata	2,743	549	4.88	0.75	0.72–0.78
Auckland	2,424	485	5.88	0.91	0.87–0.94
Counties Manukau	3,836	767	6.46	1.00	0.96–1.03
Waikato	2,811	562	6.89	1.06	1.02–1.10
Bay of Plenty	2,082	416	9.17	1.41	1.35–1.48
Lakes	772	154	6.57	1.01	0.94–1.09
Tairawhiti	553	111	9.44	1.45	1.34–1.58
Taranaki	544	109	4.55	0.70	0.64–0.76
Hawke's Bay	896	179	5.17	0.80	0.75–0.85
MidCentral	868	174	5.06	0.78	0.73–0.83
Whanganui	701	140	10.71	1.65	1.53–1.78
Hutt Valley	1,225	245	8.11	1.25	1.18–1.32
Capital & Coast	1,744	349	6.37	0.98	0.94–1.03
Wairarapa	296	59	7.04	1.08	0.97–1.22
Nelson Marlborough	690	138	5.14	0.79	0.73–0.85
South Canterbury	226	45	4.27	0.66	0.58–0.75
Canterbury	3,714	743	7.85	1.21	1.17–1.25
West Coast	163	33	5.16	0.80	0.68–0.93
Southern	2,016	403	7.20	1.11	1.06–1.16
New Zealand	29,408	5,882	6.49	1.00	

Numerator: National Minimum Dataset (acute and arranged admissions); Denominator: Statistics NZ Estimated Resident Population

Northern region distribution and trends

Comparison with New Zealand

Between 2010 and 2014 acute URTI hospitalisation rates were *significantly lower* than the national rate in Northland, Waitemata, and Auckland DHBs, while rates in Counties Manukau were *not significantly different* **(Table 58)**.

Table 58. Hospitalisations for acute upper respiratory tract infections in 0–14 year olds, Northern DHBs vs New Zealand 2010–2014

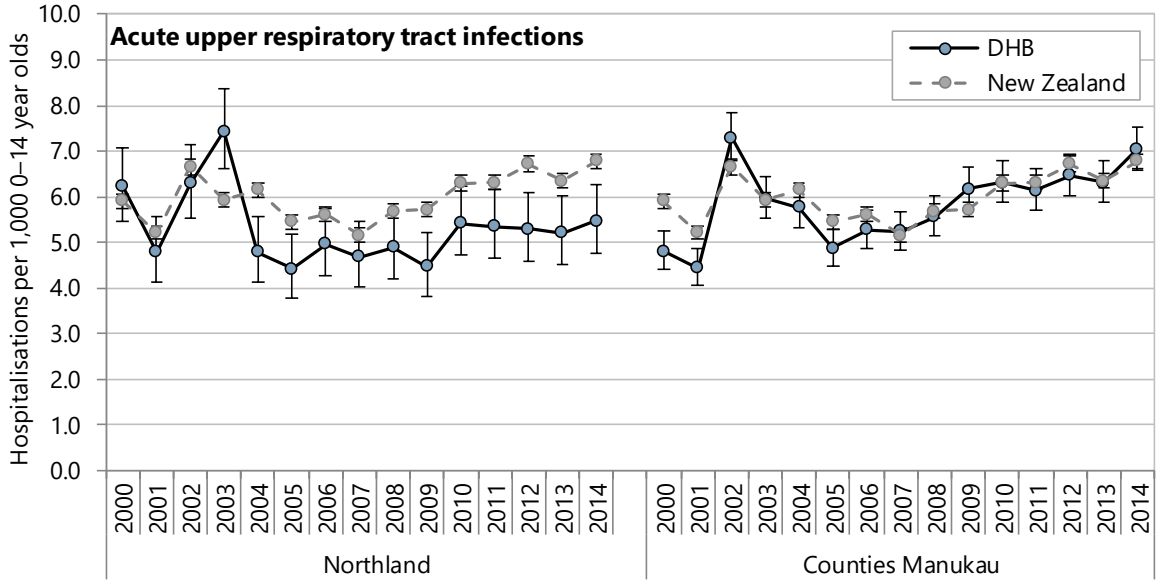
DHB	Number: 2010–2014	Number: annual average	Rate per 1,000 0–14 year olds	Rate ratio	95% CI
Acute upper respiratory tract infections in 0–14 year olds					
Northland	970	194	5.35	0.82	0.77–0.88
Waitemata	2,743	549	4.88	0.75	0.72–0.78
Auckland	2,424	485	5.88	0.91	0.87–0.94
Counties Manukau	3,836	767	6.46	1.00	0.96–1.03
New Zealand	29,408	5,882	6.49	1.00	

Numerator: National Minimum Dataset (acute and arranged admissions); Denominator: Statistics NZ Estimated Resident Population

Regional trends

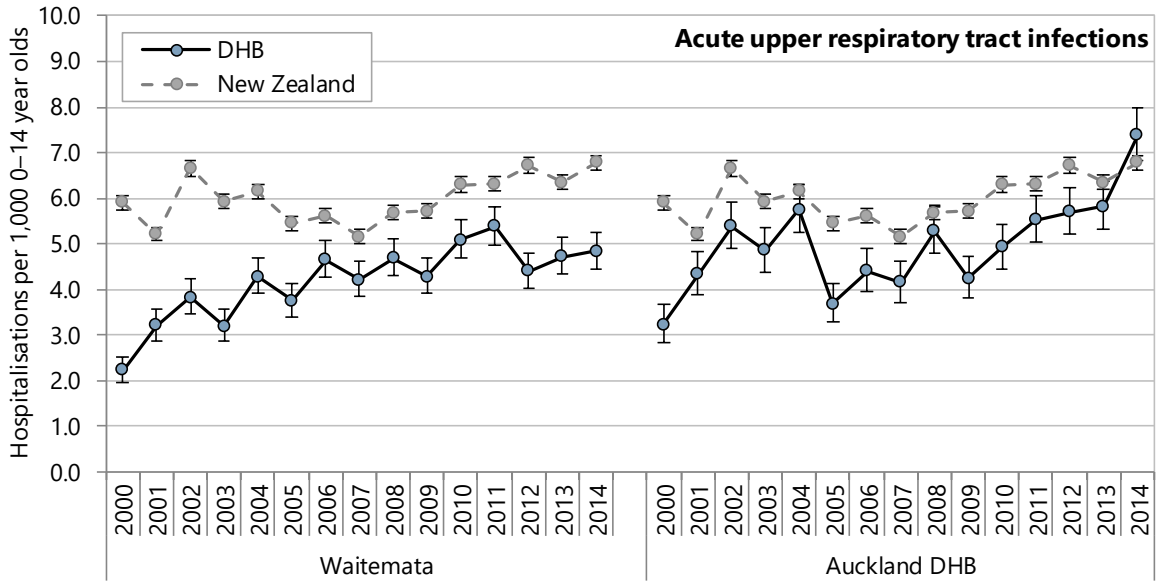
Acute URTI hospitalisations increased between 2000 and 2014 in the Waitemata, Auckland and Counties Manukau DHBs, while rates in Northland were more variable **(Figure 47**, **Figure 48)**.

Figure 47. Hospitalisations for acute upper respiratory tract infections in 0–14 year olds, Northland and Counties Manukau DHBs vs New Zealand 2000–2014



Numerator: National Minimum Dataset (acute and arranged admissions); Denominator: Statistics NZ Estimated Resident Population

Figure 48. Hospitalisations for acute upper respiratory tract infections in 0–14 year olds, Waitemata and Auckland DHBs vs New Zealand 2000–2014



Numerator: National Minimum Dataset (acute and arranged admissions); Denominator: Statistics NZ Estimated Resident Population

Regional distribution by primary diagnosis

In all four Northern DHBs, at least half of the acute URTI hospitalisations had a primary diagnosis of multiple or unspecified acute URTI sites. The most common specific diagnoses were croup, acute laryngitis or tracheitis, acute tonsillitis and acute pharyngitis (**Table 59**).

Table 59. Hospitalisations for acute upper respiratory tract infections in 0–14 year olds, by primary diagnosis, Northern DHBs 2010–2014

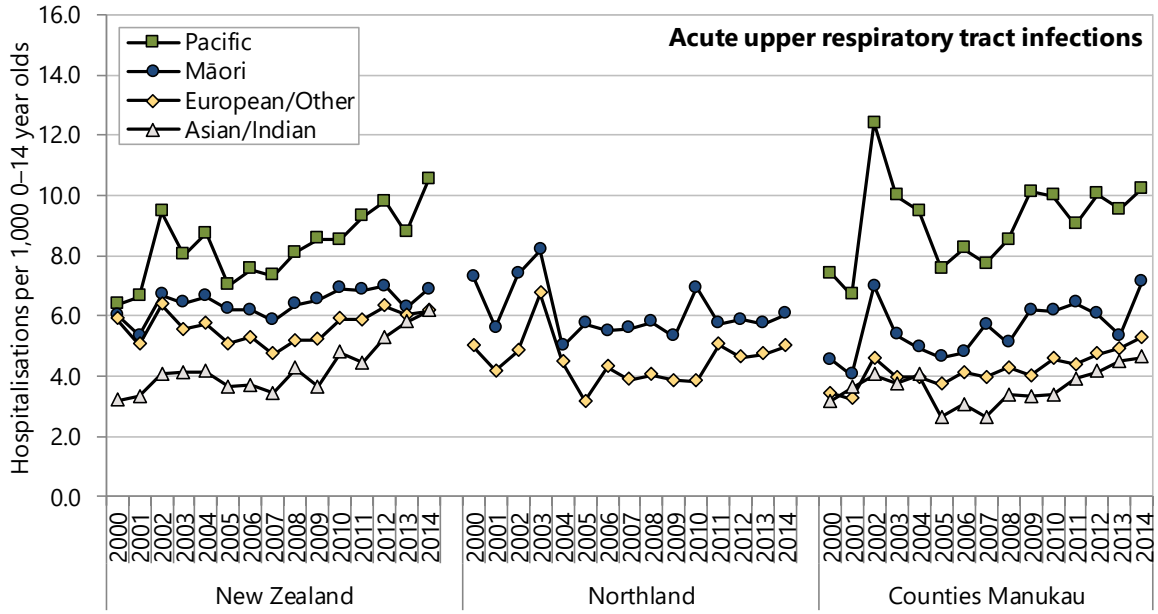
Primary diagnosis	Number: 2010–2014	Number: annual average	Rate per 1,000 0–14 year olds	95% CI	Per cent
Acute upper respiratory tract infections in 0–14 year olds					
Northland					
Croup, acute laryngitis, or tracheitis	222	44	1.22	1.07–1.40	22.9
Acute tonsillitis	129	26	0.71	0.60–0.84	13.3
Acute pharyngitis	80	16	0.44	0.35–0.55	8.2
Acute nasopharyngitis (common cold)	10	2	0.06	0.03–0.10	1.0
Acute sinusitis	<5	s	s	s	s
Epiglottitis	0	..	..	..	..
Acute URTI multiple or unspecified sites	525	105	2.89	2.66–3.15	54.1
Total	970	194	5.35	5.02–5.69	100.0
Waitemata					
Croup, acute laryngitis, or tracheitis	722	144	1.29	3.70–4.28	26.3
Acute tonsillitis	390	78	0.69	0.63–0.77	14.2
Acute pharyngitis	161	32	0.29	0.25–0.33	5.9
Acute nasopharyngitis (common cold)	8	2	0.01	0.01–0.03	0.3
Acute sinusitis	18	4	0.03	0.02–0.05	0.7
Epiglottitis	0	..	..	..	..
Acute URTI multiple or unspecified sites	1,444	289	2.57	2.44–2.71	52.6
Total	2,743	549	4.88	4.71–5.07	100.0
Auckland DHB					
Croup, acute laryngitis, or tracheitis	623	125	1.51	3.18–3.71	25.7
Acute tonsillitis	305	61	0.74	0.66–0.83	12.6
Acute pharyngitis	141	28	0.34	0.29–0.40	5.8
Acute nasopharyngitis (common cold)	9	2	0.02	0.01–0.04	0.4
Acute sinusitis	9	2	0.02	0.01–0.04	0.4
Epiglottitis	0	..	..	..	..
Acute URTI multiple or unspecified sites	1,337	267	3.24	3.07–3.42	55.2
Total	2,424	485	5.88	5.65–6.11	100.0
Counties Manukau					
Croup, acute laryngitis, or tracheitis	889	178	1.50	4.59–5.23	23.2
Acute tonsillitis	350	70	0.59	0.53–0.65	9.1
Acute pharyngitis	256	51	0.43	0.38–0.49	6.7
Acute nasopharyngitis (common cold)	22	4	0.04	0.02–0.06	0.6
Acute sinusitis	15	3	0.03	0.02–0.04	0.4
Epiglottitis	<5	s	s	s	s
Acute URTI multiple or unspecified sites	2,300	460	3.87	3.72–4.04	60.0
Total	3,836	767	6.46	6.26–6.67	100.0

Numerator: National Minimum Dataset (acute and arranged admissions); Denominator: Statistics NZ Estimated Resident Population

Regional distribution by ethnicity

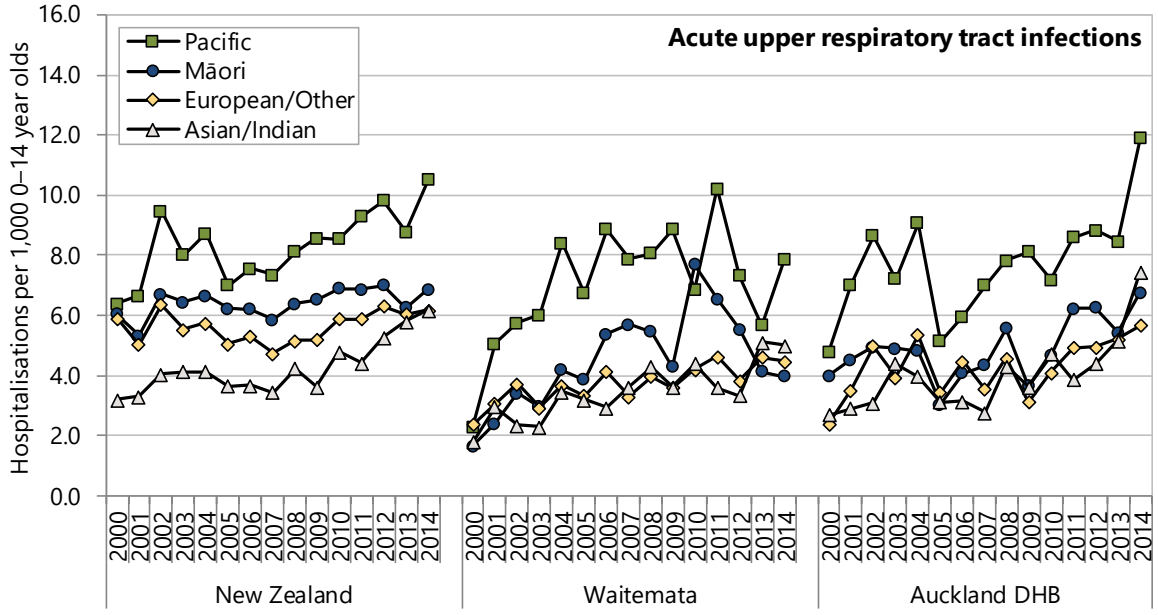
From 2000 to 2014 hospitalisation rates of Pacific 0–14 year olds with acute URTI were consistently higher than for Māori and for European/Other in Waitemata, Auckland and Counties Manukau DHBs, while in Northland hospitalisations were higher for Māori than for European/Other **(Figure 49**, **Figure 50)**.

Figure 49. Hospitalisations for acute upper respiratory tract infections in 0–14 year olds, by ethnicity, Northland and Counties Manukau DHBs 2000–2014



Numerator: National Minimum Dataset (acute and arranged admissions); Denominator: Statistics NZ Estimated Resident Population; Ethnicity is level 1 prioritised

Figure 50. Hospitalisations for acute upper respiratory tract infections in 0–14 year olds, by ethnicity, Waitemata and Auckland DHBs 2000–2014

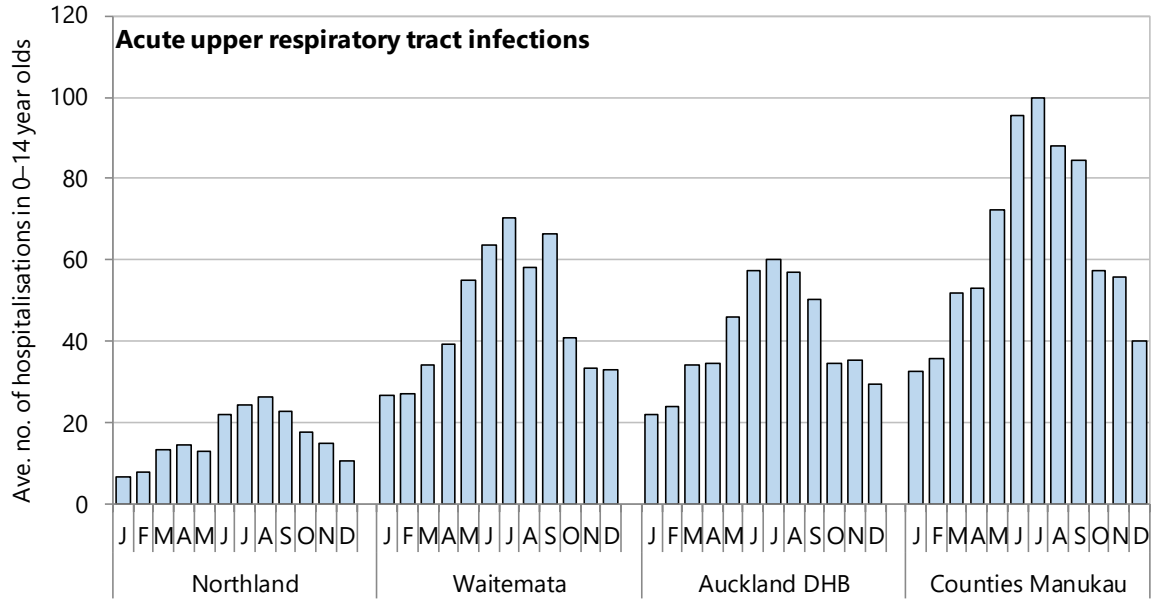


Numerator: National Minimum Dataset (acute and arranged admissions); Denominator: Statistics NZ Estimated Resident Population; Ethnicity is level 1 prioritised

Regional distribution by season

There was seasonal variation in acute URTI hospitalisations in all four Northern DHBs. The highest numbers of hospitalisations were typically in June–September and the lowest numbers in December–February **(Figure 51)**.

Figure 51. Hospitalisations for acute upper respiratory tract infections in 0–14 year olds, by ethnicity, Waitemata and Auckland DHBs 2010–2014



National Minimum Dataset (acute and arranged admissions)

Evidence for good practice for the prevention of infectious and respiratory diseases

Ministry of Health publications
Medsafe 2015. **Changes to the use of bromhexine or codeine-containing cough and cold medicines in children**. http://www.medsafe.govt.nz/safety/EWS/2015/BromhexineOrCodeine.asp accessed June 2015. This web page outlines concerns regarding the use of bromhexine (a mucolytic used to break up thick phlegm associated with a chesty cough) and codeine (a pain reliever) in cough and cold medicines used by children. Bromhexine is metabolised to ambroxol, to which there have been a number of allergic reaction (including anaphylaxis) and codeine is metabolised to morphine which induces respiratory depression in overdoses. Due to these concerns, Medsafe and the Medicines Adverse Reactions Committee (MARC) reviewed the use of cough and cold medicines containing these ingredients. MARC concluded that there was insufficient evidence to support the use of such medicines in younger age groups and recommended that their use should be restricted as follows: to adults and children six years of age and over for medicines containing bromhexine; and to adults and children 12 years of age and over for medicines containing codeine.
Ministry of Health. 2004. **National health emergency plan: Infectious diseases**. Wellington: Ministry of Health. http://www.health.govt.nz/system/files/documents/publications/nationalhealthemergencyplan.pdf This publication deals with responding to high-impact rapidly progressive infectious diseases that have the potential to create a national health-related emergency, such as severe acute respiratory syndrome (SARS) or influenza. The Plan is intended for use by all agencies and individuals in the health and disability sector.
Ministry of Health. 1997. **Nga Kupu Oranga Healthy Messages: A health and safety resource for early childhood services**. Wellington: Ministry of Health. http://www.health.govt.nz/system/files/documents/publications/ngakupuorangahealthymessages.pdf This publication provides guidance for early childhood services on common childhood illnesses, how to prevent them, the care of children with on-going conditions, and safety issues likely to occur in any early childhood service. Section B deals with preventing infectious illnesses under the headings exclusion, immunisation, personal hygiene and cleaning.
International guidelines
National Health and Medical Research Council. 2012. **Staying Healthy: Preventing infectious diseases in early childhood education and care services**. Canberra: National Health and Medical Research Council. https://www.nhmrc.gov.au/guidelines-publications/ch55 This comprehensive publication is intended to provide staff working in education and care services with simple and effective ways to minimise the spread of disease and to meet the requirements of the Australian National Quality Framework for Early Childhood Education and Care. The advice is presented in six sections, covering: concepts of infection control; monitoring illness in children; procedures; issues for employers, educators and other staff; fact sheets on diseases common to education and care services; and forms, useful contacts and websites. In addition to the *Staying Healthy* guideline, the website has a range of posters and pamphlets relevant to infection control.
Zeng L, Zhang L, Hu Z, et al. 2014. **Systematic review of evidence-based guidelines on medication therapy for upper respiratory tract infection in children with AGREE instrument**. PLoS One 9(2) e87711. http://journals.plos.org/plosone/article?id=10.1371/journal.pone.0087711 The review aimed to summarize the recommendations of existing guidelines on the treatment of upper respiratory tract infections in children, and to assess the methodological quality of these guidelines. The authors identified 13 evidence-based guidelines meeting their criteria: one on pharyngitis, four on rhinosinusitis, four on influenza, three on otitis media, and one on upper respiratory infections. They used the AGREE II tool (http://www.agreetrust.org/) to assess the quality of these guidelines. They stated that there were huge differences between the guidelines regarding the categorisation of evidence and recommendations and that nearly all of the guidelines lacked sufficient involvement of the stakeholders. Penicillin and amoxicillin were suggested for group A streptococcal pharyngitis. Amoxicillin and amoxicillin-clavulanate were recommended for acute bacterial rhinosinusitis. For mild otitis media, an observation period of 2–3 days prior to initiation of antibiotic therapy was recommended, with amoxicillin suggested as the first choice antibiotic. There was a lack of direct evidence to support strong recommendations for influenza. There was a lack of agreement on antimicrobial durations for pharyngitis and on the initiation and duration of antimicrobials for acute bacterial rhinosinusitis. The review authors recommended that future guidelines should use a consistent grading system for the quality of evidence and strength of recommendations.
Snellman L, Adams W, Anderson G, et al. 2013**. Diagnosis and treatment of respiratory illness in children and adults**. Bloomington (MN): Institute for Clinical Systems Improvement (ICSI). https://www.icsi.org/guidelines__more/catalog_guidelines_and_more/catalog_guidelines/catalog_respiratory_guidelines/respiratory_illness/ This guideline has three goals: education to assist patients to be competent and comfortable with home care of respiratory illness; to assist medical personnel to differentiate respiratory illness from more severe illness; to improve the appropriateness of care and reduce unnecessary antibiotic use for respiratory illness while decreasing the cost of that care. It covers acute conditions in infants aged >3 months, children, adolescents and adults, who are in good health. A summary of the guideline can be found at the National Guideline Clearinghouse website:

National Guideline Clearinghouse. Diagnosis and treatment of respiratory illness in children and adults
http://www.guideline.gov/content.aspx?id=43792&search=upper+respiratory+children

Vodicka TA, Thompson M, Lucas P, et al. 2013. **Reducing antibiotic prescribing for children with respiratory tract infections in primary care: a systematic review**. The British Journal of General Practice, 63(612), e445-e54.
http://www.ncbi.nlm.nih.gov/pmc/articles/PMC3693801/

Doctors frequently prescribe antibiotics for respiratory tract infections (RTIs), despite knowing that these infections are mostly self-limiting and that antibiotics are of uncertain value for RTIs. Overuse of antibiotics is of concern because it is associated with the development of antibiotic resistance, adverse effects, and increased healthcare seeking behaviour. This review aimed to assess the effectiveness of primary care based interventions to reduce antibiotic prescribing for children with RTIs. The review authors searched for randomised, cluster randomised and non-randomised studies testing educational and/or behavioural interventions to change antibiotics prescribing for children (<18 years) with RTIs. They identified 17 studies. One study included three different interventions, so in total there were 19 interventions studied: 10 directed at both clinicians and parents, six towards clinicians only, and three to parents only. Eight of the interventions targeting both parents and clinicians reported significant decreases in prescribing rates, ranging from 6% to 21% at follow-up from one week to two years. Of the six interventions aimed at clinicians only, one reported a significant reduction in antibiotic prescribing, a further two reported significant reductions in inappropriate antibiotic prescribing, and the other three reported either no significant reduction or an increase in antibiotic prescribing. None of the interventions targeting parents only, for example the provision of information pamphlets in waiting rooms, significantly reduced antibiotics prescriptions. The most effective interventions involved targeting both clinicians and parents during consultations, providing automatic computer prompts for evidence-based prescribing, and promoting clinician leadership or participation in the design of treatment guidelines and/or peer education.

Andrews T, Thompson M, Buckley DI, et al. 2012. **Interventions to influence consulting and antibiotic use for acute respiratory tract infections in children: a systematic review and meta-analysis**. PLoS One, 7(1), e30334.
http://www.ncbi.nlm.nih.gov/pmc/articles/PMC3267713/

This review aimed to assess the effect of interventions directed at parents or caregivers that were designed to influence consulting and antibiotic use for children with respiratory tract infections (RTIs) in primary care. It included studies that used randomised, cluster randomised, or non-randomised controlled designs, or one group pre/post-test designs, to assess the effect of educational or behavioural interventions directed at caregivers in influencing consulting or antibiotic use for acute RTIs in children (birth to 18 years), in developed countries. There were 23 studies (representing 20 interventions) identified meeting these criteria. Materials designed to engage children as well as parents were effective in modifying parental knowledge and behaviour, resulting in reductions in consulting rates ranging from 13% to 40% (moderate level of evidence). Providing parents with delayed prescriptions significantly decreased reported antibiotic use (Risk Ratio 0.46, 95% CI 0.40 to 0.54); and a delayed or no prescribing approach did not lessen parental satisfaction (strong evidence).

Shulman ST, Bisno AL, Clegg HW, et al. 2012. **Clinical practice guideline for the diagnosis and management of group A streptococcal pharyngitis: 2012 update by the Infectious Diseases Society of America.** Clinical Infectious Diseases, 55(10), e86-102. http://cid.oxfordjournals.org/content/55/10/e86.long (Erratum in Clin Infect Dis. 2014 May;58(10):1496. Dosage error in article text.)

This guideline is intended for healthcare providers who care for child and adult patients with group A streptococcal (GAS) pharyngitis (sore throat). GAS is the most common cause of bacterial pharyngitis, responsible for 20–30% of sore throat visits in children. Streptococcal pharyngitis is important because it can lead to the post infectious disorders of acute rheumatic fever and post-streptococcal glomerulonephritis. Strength of recommendations and quality of evidence are rated using the GRADE system. The guideline covers: establishing the diagnosis of GAS pharyngitis; who should undergo testing for GAS pharyngitis; treatment recommendations (antibiotics); adjunctive therapy; and chronic pharyngeal carriage of GAS. It states that penicillin or amoxicillin (for 10 days) remain the treatments of choice, except in penicillin allergic patients, who should be treated with first generation cephalosporin (for those not anaphylactically sensitive) for 10 days, clindamycin or clarithromycin for 10 days, or azithromycin for 5 days. Additional publications on the treatment of streptococcal pharyngitis, with an emphasis on the prevention of subsequent rheumatic fever can be found in the chapter on rheumatic fever, **on page 235.**

National Institute for Health and Clinical Excellence. 2008. **Prescribing of antibiotics for self-limiting respiratory tract infections in adults and children in primary care**. London: National Institute for Health and Clinical Excellence.
https://www.nice.org.uk/guidance/cg69

Acute respiratory infections are common and usually self-limiting. Overuse of antibiotics in primary care increases rates of antibiotic resistance which could become a major public health problem. This guideline is intended to provide evidence-based best practice advice on the care of adults and children over three months of age for whom immediate prescribing of antibiotics is not warranted. The guidelines state that a no antibiotic or delayed antibiotic prescribing strategy is appropriate for patients with the following conditions: acute otitis media, acute sore throat/acute pharyngitis/acute tonsillitis, common cold, acute rhinosinusitis, acute cough/acute bronchitis but that an immediate antibiotic prescribing strategy can be considered for bilateral acute otitis media in children younger than two years, acute otitis media in children with otorrhoea and acute sore throat/acute pharyngitis/acute tonsillitis when three or more Centor criteria are present. The guidelines also cover advice to patients and identifying patients at risk of developing complications who require immediate antibiotics and/or further investigations. The full guideline, and the supporting evidence, can be downloaded here: http://www.nice.org.uk/guidance/cg69/evidence .

Jefferson T, Del Mar C, Dooley L, et al. 2011. **Physical interventions to interrupt or reduce the spread of respiratory viruses**. Cochrane Database of Systematic Reviews, 2011(7).
http://onlinelibrary.wiley.com/doi/10.1002/14651858.CD006207.pub4/abstract

This review considers the effectiveness of physical interventions such as isolation, quarantine, hand washing and wearing masks, gloves and gowns in preventing the spread of respiratory viruses, particularly during epidemics. It includes 66 papers from 67 studies of various types (RCTs, cluster-RCTs, case-control studies, cohort studies and before-and-after studies). The five included RCTs, and most cluster RCTs, were judged to be at high risk of bias. The reviewers concluded that hand washing interventions are effective, particularly when directed at younger children. This may be because young children are less capable of managing their own hygiene and because they have longer-lived infections and more social contact (thus being more likely to make other people ill). Barrier methods such as gowns, gloves and masks are also effective, as is isolation of suspected cases. These interventions are even more effective when used in combination. The benefits of adding virucidals or antiseptics to normal hand washing are uncertain. There was limited evidence of the superior effectiveness of N95 respirators over simple surgical masks however the respirators were more expensive and more uncomfortable to wear. The authors state that N95 respirators may be useful in very high risk situations but that further research is needed to define these situations.

Lee KM, Shukla VK, Clark M, et al. 2011. **Physical Interventions to Interrupt or Reduce the Spread of Respiratory Viruses - Resource Use Implications: A Systematic Review**. Ottawa (ON): Canadian Agency for Drugs and Technologies in Health. https://www.cadth.ca/media/pdf/M0024_respiratory_viruses_tr_e.pdf

This systematic review, prepared by the CADTH in partnership with the WHO, assesses the resource use implications associated with physical interventions for interrupting or reducing the spread of respiratory viruses. It is complementary to the Cochrane review above. Seven studies were identified as meeting the reviews inclusion criteria i.e. they reported information on resource use of physical interventions or assessed the cost-effectiveness of physical interventions. They were all observational in nature and provided only low quality evidence. The review authors noted that the Cochrane review indicated that the use of physical interventions to interrupt or reduce the spread of respiratory viruses during epidemics and pandemics is effective, and they stated that, given the generally low cost of these interventions, the reviewed economic studies showed that the use of personal protective equipment was economically attractive, more so when transmission and fatality rates are high.

The following publication provides a brief summary of the review: https://www.cadth.ca/media/pdf/cadth-2-3-02.pdf .

Alves Galvão Márcia G, Rocha Crispino Santos Marilene A, Alves da Cunha Antonio JL. 2014. **Antibiotics for preventing suppurative complications from undifferentiated acute respiratory infections in children under five years of age**. Cochrane Database of Systematic Reviews http://onlinelibrary.wiley.com/doi/10.1002/14651858.CD007880.pub2/abstract

One possible reason why antibiotics may be prescribed for undifferentiated acute upper respiratory infections (those not confined to one specific part of the respiratory tract) is the belief that they may prevent bacterial complications such as otitis media, mastoiditis, quinsy (tonsillar abscess) or pneumonia. This review aimed to assess the efficacy and safety of antibiotics for preventing complications in children aged two to 59 months who have undifferentiated acute respiratory infections (ARIs). Studies were deemed eligible for inclusion in the review if they were RCTs or quasi-RCTs comparing antibiotic prescriptions with placebo or non-treatment in children up to 59 months with an undifferentiated ARI for up to seven days. Four such studies were identified, involving 1,314 children. Three trials investigated the use of amoxicillin/clavulanic acid to prevent otitis, and one investigated ampicillin to prevent pneumonia. Data from the three amoxicillin/clavulanic acid trials (414 children in total) indicated that the antibiotic was associated with a non-significant reduction in risk of otitis media: risk ratio 0.70, 95% CI 0.45 to 1.11, moderate quality evidence. Data from the one trial (889 children) that compared ampicillin trial to supportive care (continuation of breastfeeding, clearing of the nose and paracetamol for fever control) indicated that ampicillin did not significantly affect the risk developing pneumonia: risk ratio 1.05, 95% CI 0.74 to 1.49, moderate quality evidence. It was not possible to analyse harm outcomes as these were reported only as percentages. There were no studies found that assessed mastoiditis, quinsy, abscess, meningitis, hospital admission or death. The review authors concluded that the quality of evidence currently available does not provide strong support for the use of antibiotics to reduce the risk of otitis or pneumonia in children aged up to five years of age with undifferentiated ARIs and that further high quality research is needed to provide more definitive evidence of the effectiveness of antibiotics in this population.

Spurling Geoffrey KP, Del Mar Chris B, Dooley L, et al. 2013. **Delayed antibiotics for respiratory infections**. Cochrane Database of Systematic Reviews (4) http://onlinelibrary.wiley.com/doi/10.1002/14651858.CD004417.pub4/abstract

One strategy to reduce antibiotics prescribing for infections that are likely to be viral and/or self-limiting is to provide prescriptions but advise patients to delay getting them filled in the hope that symptoms will resolve first. This review sought to evaluate delayed antibiotics vs. immediate antibiotics as a prescribing strategy for acute respiratory infections. The review authors identified ten relevant RCTs with a total of 3,157 participants. For most outcomes, other than patient satisfaction, the heterogeneity of the trials precluded meta-analysis. For the clinical outcomes evaluated in cough and common cold there was no difference between *delayed, immediate* and *no* prescribed antibiotics. In patients with sore throat and otitis media, immediate antibiotics were more effective than delayed antibiotics for fever, pain and malaise in some studies. There were no significant differences in complication rates and only minor differences in adverse effects. Compared to *immediate* antibiotics, *delayed* antibiotics resulted in a significant reduction in antibiotic use, and the strategy of *no* antibiotics use led to the least antibiotic use. Patients were slightly less satisfied with delayed antibiotics than immediate antibiotics: 87% vs. 92%, odds ratio (OR) 0.52; 95% CI 0.35 to 0.76. *Delayed* and *no* antibiotics had similar satisfaction rates: 87% vs. 83%, OR 1.44; 95% CI 0.99 to 2.10, with both strategies achieving over 80% satisfaction. There was no difference between the *immediate* and *delayed* antibiotics groups in re-consultation rates. No studies evaluated antibiotic resistance. The review authors concluded that in patients with respiratory infections, where clinicians believe it is safe not to give antibiotics immediately, giving *no* antibiotics with advice to return if symptoms don't resolve is likely to result in the least antibiotics use, with similar clinical outcomes and patient satisfaction to delayed antibiotics.

Jefferson T, Rivetti A, Di Pietrantonj C, et al. 2012. **Vaccines for preventing influenza in healthy children**. Cochrane Database of Systematic Reviews (8) http://onlinelibrary.wiley.com/doi/10.1002/14651858.CD004879.pub4/abstract

The aim of this review was to appraise all comparative studies evaluating the effects of influenza vaccines in healthy children, assess vaccine efficacy (prevention of confirmed influenza) and effectiveness (prevention of influenza-like illness (ILI)) and document adverse events

associated with influenza vaccines. The review included 75 studies with around 300,000 observations. Seventeen RCTs, 19 cohort studies and 11 case-control studies were included in the analysis of vaccine efficacy and effectiveness. Evidence from RCTs of live attenuated vaccine (administered via nasal spray) indicated that six children under the age of six need to be vaccinated to prevent one case of influenza (infection and symptoms). There was no usable data on live attenuated vaccine use in children aged ≤ two years. Inactivated vaccines (administered via injection) were not significantly more efficacious than placebo in children aged ≤ two years. Twenty-eight children over the age of six needed to be vaccinated to prevent one case of influenza (infection and symptoms), and eight need to be vaccinated to prevent one case of influenza-like illness (ILI). There was no evidence found regarding an effect on secondary cases, lower respiratory disease, drug prescriptions, otitis media and its consequences and socioeconomic impact. There was weak single-study evidence of an effect on children's school absenteeism, and caring parents' work absenteeism. Due to variability in study design and presentation of data, a meta-analysis of safety outcome data was unfeasible. Extensive evidence of reporting bias of safety outcomes from trials of live-attenuated vaccines inhibited meaningful analysis. One specific brand of monovalent pandemic vaccine is associated with cataplexy and narcolepsy in children and there is sparse evidence of serious harms (such as febrile convulsions) in specific situations. The review authors concluded that influenza vaccine are efficacious in preventing cases of influenza in children > two years of age, but there is little evidence available for younger children. They noted that vaccination of healthy children is recommended from six months of age in the US, Canada, parts of Europe and Australia despite there being only one study of inactivated vaccine in children < two years of age. They also noted that many published trials are funded by industry and there is widespread evidence of manipulation of conclusions and spurious notoriety of studies. They stated that the review content and findings should be interpreted with this in mind.

Wang K, Shun-Shin M, Gill P, et al. 2012. **Neuraminidase inhibitors for preventing and treating influenza in children (published trials only)**. Cochrane Database of Systematic Reviews (4) http://onlinelibrary.wiley.com/doi/10.1002/14651858.CD002744.pub4/abstract

During influenza epidemics, more than 40% of children may become ill. Options for prevention include the neuraminidase inhibitors zanamivir (Relenza) and oseltamivir (Tamiflu). Laninamivir octanoate, the prodrug of laninamivir, is under development. This review aimed to assess the efficacy, safety and tolerability of neuraminidase inhibitors in treating and preventing influenza in children. The review authors identified six double-blind RCTs involving 1,906 children with clinical influenza and 450 children with influenza diagnosed on rapid near-patient influenza testing. Of these 2,356 children, 1,255 had laboratory-confirmed influenza. The review also included three prophylaxis trials involving 863 children exposed to influenza. In children with laboratory-confirmed influenza oseltamivir reduced median duration of illness by 36 hours (26%, $p < 0.001$). One trial of oseltamivir in children with asthma who had laboratory-confirmed influenza showed only a small reduction in illness duration (10.4 hours, 8%), which was not statistically significant ($p = 0.542$). Laninamivir octanoate 20 mg reduced symptom duration by 2.8 days (60%, $p < 0.001$) in children with oseltamivir-resistant influenza A/H1N1. Zanamivir reduced median duration of illness by 1.3 days (24%, $p < 0.001$). Oseltamivir significantly reduced acute otitis media in children aged one to five years with laboratory-confirmed influenza (risk difference (RD) −0.14, 95% CI −0.24 to −0.04). Prophylaxis with either zanamivir or oseltamivir was associated with an 8% absolute reduction in developing influenza after a case came into the household (RD −0.08, 95% CI −0.12 to −0.05, $p < 0.001$). The adverse event profile of zanamivir was no worse than placebo but vomiting was more common with oseltamivir than placebo (number needed to harm = 17, 95% CI 10 to 34). Laninamivir octanoate and oseltamivir had similar adverse event profiles. The review authors concluded that oseltamivir and zanamivir appear to have modest benefit in reducing duration of illness in children with influenza. They noted that their analysis was limited by small sample sizes and being unable to pool data from different studies, and that using data from only published studies may have resulted in significant publication bias. They concluded that: based on published trial data, ostelamivir reduces the incidence of otitis media in children aged one to five years, but is associated with a significant risk of vomiting; one study indicated that laninamivir octanoate was more effective than oseltamivir in reducing duration of illness in children with oseltamivir-resistant influenza A/H1N1; there is weak evidence that oseltamivir and zanamivir have modest benefits in preventing the transmission of influenza in households. They stated that the clinical efficacy of neuraminidase inhibitors in 'at risk' children, such as those with chronic medical conditions, is still uncertain and that larger high-quality trials are needed to determine the efficacy of neuraminadase inhibitors in preventing serious complications of influenza, such as hospital admission or pneumonia, especially in "at-risk" groups.

Immunisation Advisory Centre. 2014. **Influenza vaccine (Fluarix® or Influvac®)** http://www.immune.org.nz/node/604 accessed June 2015.

This webpage provides information about influenza vaccination. The section "Who should get the vaccine" states that the vaccine is available for anyone aged 6 months or more, and free for children aged four and under who have been hospitalised for respiratory illness or have a history of a significant respiratory illness, children and adults with a medical condition that increases their risk of acquiring influenza or developing complications from influenza, and Children and young people aged 6 months to 18 years living within the Canterbury District Health Board area

MacDonald N E, McDonald J C, Canadian Paediatric Society Infectious Diseases and Immunization Committee. 2014. **The benefits of influenza vaccine in pregnancy for the fetus and the infant younger than six months of age** http://www.cps.ca/en/documents/position/influenza-vaccine-in-pregnancy accessed June 2015.

This practice point (with references) explains that influenza is a serious problem for infants aged <6 months, who have hospitalisation rates comparable with those of the elderly. Because influenza vaccination is ineffective in this age group, the optimal evidence-based strategy is to administer trivalent inactivated influenza vaccines during pregnancy. Immunizing with trivalent inactivated influenza vaccines in the second and third trimester is stated to be well studied and safe, not only providing protection for the pregnant woman and her infant <6 months of age, but also for the fetus by decreasing the risk for low birth weight.

TONSILLECTOMY

Introduction

In New Zealand, there are large number of waiting list admissions for tonsillectomy each year.[31] While some tonsillectomies are performed for the management of upper airway obstruction and/or obstructive sleep apnoea, most are for the management of recurrent tonsillitis.[31] There has been considerable controversy regarding the benefits of tonsillectomy for recurrent throat infections, and internationally tonsillectomy is now a much less frequently performed procedure than it was in the past.[32-34] Several national guidelines and an Australasian position paper recommend the use of the "Paradise Criteria" when determining the indications for tonsillectomy.[32,35,36] These are: seven or more well-documented, adequately treated disabling sore throats due to tonsillitis in the preceding year; OR five or more such episodes in each of the previous two years; OR three or more such episodes in the previous three years.[37]

A recent Cochrane review of this issue found that for children with chronic or recurrent acute tonsillitis, having a tonsillectomy or adenotonsillectomy resulted in having, on average, 0.6 fewer episodes of sore throat of any severity in the first post-operative year (including as one episode the period post-surgery).[38] In the sub-group of severely affected patients, there was low quality evidence that having tonsillectomy resulted in 0.1 fewer episodes of moderate/severe sore throat, while in the sub-group of moderately affected patients, there was moderate quality evidence that having tonsillectomy resulted in 0.8 more episodes of moderate/severe sore throat, including the period post-surgery in both sub-group analyses.

The most significant complication of tonsillectomy is haemorrhage which has been reported as occurring in 2–3% of cases and which has, on rare occasions, proved fatal.[32,39]

The following section uses data from the National Minimum Dataset to review waiting list admissions for tonsillectomy with or without adenoidectomy. Guidelines and evidence-based reviews, which consider how these conditions might best be prevented or managed, are summarised at the end of the section.

Data sources and methods

Indicator

Hospitalisations for tonsillectomy +/− adenoidectomy in 0–14 year olds

Data sources

Numerator: National Minimum Dataset
Denominator: Statistics NZ Estimated Resident Population (with linear extrapolation being used to calculate denominators between Census years)

Definition

Arranged or waiting list hospitalisations of 0–14 year olds for tonsillectomy +/− adenoidectomy (hospitalisations per 1,000 population)
Indications (primary diagnosis) for tonsillectomy include: Chronic tonsillitis; hypertrophy of the tonsils/adenoids; sleep apnoea, and other or unspecified chronic diseases of tonsils/adenoids. Refer to **Appendix 6** for the codes included.

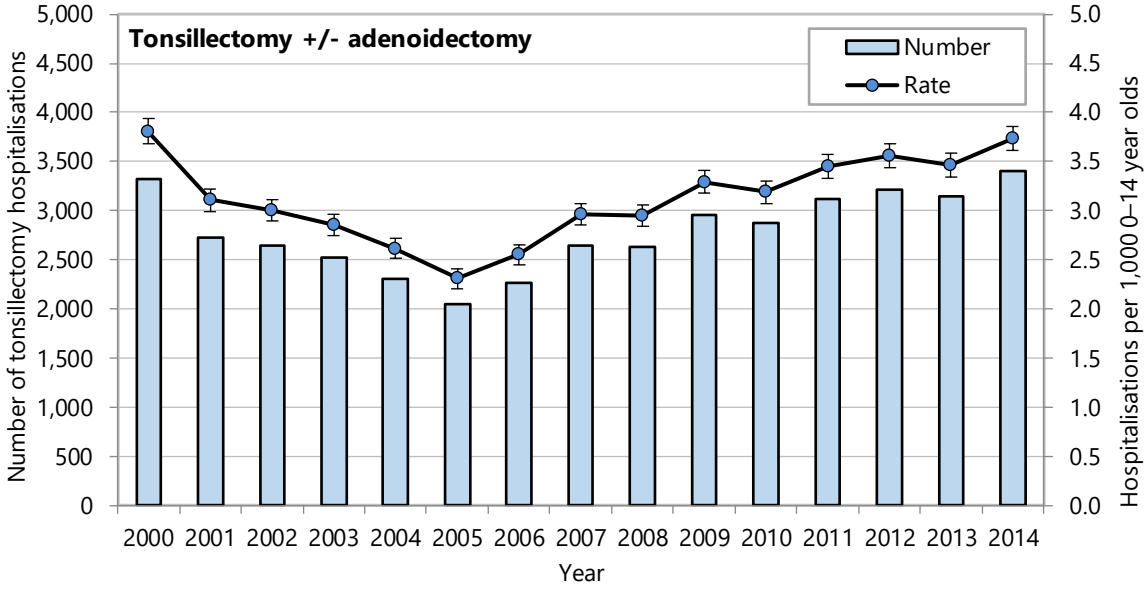
Notes on interpretation

Note 1: An acute admission is an unplanned hospitalisation occurring on the day of presentation, while an arranged admission (also referred to as a semi-acute admission) is a non-acute hospitalisation with an admission date less than seven days after the date the decision was made that the hospitalisation was necessary. A waiting list admission is a planned hospitalisation, where the admission date is seven or more days after the date the decision was made that the hospitalisation was necessary. Because arranged admissions comprise a mix of patients being admitted semi-acutely for the management of medical conditions, and semi-urgently for operative procedures, in this section arranged admissions have been included.
While in a small number of cases a single child may have appeared in both the tonsillectomy and acute URTI analyses, in reality the majority of hospitalisations for tonsillectomy were for chronic upper respiratory conditions (e.g. chronic tonsillitis, obstructive sleep apnoea) and are not included in the acute URTI section.
Note 2: The term "tonsillectomy +/- adenoidectomy" has been used as adenoidectomy is often performed simultaneously with tonsillectomy and it is difficult to exclude those receiving both procedures without excluding a large number of cases of tonsillectomy.
Note 3: **Appendix 3** outlines the limitations of the data utilised from the National Minimum Dataset. The reader is advised to review this appendix before interpreting any trends.

National trends and distribution

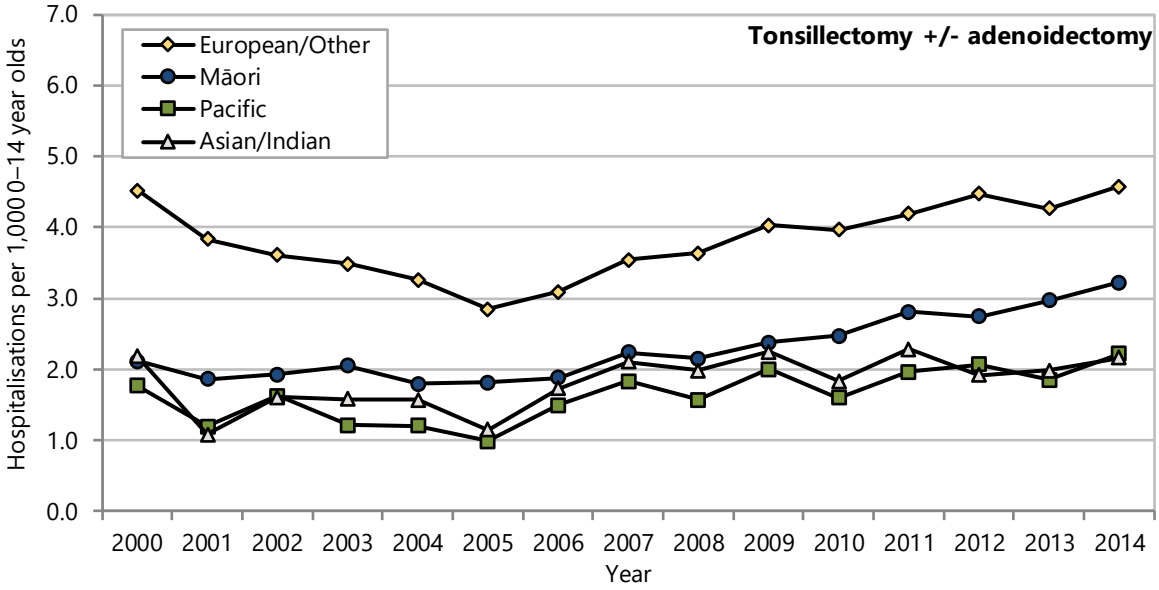
From 2000 to 2005 the hospitalisation rate for tonsillectomy +/- adenoidectomy (tonsillectomy) fell, and then increased from 2005 until 2014.The rate was *not significantly different* in 2014 to that in 2000 **(Figure 52)**. The highest tonsillectomy hospitalisation rates were in European/Other, and it was in this ethnic group that the fall in rates to 2005 and later rise in rates was evident. Rates for Māori, Pacific and Asian/Indian were fairly stable until 2005–2006. Since 2006 rates for Māori have increased steadily, while rates for Pacific and Asian/Indian increased between 2005 and 2007 and have been fairly stable since **(Figure 53)**.

Figure 52. Hospitalisations for tonsillectomy +/– adenoidectomy in 0–14 year olds, New Zealand 2000–2014



Numerator: National Minimum Dataset (arranged and waiting list admissions); Denominator: Statistics NZ Estimated Resident Population

Figure 53. Hospitalisations for tonsillectomy +/– adenoidectomy in 0–14 year olds, by ethnicity, New Zealand 2000–2014



Numerator: National Minimum Dataset (arranged and waiting list admissions only); Denominator: Statistics NZ Estimated Resident Population; Ethnicity is level 1 prioritised

Distribution by primary diagnosis

Between 2010 and 2014 the most common primary diagnosis associated with hospitalisation for tonsillectomy was chronic tonsillitis. Hypertrophy of tonsils or adenoids and sleep apnoea were also common **(Table 60)**.

Table 60. Hospitalisations for tonsillectomy +/– adenoidectomy in 0–14 year olds, by primary diagnosis, New Zealand 2010–2014

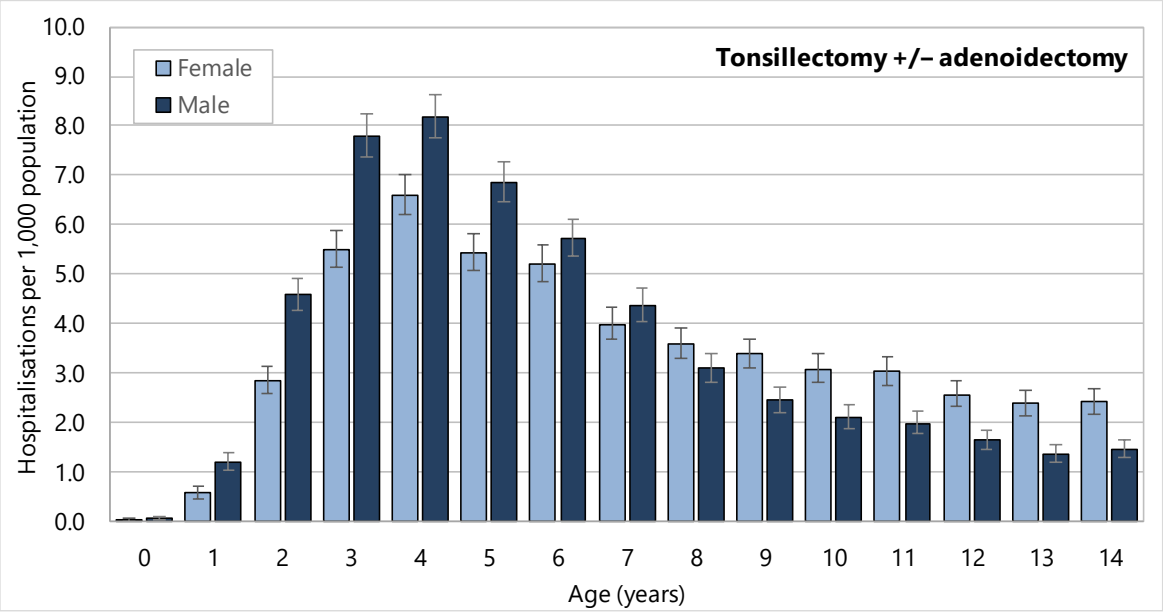
Primary diagnosis	Number: 2010–2014	Number: annual average	Rate per 1,000 0–14 year olds	95% CI	Per cent
Tonsillectomy +/– adenoidectomy in 0–14 year olds					
New Zealand					
Chronic tonsillitis	8,732	1,746	1.93	1.89–1.97	55.40
Hypertrophy tonsils/adenoids	3,532	706	0.78	0.75–0.81	22.40
Sleep apnoea	2,866	573	0.63	0.61–0.66	18.20
Acute tonsillitis	34	7	0.01	<0.01–0.01	0.20
Otitis media	145	29	0.03	0.03–0.04	0.90
Perforation or other disorders tympanic membrane	5	1	<0.01	s	<0.1
Peritonsillar abscess	<5	s	s	s	s
Other or unspecified chronic diseases of the tonsils or adenoids	23	5	<0.01	s	0.10
Other diagnoses	421	84	0.09	0.08–0.10	2.67
Total	15,761	3,152	3.48	3.43–3.53	100.00

Numerator: National Minimum Dataset (arranged and waiting list admissions); Denominator: Statistics NZ Estimated Resident Population

Distribution by demographic factors

Male tonsillectomy rates were higher than female to age seven, and female rates higher from age eight. The peak age for tonsillectomy hospitalisation in all ethnic groups was four years after which rates decreased with increasing age to age 13 (**Figure 54**). The peak age for tonsillectomy hospitalisation was four years for European/Other and Asian/Indian and six years for Māori and Pacific, otherwise the age pattern was similar across ethnic groups.

Figure 54. Hospitalisations for tonsillectomy +/– adenoidectomy in 0–14 year olds, by age and sex, New Zealand 2010–2014



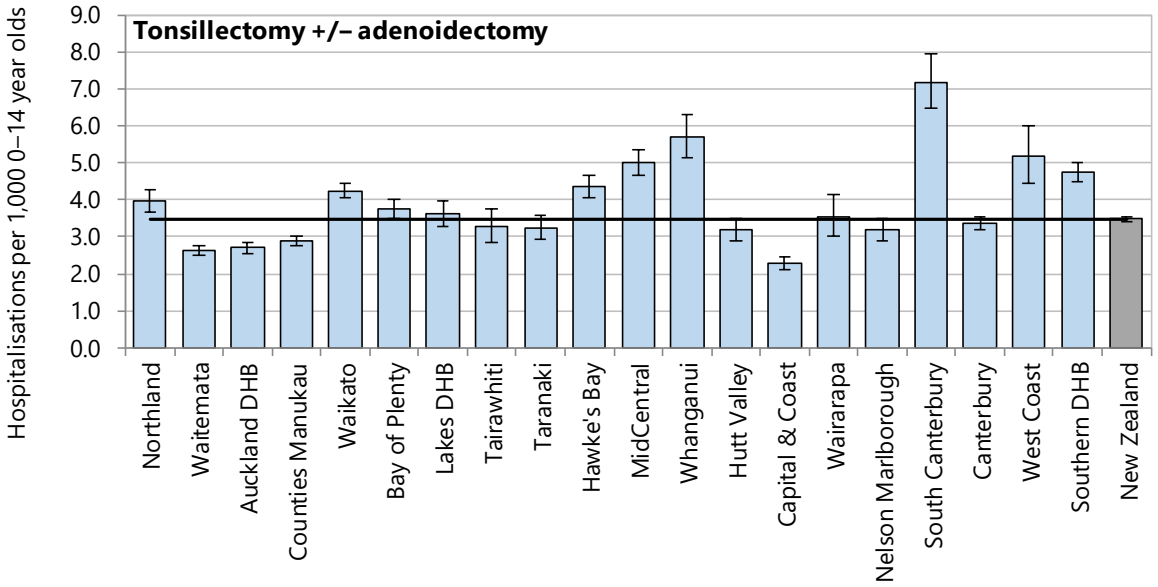
Numerator: National Minimum Dataset (arranged and waiting list admissions); Denominator: Statistics NZ Estimated Resident Population

Distribution by region

Between 2010 and 2014 hospitalisation rates for tonsillectomy were *significantly higher* than the national rate in the Northland, Waikato, Bay of Plenty, Hawke's Bay, MidCentral, Whanganui, South Canterbury, West Coast and Southern DHBs, and *significantly lower* in the Waitemata, Auckland, Counties Manukau, and Capital &

Coast DHBs. In remaining district health boards there was *no significant difference* from the national rate **(Figure 55, Table 61).**

Figure 55. Hospitalisations for tonsillectomy +/– adenoidectomy in 0–14 year olds, by district health board, New Zealand 2010–2014



Numerator: National Minimum Dataset (arranged and waiting list admissions); Denominator: Statistics NZ Estimated Resident Population

Table 61. Hospitalisations for tonsillectomy +/– adenoidectomy in 0–14 year olds, by district health board, New Zealand 2010–2014

DHB	Number: 2010–2014	Number: annual average	Rate per 1,000 0–14 year olds	Rate ratio	95% CI
Tonsillectomy +/– adenoidectomy in 0–14 year olds					
Northland	717	143	3.95	1.14	1.05–1.22
Waitemata	1,482	296	2.64	0.76	0.72–0.80
Auckland	1,113	223	2.70	0.78	0.73–0.82
Counties Manukau	1,717	343	2.89	0.83	0.79–0.87
Waikato	1,731	346	4.24	1.22	1.16–1.28
Bay of Plenty	851	170	3.75	1.08	1.01–1.15
Lakes	426	85	3.62	1.04	0.95–1.15
Tairawhiti	192	38	3.28	0.94	0.82–1.09
Taranaki	386	77	3.23	0.93	0.84–1.03
Hawke's Bay	752	150	4.34	1.25	1.16–1.34
MidCentral	857	171	5.00	1.44	1.34–1.54
Whanganui	373	75	5.70	1.64	1.48–1.81
Hutt Valley	481	96	3.18	0.92	0.84–1.00
Capital & Coast	628	126	2.29	0.66	0.61–0.71
Wairarapa	149	30	3.55	1.02	0.87–1.20
Nelson Marlborough	429	86	3.19	0.92	0.83–1.01
South Canterbury	380	76	7.18	2.06	1.86–2.28
Canterbury	1,597	319	3.37	0.97	0.92–1.02
West Coast	163	33	5.16	1.48	1.27–1.73
Southern	1,327	265	4.74	1.36	1.29–1.44
New Zealand	15,761	3,152	3.48	1.00	

Numerator: National Minimum Dataset (arranged and waiting list admissions); Denominator: Statistics NZ Estimated Resident Population

Northern region distribution and trends

Comparison with New Zealand

Between 2010 and 2014 hospitalisation rates for tonsillectomy +/- adenoidectomy (tonsillectomy) in Northland were *significantly higher* than the national rate, and *significantly lower* in Waitemata, Auckland, and Counties Manukau DHBs **(Table 62)**.

Table 62. Hospitalisations for tonsillectomy +/− adenoidectomy in 0–14 year olds, Northern DHBs vs New Zealand 2010−2014

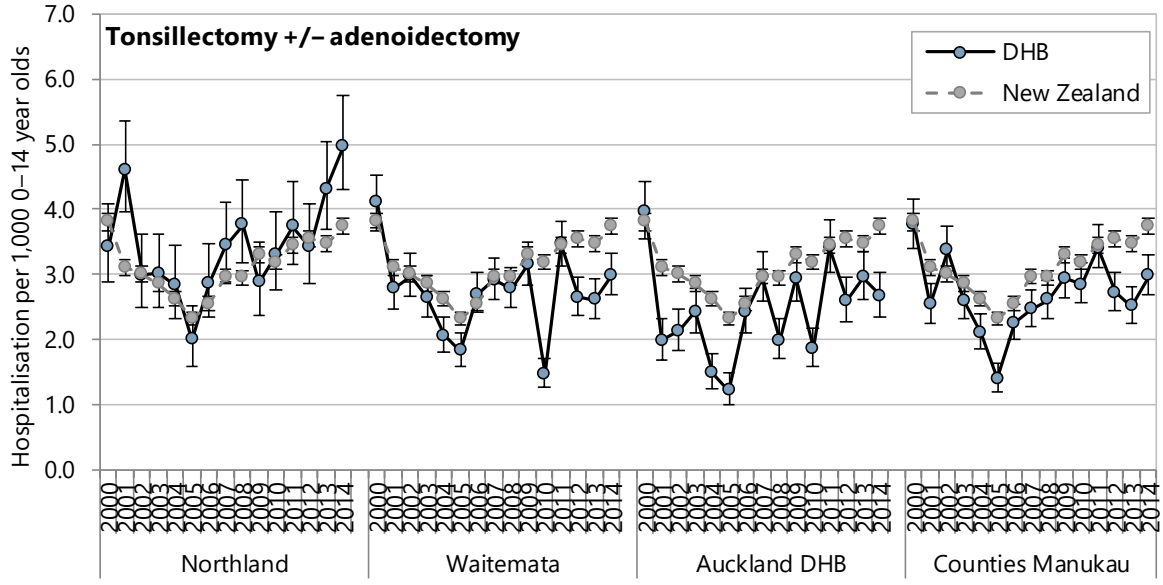
DHB	Number: 2010−2014	Number: annual average	Rate per 1,000 0–14 year olds	Rate ratio	95% CI
Tonsillectomy +/− adenoidectomy in 0–14 year olds					
Northland	717	143	3.95	1.14	1.05–1.22
Waitemata	1,482	296	2.64	0.76	0.72–0.80
Auckland	1,113	223	2.70	0.78	0.73–0.82
Counties Manukau	1,717	343	2.89	0.83	0.79–0.87
New Zealand	15,761	3,152	3.48	1.00	

Numerator: National Minimum Dataset (arranged and waiting list admissions); Denominator: Statistics NZ Estimated Resident Population

Regional trends

Between 2000 and 2014 there has been year-on-year variability in the tonsillectomy hospitalisation rates in the Northern DHBs. The rate of hospitalisations has generally been variable in Waitemata, Auckland, and Counties Manukau DHBs, while Northland has been gradually increasing **(Figure 56)**.

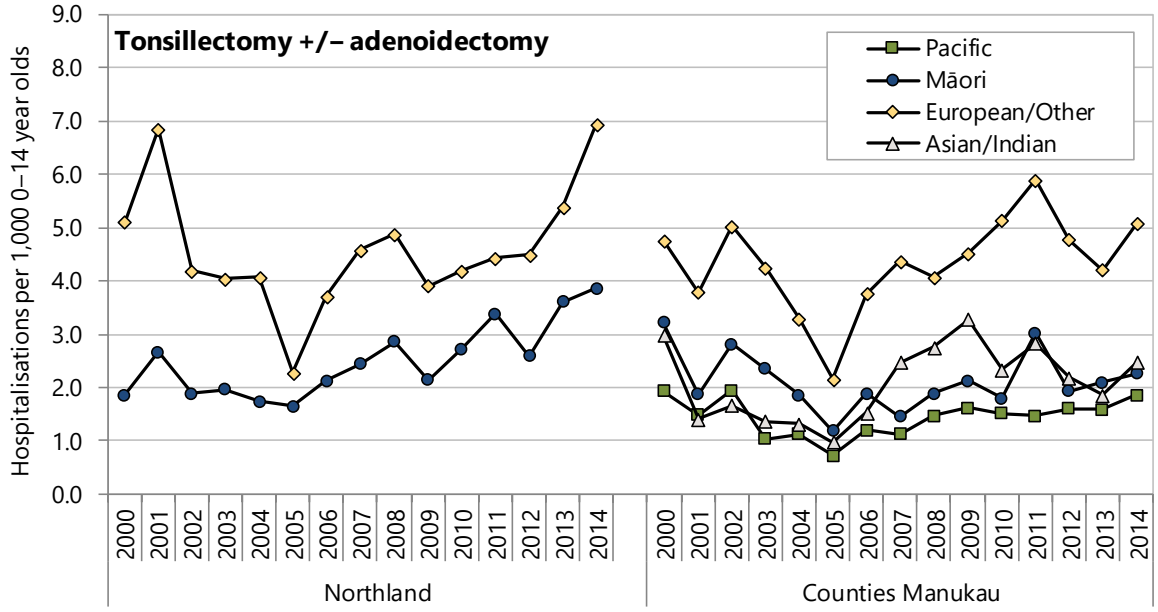
Figure 56. Hospitalisations for tonsillectomy +/− adenoidectomy in 0–14 year olds, Northern DHBs vs New Zealand 2000–2014



Numerator: National Minimum Dataset (arranged and waiting list admissions); Denominator: Statistics NZ Estimated Resident Population

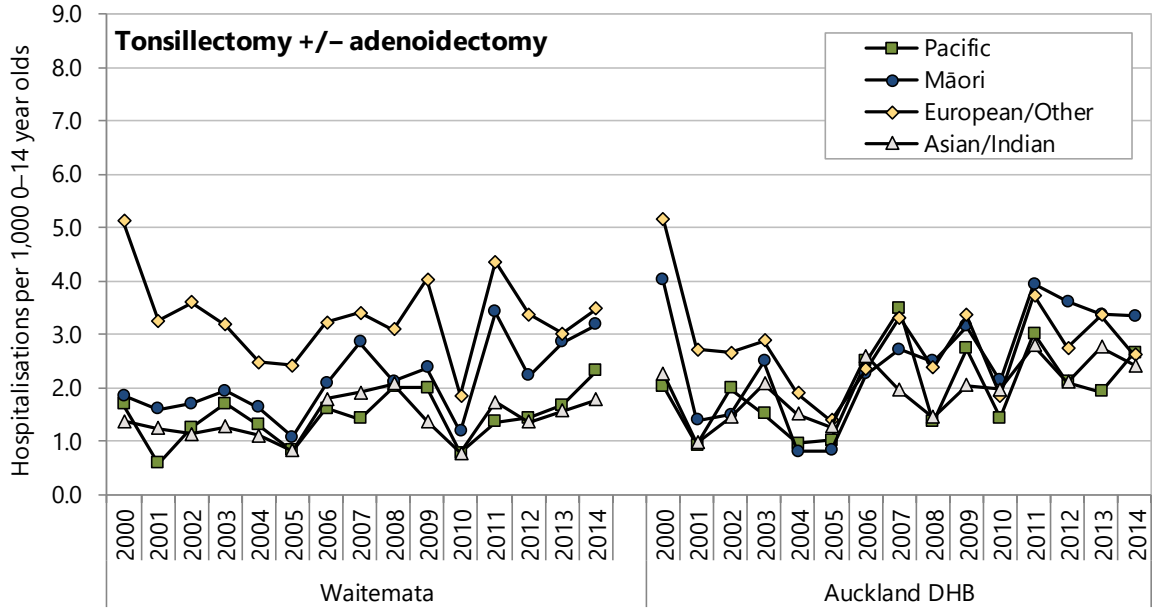
Between 2000 and 2014 the tonsillectomy hospitalisation rates were higher for European 0–14 year olds than for the other ethnic groups in Northland, Waitemata, and Counties Manukau DHBs, while in Auckland DHB ethnic differences were less evident **(Figure 57, Figure 58)**.

Figure 57. Hospitalisations for tonsillectomy +/− adenoidectomy in 0–14 year olds, by ethnicity, Northland and Counties Manukau DHBs 2000−2014



Numerator: National Minimum Dataset (arranged and waiting list admissions); Denominator: Statistics NZ Estimated Resident Population; Ethnicity is level 1 prioritised

Figure 58. Hospitalisations for tonsillectomy +/− adenoidectomy in 0–14 year olds, by ethnicity, Waitemata and Auckland DHBs 2000−2014



Numerator: National Minimum Dataset (arranged and waiting list admissions); Denominator: Statistics NZ Estimated Resident Population; Ethnicity is level 1 prioritised

Regional distribution by primary diagnosis

Between 2010 and 2014 the most common primary diagnosis associated with hospitalisation for tonsillectomy in all four Northern DHBs was chronic tonsillitis. Hypertrophy of tonsils and/or adenoids and sleep apnoea were also common **(Table 63)**.

Table 63. Hospitalisations for tonsillectomy +/− adenoidectomy in 0−14 year olds, by primary diagnosis, Northern DHBs 2010−2014

Primary diagnosis	Number: 2010−2014	Number: annual average	Rate per 1,000 0–14 year olds	95% CI	Per cent
Tonsillectomy +/− adenoidectomy in 0–14 year olds					
Northland					
Chronic tonsillitis	434	87	2.39	2.18–2.63	60.5
Hypertrophic tonsils and/or adenoids	136	27	0.75	0.63–0.89	19.0
Sleep apnoea	80	16	0.44	0.35–0.55	11.2
Acute tonsillitis	<5	s	s	s	s
Otitis media	12	2	0.07	0.04–0.12	1.7
Other/unspecified chronic diseases of tonsils/adenoids	<5	s	s	s	s
Perforation or other disorders of tympanic membrane	<5	s	s	s	s
Other diagnoses	46	9	0.25	0.19–0.34	6.4
Total	717	143	3.95	3.67–4.25	100.0
Waitemata					
Chronic tonsillitis	892	178	1.59	1.49–1.70	60.2
Hypertrophic tonsils and/or adenoids	204	41	0.36	0.32–0.42	13.8
Sleep apnoea	359	72	0.64	0.58–0.71	24.2
Otitis media	7	1	0.01	0.01–0.03	0.5
Other/unspecified chronic diseases of tonsils/adenoids	<5	s	s	s	s
Peritonsillar abscess	<5	s	s	s	s
Other diagnoses	15	3	0.03	0.02–0.04	1.0
Total	1482	296	2.64	2.51–2.78	100.0
Auckland DHB					
Chronic tonsillitis	538	108	1.30	1.20–1.42	48.3
Hypertrophic tonsils and/or adenoids	204	41	0.49	0.43–0.57	18.3
Sleep apnoea	333	67	0.81	0.73–0.90	29.9
Otitis media	11	2	0.03	0.01–0.05	1.0
Other/unspecified chronic diseases of tonsils/adenoids	<5	s	s	s	s
Perforation or other disorders of tympanic membrane	<5	s	s	s	s
Other diagnoses	23	5	0.06	0.04–0.08	2.1
Total	1113	223	2.70	2.54–2.86	100.0
Counties Manukau					
Chronic tonsillitis	976	195	1.64	1.54–1.75	56.8
Hypertrophic tonsils and/or adenoids	562	112	0.95	0.87–1.03	32.7
Sleep apnoea	118	24	0.20	0.17–0.24	6.9
Acute tonsillitis	5	1	0.01	s	0.3
Otitis media	15	3	0.03	0.02–0.04	0.9
Other/unspecified chronic diseases of tonsils/adenoids	<5	s	s	s	s
Perforation or other disorders of tympanic membrane	<5	s	s	s	s
Other diagnoses	38	8	0.06	0.05–0.09	2.2
Total	1717	343	2.89	2.76–3.03	100.0

Numerator: National Minimum Dataset (arranged and waiting list admissions); Denominator: Statistics NZ Estimated Resident Population

Evidence for good practice for the prevention and treatment of tonsillitis

International guidelines on the indications for tonsillectomy
Marcus CL, Brooks LJ, Draper KA, et al. 2012. **Diagnosis and management of childhood obstructive sleep apnea syndrome**. Pediatrics. http://pediatrics.aappublications.org/content/early/2012/08/22/peds.2012-1671.abstract This clinical practice guideline, from the American Academy of Pediatrics, provides recommendations for the diagnosis and management of obstructive sleep apnoea syndrome (OSAS) in children and adolescents. It focusses on uncomplicated childhood OSAS associated with adenotonsillar hypertrophy and/or obesity in an otherwise healthy child who is being treated in primary care. The recommendations and strength of evidence are graded according to the AAP policy statement, "Classifying Recommendations for Clinical Practice Guidelines". The recommendations are: (1) All children/adolescents should be screened for snoring. (2) Polysomnography should be performed in children/adolescents with snoring and symptoms/signs of OSAS and, if polysomnography is not available, then alternative diagnostic tests or specialist referral for more extensive evaluation may be considered. (3) Adenotonsillectomy is the recommended first-line treatment for patients with adenotonsillar hypertrophy. (4) High-risk patients should have postoperative monitoring as inpatients. (5) Patients should be re-evaluated postoperatively to determine whether further treatment is required, and objective testing should be performed in patients who are high risk or have persistent symptoms/signs of OSAS after therapy. (6) Continuous positive airway pressure is recommended for treatment of OSAS if adenotonsillectomy is not performed or if OSAS persists postoperatively. (7) Weight loss is recommended in addition to other therapy for patients who are overweight or obese. (8) Intranasal corticosteroids are an option for children with mild OSAS in whom adenotonsillectomy is contraindicated or for children with mild postoperative OSAS.
Marcus CL, Brooks LJ, Ward SD, et al. 2012. **Diagnosis and management of childhood obstructive sleep apnea syndrome**. Pediatrics, 130(3), e714-e55. http://pediatrics.aappublications.org/content/130/3/e714.abstract This technical report describes the procedures involved in developing the AAP's recommendations on the management of childhood obstructive sleep apnoea syndrome (OSAS), see above. The authors evaluated literature from 1999 through 2011 and identified 350 articles which provided relevant data. Most studies (76%) were given an evidence grading of level III or IV, and did not include a control group. The authors stated that there was a clear need for randomised clinical trials with blinding. The literature indicated that the prevalence of OSAS in children ranged from 0% to 5.7% and that obesity is an independent risk factor. Most diagnostic tests for OSAS had low sensitivity and specificity. Treatment of OSAS (with adenotonsillectomy) leads to improvements in behaviour and attention, and probably improvement in cognitive abilities, but a proportion of patients have residual OSAS post-operatively, ranging from 13% to 29% in low risk groups to 73% when obese children were included and stricter polysomnographic criteria for initial diagnosis were used. A significant proportion of obese patients needed intubation or continuous positive airway pressure (CPAP) postoperatively, which reinforces the need for inpatient observation. CPAP was found to be an effective treatment for OSAS but adherence is a major barrier and therefore CPAP is not recommended as a first-line therapy for OSAS where adenotonsillectomy is an option. Mild OSAS may be ameliorated by intranasal steroids but follow-up is required.
Baugh R, Archer S, Mitchell R, et al. 2011. **Clinical practice guideline: Tonsillectomy in children**. American Academy of Otolaryngology–Head and Neck Surgery. http://oto.sagepub.com/content/144/1_suppl/S1.full.pdf+html This guideline provides evidence-based guidance for identifying the children (1–18 years) who are the best candidates for tonsillectomy; optimising perioperative management; and improving communication with parents about management options. Each evidence-based statement is followed by an indication of the strength of the recommendation based on the quality of the evidence. It recommends watchful waiting for recurrent throat infections if there have been <7 episodes in the past year, <5 episodes per year in the past 2 years, or <3 episodes per year in the past 3 years. These criteria form part of the "Paradise Criteria", which are used in what the guidelines call the most frequently cited and meticulous RCTs investigating the efficacy of tonsillectomy. Table 9 compares three major guidelines: those of the US, Scotland and Italy. The Scottish and US guidelines recommend the Paradise criteria for assessing the need for tonsillectomy. The Italian guidelines state the that tonsillectomy is indicated in patients with at least one year of recurrent tonsillitis (5+ episodes per year) that is disabling and interferes with normal activities, but only after an additional six months of watchful waiting during which a diary documenting clinical symptoms is kept. The guidelines also cover indications for tonsillectomy in children with sleep disordered breathing (the common indication for tonsillectomy other than recurrent sore throat).
Roland PS, Rosenfeld RM, Brooks LJ, et al. 2011. **Clinical practice guideline: Polysomnography for sleep-disordered breathing prior to tonsillectomy in children**. Otolaryngol Head Neck Surg, 145(1 Suppl), S1-15 Polysomnography (PSG) is the electrographic recording of simultaneous physiologic variables during sleep, in a dedicated sleep laboratory. It is considered to be the best method for objectively assessing sleep disorders. The purpose of this guideline is to provide evidence-based recommendations for PSG prior to tonsillectomy in children aged 2–18 years for whom sleep disordered breathing (SDB) is the primary indication for surgery. It does not apply to children having adenoidectomy alone, or to children who are being considered for continuous positive airway pressure (CPAP) or other surgery for SDB. The guideline makes following recommendations based on observational studies with a preponderance of benefit over harm: children with obesity, Down syndrome, craniofacial abnormalities, neuromuscular disorders, sickle cell disease or mucopolysaccaridoses and SDB should be referred for PSG; for children without any of the previous conditions but for whom the need for surgery is uncertain or for whom there is discordance between observed tonsillar size and the reported severity of SDB, clinicians should advocate for PSG; clinicians should communicate PSG results to the anaesthetist; clinicians should admit children with OSA documented via PSG for inpatient, overnight monitoring after tonsillectomy if they are aged < 3 years or have severe OSA (apnoea-hypopnea index of 10 or more obstructive events/hour, oxygen saturation nadir less than 80%, or both). Based on diagnostic studies with limitations, and a preponderance of benefit over harm, the guideline recommends laboratory-based PSG over unattended monitoring at home with a portable device, when possible.
Evidence-based Medicine reviews
Chaithongwongwatthana S, Yamasmit W, Limpongsanurak S, et al. 2015. **Pneumococcal vaccination during pregnancy for preventing infant infection**. Cochrane Database of Systematic Reviews (1) http://onlinelibrary.wiley.com/doi/10.1002/14651858.CD004903.pub4/abstract

The bacterium *Streptococcus pneumoniae* can cause serious illnesses including bacteraemia, meningitis and pneumonia, as well as other lower and upper respiratory tract infections such as otitis media and sinusitis. Pneumococcal vaccination is ineffective in infants less than three months of age. Vaccination of pregnant women may offer their infants protection from pneumococcal disease in their early months of life. The authors of this review identified seven RCTs of pneumococcal vaccination in pregnant women. Six of these (919 participants) contributed data for meta-analysis. There was no evidence that pneumococcal vaccination during pregnancy reduces the risk of neonatal infection (risk ratio (RR) 0.66; 95% CI 0.30 to 1.46; two trials, 241 pregnancies, *low quality evidence*). For the other outcomes of interest (maternal and neonatal antibody levels, percentage of women with seroprotection) there were mostly wide confidence intervals crossing one (indicating no significant effect). Most of the trials had small numbers of participants and few events so the quality of the evidence they provided was low. The review authors concluded that there is insufficient evidence to determine whether pneumococcal vaccination during pregnancy could reduce infant infection.

Sauni R, Verbeek Jos H, Uitti J, et al. 2015. **Remediating buildings damaged by dampness and mould for preventing or reducing respiratory tract symptoms, infections and asthma**. Cochrane Database of Systematic Reviews (2) http://onlinelibrary.wiley.com/doi/10.1002/14651858.CD007897.pub3/abstract

Moisture damage is a common problem in homes, workplaces and public buildings such as schools. The resulting dampness and mould has been associated with respiratory symptoms, asthma and respiratory infections in the buildings' occupants. This review aimed to determine the effectiveness of repairing buildings damaged by dampness and mould in reducing or preventing respiratory symptoms, asthma and respiratory infections. It included 12 studies with a total of 8,028 participants: two RCTs (294 participants), one cluster RCT (4,407 participants), and nine controlled before and after (CBA) studies (3,327 participants). Interventions varied from thorough renovation to cleaning only. There was moderate to low quality evidence that repairing houses decreased asthma-related symptoms and respiratory infections in adults. For children, there was no difference between those whose houses were repaired and those who received information only in the number of asthma days or asthma-related emergency department visits (one study, moderate quality evidence). One CBA study provided very low quality evidence that asthma-related and other respiratory symptoms decreased after repairing a mould-damaged office building, and another CBA study found no difference between full and partial repair of houses. For children in schools, the evidence regarding an effect of mould remediation on respiratory symptoms was inconsistent. Out of many symptom measures only respiratory infections might have decreased after the intervention. For staff in schools, there was very low quality evidence that asthma-related and other respiratory symptoms were similar in staff in mould-damaged schools and staff in undamaged schools, both before and after intervention. The review authors stated that better research is needed, preferably with a cluster-RCT design and more validated outcome measures.

Hao Q, Dong Bi R, Wu T. 2015. **Probiotics for preventing acute upper respiratory tract infections**. Cochrane Database of Systematic Reviews (2) http://onlinelibrary.wiley.com/doi/10.1002/14651858.CD006895.pub3/abstract

Probiotics are live bacteria believed to confer health benefits (such as improved immune system function) when consumed in foods such as yoghurt, or as dietary supplements. This review aimed to assess the effectiveness and safety of probiotics, compared to placebo, in preventing upper respiratory infections (URTIs) in people of all ages, at risk of URTIs. The review authors identified 13 relevant RCTs, but could extract data for meta-analysis from only 12 of them (3,720 participants including children, adults, and older people). They found that probiotics were better than placebo when measuring the number of participants experiencing episodes of acute URTI as follows: at least one episode (odds ratio (OR) 0.53; 95% CI 0.37 to 0.76, $p < 0.001$, low quality evidence); at least three episodes (OR 0.53; 95% CI 0.36 to 0.80, $p = 0.002$, low quality evidence); the mean duration of an episode of acute URTI (mean difference −1.89 days; 95% CI −2.03 to −1.75 days, $p < 0.001$, low quality evidence); reduced antibiotic prescription rates for acute URTIs (OR 0.65; 95% CI 0.45 to 0.94, moderate quality evidence), and cold-related school absence (OR 0.10; 95% CI 0.02 to 0.47, very low quality evidence). Probiotics and placebo were similar when measuring the rate ratio of episodes of acute URTI (rate ratio 0.83; 95% CI 0.66 to 1.05, $p = 0.12$, very low quality evidence) and adverse events (OR 0.88; 95% CI 0.65 to 1.19, $p = 0.40$, low quality evidence). Probiotics were associated with minor side effects, most commonly gastrointestinal symptoms. The review authors found that some subgroups had a high level of heterogeneity when they conducted pooled analyses and the evidence level was low or very low quality. They concluded that probiotics were better than placebo in reducing the number of participants experiencing episodes of acute URTI, the mean duration of an episode of acute URTI, antibiotic use and cold-related school absence. They stated that these findings indicate that probiotics may be better than placebo for preventing acute URTIs but that the quality of the evidence was low or very low.

Burton Martin J, Glasziou Paul P, Chong Lee Y, et al. 2014. **Tonsillectomy or adenotonsillectomy versus non-surgical treatment for chronic/recurrent acute tonsillitis**. Cochrane Database of Systematic Reviews (11) http://onlinelibrary.wiley.com/doi/10.1002/14651858.CD001802.pub3/abstract

There is some controversy about the indications for tonsillectomy. This updated review aimed to assess the effectiveness of tonsillectomy (with or without adenoidectomy) in children and adults with chronic/recurrent tonsillitis in reducing the number and severity of episodes of sore throat or tonsillitis. It included seven RCTs, judged to have low to moderate risk of bias, comparing tonsillectomy (with or without adenoidectomy) with non-surgical treatment in adults and children with chronic/recurrent acute tonsillitis. Five trials involved children (987 participants) and two, adults (156 participants). There was good information about the effectiveness of adeno-tonsillectomy only for the first year after surgery in children (due to the high numbers of children lost to follow up after that time) and only for the first six months after surgery in adults.

Combined data from five trials in children, involving both severely affected and less severely affected children, indicated that children who had an adeno-/tonsillectomy had an average of three episodes of sore throats (of *any severity*) in the first postoperative year, compared to 3.6 episodes in the control group; a difference of 0.6 episodes (95% confidence interval (CI) −1 to −0.1; moderate quality evidence). One of the three episodes in the surgical group was the 'predictable' one in the immediate postoperative period. Analysis of only episodes of moderate or severe sore throat indicated that children who had been more severely affected and had adeno-/tonsillectomy had on average 1.1 episodes of sore throat in the first postoperative year, compared with 1.2 episodes in the control group (low quality evidence). This difference was not significant, but it must be remembered that one episode in the surgical group was the one occurring immediately following surgery. Less severely affected children had more episodes of moderate/severe sore throat after surgery (1.2 episodes) than in the control group (0.4 episodes: difference 0.8, 95% CI 0.7 to 0.9), but again one episode was the predictable postoperative episode (moderate quality evidence). There was data on the number of sore throat days only for moderately affected children. In the first year after surgery children undergoing surgery had an average of 18 days of sore throat (of which some – between five and seven on average – would have been in the immediate postoperative period), compared with 23 days in the control group (difference 5.1 days, 95% CI 2.2 to 8.1; moderate quality evidence).

Two studies in children reported on quality of life outcomes. These found no statistically significant differences between the surgery and non-surgery groups. One study reported no difference in consumption of analgesics. No studies provided evidence regarding the prescription of antibiotics. There was limited data available for quantifying the important risks of primary and secondary haemorrhage after surgery.

The review authors stated that there was insufficient information to draw firm conclusions about the effectiveness of adenotonsillectomy vs. non-surgical treatment in adults. They stated that for children the impact of surgery is modest and many children improve spontaneously without surgery. They also stated that the potential benefit of surgery needs to be weighed against the risks of the procedure, particularly primary and secondary haemorrhage, and that, even with good analgesia, adults tend to find the procedure particularly uncomfortable.

McCallum Gabrielle B, Bailey Emily J, Morris Peter S, et al. 2014. **Clinical pathways for chronic cough in children**. Cochrane Database of Systematic Reviews (9) http://onlinelibrary.wiley.com/doi/10.1002/14651858.CD006595.pub3/abstract

Chronic cough, defined as a cough lasting for more than four weeks is a common problem in children internationally. Evidence-based clinical guidelines (pathways) for the management of chronic cough in children have been developed. This review aimed to evaluate the effectiveness of using a clinical pathway in the management of children with chronic cough. It included one RCT, a multi-centre trial based in five Australian hospitals which recruited 272 children. Children were randomly assigned to early (two weeks) and delayed (six weeks) referral to respiratory specialists who used a cough management pathway. An intention-to-treat analysis indicated that clinical failure at six weeks post-randomisation was significantly less in the early pathway arm compared to the control arm: odds ratio 0.35, 95% CI 0.21 to 0.58. (Clinical failure was defined as < 75% improvement in cough score, or total resolution of cough for less than three consecutive days.) These results indicate that one extra child will be cured for every five treated via the cough pathway: number needed to treat for additional benefit = 5, 95% CI 3 to 9, at six weeks. Cough-specific parent-reported quality of life scores were significantly better in the early-pathway group; the mean difference (MD) between groups was 0.60 (95% CI 0.19 to 1.01, possible scores ranged from 0–7). Duration of cough post randomisation was significantly shorter in the intervention group (early-pathway arm) compared with the control group (delayed-pathway arm): MD −2.70 weeks, 95% CI −4.26 to −1.14. The review authors concluded that using a clinical algorithm for the management of children with chronic cough in hospital outpatient settings is more effective than providing waiting list care and that further high quality RCTs are needed to evaluate cough management pathway in GP and other primary care settings.

Teoh L, Hurwitz M, Acworth Jason P, et al. 2011. **Treatment of obstructive sleep apnoea for chronic cough in children**. Cochrane Database of Systematic Reviews (4) http://onlinelibrary.wiley.com/doi/10.1002/14651858.CD008182.pub2/abstract

Obstructive sleep apnoea (OSA) in children is characterised by repeated episodes of partial or complete upper airway obstruction during sleep that result in disruption of normal ventilation and sleep patterns. It has been reported that OSA is a cause of chronic cough in adults, but there is little data available for children, despite both chronic cough and OSA being relatively common. Because OSA and chronic cough are common, the probability of a child having both symptoms by chance alone is high and any observed association between the two conditions may not reflect causality. This review aimed to investigate the efficacy of treatment of OSA in the management of children with chronic cough. The review authors did not find any RCTs comparing an intervention for OSA to a control group (placebo or usual treatment) in children with chronic cough and therefore they concluded that there is currently no evidence that therapies directed at OSA are useful for the management of chronic cough in children. They stated that that the presence or absence of cough should not be a factor in clinicians' decisions regarding management of OSA.

In addition to the reviews above, the **Cochrane Collection:** http://www.thecochranelibrary.com/view/0/index.html contains a very large number of other reviews relevant to upper respiratory conditions. Review topics include:

- Adenoidectomy: adenoidectomy for otitis media, intranasal steroids for adenoidal hypertrophy, curettage vs. other methods
- Tonsillectomy: antibiotics to reduce post tonsillectomy morbidity, coblation vs. other techniques, dissection vs. diathermy, oral rinses, mouthwashes and sprays post tonsillectomy, perioperative local anaesthesia, steroids for improving post-tonsillectomy recovery, tonsillectomy for periodic fever, aphthous stomatitis, pharyngitis, & cervical adenitis syndrome (PFAPA), non-steroidal anti-inflammatory drugs and post tonsillectomy bleeding, adenoidectomy for obstructive sleep apnoea
- Sore throat/pharyngitis: corticosteroids (as stand-alone or add-on treatment), antibiotics, different antibiotics for group A streptococcal pharyngitis, short-term late-generation antibiotics vs. longer term penicillin for acute streptococcal pharyngitis in children, Chinese medicinal herbs, tonsillectomy/adenoidectomy vs. non-surgical treatment, rapid antigen testing for group A streptococcus

Other relevant publications

Paradise JL, Bluestone CD, Bachman RZ, et al. 1984. **Efficacy of tonsillectomy for recurrent throat infection in severely affected children. Results of parallel randomized and nonrandomized clinical trials**. New England Journal of Medicine 310(11) 674-83.

This paper reports on two studies comparing the efficacy of tonsillectomy with non-surgical treatment in children meeting strict criteria for recurrent tonsillitis in the following categories: frequency of episodes of throat infection (7+ episodes in the preceding year, or 5+ in each of the preceding 2 years, or 3+ in each of the preceding 3 years), clinical features, treatment and documentation. There was a non-randomised study of 96 children whose parents did not consent to being part of the randomised study and a RCT involving 91 children. In both studies the incidence of throat infections was significantly lower in the surgical group ($p \leq 0.05$) in the first two years of follow up but not in the third year, however many in the non-surgical group had only 1–2 if any episodes of infection and most episodes were mild. The authors say their results support choosing tonsillectomy.

MIDDLE EAR CONDITIONS: OTITIS MEDIA AND GROMMETS

Introduction

Otitis media is the clinical term for any inflammation of the middle ear.[40] It is a very common condition in children and one of the most common reasons for children to visit a general practitioner and to be prescribed antibiotics.[41] The two main types of otitis media are acute otitis media (AOM) and otitis media with effusion (OME).

Acute otitis media is a condition of rapid onset which often follows an upper respiratory infection. Symptoms include ear pain, irritability, and fever. If there is perforation of the tympanic membrane (ear drum) there may be otorrhoea (discharge from the ear).[40] Examination of the ear via an otoscope may reveal bulging and redness of the tympanic membrane.[41] Risk factors for AOM include exposure to secondhand smoke, bottle feeding and attendance at childcare.[40] Antibiotics are commonly prescribed for AOM but international guidelines emphasise that in children aged two years or over with uncomplicated AOM antibiotics are of little benefit and treatment should comprise adequate analgesia and watchful waiting.[41-43] Serious complications from AOM are rare. They include mastoiditis, cholesteatoma, labyrinthitis, facial paralysis, and, very rarely, intracranial infection such as meningitis, lateral sinus thrombosis brain abscess.[42]

Otitis media with effusion is defined as an accumulation of non-purulent fluid behind an intact eardrum without signs of acute infection.[42] It is a common condition in early childhood and it causes hearing loss which is usually transient and self-limiting but which may be persistent and associated with educational, language and behavioural problems.[44] For children with long-standing (lasting for more than 3–6 months) bilateral OME, or recurrent AOM, and for children particularly susceptible to OME such as children with Down syndrome or cleft palate, grommets (ventilation or tympanostomy tubes) are often considered as a means of restoring normal hearing. The procedure improves ventilation and pressure regulation in the middle ear. It involves making a small incision in the eardrum (with or without the aspiration of middle ear fluid) and inserting a small ventilation tube. On average, grommets remain in the eardrum for 6–12 months before falling out.[45] Little is known about the long term effects of grommets on children's language, speech or development as very little research has been done in this area.[46] The following section uses data from the National Minimum Dataset to explore acute hospital admission for otitis media in children, as well as arranged and waiting list admissions for the insertion of grommets.

Data sources and methods

Indicator

Hospitalisations of 0–14 year olds for otitis media or for insertion of grommets

Data sources

Numerator: National Minimum Dataset
Denominator: Statistics NZ Estimated Resident Population (with linear extrapolation being used to calculate denominators between Census years).

Definition

Hospitalisations: Acute hospitalisations of 0–14 year olds for otitis media or for other conditions of the middle ear and mastoid.
Arranged and waiting list hospitalisations of 0–14 year olds for the insertion of grommets
Indications for Otitis media and grommets include: chronic tonsillitis; hypertrophy of the tonsils/adenoids; sleep apnoea; and other or unspecified chronic diseases of tonsils/adenoids. Refer to **Appendix 6** for the codes included.

Notes on interpretation

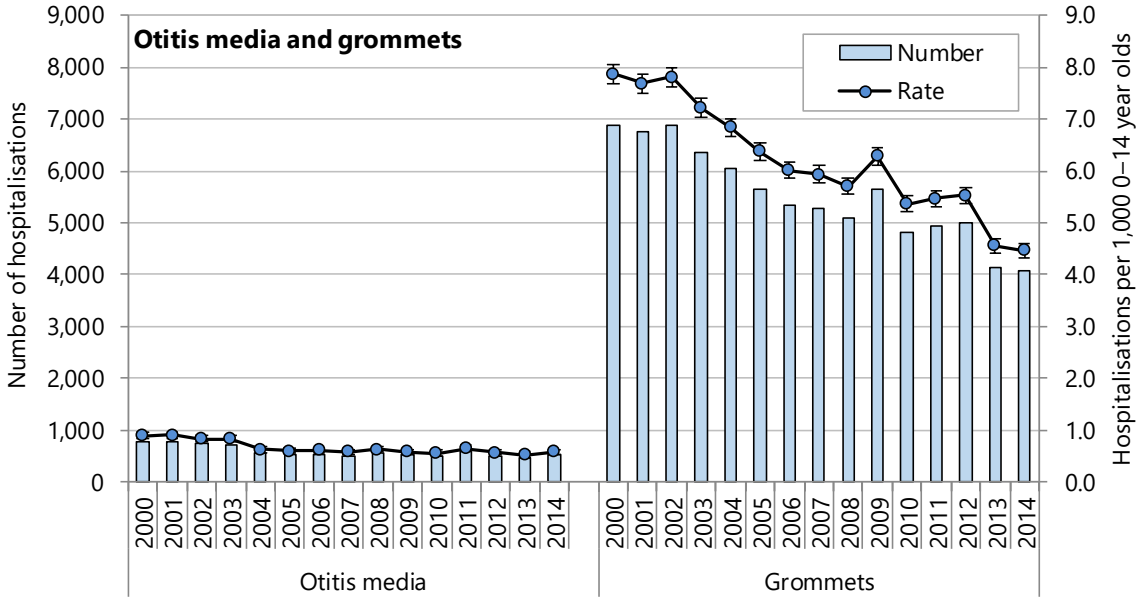
Note 1: An acute admission is an unplanned hospitalisation occurring on the day of presentation, while an arranged admission (also referred to as a semi-acute admission) is a non-acute hospitalisation with an admission date less than seven days after the date the decision was made that the admission was necessary. A waiting list admission is a planned hospitalisation, where the admission date is seven or more days after the date the decision was made that the hospitalisation was necessary.
While the majority of children admitted acutely with a primary diagnosis of otitis media do not receive a surgical intervention, the majority of children admitted from the waiting list with the same primary diagnosis do, with the most common operative procedure being the insertion of grommets.

For arranged admissions the picture is more mixed, with some patients being admitted semi-acutely for the non-surgical management of otitis media, and others for an operative intervention such as grommets. On balance however, more arranged admissions with a primary diagnosis of otitis media are for surgical interventions, and thus in this section arranged admissions have been grouped with the waiting list category (in contrast to other sections where acute and arranged admission are considered together).
Note 2: **Appendix 3** describes the National Minimum Dataset and outlines the limitations of the data utilised from this data collection. The reader is advised to review this appendix before interpreting any trends.
Note 3: 95% confidence intervals have been provided for the rate ratios in this section and where appropriate, the terms significant or not significant have been used to communicate the significance of the observed associations. Tests of statistical significance have not been applied to other data in this section, and thus (unless the terms significant or non-significant are specifically used) the associations described do not imply statistical significance or non-significance (see Appendices for further discussion of this issue).

National trends and distribution

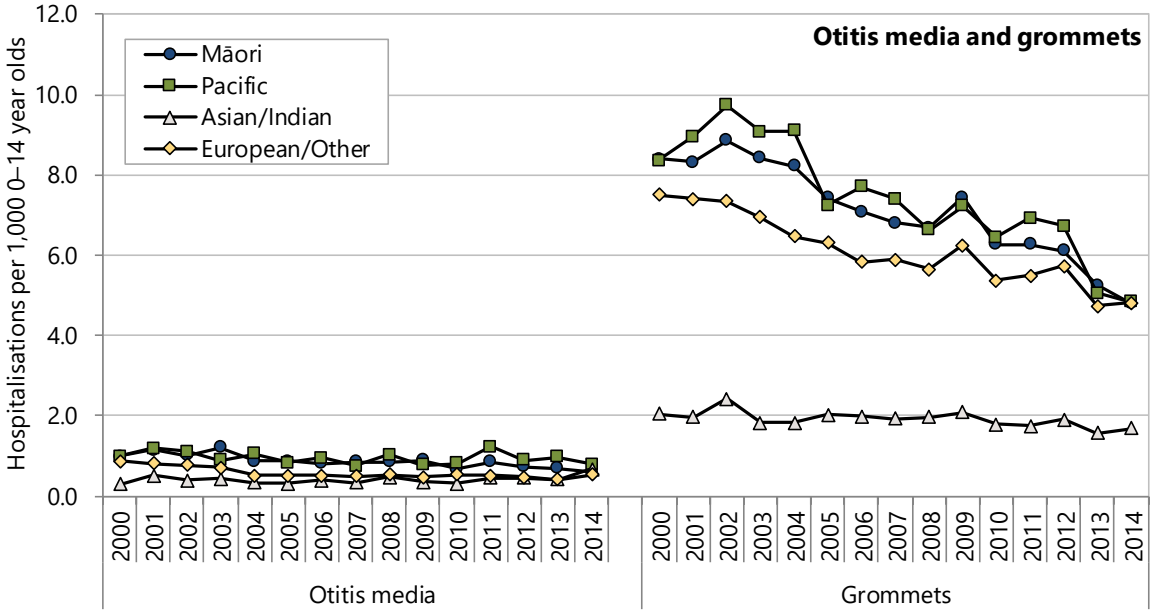
From 2000 to 2004 the hospitalisation rate of 0–14 year olds for otitis media (otitis media hospitalisation rate) fell slightly and then remained stable with minor year-to-year fluctuations. From 2000 to 2014 the hospitalisation rate for insertion of grommets (grommet hospitalisation rate) *fell significantly* **(Figure 59)**. Different patterns over time were observed by ethnicity. From 2000 to 2014 the fall in otitis media hospitalisation rate was more marked for European/Other and Māori than for Pacific, and the rate was stable with year-to-year fluctuations for Asian/Indian. The grommet hospitalisation rate for Asian/Indian has been fairly stable over time and consistently much lower than the rates for other ethnic groups. The decrease in grommet hospitalisation rates has been more marked for Māori and Pacific compared with European/Other and although rates for Māori and Pacific were higher until 2013, in 2014 rates were similar for Māori, Pacific and European/Other **(Figure 60)**.

Figure 59. Hospitalisations for otitis media and grommets in 0–14 year olds, New Zealand 2000–2014



Numerator: National Minimum Dataset (*Otitis media*: acute admissions; *Grommets*: arranged and waiting list admissions);
Denominator: Statistics NZ Estimated Resident Population

Figure 60. Hospitalisations for otitis media and grommets in 0–14 year olds, by ethnicity, New Zealand 2000–2014



Numerator: National Minimum Dataset (*Otitis media*: acute admissions; *Grommets*: arranged and waiting list admissions); Denominator: Statistics NZ Estimated Resident Population; Ethnicity is level 1 prioritised

Distribution by primary diagnosis

Between 2010 and 2014 otitis media was by far the most common primary diagnosis in this category accounting for 92.9% of hospitalisations for conditions of the middle ear and mastoid and 95.4% of grommet hospitalisations **(Table 64**, **Table 65)**.

Table 64. Hospitalisations for conditions of the middle ear and mastoid in 0–14 year olds, by primary diagnosis, New Zealand 2010–2014

Primary diagnosis	Number: 2010–2014	Number: annual average	Rate per 1,000 0–14 year olds	95% CI	Per cent
Conditions of middle ear and mastoid in 0–14 year olds					
New Zealand					
Otitis media	2,637	527	0.58	0.56–0.60	92.9
Mastoiditis and related disorders	164	33	0.04	0.03–0.04	5.8
Perforation or other disorders of the tympanic membrane	27	5	<0.01	s	1.0
Cholesteatoma of the Middle Ear	8	2	<0.01	s	0.3
Other disorders of the Middle Ear or Mastoid	<5	s	s	s	s
Eustachian tube disorders	0	..	..	..	..
Total	2,838	568	0.63	0.60–0.65	100.0

Numerator: National Minimum Dataset (acute admissions); Denominator: Statistics NZ Estimated Resident Population; s: suppressed due to small numbers

Table 65. Hospitalisations for grommet insertion in 0–14 year olds, by primary diagnosis, New Zealand 2010–2014

Primary diagnosis	Number: 2010–2014	Number: annual average	Rate per 1,000 0–14 year olds	95% CI	Per cent
Insertion of grommets in 0–14 year olds					
New Zealand					
Otitis media	21,935	4,387	4.84	4.78–4.91	95.4
Perforation or other disorders of tympanic membrane	465	93	0.10	0.09–0.11	2.0
Eustachian tube disorders	140	28	0.03	0.03–0.04	0.6
Other disorders of middle ear or mastoid	90	18	0.02	0.02–0.02	0.4
Sleep apnoea	33	7	0.01	s	0.1
Hypertrophic tonsils and/or adenoids	27	5	<0.01	s	0.1
Chronic tonsillitis	19	4	<0.01	s	0.1
Cholesteatoma of the middle ear	11	2	<0.01	s	<0.1
Other diagnoses	274	54	0.06	0.05–0.07	1.2
Total	22,994	4,599	5.08	5.01–5.14	100.0

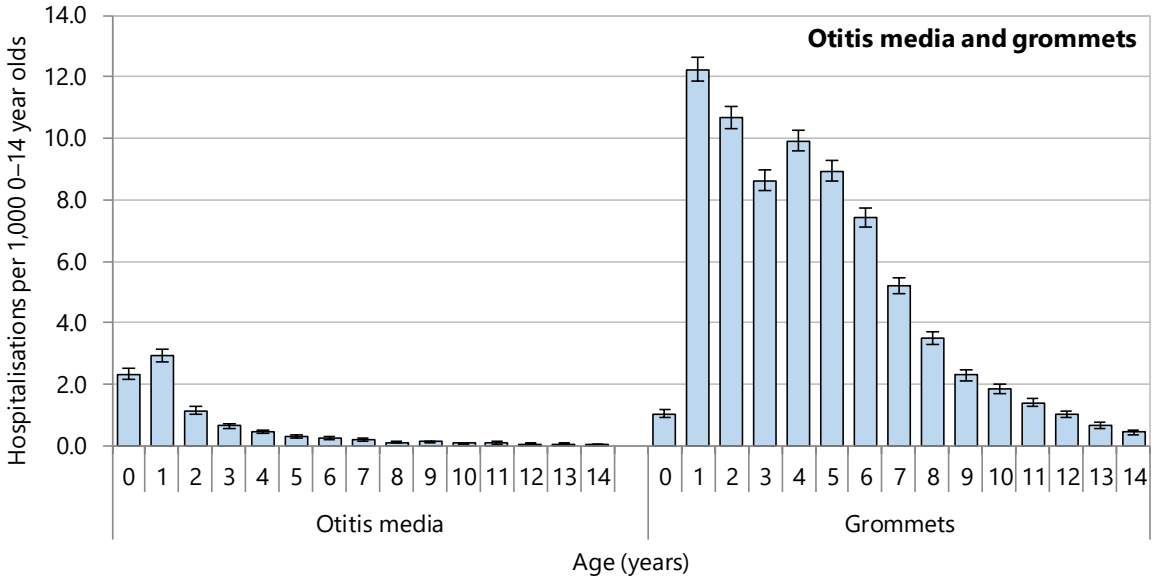
Numerator: National Minimum Dataset (arranged and waiting list admissions); Denominator: Statistics NZ Estimated Resident Population; s: suppressed due to small numbers

Distribution by demographic factors

Otitis media hospitalisation rates were highest for 0–1 year olds and then decreased *significantly* to age 3 years followed by a steady decrease with increasing age. Grommet hospitalisations were uncommon in the first year of life; the highest rate was for 1 year olds and a second peak at age 4–5 years after which they decreased with increasing age (**Figure 61**). The otitis media pattern by age was similar for all ethnic groups, with consistently higher hospitalisation rates for Māori to age 13 years, for Pacific to age 10 years and consistently lower rates for Asian/Indian, compared with European/Other. The peak of grommet hospitalisation rates for European/Other and Māori was at age 1 year with a secondary peak at ages 4–6 years, however for Pacific the peak was at age 5–6 years with a lower peak at age 1 year and for Asian/Indian there was a sustained peak for 1–5 year olds. Grommet hospitalisation rates were consistently lower for Asian/Indian than for other ethnic groups, and European/Other rates were higher than Māori and Pacific for 0–4 year olds and lower for 5–14 year olds (**Figure 62**).

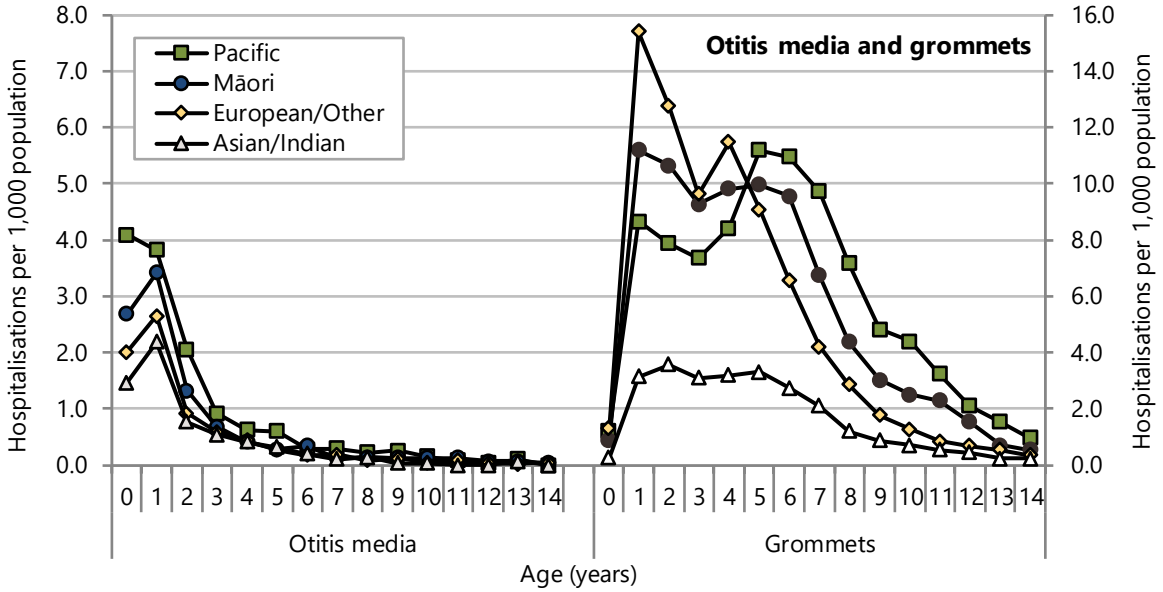
Between 2010 and 2014 there was disparity in otitis media and in grommet hospitalisation rates by NZDep2013 index of deprivation score, ethnicity and gender.

Figure 61. Hospitalisations for otitis media and grommets in 0–14 year olds, by age, New Zealand 2010–2014



Numerator: National Minimum Dataset (*Otitis media*: acute admissions; *Grommets*: arranged and waiting list admissions); Denominator: Statistics NZ Estimated Resident Population

Figure 62. Hospitalisations for otitis media and grommets in 0–14 year olds, by age and ethnicity, New Zealand 2010–2014



Numerator: National Minimum Dataset (*Otitis media*: acute admissions; *Grommets*: arranged and waiting list admissions); Denominator: Statistics NZ Estimated Resident Population; Ethnicity is level 1 prioritised

Otitis media hospitalisation rates were *significantly lower* in areas with the lowest deprivation scores (NZDep2013 deciles 1–2) compared with higher deprivation scores (deciles 3–10) and for the highest deprivation areas (deciles 5–10) there was a *significant increase* in otitis media hospitalisation rates between each quintile of NZDep2013 scores compared with the quintile below. Compared with European/Other, rates were *significantly higher* for Māori, Pacific, and MELAA and *not significantly different* for Asian/Indian. Male rates were *significantly higher* than female rates (**Table 66**).

There was a *significant increase* in grommet hospitalisation rates between each quintile of NZDep2013 scores compared with the quintile below. Compared with European/Other, rates were *significantly higher* for Māori and Pacific and *significantly lower* for Asian/Indian and MELAA. Male rates were *significantly higher* than female rates **(Table 67)**.

Table 66. Hospitalisations for otitis media in 0–14 year olds, by demographic factor, New Zealand 2010–2014

Variable	Number: 2010–2014	Rate per 1,000 0–14 year olds	Rate ratio	95% CI
Otitis media in 0–14 year olds				
New Zealand				
NZDep2013 Index of deprivation quintile				
Deciles 1–2	311	0.36	1.00	
Deciles 3–4	338	0.42	1.17	1.01–1.37
Deciles 5–6	394	0.46	1.29	1.11–1.50
Deciles 7–8	602	0.64	1.79	1.57–2.06
Deciles 9–10	975	0.92	2.59	2.28–2.94
Prioritised ethnicity				
Māori	806	0.70	1.46	1.33–1.59
Pacific	406	0.93	1.94	1.74–2.18
Asian/Indian	221	0.46	0.97	0.84–1.12
MELAA	44	0.79	1.65	1.22–2.22
European/Other	1,157	0.48	1.00	
Gender				
Female	1,124	0.51	1.00	
Male	1,513	0.65	1.28	1.18–1.38

Numerator: National Minimum Dataset (acute admissions); Denominator: Statistics NZ Estimated Resident Population; Rates are per 1,000 0–14 year olds; Rate ratios are unadjusted; Ethnicity is level 1 prioritised; Decile is NZDep2013

Table 67. Hospitalisations for grommets in 0–14 year olds, by demographic factor, New Zealand 2010–2014

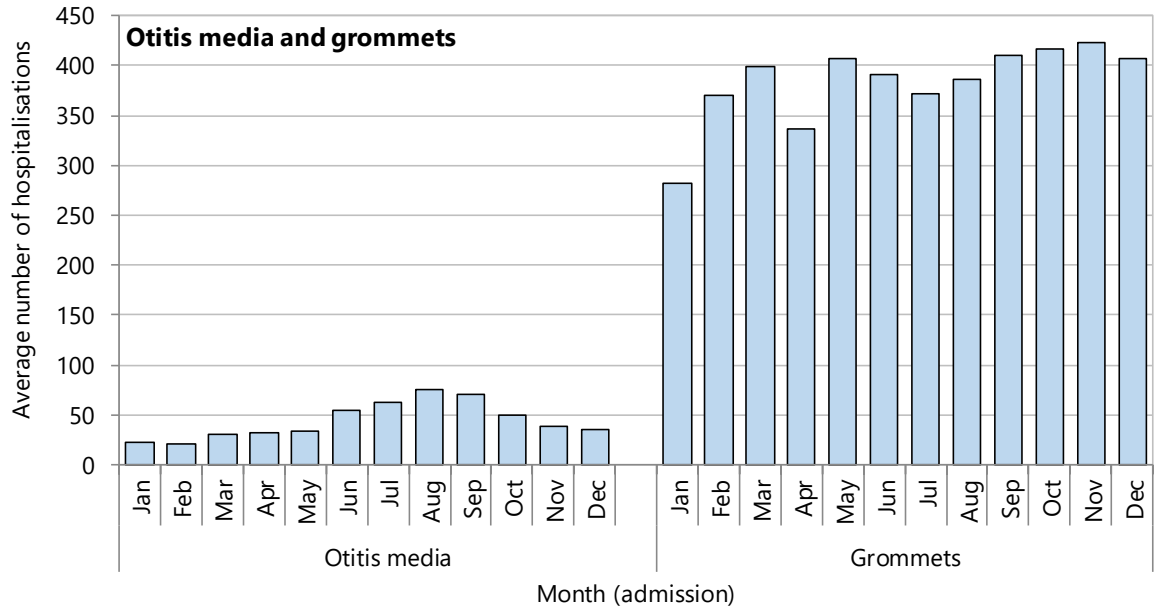
Variable	Number: 2010–2014	Rate per 1,000 0–14 year olds	Rate ratio	95% CI
Insertion of grommets in 0–14 year olds				
New Zealand				
NZDep2013 Index of deprivation quintile				
Deciles 1–2	2,993	3.43	1.00	
Deciles 3–4	3,394	4.20	1.22	1.17–1.29
Deciles 5–6	4,326	5.06	1.47	1.41–1.54
Deciles 7–8	5,320	5.66	1.65	1.58–1.72
Deciles 9–10	6,947	6.58	1.92	1.84–2.00
Prioritised ethnicity				
Māori	6,604	5.73	1.09	1.06–1.12
Pacific	2,608	5.99	1.14	1.09–1.19
Asian/Indian	825	1.73	0.33	0.31–0.35
MELAA	201	3.61	0.69	0.60–0.79
European/Other	12,691	5.27	1.00	
Gender				
Female	9,156	4.15	1.00	
Male	13,838	5.96	1.44	1.40–1.48

Numerator: National Minimum Dataset (arranged and waiting list admissions); Denominator: Statistics NZ Estimated Resident Population; Rates are per 1,000 0–14 year olds; Rate ratios are unadjusted; Ethnicity is level 1 prioritised; Decile is NZDep2013

Distribution by season

There was seasonal variation in otitis media hospitalisation rates. The highest rates were observed in June–September and the lowest rates in January-February. There was no seasonal variation in grommet hospitalisations **(Figure 63)**.

Figure 63. Hospitalisations for otitis media and grommets in 0–14 year olds, by month, New Zealand 2010–2014



Numerator: National Minimum Dataset (*Otitis media*: acute admissions; *Grommets*: arranged and waiting list admissions); Number is annual average, Month is based on hospitalisation admission date

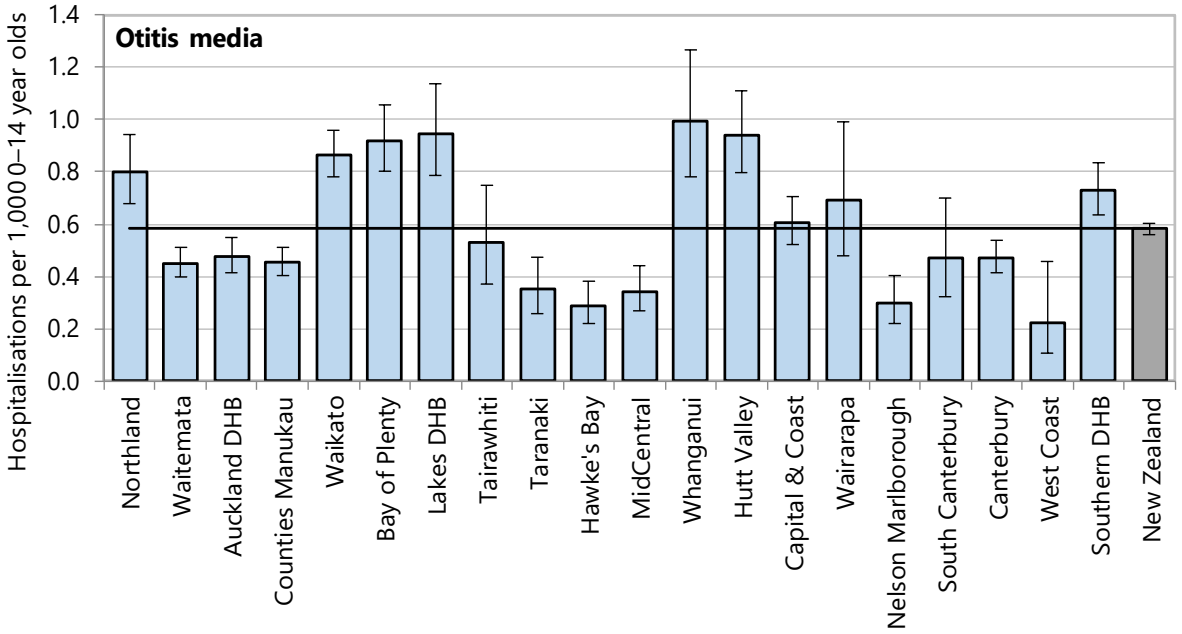
Distribution by region

Otitis media

Between 2010 and 2014 hospitalisation rates for otitis media were *significantly higher* in the Northland, Waikato, Bay of Plenty, Lakes, Whanganui, Hutt Valley, and Southern DHBs than the national rate, and *significantly lower* in the Waitemata, Auckland, Counties Manukau, Taranaki, Hawke's Bay, MidCentral, and

West Coast DHBs. In remaining district health boards there was *no significant difference* from the national rate. **(Table 68**, **Figure 64)**.

Figure 64. Hospitalisations for otitis media in 0–14 year olds, by district health board, New Zealand 2010–2014



Numerator: National Minimum Dataset (acute admissions); Denominator: Statistics NZ Estimated Resident Population

Table 68. Hospitalisations for otitis media in 0–14 year olds, by district health board, New Zealand 2010–2014

DHB	Number: 2010–2014	Number: annual average	Rate per 1,000 0–14 year olds	Rate ratio	95% CI
Otitis media in 0–14 year olds					
Northland	145	29	0.80	1.37	1.16–1.62
Waitemata	253	51	0.45	0.77	0.68–0.88
Auckland	196	39	0.48	0.82	0.71–0.94
Counties Manukau	270	54	0.45	0.78	0.69–0.89
Waikato	353	71	0.87	1.49	1.33–1.66
Bay of Plenty	209	42	0.92	1.58	1.37–1.82
Lakes	111	22	0.94	1.62	1.34–1.96
Tairawhiti	31	6	0.53	0.91	0.64–1.30
Taranaki	42	8	0.35	0.60	0.44–0.82
Hawke's Bay	50	10	0.29	0.50	0.37–0.66
MidCentral	59	12	0.34	0.59	0.46–0.76
Whanganui	65	13	0.99	1.71	1.33–2.18
Hutt Valley	142	28	0.94	1.61	1.36–1.91
Capital & Coast	166	33	0.61	1.04	0.89–1.22
Wairarapa	29	6	0.69	1.19	0.82–1.71
Nelson Marlborough	40	8	0.30	0.51	0.37–0.70
South Canterbury	25	5	0.47	0.81	0.55–1.20
Canterbury	224	45	0.47	0.81	0.71–0.93
West Coast	7	1	0.22	0.38	0.18–0.80
Southern	204	41	0.73	1.25	1.08–1.44
New Zealand	2,637	527	0.58	1.00	

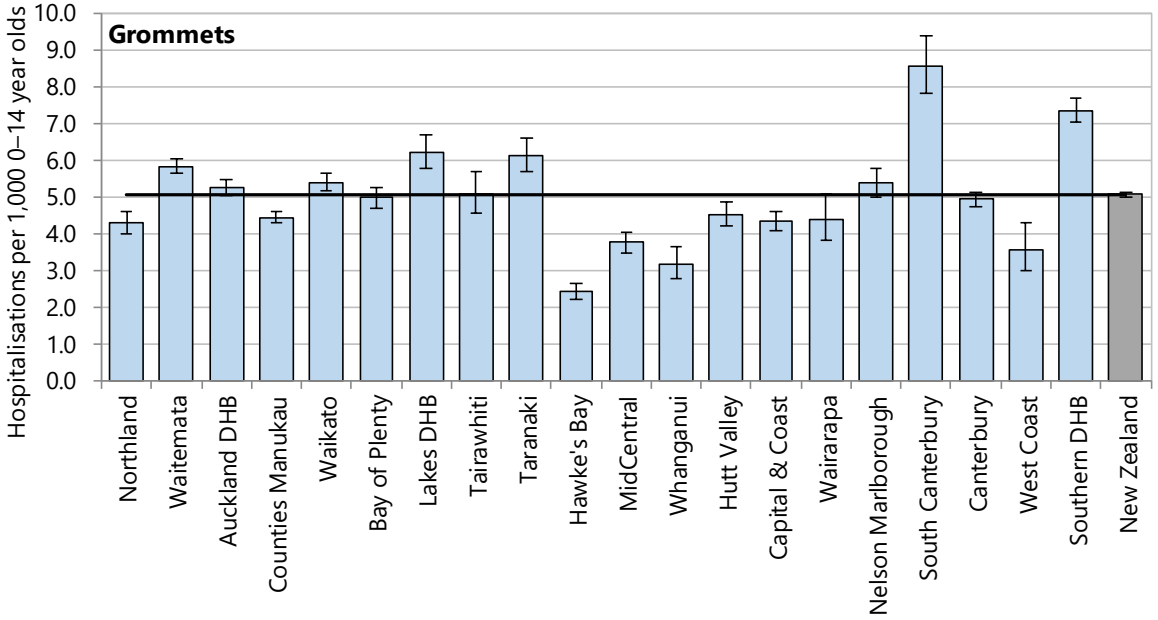
Numerator: National Minimum Dataset (acute admissions); Denominator: Statistics NZ Estimated Resident Population

Grommets

Between 2010 and 2014 hospitalisation rates for insertion of grommets were *significantly higher* in the Waitemata, Waikato, Lakes, Taranaki, South Canterbury, and Southern DHBs than the national rate and

significantly lower in the Northland, Counties Manukau, Hawke's Bay, MidCentral, Whanganui, Hutt Valley, Capital & Coast, and West Coast DHBs. In remaining district health boards there was *no significant difference* from the national rate **(Table 69**, **Figure 65)**.

Figure 65. Hospitalisations for grommet insertion in 0–14 year olds, by district health board, New Zealand 2010–2014



Numerator: National Minimum Dataset (arranged and waiting list admissions); Denominator: Statistics NZ Estimated Resident Population

Table 69. Hospitalisations for grommets insertion in 0–14 year olds, by district health board, New Zealand 2010–2014

DHB	Number: 2010–2014	Number: annual average	Rate per 1,000 0–14 year olds	Rate ratio	95% CI
Insertion of grommets in 0–14 year olds					
Northland	780	156	4.30	0.85	0.79–0.91
Waitemata	3,277	655	5.84	1.15	1.11–1.19
Auckland	2,162	432	5.24	1.03	0.99–1.08
Counties Manukau	2,645	529	4.45	0.88	0.84–0.91
Waikato	2,206	441	5.41	1.07	1.02–1.11
Bay of Plenty	1,130	226	4.98	0.98	0.92–1.04
Lakes	733	147	6.23	1.23	1.14–1.32
Tairawhiti	299	60	5.10	1.01	0.90–1.13
Taranaki	735	147	6.14	1.21	1.12–1.30
Hawke's Bay	418	84	2.41	0.48	0.43–0.52
MidCentral	645	129	3.76	0.74	0.68–0.80
Whanganui	209	42	3.19	0.63	0.55–0.72
Hutt Valley	685	137	4.54	0.89	0.83–0.96
Capital & Coast	1,187	237	4.34	0.85	0.81–0.91
Wairarapa	185	37	4.40	0.87	0.75–1.00
Nelson Marlborough	722	144	5.38	1.06	0.98–1.14
South Canterbury	453	91	8.56	1.69	1.54–1.85
Canterbury	2,341	468	4.94	0.97	0.93–1.02
West Coast	113	23	3.58	0.71	0.59–0.85
Southern	2,063	413	7.36	1.45	1.39–1.52
New Zealand	22,994	4,599	5.08	1.00	

Numerator: National Minimum Dataset (arranged and waiting list admissions); Denominator: Statistics NZ Estimated Resident Population

Northern region distribution and trends

Comparison with New Zealand

Between 2010 and 2014 hospitalisation rates for otitis media were *significantly higher* than the national rate in Northland, and *significantly lower* in Waitemata, Auckland, and Counties Manukau DHBs. During the same period, hospitalisation rates for insertion of grommets were *significantly higher* than the national rate in Waitemata, and *significantly lower* in Northland and Counties Manukau DHBs, while Auckland DHB was *not significantly different* **(Table 70).**

Table 70. Hospitalisation for otitis media and grommets in 0–14 year olds, Northern DHBs vs New Zealand 2010–2014

DHB	Number: 2010–2014	Number: annual average	Rate per 1,000 0–14 year olds	Rate ratio	95% CI
Otitis media in 0–14 year olds					
Northland	145	29	0.80	1.37	1.16–1.62
Waitemata	253	51	0.45	0.77	0.68–0.88
Auckland	196	39	0.48	0.82	0.71–0.94
Counties Manukau	270	54	0.45	0.78	0.69–0.89
New Zealand	2,637	527	0.58	1.00	
Insertion of grommets in 0–14 year olds					
Northland	780	156	4.30	0.85	0.79–0.91
Waitemata	3,277	655	5.84	1.15	1.11–1.19
Auckland	2,162	432	5.24	1.03	0.99–1.08
Counties Manukau	2,645	529	4.45	0.88	0.84–0.91
New Zealand	22,994	4599	5.08	1.00	

Numerator: National Minimum Dataset (*Otitis media*: acute admissions; *Grommets*: arranged and waiting list admissions); Denominator: Statistics NZ Estimated Resident Population

Regional distribution by primary diagnosis

Between 2010 and 2014 otitis media was the most common primary diagnosis among hospitalisations for conditions of the middle ear and mastoid in all four Northern DHBs, and also accounted for over 90% of grommet hospitalisations **(Table 71**, **Table 72**, **Table 73)**.

Table 71. Hospitalisations for conditions of the middle ear and mastoid in 0–14 year olds, by primary diagnosis, Northern DHBs 2010–2014

Primary diagnosis	Number: 2010–2014	Number: annual average	Rate per 1,000 0–14 year olds	95% CI	Per cent
Conditions of Middle Ear and Mastoid in 0–14 year olds					
Northland					
Otitis media	145	29	0.80	0.68–0.94	91.8
Mastoiditis and related disorders	11	2	0.06	0.03–0.11	7.0
Perforation or other disorders of the Tympanic Membrane	<5	s	s	s	s
Other disorders of the Middle Ear or Mastoid	<5	s	s	s	s
Total	158	32	0.87	0.75–1.02	100.0
Waitemata					
Otitis media	253	51	0.45	0.40–0.51	87.2
Mastoiditis and related disorders	31	6	0.06	0.04–0.08	10.7
Perforation or other disorders of the Tympanic Membrane	5	1	0.01	s	1.7
Cholesteatoma of the Middle Ear	<5	s	s	s	s
Total	290	58	0.52	0.46–0.58	100.0
Auckland DHB					
Otitis media	196	39	0.48	0.41–0.55	91.2
Mastoiditis and related disorders	15	3	0.04	0.02–0.06	7.0
Perforation or other disorders of the Tympanic Membrane	<5	s	s	s	s
Cholesteatoma of the Middle Ear	<5	s	s	s	s
Total	215	43	0.52	0.46–0.6	100.0
Counties Manukau					
Otitis media	270	54	0.45	0.40–0.51	84.9
Mastoiditis and related disorders	43	9	0.07	0.05–0.10	13.5
Perforation or other disorders of the Tympanic Membrane	<5	s	s	s	s
Cholesteatoma of the Middle Ear	<5	s	s	s	s
Other disorders of the Middle Ear or Mastoid	<5	s	s	s	s
Total	318	64	0.54	0.48–0.6	100.0

Numerator: National Minimum Dataset (acute admissions); Denominator: Statistics NZ Estimated Resident Population; s: suppressed due to small numbers

Table 72. Hospitalisations for grommets in 0–14 year olds, by primary diagnosis, Northland, Waitemata and Auckland DHBs 2010–2014

Primary diagnosis	Number: 2010–2014	Number: annual average	Rate per 1,000 0–14 year olds	95% CI	Per cent
Insertion of grommets in 0–14 year olds					
Northland					
Otitis media	745	149	4.11	3.82–4.41	95.5
Perforation or other disorders of tympanic membrane	21	4	0.12	0.08–0.18	2.7
Hypertrophic tonsils and/or adenoids	<5	s	s	s	s
Chronic tonsillitis	<5	s	s	s	s
Eustachian tube disorders	<5	s	s	s	s
Sleep apnoea	<5	s	s	s	s
Other diagnoses	6	1	0.03	0.02–0.07	0.8
Total	780	156	4.30	4.01–4.61	100.0
Waitemata					
Otitis media	3,132	626	5.58	5.39–5.78	95.6
Perforation or other disorders of tympanic membrane	86	17	0.15	0.12–0.19	2.6
Other disorders of Middle Ear or Mastoid	7	1	0.01	0.01–0.03	0.2
Sleep apnoea	<5	s	s	s	s
Eustachian tube disorders	<5	s	s	s	s
Hypertrophic tonsils and/or adenoids	<5	s	s	s	s
Chronic tonsillitis	<5	s	s	s	s
Cholesteatoma of the Middle Ear	<5	s	s	s	s
Mastoiditis and related disorders	<5	s	s	s	s
Other diagnoses	41	8	0.07	0.05–0.10	1.3
Total	3,277	655	5.84	5.64–6.04	100.0
Auckland DHB					
Otitis media	2,007	401	4.87	4.66–5.08	92.8
Perforation or other disorders of tympanic membrane	96	19	0.23	0.19–0.28	4.4
Eustachian tube disorders	15	3	0.04	0.02–0.06	0.7
Sleep apnoea	6	1	0.01	0.01–0.03	0.3
Other disorders of Middle Ear or Mastoid	<5	s	s	s	s
Chronic tonsillitis	<5	s	s	s	s
Hypertrophic tonsils and/or adenoids	<5	s	s	s	s
Cholesteatoma of the Middle Ear	<5	s	s	s	s
Other diagnoses	29	6	0.07	0.05–0.10	1.3
Total	2,162	432	5.24	5.03–5.47	100.0

Numerator: National Minimum Dataset (arranged and waiting list admissions); Denominator: Statistics NZ Estimated Resident Population; s: suppressed due to small numbers

Table 73. Hospitalisations for grommets in 0–14 year olds, by primary diagnosis, Counties Manukau DHB 2010–2014

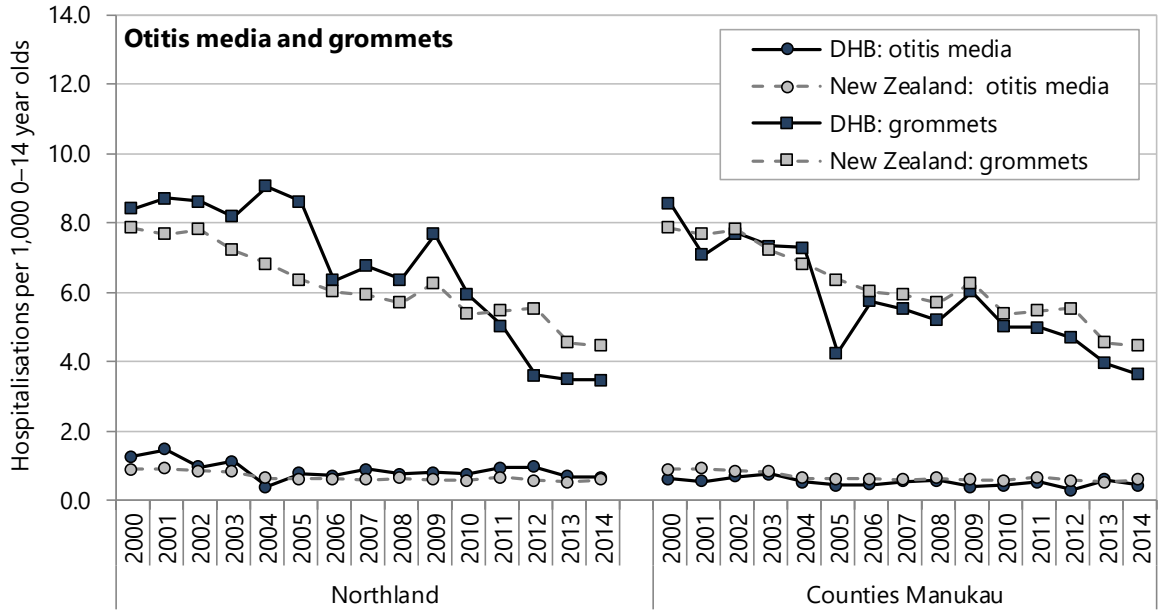
Primary diagnosis	Number: 2010–2014	Number: annual average	Rate per 1,000 0–14 year olds	95% CI	Per cent
Insertion of grommets in 0–14 year olds					
Counties Manukau					
Otitis media	2,485	497	4.19	4.02–4.35	94.0
Perforation or other disorders of tympanic membrane	47	9	0.08	0.06–0.11	1.8
Eustachian tube disorders	54	11	0.09	0.07–0.12	2.0
Other disorders of Middle Ear or Mastoid	12	2	0.02	0.01–0.04	0.5
Hypertrophic tonsils and/or adenoids	<5	s	s	s	s
Chronic tonsillitis	<5	s	s	s	s
Sleep apnoea	<5	s	s	s	s
Cholesteatoma of the Middle Ear	<5	s	s	s	s
Other diagnoses	37	7	0.06	0.05–0.09	1.4
Total	2,645	529	4.45	4.29–4.63	100.0

Numerator: National Minimum Dataset (arranged and waiting list admissions); Denominator: Statistics NZ Estimated Resident Population; s: suppressed due to small numbers

Regional trends

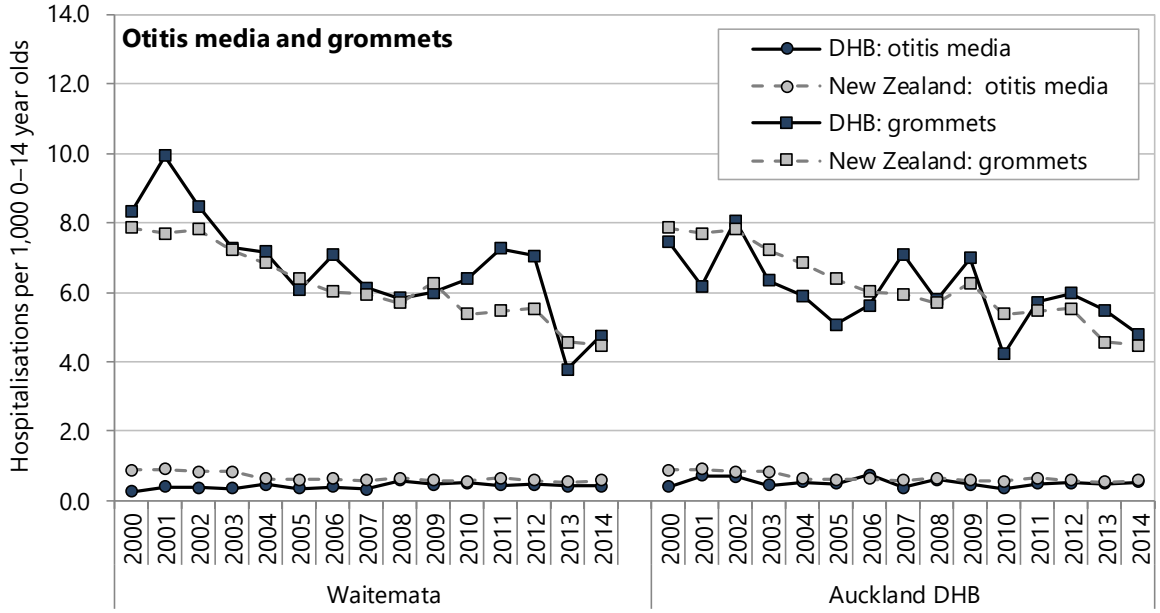
Hospitalisation rates for otitis media fluctuated between 2000 and 2014 in all four Northern DHBs, although rates generally decreased in Northland, whereas hospitalisation rates for insertion of grommets fell in all four Northern DHBs **(Figure 66**, **Figure 67)**.

Figure 66. Hospitalisations for otitis media and insertion of grommets in 0–14 years, Northland and Counties Manukau DHBs vs New Zealand 2000–2014



Numerator: National Minimum Dataset (*Otitis media*: acute admissions; *Grommets*: arranged and waiting list admissions); Denominator: Statistics NZ Estimated Resident Population; Ethnicity is level 1 prioritised

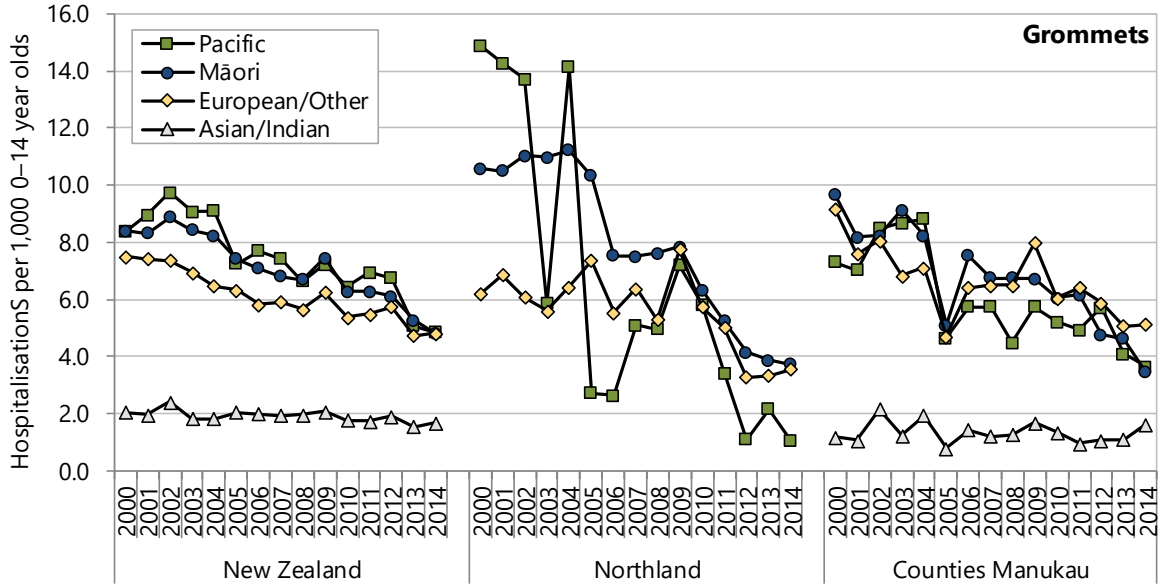
Figure 67. Hospitalisations for otitis media and insertion of grommets in 0–14 years, Waitemata and Auckland DHBs vs New Zealand 2000–2014



Regional distribution by ethnicity

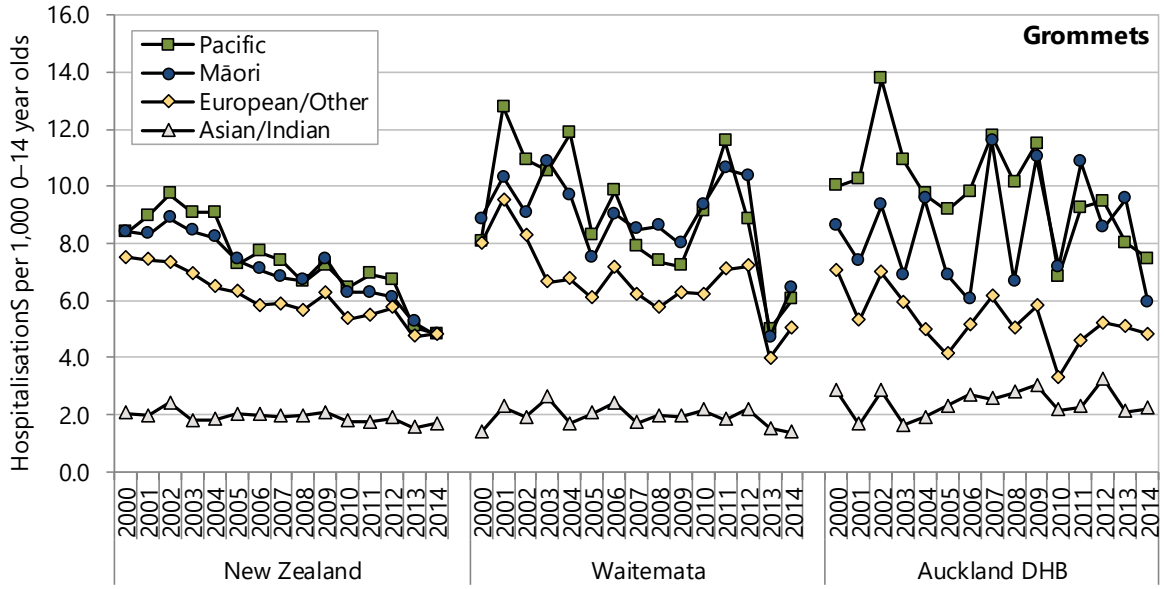
Different patterns over time for insertion of grommets were observed by ethnicity in all four Northern DHBs with a tendency for rates to fall. Hospitalisation rates for insertion of grommets were consistently lowest for Asian/Indian and often higher for Māori and Pacific than for European/Other **(Figure 68**, **Figure 69)**. Small numbers prevented a more detailed review of differences in otitis media hospitalisations by ethnicity.

Figure 68. Hospitalisations for insertion of grommets in 0–14 year olds, by ethnicity, Northland and Counties Manukau DHBs vs New Zealand 2000–2014



Numerator: National Minimum Dataset (arranged and waiting list admissions); Denominator: Statistics NZ Estimated Resident Population; Ethnicity is level 1 prioritised; Rates for Pacific in Northland are based upon small numbers

Figure 69. Hospitalisations for insertion of grommets in 0–14 year olds, by ethnicity, Waitemata and Auckland DHBs vs New Zealand 2000–2014

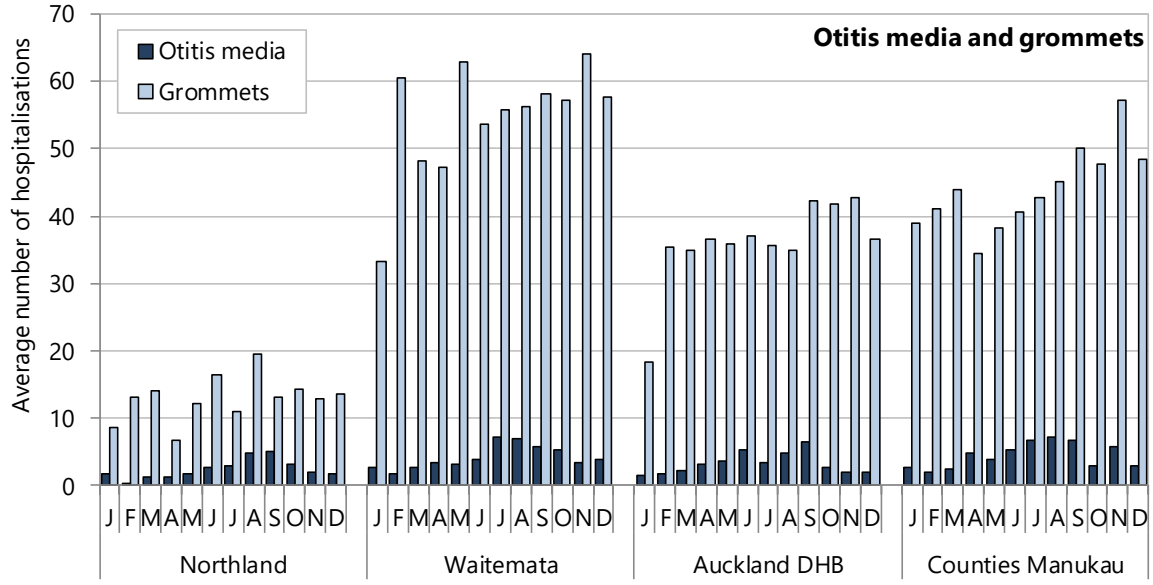


Numerator: National Minimum Dataset (arranged and waiting list admissions); Denominator: Statistics NZ Estimated Resident Population; Ethnicity is level 1 prioritised

Regional distribution by season

There was seasonal variation in otitis media hospitalisation rates in all four Northern DHBs. The highest rates were observed in June–September and the lowest rates in January-February. There was no seasonal variation in grommet hospitalisations **(Figure 70)**.

Figure 70. Hospitalisations for otitis media and grommets in 0–14 year olds, by month, Northern DHBs 2010–2014



National Minimum Dataset (*Otitis media*: acute admissions; *Grommets*: arranged and waiting list admissions); Number is annual average; Month is based on hospitalisation admission date

Evidence for good practice for the prevention and management of otitis media and grommets

Ministry of Health Publications
Ministry of Health. 2014. **National vision and hearing screening protocols: revised 2014**. Wellington: Ministry of Health. http://www.health.govt.nz/publication/national-vision-and-hearing-screening-protocols This document describes the best practice for Vision Hearing Technicians (VHTs) who deliver the National Vision and Hearing screening programme. The programme involves hearing and vision screening of all four year olds (as part of the B4 school check), and vision screen for all 11 year olds (year 7 students). Hearing screening for four year olds is by audiometry, with additional tympanometry if audiometry results are abnormal. Individual DHBs may choose to offer targeted tympanometry screening at three years of age to groups at high-risk of harm from glue ear, at their discretion. The web page has a training video which demonstrates best practice for VHTs delivering vision and hearing screening.
Ministry of Health. 2014. **Well Child / Tamariki Ora Programme Practitioner Handbook: Supporting families and whānau to promote their child's health and development. Revised 2014**. Wellington: Ministry of Health. http://www.health.govt.nz/publication/well-child-tamariki-ora-programme-practitioner-handbook-2013 This handbook was produced to assist and support all providers who deliver Well Child/Tamariki Ora (WCTO) services in accordance with the WCTO Schedule. It includes information from the *National vision and hearing screening protocols* (above) and *The B4 School Check: A handbook for practitioners* (below). Additional information for the health sector on the B4 School Check can be found here: http://www.health.govt.nz/our-work/life-stages/child-health/b4-school-check/b4-school-check-information-health-sector
Ministry of Health. 2008. **The B4 School Check: A handbook for practitioners**. Wellington: Ministry of Health. http://www.health.govt.nz/publication/b4-school-check-handbook-practitioners The B4 School Check includes vision and hearing screening. Section 4 of this publication provides brief information on childhood hearing impairment and provides guidance for practitioners on audiometry screening of four, five and six year old children using the sweep test and, if the sweep test is equivocal or abnormal, tympanometry.
International Guidelines
Guidelines and Protocols Advisory Committee, Medical Services Commission. 2010. **Otitis media: acute otitis media (AOM) and otitis media with effusion (OME)**. Victoria, BC: Government of British Columbia. http://www2.gov.bc.ca/assets/gov/health/practitioner-pro/bc-guidelines/otitis.pdf This concise Canadian guideline applies to otherwise healthy children over the age of six months, presenting with either acute otitis media (AOM) or otitis media with effusion (OME). It is well-referenced but recommendations in the guideline are not accompanied by evidence grades or an indication of strength of recommendation. There is a summary of this guideline at the National Guideline Clearinghouse website: http://www.guideline.gov/content.aspx?id=38906.
Lieberthal AS, Carroll AE, Chonmaitree T, et al. 2013. **The diagnosis and management of acute otitis media**. Pediatrics, 131(3), e964-99. (Erratum in Pediatrics. 2014 Feb;133(2):346. Dosage error in article text.**)** http://pediatrics.aappublications.org/content/131/3/e964.long This evidence-based guideline from the American Academy of Pediatrics provides recommendations for primary care clinicians on the diagnosis and management of children (aged from six months through 12 years) with uncomplicated acute otitis media (AOM). It covers pain management, initial observation versus antibiotic treatment, appropriate choices of antibiotic agents, and preventive measures. It also addresses recurrent AOM. Recommendations in the guideline are accompanied by indications of the strength of recommendation and the quality of the evidence on which the recommendation is based. A summary of this guideline can be found on the National Guideline Clearinghouse website: http://www.guideline.gov/content.aspx?id=43892&search=otitis+media
University of Michigan Health System. 2013. **Otitis media**. Ann Arbor (MI): University of Michigan Health System. http://www.med.umich.edu/1info/FHP/practiceguides/om/OM.pdf This guideline covers diagnosis and management of acute otitis media and otitis media with effusion in children (older than two months) and adults. Recommendations in the guideline are accompanied by an indication of the strength of recommendation (from I to III) and the quality of the supporting evidence (from A to D). A summary of this guideline can be found on the National Guideline Clearinghouse website: http://www.guideline.gov/content.aspx?id=46420&search=otitis+media
Rosenfeld RM, Schwartz SR, Pynnonen MA, et al. 2013. **Clinical practice guideline: Tympanostomy tubes in children**. Otolaryngol Head Neck Surg, 149(1 Suppl), S1-35 The main purpose of this guideline from the American Academy of Otolaryngology - Head and Neck Surgery is to provide US clinicians with evidence-based recommendations on the indications for, and management of, tympanostomy tubes in children aged six months to 12 years. The guidelines are structured as a series of key action statements, each followed by a strength of recommendation and an "action statement profile" indicating aggregate evidence quality, level of confidence in the evidence, benefit-harm assessment, statement of costs, value judgments, the role of patient and caregiver preferences, clarification of any intentional vagueness by the guideline panel, exceptions to the statement, and any differences of opinion among the panel. After each action statement profile there is a discussion of the evidence base supporting the statement. Statement 3 is: "Clinicians should offer tympanostomy bilateral tube insertion to children with bilateral otitis media with effusion (OME) for 3 months or longer AND documented hearing difficulties." Other

statements deal with children with an isolated single short-term episode of OME, when hearing tests are indicated, symptoms associated with OME that may be indications for tympanostomy, surveillance of chronic OME, recurrent acute otitis media in the absence of middle ear effusion, bilateral vs. unilateral tympanostomy, OME and tympanostomy tubes in at-risk children (such as children with developmental delays and children with Down syndrome), perioperative education, acute tympanostomy tube otorrhoea, and water precautions for children with tympanostomy tubes.

National Institute for Health and Care Excellence. 2008. **Surgical management of otitis media with effusion in children**. London: National Institute for Health and Care Excellence. http://www.nice.org.uk/guidance/cg60

This evidence-based guideline covers the surgical management of OME in children aged less than 12 years and it includes specific recommendations for children with Down syndrome and cleft palate. It provides information on assessment, diagnosis and indications for specialist referral, indications for surgical intervention, the effectiveness of surgical and non-surgical interventions, information for parents and carers and recommendations for research. It states that children with persistent bilateral OME documented over a period of three months with a hearing level in the better ear of 25–30 dBHL or worse should be considered for surgery. The following treatments are not recommended as non-surgical interventions: antibiotics, topical/systemic antihistamines, decongestants or steroids, homeopathy, cranial osteopathy, acupuncture, dietary modifications, probiotics, immunostimulants or massage. Hearing aids should be offered to children with persistent bilateral hearing loss for whom surgery is contraindicated or unacceptable and autoinflation (forced exhalation with closed mouth and nose to reopen the Eustachian tube) may be considered during the observation period for cooperative children. The full guideline, which includes a review of the evidence and an evidence summary for each section, is:

National Collaborating Centre for Women's and Children's Health. 2008. **Surgical management of children with otitis media with effusion (OME)**. London: RCOG Press. http://www.nice.org.uk/guidance/cg60/evidence/cg60-surgical-management-of-ome-full-guideline

Appendix C of the full guideline provides an economic evaluation of alternative management strategies for OME in children. The evidence tables on which the guidelines were based can be found at: http://www.nice.org.uk/guidance/CG60/documents/cg60-surgical-management-of-ome-evidence-tables2

National Institute for Health and Clinical Excellence. 2008. **Prescribing of antibiotics for self-limiting respiratory tract infections in adults and children in primary care**. London: National Institute for Health and Clinical Excellence. https://www.nice.org.uk/guidance/cg69

This guidelines states that a no antibiotic or delayed antibiotic prescribing strategy is appropriate for patients with acute otitis media but that an immediate antibiotic prescribing strategy can be considered for bilateral acute otitis media in children younger than two years and acute otitis media in children with otorrhoea (discharge from the ear). The full guideline, and the supporting evidence, can be downloaded here: http://www.nice.org.uk/guidance/cg69/evidence .

Evidence-based medicine reviews

Venekamp RP, Sanders S, Glasziou PP, et al. 2015. **Antibiotics for acute otitis media in children**. Cochrane Database Systematic Reviews (6). http://onlinelibrary.wiley.com/doi/10.1002/14651858.CD000219.pub4/abstract

This review assessed the effects of antibiotics for acute otitis media (AOM) through a review of RCTs comparing (1) antibiotics with placebo and (2) antibiotics with expectant observation (including delayed antibiotics prescribing) in children with AOM. Thirteen RCTs generally at low risk of bias (3,401 children and 3,938 AOM episodes in high income countries) compared antibiotics with placebo. The combined results of these trials indicated that, 24 hours from the start of treatment, 60% of children had recovered whether or not they had received antibiotics. Pain was not reduced by antibiotics at 24 hours (risk ratio (RR) 0.89, 95% CI 0.78 to 1.01) but almost a third fewer had residual pain at two to three days (RR 0.70, 95% CI 0.57 to 0.86; number needed to treat for an additional beneficial outcome (NNTB) 20). Antibiotics did reduce the number of children with abnormal tympanostomy findings at 2–4 weeks and 6–8 weeks, and the number of children with tympanic membrane perforations, and halved the number of contralateral otitis episodes compared to placebo. There was no difference between the antibiotics and placebo groups in rates of severe complications, which were rare, but children taking antibiotics had more adverse events such as vomiting and diarrhoea. Individual patient data meta-analysis of a subset of included trials indicated that antibiotics are most beneficial in children aged less than two years with bilateral AOM, or with both AOM and otorrhoea. For the comparison of immediate antibiotics vs. expectant observation, four RCTs (1,007 children) provided usable data for meta-analysis. Data from 959 children indicated no detectable difference in pain at three to seven days (RR 0.75, 95% CI 0.50 to 1.12). There were also no differences between groups in number of children with abnormal tympanometry findings at four weeks, tympanic membrane perforations and AOM recurrence. No serious complications occurred in either group but there was a substantially increased risk of vomiting, diarrhoea or rash in the antibiotics group. Results from an individual patient data meta-analysis including data from six high-quality trials (1,643 children) that were also included as individual trials in the review indicated that antibiotics appear to be most beneficial in children younger than two years of age with bilateral AOM (NNTB 4) and in children with both AOM and otorrhoea (NNTB 3). The review authors concluded that clinical management of AOM should emphasise advice about adequate analgesia and the limited role for antibiotics. They stated that Antibiotics are most beneficial in children under two years of age with bilateral AOM, or with both AOM and otorrhoea, and that for most other children with mild disease in high-income countries, an expectant observational approach seems justified.

Norhayati Mohd N, Ho Jacqueline J, Azman Mohd Y. 2015. **Influenza vaccines for preventing acute otitis media in infants and children**. Cochrane Database of Systematic Reviews (3). http://onlinelibrary.wiley.com/doi/10.1002/14651858.CD010089.pub2/abstract

Although most cases of acute otitis media (AOM) in children are due to bacterial infection, episodes of AOM are often triggered by a viral infection. This review aimed to evaluate the effectiveness of influenza vaccine in reducing the occurrence of AOM in infants and

children. Ten placebo RCTs involving16,707 children aged six months to six years were included. Nine trials, and all five trials that contributed to the primary outcome (reduction in AOM), were funded by vaccine manufacturers. Trials assessing the primary outcome showed a small reduction in at least one episode of AOM over at least six months of follow-up (five trials, 4,736 participants: risk ratio 0.80, 95% CI 0.67 to 0.96; risk difference −0.04, 95% CI −0.07 to −0.02; number needed to treat to benefit 25, 95% CI 15 to 50). There was a reduction in the use of antibiotics in vaccinated children (two trials, 1223 participants: RR 0.70, 95% CI 0.59 to 0.83; RD −0.15, 95% CI −0.30 to −0.00). The review authors concluded that influenza vaccination results in a small reduction in AOM but the benefits may not justify the use of influenza vaccine without taking into account vaccine efficacy in reducing influenza and safety data. They stated that the quality of the evidence was high to moderate and that further research is needed.

Wallace IF, Berkman ND, Lohr KN, et al. 2014. **Surgical treatments for otitis media with effusion: a systematic review**. Pediatrics, 133(2), 296-311. http://pediatrics.aappublications.org/content/133/2/296.long

This review aimed to compare the effectiveness of surgical strategies currently used in the management of otitis media with effusion (OME). The review authors identified three recent systematic reviews and 41 unique studies. The studies included RCTs, non-randomised trials and cohort studies that compared myringotomy (incision of the eardrum to release fluid from the middle ear), adenoidectomy, tympanostomy tubes (tubes, grommets) and watchful waiting. In comparison with watchful waiting or myringotomy, tubes decreased time with OME and improved hearing in the short term (12 RCTs); no specific tube type was superior (8 RCTs). Adenoidectomy alone, as an adjunct to myringotomy, or combined with tubes, (8 RCTs in total), reduced OME and improved hearing in comparison with either myringotomy or watchful waiting. Tubes and watchful waiting did not differ in language (4 trials), or cognitive or academic outcomes (2 trials). Otorrhoea (discharge from the ear) and tympanosclerosis (scarring of the eardrum) were more common in ears with tubes. Adenoidectomy increased the risk of postsurgical haemorrhage. The review authors concluded that tubes and adenoidectomy reduce time with OME and improve hearing in the short-term (up to 1–2 years). They noted that both treatments have associated harms. They stated that large, well-controlled studies could help resolve the risk-benefit ratio by measuring acute otitis media recurrence, functional outcomes, quality of life, and long-term outcomes and that research is needed to support treatment decisions in subpopulations, especially in patients with comorbidities.

Boonacker CW, Rovers MM, Browning GG, et al. 2014. **Adenoidectomy with or without grommets for children with otitis media: an individual patient data meta-analysis**. Health Technol Assess, 18(5), 1-118. http://www.ncbi.nlm.nih.gov/books/NBK261525/

Children with persistent otitis media with effusion (OME) or recurrent acute otitis media (AOM) may be offered insertion of grommets, adenoidectomy, or a combination of the two. This study aimed to: (1) Develop a model to predict the risk of children referred for adenoidectomy having prolonged duration of their OM, and then (2a) evaluate the overall effect of adenoidectomy, with or without grommets, on OM by evaluating individual patient data, and (2b) identify those sub-groups of children who are most likely to benefit from adenoidectomy with or without grommets. Studies were deemed eligible for inclusion in the meta-analysis if they were RCTs in children aged up to 12 years of age diagnosed with recurrent AOM and/or persistent OME in which adenoidectomy (with or without grommets) was compared with non-surgical treatment or grommets alone. Ten trials (1,761 children) were included in the meta-analysis: eight were considered to be at low risk of bias and two at moderate risk. The primary outcome measure was failure at 12 months, defined by a set of persisting symptoms and signs. The prognostic analyses indicated that, of the 342 children who were referred for adenoidectomy but were randomised to non-surgical groups, 193 (56%) failed to improve at 12 months. Indication was an independent predictor of failure. The absolute risk of failing to improve for children with an indication of persistent OME was 89%, and for children with an indication of recurrent AOM it was 38%.

The proportion of children who failed at 12 months in the adenoidectomy group (adenoidectomy with or without grommets) was 32% while the proportion of children who failed at 12 months in the no adenoidectomy (non-surgical or grommets alone) group was 45%. The unadjusted risk difference for failure at 12 months was –13% [95% confidence interval (CI) –17% to –8%], resulting in a number needed to treat (NNT) of eight children to prevent one failure. The adjusted RR was 0.76 (95% CI 0.69 to 0.85), which was similar to the unadjusted RR (0.72, 95% CI 0.63 to 0.81). For all secondary outcomes, other than presence of effusion for ≥ 50% of the time in the first 12 months, results for children in the adenoidectomy group were also statistically significantly better than results for those in the no adenoidectomy group. Two sub-groups of children were found to be most likely to benefit from adenoidectomy: (1) children aged < 2 years with recurrent AOM, where 16% of those who had adenoidectomy failed at 12 months compared to 27% of those who did not [rate difference (RD) 12%, 95% CI 6% to 18%; number needed to treat (NNT) = 9]; (2) children aged ≥4 years with persistent OME, where 51% of those who had adenoidectomy failed at 12 months compared to 70% of those who did not (RD 19%, 95% CI 12% to 26%; NNT = 6). There was found to be no significant benefit of adenoidectomy in children aged ≥ 2 years with recurrent AOM and children aged <4 years with persistent OME. The review authors concluded that adenoidectomy is most beneficial in children with persistent OME aged ≥4 years.

Mohiuddin S, Schilder A, Bruce I. 2014. **Economic evaluation of surgical insertion of ventilation tubes for the management of persistent bilateral otitis media with effusion in children**. BMC Health Serv Res, 14, 253. http://www.biomedcentral.com/1472-6963/14/253

The commonest surgical treatment for otitis media with effusion (OME) is the insertion of ventilation tubes (VTs), also known as grommets or tympanostomy tubes. The use of VTs to treat OME is somewhat contentious, because OME tends to resolve spontaneously with increasing age in the majority of children. An alternative to insertion of VTs is to fit a child with hearing aids (HAs) to compensate for the hearing loss associated with OME, and await the natural resolution of the condition. The aim of this study as to evaluate the cost-effectiveness of VTs insertion for the management of persistent bilateral OME in children, compared with HAs alone and HAs plus VTs strategies. The study authors employed a decision-tree model, using data from published sources, and assuming a 2-year time horizon and a UK NHS perspective for costs. They found that the VTs strategy was more effective and less costly than the HAs plus VTs strategy, and that the incremental cost-effectiveness ratio for the VTs strategy compared to the HAs alone strategy was £5,086 per quality-adjusted life year (QALY) gained. At a willingness-to-pay threshold of £20,000 per QALY, the probability that the VTs strategy is

likely to be more cost-effective was 0.58. The authors stated that the expected value of perfect information (EVPI) value at population level of around £9.5 million at the willingness-to-pay threshold of £20,000 indicated that future research in this area is potentially worthwhile, while the partial EVPI analysis indicated considerable uncertainty surrounding the parameters used for computing the QALYs for which more precise estimates would be most valuable. They concluded that The VTs strategy is a cost-effective option when compared with the HAs alone and HAs plus VTs strategies, but that further research is needed and that future studies of surgical and non-surgical treatment of OME in children should evaluate the economic impact of interventions.

Gisselsson-Solen M. 2014. **The importance of being specific–a meta-analysis evaluating the effect of antibiotics in acute otitis media**. International Journal of Pediatric Otorhinolaryngology, 78(8), 1221-27. http://www.sciencedirect.com/science/article/pii/S0165587614003139

Making a diagnosis of acute otitis media in clinical practice is often difficult and physicians may be uncertain of the diagnosis in a substantial minority of cases. This paper points out that many trials assessing the effect of antibiotics in acute otitis media (AOM) in children have used symptomatic outcome measures, such as pain, and found that antibiotics have only modest effects on AOM but two recent trials which used treatment failure as an outcome measure found more substantial effects. The aim of this study was to perform a meta-analysis to calculate the composite risk ratio for treatment failure in AOM (indicated by diagnostic findings such as bulging and immobility of the tympanic membrane on otoscopy, as well as symptoms) and to investigate whether the specificity of treatment failure as an outcome measure is different from that of other symptomatic outcomes, such as pain. The authors identified trials evaluating the effects of antibiotics in AOM and reporting the number of treatment failures and performed a fixed-effects meta-analysis. They also searched the literature for articles providing direct or indirect figures on the specificity of different outcome measures in AOM trials and designed a hypothetical study to show how differences in the sensitivity/specificity of inclusion/outcome criteria affect the results of a trial. The meta-analysis yielded a composite risk ratio of 0.4 (95% CI 0.35 to 0.48, $p < 0.001$) for the effect of antibiotics on treatment failure. Based on data from the literature, the specificity of treatment failure was estimated to be 92–100%. The hypothetical study showed how using a non-specific outcome measure biases the effect estimate towards the null, whereas other kinds of misclassification only decrease precision. The authors concluded that future trials should improve diagnostic criteria to increase precision but primarily, they should focus on choosing a specific outcome measure so as to avoid getting a biased effect estimate.

Mikals SJ, Brigger MT. 2014. **Adenoidectomy as an adjuvant to primary tympanostomy tube placement: a systematic review and meta-analysis**. JAMA Otolaryngol Head Neck Surg, 140(2), 95-101

Adenoidectomy (Ad) done in conjunction with tympanostomy tube (grommet) placement (TT) may reduce the likelihood of a child needing repeat surgery for tube placement (r-TT) because of otitis media. This review aimed to assess the effectiveness of primary adenoidectomy as an adjuvant to TT (Ad + TT) compared with TT alone. It included 15 prospective and retrospective studies comparing outcomes for children (aged ≤ 18 years) who underwent primary Ad+TT with children who had undergone TT only for middle ear disease. To be included studies had to have (1) extractable data regarding indications, procedures, and outcomes for each group; (2) an adequately described study design, and (3) documented follow-up. Ten studies (71,353 children) reported that primary Ad + TT decreased the risk of r-TT or risk of recurrent acute otitis media (RAOM), otitis media with effusion (OME), or otorrhea compared with TT alone. Four studies (n = 538) reported no difference between Ad + TT groups and TT-only groups in the prevention of r-TT or of RAOM, OME, or otorrhea. Despite significant heterogeneity, limited meta-analysis and pooling of data indicated that the children undergoing primary Ad + TT had an estimated rate of r-TT of 17.2% (95% CI, 12.2% to 22.2%) vs 31.8% (95% CI, 23.9%-39.8%) for children undergoing TT only. When stratified by age, the protective effects of adenoidectomy were diminished in children younger than 4 years. The review authors concluded that the current evidence suggests that primary Ad + TT may be superior to TT only in decreasing the risk of r-TT and the risk of RAOM, OME, or otorrhea in children older than four years but this benefit needs to be weighed against the additional morbidity of an adenoidectomy and the cost effectiveness of Ad + TT given the modest improvement in outcomes. They noted limitations of the evidence including heterogeneity of the source data, with the predominance of retrospective data.

Perera R, Glasziou Paul P, Heneghan Carl J, et al. 2013. **Autoinflation for hearing loss associated with otitis media with effusion**. Cochrane Database of Systematic Reviews (5). http://onlinelibrary.wiley.com/doi/10.1002/14651858.CD006285.pub2/abstract

This review aimed to assess the effectiveness of autoinflation compared to no treatment in children and adults with otitis media with effusion (OME, 'glue ear'). Autoinflation is the opening of, and fording air through, the Eustachian tube by raising intranasal pressure. The can be achieved by forced exhalation with closed mouth and nose, blowing up a small balloon attached to a nose piece through each nostril in turn, use of an anaesthetic mask or a Politzer device. The review included eight studies (702 participants in total) comparing a form of autoinflation to no autoinflation in individuals with glue ear. All of the studies were small, of limited duration and had short follow-up. The review authors combined data from seven studies using a composite outcome measure which included any outcome signifying improvement (as defined in the individual studies, either by tympanogram or audiometry) and assessed outcomes at two time points: ≤ one month and > one month. Only the > one month analysis indicated a significant improvement: relative risk of improvement 1.74, 95% CI 1.22 to 2.50. Sub-group analysis based on the type of intervention indicated a significant effect for using a Politzer device both at ≤ one month (RRI 7.07, 95% CI 3.70 to 13.51) and > one month (RRI 2.25, 95% CI 1.67 to 3.04). The review authors concluded that, because of autoinflation's low cost and the absence of associated adverse effects, it is reasonable to consider its use while awaiting natural resolution of OME. They suggested that primary care could be a suitable place to evaluate this intervention further. They stated that further research should also consider the duration of treatment, long term impacts on developmental outcomes in children, and additional quality of life outcome measures for children and families.

Syed Mohammed I, Suller S, Browning George G, et al. 2013. **Interventions for the prevention of postoperative ear discharge after insertion of ventilation tubes (grommets) in children**. Cochrane Database of Systematic Reviews (4). http://onlinelibrary.wiley.com/doi/10.1002/14651858.CD008512.pub2/abstract

This review aimed to assess the effectiveness of prophylactic interventions in reducing the incidence of otorrhoea (ear discharge) after the insertion of grommets in children. The review authors identified 15 relevant RCTs (2,476 children, aged from four months to 17 years). Seven trials (936 children) were considered to be at low risk of bias, as were two arms of another RCT. The other seven were deemed to be at high risk of bias. For a single application at surgery, two low risk trial provided evidence that the risk of otorrhoea at two weeks post-surgery provided was reduced by: multiple saline washouts (from 30% to 16%; relative risk (RR) 0.52, 95% CI 0.27 to 1.00; number needed to treat to benefit (NNTB) 7, one RCT with 140 children); and by antibiotic/steroid ear drops (from 9% to 1%; RR 0.13, 95% CI 0.03 to 0.57; NNTB 13; one RCT; 322 ears). A meta-analysis of two trials at low risk of bias (222 ears) did not find any effect at four to six weeks postoperatively from single application of antibiotic/steroid ear drops. For prolonged application of an intervention, four trials at low risk of bias provided evidence that the risk of otorrhoea was reduced at two weeks post-surgery by antibiotic ear drops (from 15% to 8%; RR 0.54, 95% CI 0.30 to 0.97; NNTB 15; one RCT; 372 children), antibiotic/steroid ear drops (from 39% to 5%; RR 0.13, 95% CI 0.05 to 0.31; NNTB 3; one RCT; 200 children), aminoglycoside/steroid ear drops (from 15% to 5%; RR 0.37, 95% CI 0.18 to 0.74; NNTB 11; one RCT; 356 children) or oral antibacterial agents/steroids (from 39% to 5%; RR 0.13, 95% CI 0.03 to 0.51; NNTB 3; one RCT; 77 children). Only one trial assessed the secondary outcome of ototoxicity: it found no effect. No trials assessed quality of life. The review authors noted the wide variation between trials in rates of otorrhoea, and that the higher the rate of otorrhoea within a RCT, the lower the NNTB for therapy. They concluded that if surgeon has a high rate of postoperative otorrhoea in children then either saline irrigation or antibiotic ear drops at the time of surgery would significantly reduce that rate. They suggested that, if topical drops are chosen, then to reduce the cost and the potential for ototoxic damage, a single application at the time of surgery should be used rather than prolonged application.

Berkman ND, Wallace IF, Steiner MJ, et al. 2013. **AHRQ Comparative Effectiveness Reviews**: **Otitis Media With Effusion: Comparative Effectiveness of Treatments.** Rockville (MD): Agency for Healthcare Research and Quality (US). http://www.effectivehealthcare.ahrq.gov/search-for-guides-reviews-and-reports/?pageaction=displayproduct&productid=1485

This comparative effectiveness review for the AHRQ addressed five key questions relating to the treatment of otitis media with effusion (OME):

- **KQ 1**. What is the comparative effectiveness of the following treatment options (active treatments and watchful waiting) in affecting clinical outcomes or health care utilisation in patients with OME? Treatment options include: tympanostomy tubes (grommets), myringotomy, oral or topical nasal steroids, autoinflation, complementary and alternative medical procedures, watchful waiting, and variations in surgical technique or procedures.
- **KQ 2**. What is the comparative effectiveness of the different treatment options listed in KQ 1 (active treatments, watchful waiting, and variations in surgical procedures) in improving functional and health-related quality of life outcomes in patients with OME?
- **KQ 3**. What are the harms or tolerability among the different treatment options?
- **KQ 4**. What are the comparative benefits and harms of treatment options in subgroups of patients with OME?
- **KQ 5**. Is the comparative effectiveness of treatment options related to factors affecting health care delivery or the receipt of pneumococcal vaccine inoculation?

In total, the review included 59 studies: 49 RCTs, six non-randomised studies, and four cohort studies. Forty-two of these were included in five systematic reviews, and of the other 17, 15 were considered to be at medium risk of bias, one at high risk and one at low risk. Of the five systematic reviews, four were assessed as being at low risk of bias (they included only RCTs) and one at medium risk. The findings relating to the key questions are summarised in tables which give numbers of studies and sample sizes, outcomes and results and strength of evidence for each intervention vs. comparator combination. Overall, the reviewers found an uneven body of evidence across treatment comparisons and outcomes. They found strong and consistent evidence that, compared to watchful waiting or myringotomy, tympanostomy tubes decreased effusion and improved hearing over the short term but did not affect longer-term speech, language or other functional outcomes. There was, however, weaker evidence that tube placement was associated with increased rates of side effects such as otorrhoea and tympanosclerosis. Although adenoidectomy results in fewer children having OME in the short term compared to watchful waiting, less is known about its long term effects, particularly with regard to functional outcomes. Steroids were found not to be of benefit. The reviewers stated that additional research and better methods are needed to develop a comprehensive evidence base to support decision making about the various treatment options, especially in sub-populations defined by age and co-existing conditions.

Levi JR, Brody RM, McKee-Cole K, et al. 2013. **Complementary and alternative medicine for pediatric otitis media**. International Journal of Pediatric Otorhinolaryngology, 77(6), 926-31.

This review discusses complementary and alternative medicine for otitis media in children. Thirty-six unique publications were reviewed. These included case reports, case series, RCTs, and basic science research. The review authors notes that, of all therapies in complementary and alternative medicine, only xylitol has been studied in well-designed, randomized, blinded trials. (Xylitol is a natural sugar found in many fruits and used as a sweetener in chewing gum.) They stated that xylitol is probably effective in preventing acute otitis media, but compliance limits its applicability. They identified breastfeeding and avoidance of secondhand smoke as effective preventive measures.

van Zon A, van der Heijden Geert J, van Dongen Thijs MA, et al. 2012. **Antibiotics for otitis media with effusion in children**. Cochrane Database of Systematic Reviews (9). http://onlinelibrary.wiley.com/doi/10.1002/14651858.CD009163.pub2/abstract

Otitis media with effusion (OME) is characterised by an accumulation of fluid in the middle ear behind the tympanic membrane (ear drum), without symptoms signs of acute infection. Despite the absence of evidence of acute infection, in around one in three children

with OME a bacterial pathogen can be identified in the middle ear fluid. This review therefore aimed to assess the effects of antibiotics in children with OME (aged up to 18 years). The review included 23 RCTs (3,207 children) covering a range of antibiotics, participants, outcome measures and time points of evaluation. The reviewers considered the trials to be generally at low risk of bias. The outcome of primary interest was complete resolution of OME at two to three months. Five individual studies provided data on this outcome. The differences (improvement) in the proportion of children having such resolution (risk difference (RD)) ranged from 1% (RD 0.01, 95% CI −0.11 to 0.12; not significant) to 45% (RD 0.45, 95% CI 0.25 to 0.65). Results from these studies could not be pooled because of clinical and statistical heterogeneity. It was possible to pool results from studies assessing complete resolution at more than six months: antibiotics were associated with an increase in resolution of 13% (RD 0.13, 95% CI 0.06 to 0.19). Pooled analysis was also possible for complete resolution at the end of treatment, with the following increases in resolution rates: 17% (RD 0.17, 95% CI 0.09 to 0.24) for treatment for 10 days to two weeks, 34% (RD 0.34, 95% CI 0.19 to 0.50) for treatment for four weeks, 32% (RD 0.32, 95% CI 0.17 to 0.47) for treatment for three months, and 14% (RD 0.14, 95% CI 0.03 to 0.24) for treatment continuously for at least six months. The review authors found no evidence of a substantial improvement in hearing as a result of antibiotics, nor did they find an effect on the rate of ventilation tube insertion. No trials examined speech, language, cognitive development or quality of life. Six studies reported on adverse effects but their results could not be pooled due to high heterogeneity. Increases in the rates of adverse events ranged from 3% (RD 0.03, 95% CI −0.01 to 0.07; not significant) to 33% (RD 0.33, 95% CI 0.22 to 0.44) in the individual studies. The review authors concluded that the evidence did not support routine use of antibiotics in children with OME. They noted that the greatest effects of antibiotics were found in children treated continuously for four weeks and three months. The stated that, even when benefits of antibiotics are apparent, these must be weighed against potential adverse events, both for the individual (e.g. diarrhoea) and society (e.g. emergence of antibiotic resistance).

El-Makhzangy AM, Ismail NM, Galal SB, et al. 2012. **Can vaccination against pneumococci prevent otitis media with effusion?** Eur Arch Otorhinolaryngol, 269(9), 2021-6

This review aimed to determine, according to the best available published evidence, whether vaccination against pneumococci effectively prevents otitis media with effusion. Three relevant studies were identified: one RCT (161 children with OME aged 2–8 years), and two secondary analyses of previously conducted RCTs (1,662 children aged 2–12 months and 383 children aged 1–7 years). Meta-analysis indicated that anti-pneumococcal vaccination conferred no significant preventive advantage for OME. The review authors concluded that analysis of the best available published evidence does not show a significant value for anti-pneumococcal vaccination in preventing OME, but given the very small number of RCTs directly addressing the disease in question, research is still open to resolve this issue.

Shekelle PG, Takata G, Newberry SJ, et al. 2010. **Management of Acute Otitis Media: Update. Evidence Report/Technology Assessment No. 198. (Prepared by the RAND Evidence-Based Practice Center under Contract No. 290 2007 10056 I).** Rockville, MD: Agency for Healthcare Research and Quality. http://www.ahrq.gov/research/findings/evidence-based-reports/otitisup-evidence-report.pdf

This review is an update of a previous AHRQ review (2001). It updates findings on the diagnosis and treatment of uncomplicated acute otitis media (AOM), assesses the evidence for the treatment of recurrent AOM, and assesses the impact of the heptavalent pneumococcal conjugate vaccine (PCV-7) on the microbiology of AOM. (Since the publication of this report the US has introduced a 13-valent PCV vaccine.) The review authors found few studies that had examined the accuracy and precision of diagnosis of AOM. Following the introduction of PCV-7, *Streptococcus pneumoniae* became less commonly identified in AOM microbiology while *Haemophilus influenzae* became more prominent. Pooled analysis of RCT results from seven trials indicated that for uncomplicated AOM, nine children (95% CI 6 to 20) would need to be treated with ampicillin or amoxicillin rather than placebo to note a difference in the rate of clinical success. Of four studies of delayed antibiotic treatment for uncomplicated AOM, two found that immediate antibiotic treatment had a higher rate of clinical success while two did not. Three studies found a marked decrease in antibiotic utilisation. The review authors could not determine the comparative effectiveness of different antibiotics for AOM in children with recurrent otitis media (ROM), or the comparative effectiveness of different treatments in subgroups of children with AOM. For children with ROM, long term treatment with antibiotics decreased AOM episodes from 3 to 1.5 per 12 months of treatment for each AOM-prone child (95% CI 1.2 to 2.1), but this benefit needs to be weighed against the potential consequences of long term treatment (such as diarrhoea). Amoxicillin-clavulanate was generally associated with more frequent adverse events than cefdinir, ceftriaxone, or azithromycin. The review authors stated that higher quality studies and improved reporting of quality-related study characteristics are needed to provide definitive conclusions about treatment for AOM and ROM.

Other relevant publications

Gribben B, Salkeld LJ, Hoare S, et al. 2012. **The incidence of acute otitis media in New Zealand children under five years of age in the primary care setting**. Journal of Primary Health Care 4(3) 205-12

This paper reports on a cohort study of children aged less than five years enrolled in a sample of GP practices (63 in total) in New Zealand from 1 November 2008 to 31 October 2009. The aim of the study was to estimate the incidence of acute otitis media (AOM). There were 19,146 children included in the sample. The raw incidence of AOM was 273 per 1,000 children (27.3%; 95% CI 216 to 330). Of the 3,885 children, 2888 (74%) had one episode of AOM and 152 (4%) of these children developed recurrent AOM. Incidence declined with age. There was no difference in incidence between Māori, Pacific and 'Other' ethnicities. Antibiotics were used to treat 2653 (51%) AOM episodes and 113 (4.3%) of these children re-presented within three days of antibiotic therapy for persistent symptoms. The only complication noted was tympanic membrane perforation, which was observed in 62 (1%) episodes. The authors believed this figure was likely to be an underestimate of the true incidence of this complication. They stated that their data indicate that AOM is an important and frequent childhood infection in New Zealand. They also stated that their data show a significant decline in the use of antibiotics to manage AOM in concordance with accepted best practice.

BRONCHIOLITIS

Introduction

Bronchiolitis occurs predominantly in infants aged under one year and is a leading cause of hospital admission in this age group.[47] Around one in three infants will develop bronchiolitis in their first year of life and 2–3% will require hospitalisation.[47] Bronchiolitis is due to viral infection, most commonly with respiratory syncytial virus (RSV), although many other respiratory viruses can cause the illness.[47] In temperate climates such as New Zealand's, bronchiolitis tends to occur in seasonal epidemics peaking in late winter.[48]

Affected infants appear initially to have a simple upper respiratory infection with a mild fever, a runny nose and a cough but after a few days this progresses to wheezing and respiratory distress, with rapid breathing, nasal flaring and the use of accessory muscles. Feeding and sleeping may be impaired, and very young infants may also have episodes of apnoea. Severely affected infants require hospital care, which consists of supportive therapy with nasal suction to facilitate oral feeding, support for hydration by nasogastric or intravenous fluids, and supplemental oxygen.[47] Recovery from the acute illness normally takes 5–7 days, although around 50% of children have a persistent cough for more than two weeks.[47] Deaths from bronchiolitis are rare, with reported rates in the US and the UK of around 2 per 100,000 live births.[48]

Risk factors for severe illness requiring intensive care include young age (<6 weeks), premature birth, chronic lung disease of prematurity, congenital heart disease and immunodeficiency.[48-50] More common risk factors that are associated with hospitalisation for less severe bronchiolitis include male sex, age less than six months, birth during the first half of the RSV season, overcrowding, socio-economic disadvantage, older siblings, attendance at day care, lack of breast feeding and maternal smoking.[51,52] Hospital admissions for RSV bronchiolitis can be prevented by the use of a monthly-injected monoclonal antibody (Palivizumab), but this therapy is very expensive so its use is considered only in very high-risk infants.[53]

The following section reviews bronchiolitis in infants aged less than one year using information from the National Minimum Dataset and Mortality Collection. The section concludes with a brief overview of evidence-based guidelines and reviews on interventions to prevent or manage bronchiolitis in infants.

Data sources and methods

Indicator

1. *Infant deaths from bronchiolitis*
2. *Infants hospitalised for bronchiolitis*

Data sources

Numerator:
Deaths: National Mortality Collection
Hospitalisations: National Minimum Dataset
Denominator: Birth Registration Dataset

Definition

Deaths: Deaths of infants (aged less than one year) where the main underlying cause of death was bronchiolitis
Hospitalisations: Acute and arranged hospitalisations for infants (aged less than one year) with a primary diagnosis of bronchiolitis (per 1,000 livebirths). Refer to **Appendix 6** for the codes included.

Notes on interpretation

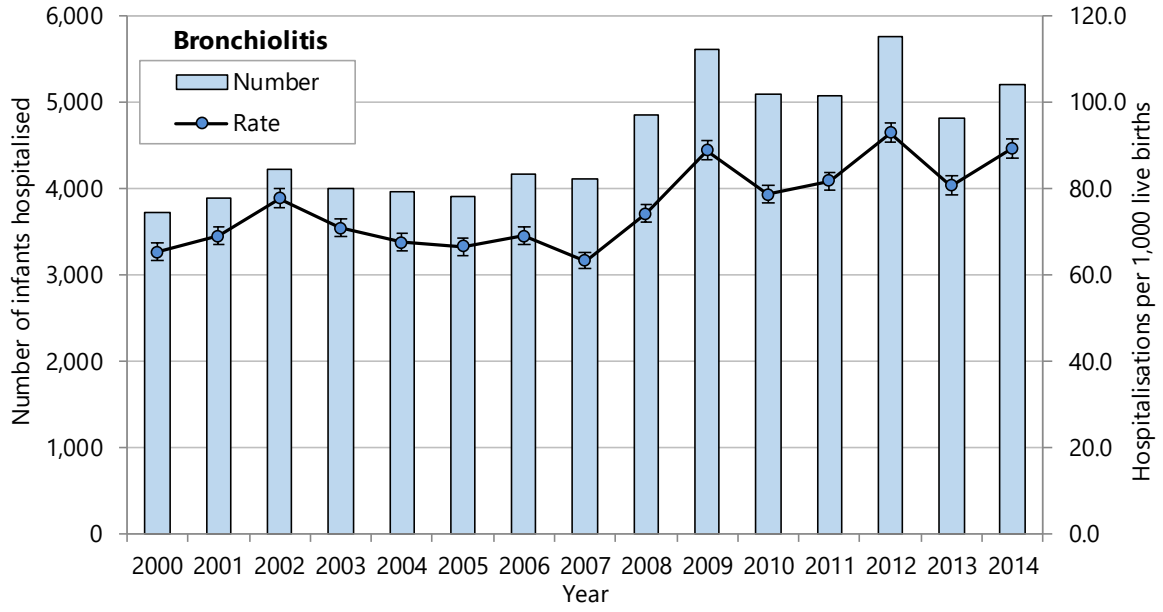
Note 1: An acute admission is an unplanned hospitalisation occurring on the day of presentation, while an arranged admission is a non-acute hospitalisation with an admission date less than seven days after the date the decision was made that hospitalisation was necessary.
Note 2: **Appendix 3** describes the National Minimum Dataset and outlines the limitations of the data utilised from this data collection. The reader is advised to review this appendix before interpreting any trends.

National trends and distribution

There were three deaths of infants aged less than one year with bronchiolitis as the underlying cause from 2008 to 2012. From 2000 to 2014 the bronchiolitis hospitalisation rate of infants aged less than one year rose with most of this increase occurring from 2007 to 2009 (**Figure 71**). Bronchiolitis hospitalisation rates for Māori and Pacific rose from 2000–2014 with noticeable periods of rising and falling rates within the time frame. The rise in rates was less marked for European/Other and Asian/Indian infants. Hospitalisation rates were consistently

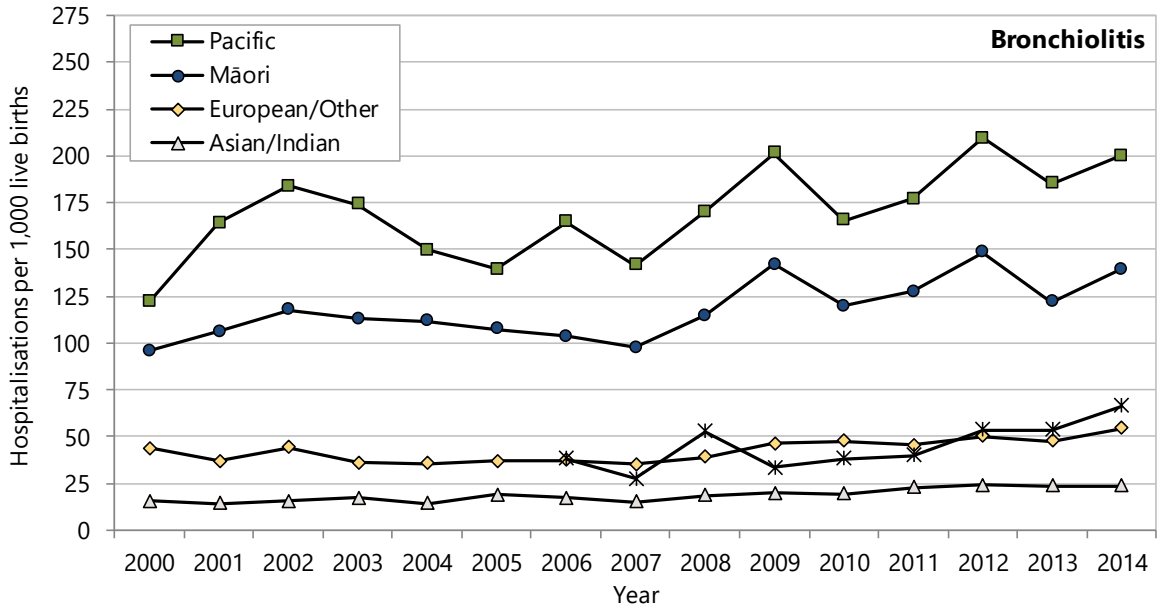
highest for Pacific, followed by Māori, European/Other and Asian/Indian. From 2006 to 2014 MELAA rates showed a slight rise at rates similar to those for European/Other **(Figure 72)**.

Figure 71. Hospitalisations for bronchiolitis in infants, New Zealand 2000–2014



Numerator: National Minimum Dataset (acute and arranged admissions); Denominator: Birth Registration Dataset

Figure 72. Infants hospitalised for bronchiolitis, by ethnicity, New Zealand 2000–2014

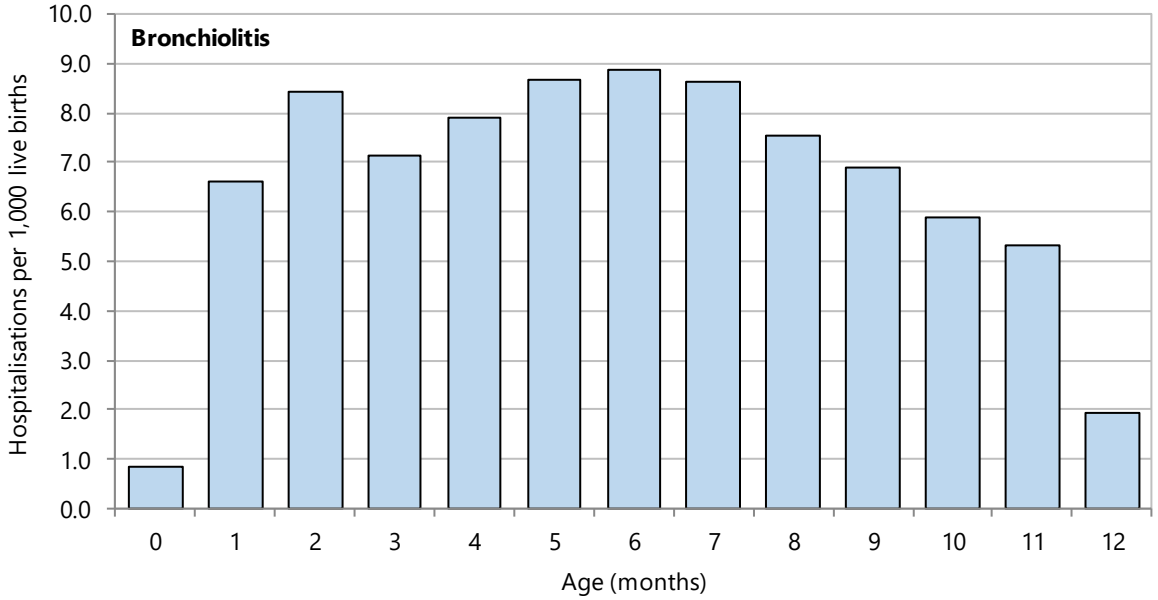


Numerator: National Minimum Dataset (acute and arranged admissions); Denominator: Birth Registration Dataset; Ethnicity is level 1 prioritised

Distribution by demographic factors

Between 2010 and 2014 bronchiolitis the highest hospitalisation rates were at ages 2–7 months and then decreased with increasing age with a particularly rapid decrease between 11 and 12 months of age **(Figure 73)**. Between 2010 and 2014 there was disparity in bronchiolitis hospitalisation rates by NZDep2013 index of deprivation score, ethnicity and gender. There was a strong social gradient in bronchiolitis hospitalisation rates with a *significant increase* between each quintile of NZDep2013 scores compared with the quintile below. Compared with European/Other, rates were *significantly higher* for Māori and Pacific, *significantly lower for* Asian/Indian and *not significantly different* for MELAA. Male rates were *significantly higher* than female rate **(Table 74)**.

Figure 73. Infants hospitalised for bronchiolitis, by age New Zealand 2010–2014



Numerator: National Minimum Dataset (acute and arranged admissions); Denominator: Birth Registration Dataset

Table 74. Infants hospitalised for bronchiolitis, by demographic factor, New Zealand 2010–2014

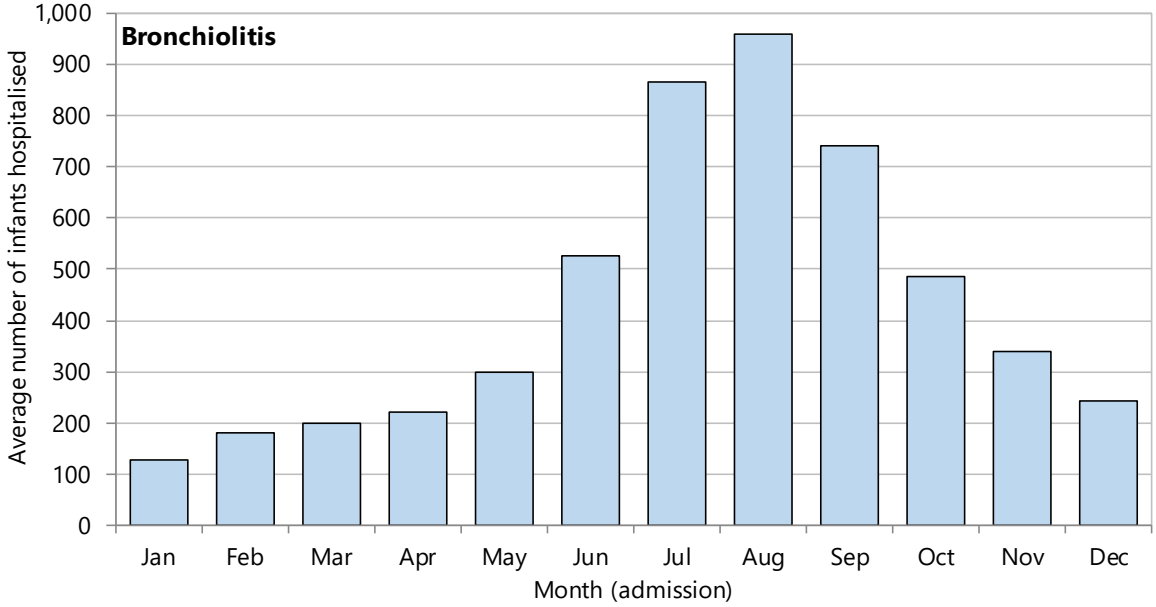
Variable	Number: 2010–2014	Rate per 1,000 livebirths	Rate ratio	95% CI
Bronchiolitis in under 1 year olds				
New Zealand				
NZDep2013 Index of deprivation quintile				
Deciles 1–2	1,673	37.1	1.00	
Deciles 3–4	2,221	44.9	1.21	1.14–1.29
Deciles 5–6	3,221	57.1	1.54	1.45–1.63
Deciles 7–8	5,592	82.9	2.23	2.12–2.36
Deciles 9–10	13,156	150.6	4.06	3.86–4.26
Prioritised ethnicity				
Māori	11,625	131.4	2.69	2.61–2.76
Pacific	6,360	187.1	3.83	3.70–3.95
Asian/Indian	952	22.9	0.47	0.44–0.50
MELAA	274	50.5	1.03	0.92–1.16
European/Other	6,715	48.9	1.00	
Gender				
Female	9,853	66.0	1.00	
Male	16,103	102.1	1.55	1.51–1.58

Numerator: National Minimum Dataset (acute and arranged admissions); Denominator: Birth Registration Dataset; Rates are per 1,000 livebirths; Rate ratios are unadjusted; Ethnicity is level 1 prioritised; Decile is NZDep2013

Distribution by season

There was seasonal variation in bronchiolitis hospitalisation rates. The highest rates were observed in July to September and the lowest rates in January to March **(Figure 74)**.

Figure 74. Hospitalisations for bronchiolitis in infants, by month, New Zealand 2010–2014

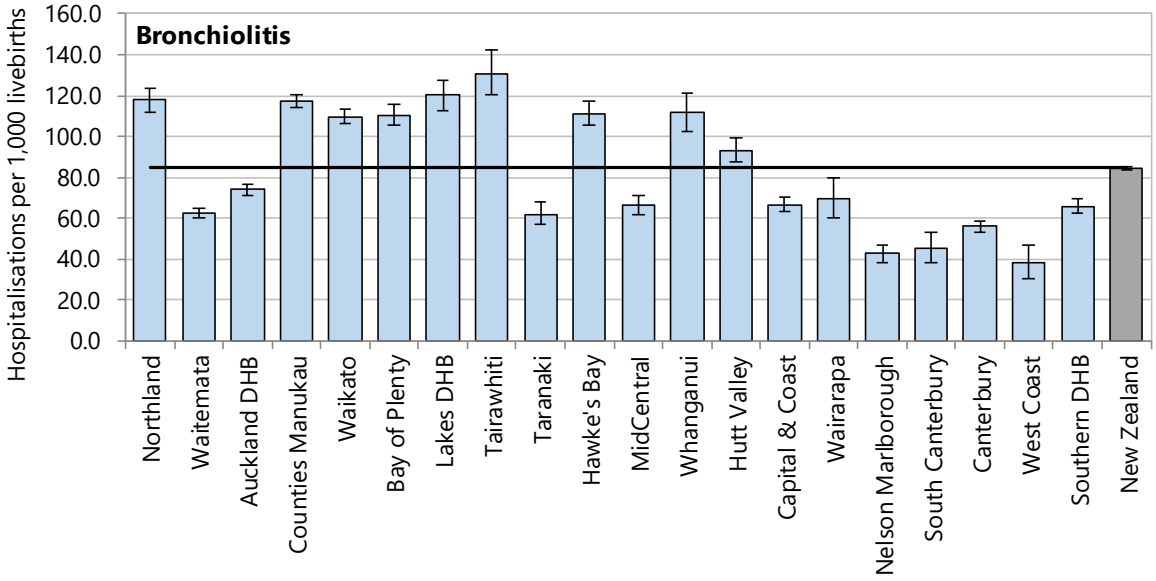


National Minimum Dataset (acute and arranged admissions); Number is annual average, Month is based on hospitalisation admission date

Distribution by region

Between 2010 and 2014 hospitalisation rates for bronchiolitis were *significantly higher* than the national rate in the Northland, Counties Manukau, Waikato, Bay of Plenty, Lakes, Tairawhiti, Hawke's Bay, Whanganui and Hutt Valley DHBs and *significantly lower* in the remaining DHBs. **(Figure 75**, **Table 75).**

Figure 75. Infants hospitalised for bronchiolitis, by district health board, New Zealand 2010–2014



Numerator: National Minimum Dataset (acute and arranged admissions); Denominator: Statistics NZ Estimated Resident Population

Table 75. Infants hospitalised for bronchiolitis, by district health board, New Zealand 2010–2014

DHB	Number: 2010–2014	Number: annual average	Rate per 1,000 livebirths	Rate ratio	95% CI
Bronchiolitis in infants					
Northland	1,345	269	117.7	1.39	1.32–1.47
Waitemata	2,459	492	62.5	0.74	0.71–0.77
Auckland	2,371	474	73.9	0.87	0.84–0.91
Counties Manukau	4,993	999	117.1	1.38	1.35–1.42
Waikato	2,975	595	109.8	1.30	1.25–1.35
Bay of Plenty	1,594	319	110.4	1.31	1.24–1.37
Lakes	905	181	120.1	1.42	1.33–1.51
Tairawhiti	480	96	130.8	1.55	1.42–1.68
Taranaki	483	97	62.1	0.73	0.67–0.80
Hawke's Bay	1,244	249	111.1	1.31	1.24–1.39
MidCentral	737	147	66.1	0.78	0.73–0.84
Whanganui	474	95	111.5	1.32	1.21–1.44
Hutt Valley	927	185	93.1	1.10	1.03–1.17
Capital & Coast	1,257	251	66.5	0.79	0.74–0.83
Wairarapa	179	36	69.2	0.82	0.71–0.94
Nelson Marlborough	337	67	42.6	0.50	0.45–0.56
South Canterbury	139	28	45.0	0.53	0.45–0.63
Canterbury	1,720	344	55.9	0.66	0.63–0.69
West Coast	78	16	37.9	0.45	0.36–0.56
Southern	1,176	235	65.9	0.78	0.74–0.82
New Zealand	25,956	5,191	84.6	1.00	

Numerator: National Minimum Dataset (acute and arranged admissions); Denominator: Statistics NZ Estimated Resident Population

Northern region distribution and trends

Comparisons with New Zealand

Between 2010 and 2014 hospitalisation rates for bronchiolitis were *significantly higher* than the national rate in Northland, and Counties Manukau DHBs and *significantly lower* in Waitemata and Auckland DHBs **(Table 76)**.

Table 76. Hospitalisations for bronchiolitis in infants, Northern DHBs vs New Zealand 2010–2014

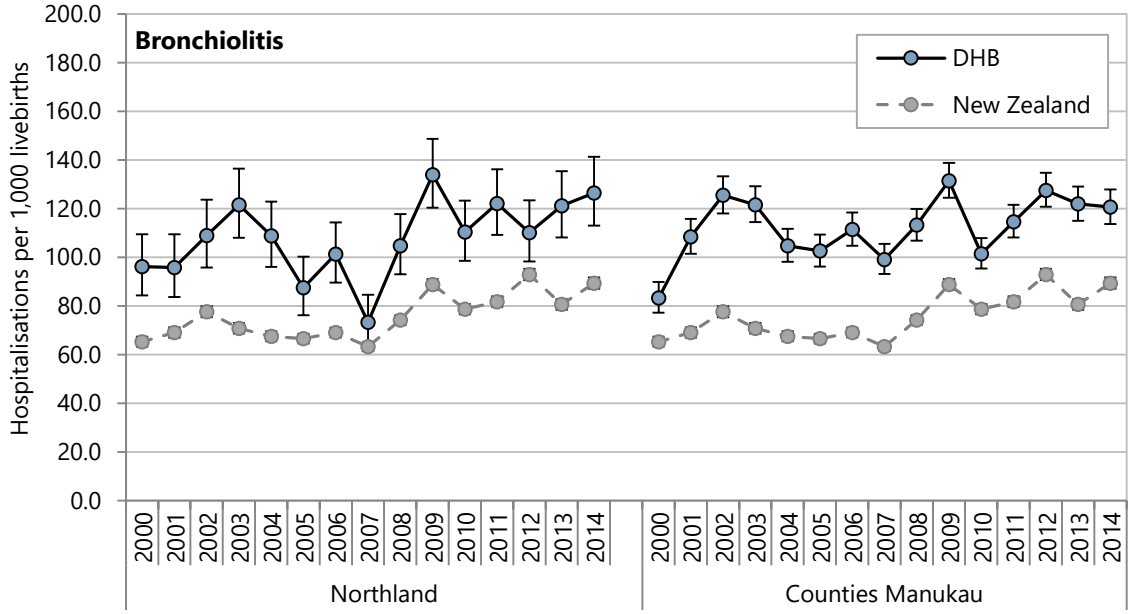
DHB	Number: 2010–2014	Number: annual average	Rate per 1,000 livebirths	Rate ratio	95% CI
Bronchiolitis in infants					
Northland	1,345	269	117.7	1.39	1.32–1.47
Waitemata	2,459	492	62.5	0.74	0.71–0.77
Auckland	2,371	474	73.9	0.87	0.84–0.91
Counties Manukau	4,993	999	117.1	1.38	1.35–1.42
New Zealand	25,956	5,191	84.6	1.00	

Numerator: National Minimum Dataset (acute and arranged admissions); Denominator: Birth Registration Dataset

Regional trends

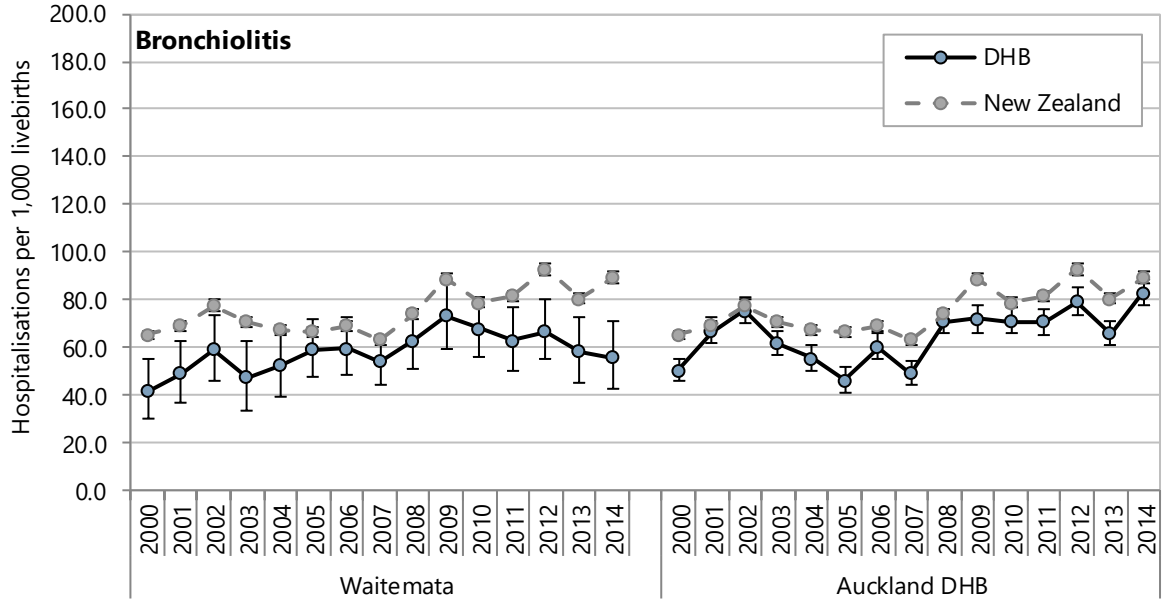
In all four Northern DHBs the bronchiolitis hospitalisation rate of infants aged less than one year generally increased from 2000 to 2014 **(Figure 76**, **Figure 77)**. Over the same period, hospitalisation rates were consistently highest for Pacific, followed by Māori, European/Other and Asian/Indian in Waitemata, Auckland and Counties Manukau DHBs, and in Northland rates were consistently higher for Māori than for European/Other infants **(Figure 78**, **Figure 79)**.

Figure 76. Infants hospitalised for bronchiolitis, Northland and Counties Manukau DHBs vs New Zealand 2000–2014



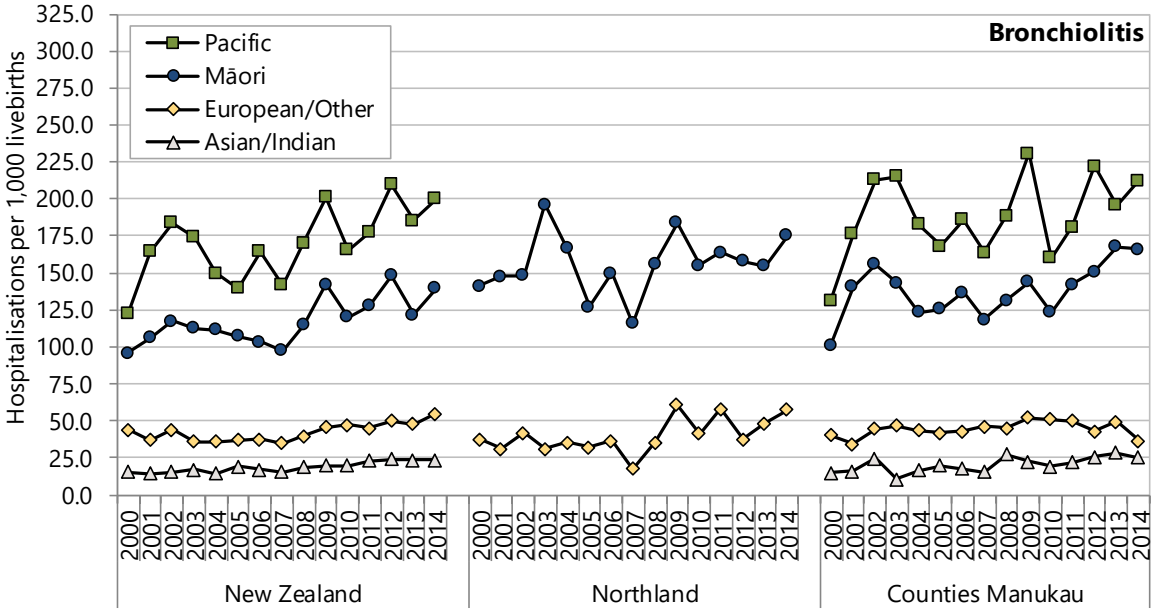
Numerator: National Minimum Dataset (acute and arranged admissions); Denominator: Birth Registration Dataset

Figure 77. Infants hospitalised for bronchiolitis, Waitemata and Auckland DHBs vs New Zealand 2000–2014



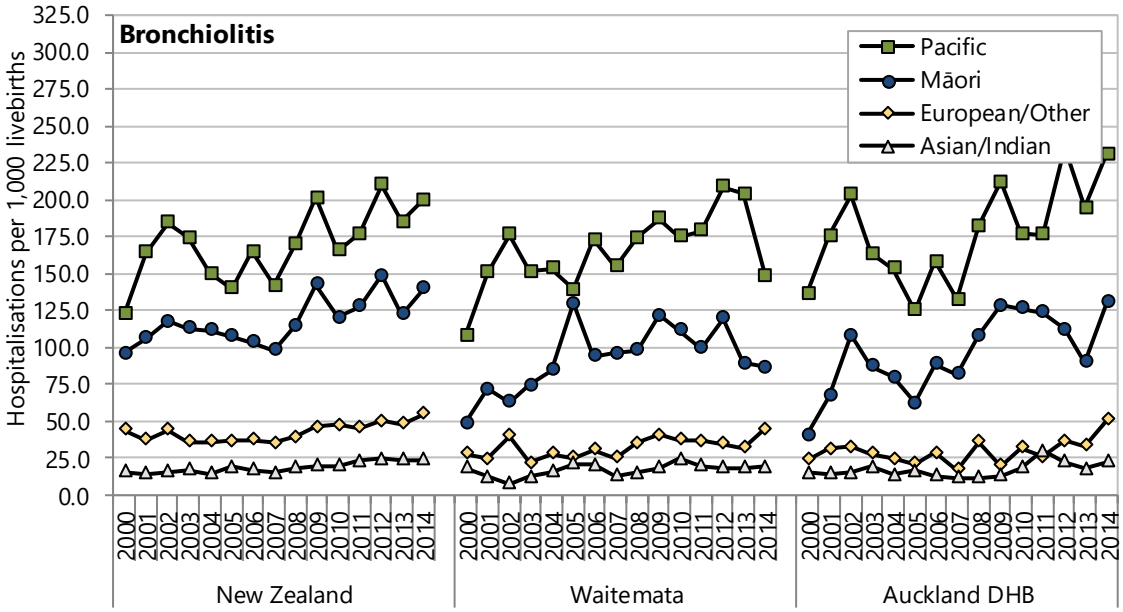
Numerator: National Minimum Dataset (acute and arranged admissions); Denominator: Birth Registration Dataset

Figure 78. Infants hospitalised for bronchiolitis, by ethnicity, Northland and Counties Manukau DHBs vs New Zealand 2000–2014



Numerator: National Minimum Dataset (acute and arranged admissions); Denominator: Birth Registration Dataset; Ethnicity is level 1 prioritised; Northland - Pacific and Asian/Indian rates are suppressed due to small numbers

Figure 79. Infants hospitalised for bronchiolitis, by ethnicity, Waitemata and Auckland DHBs vs New Zealand 2000–2014

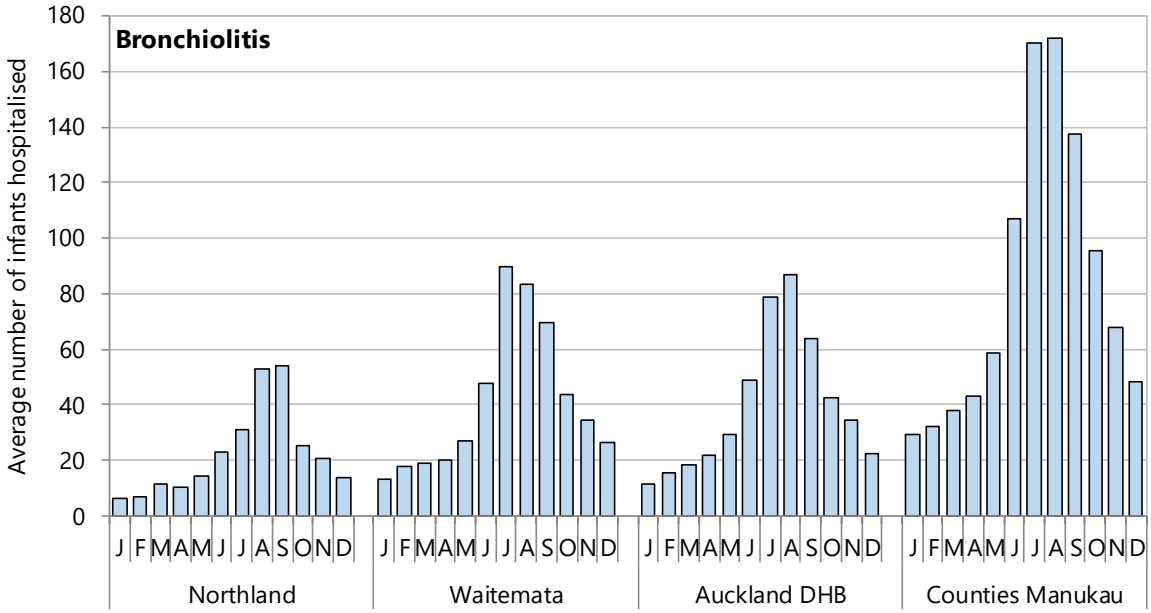


Numerator: National Minimum Dataset (acute and arranged admissions); Denominator: Birth Registration Dataset; Ethnicity is level 1 prioritised

Regional distribution by season

There was seasonal variation in bronchiolitis hospitalisation rates in the four Northern DHBs. The highest rates were observed in July–September and the lowest rates in January–March **(Figure 80)**.

Figure 80. Average number of infants hospitalised for bronchiolitis, by month, Northern DHBs 2010–2014



National Minimum Dataset (acute and arranged admissions); Number is annual average, Month is based on hospitalisation admission date

Evidence for good practice for the prevention and management of bronchiolitis

International guidelines
National Institute for Health and Care Excellence. 2015. **Bronchiolitis in children**. London: National Institute for Health and Care Excellence. https://www.nice.org.uk/guidance/ng9 This clinical guideline provides best practice advice on the care of children with bronchiolitis. It contains 'key priorities for implementation', the most important points for practitioners to be aware of, followed by more detailed recommendations covering assessment and diagnosis, when to refer, when to admit, management of bronchiolitis, when to discharge, and key safety information for looking after a child at home. It also contains recommendations for further research from the Guideline Development Group. This version of the guideline does not contain details of the evidence used to develop the guideline. This information is contained in the full guideline: National Collaborating Centre for Women's and Children's Health. 2015. **Bronchiolitis: diagnosis and management of bronchiolitis in children**. London: National Collaborating Centre for Women's and Children's Health. http://www.nice.org.uk/guidance/ng9/evidence/full-guideline-60851053 This is the full guideline (301 Pages) which contains the evidence used to develop the clinical guideline. It addresses 19 review questions relating to the description of the condition, diagnosis, prognosis and interventions. Evidence from published studies was reviewed and synthesised according to the GRADE approach. Where it was thought to be relevant, economic evidence was also reviewed. For each question there is a description of the evidence, tables which summarise the GRADE profile for all the reviewed studies, a series of evidence statement summarising the evidence, a discussion of the evidence, and recommendations for practice along with recommendations for research with brief explanations of why the research questions are important. The appendices to the full guideline, which include more detailed evidence tables (in Appendix I), can be found here: http://www.nice.org.uk/guidance/ng9/evidence/appendices-aj-60851054.
Ralston SL, Lieberthal AS, Meissner HC, et al. 2014. **Clinical Practice Guideline: The Diagnosis, Management, and Prevention of Bronchiolitis**. Pediatrics:1 34:e1474–e1502 http://pediatrics.aappublications.org/content/early/2014/10/21/peds.2014-2742.abstract This guideline from the American Academy of Pediatrics is a revision of the 2006 guideline. It applies to children aged from one through 23 months of age. It is structured as a series of 'key action statements' under the headings: diagnosis, treatment and prevention. Each key action statement indicates level of evidence, benefit-harm relationship, and level of recommendation.
National Guideline Clearinghouse. 2007 Sep (revised 2014 Jun). **Guideline synthesis: Prevention, diagnosis and management of pediatric bronchiolitis**. Rockville (MD): Agency for Healthcare Research and Quality (AHRQ). http://www.guideline.gov/syntheses/synthesis.aspx?id=48172&search=bronchiolitis This webpage at the National Guideline Clearinghouse provides a guideline synthesis of the two guidelines below, including a direct comparison of the recommendations in the guidelines, noting areas of similarity and difference.
Working Group of the Clinical Practice Guideline on Acute Bronchiolitis, Fundació Sant Joan de Déu. 2010. **Clinical Practice Guideline on Acute Bronchiolitis**. Barcelona, Spain: Catalan Agency for Health Technology Assessment and Research (CAHTA). http://www.guiasalud.es/GPC/GPC_475_Bronchiolitis_AIAQS_compl_en.pdf This Spanish guideline addresses a total of 46 clinical questions (formulated using the PICO method) under the headings: diagnosis, additional examinations, treatment, monitoring, prevention, and progression. For each question there is a review of previously published clinical practice guidelines from around the world and relevant published studies. Recommendations are presented, graded A to D according to the quality of the evidence, or as good clinical practice if the recommendation is based only on the consensus of the working group. A summary of the guideline can be found on the National Guideline Clearinghouse website: http://www.guideline.gov/content.aspx?id=38414.
Bronchiolitis Guideline Team, Cincinnati Children's Hospital Medical Center. 2010. **Evidence-based care guideline for the management of bronchiolitis in infants 1 year or less with a first time episode**. Cincinnati (OH): Cincinnati Children's Hospital Medical Center. http://www.cincinnatichildrens.org/WorkArea/DownloadAsset.aspx?id=87885 These concise guidelines are intended primarily for use in children with bronchiolitis typical in presentation and clinical course. They are not intended for use in children with cystic fibrosis, a history of bronchopulmonary dysplasia, or immunodeficiencies, children admitted to intensive care, children requiring ventilator care, or children with other severe comorbid conditions complicating care. They cover prevention (in the community and in hospitals), emergency department and inpatient management, admission and discharge criteria, therapies not routinely recommended, and questions for further research. There are brief notes on relevant research and references for each recommendation, and an indication of evidence quality and strength of recommendation. There is an algorithm (flowchart) summarising medical management. A summary of the guideline can be found on the National Guideline Clearinghouse website: http://www.guideline.gov/content.aspx?id=34411.
Evidence-based medicine reviews
Jat Kana R, Mathew Joseph L. 2015. **Continuous positive airway pressure (CPAP) for acute bronchiolitis in children**. Cochrane Database of Systematic Reviews (1) http://onlinelibrary.wiley.com/doi/10.1002/14651858.CD010473.pub2/abstract

There is no specific treatment for bronchiolitis, only supportive therapy. Continuous positive airway pressure (CPAP) is supposed to be helpful in bronchiolitis through widening peripheral airways in the lung allowing the deflation of over-distended lungs and through preventing the collapse of poorly supported peripheral small airways during expiration. Observational studies have described benefits from CPAP. The authors of this review could find only two small RCTS (50 participants in total) evaluating the effect of CPAP in children aged < three years with bronchiolitis. They concluded that the effect of CPAP is uncertain due to the limited evidence and that larger adequately powered RCTs are needed.

Liu F, Ouyang J, Sharma Atul N, et al. 2015. **Leukotriene inhibitors for bronchiolitis in infants and young children**. Cochrane Database of Systematic Reviews (3) http://onlinelibrary.wiley.com/doi/10.1002/14651858.CD010636.pub2/abstract

Leucotriene inhibitors are thought to reduce airway inflammation and so they might be of benefit to patients with bronchiolitis (inflammation of the small airways). The authors of this review identified five RCTs (1,296 participants aged < two years) comparing monteleukast (a leukotriene inhibitor) with placebo. Two studies at low risk of bias assessed its impact on length of hospital stay and provided low quality evidence of a non-significant effect on length of stay: mean difference (MD) −0.95 days, 95% CI −3.08 to 1.19, P value = 0.38, and on clinical severity scores on day two and day three. Individual analysis of the data from the other three studies, which assessed the effects of several weeks of monteleukast in preventing post-bronchiolitis symptoms, did not find significant differences between the leukotriene inhibitors group and the control group in symptom-free days and incidence of recurrent wheezing. The review authors concluded that the quality of the evidence was low and did not allow definitive conclusions to be made regarding the effects of leukotriene inhibitors on length of hospital stay and clinical severity score in infants and young children with bronchiolitis. They stated that further research is needed and they noted one on-going study which may be helpful.

McNally JD, Sampson M, Matheson LA, et al. 2014. **Vitamin D receptor (VDR) polymorphisms and severe RSV bronchiolitis: A systematic review and meta-analysis**. Pediatric Pulmonology, 49(8), 790-99.

A small number of studies have suggested a relationship between vitamin D status and severe acute lower respiratory infection, including bronchiolitis. This study aimed to evaluate the relationship between vitamin D receptor (VDR) polymorphism and severe RSV-bronchiolitis through a systemic literature review and meta-analysis. The authors identified three case-control studies meeting their criteria. Two VDR polymorphisms were included in more than one study: TaqI (rs731236) and FokI (rs2228570). All three studies reported a positive relationship between the FokI minor allele and disease with random effects meta-analyses indicating a statistically significant relationship (OR 1.52, 95% CI 1.12 to 2.05). Genotype analysis was highly suggestive of a dominant or incomplete dominance model with combined odds ratios for fF (OR 1.73, 95% CI: 0.92 to 3.36) and ff (OR 2.24, 95% CI: 0.98 to 5.14) compared to the FF genotype. No association between TaqI and severe RSV-bronchiolitis was evident at the allele or genotype level. The authors concluded that the available literature supports an association between the FokI polymorphism and severe RSV disease. They stated that determination of VDR receptor polymorphism status could help predict high risk infants who might benefit from preventive measures (such as administration of monthly RSV antibody, which is well known to reduce hospital admissions in high-risk subpopulations, including infants born extremely prematurely or with congenital heart disease, although it is very expensive).

Farley R, Spurling Geoffrey KP, Eriksson L, et al. 2014. **Antibiotics for bronchiolitis in children under two years of age**. Cochrane Database of Systematic Reviews (10) http://onlinelibrary.wiley.com/doi/10.1002/14651858.CD005189.pub4/abstract

Bronchiolitis is most commonly caused by respiratory syncytial virus (RSV) but babies with the condition are often prescribed antibiotics, because doctors may be concerned about secondary bacterial infection or be expecting benefits from anti-inflammatory effects attributed to some antibiotics. This updated review sought to evaluate the effectiveness of antibiotics for bronchiolitis in children < two years of age compared to placebo or other interventions. It included seven placebo RCTs with a total of 824 participants. Due to heterogeneity between the studies, pooling of results for meta-analysis was only possible for the outcomes length of supplemental oxygen use, length of hospital admission, and death. Two studies (281 participants) had been published since the previous review, both comparing azithromycin with placebo. Data from three studies with adequate data on days of supplementary oxygen indicated no difference between antibiotics and placebo: pooled mean difference (MD) −0.20 days; 95% CI −0.72 to 0.33. Similarly, data from three studies indicated no difference in length of hospital stay between antibiotics (azithromycin) and placebo: pooled MD −0.58 days; 95% CI −1.18 to 0.02). Two studies randomised children to intravenous ampicillin, oral erythromycin and control and found no difference for most symptom measures. None of the seven studies reported any deaths and no other adverse effects were reported. The review authors concluded that there was not sufficient evidence to support the use of antibiotics for bronchiolitis, but that further research may be justified to identify a subgroup of patients who may benefit from antibiotics, to determine why clinicians prescribe antibiotics, and to determine how to decrease their anxiety about not doing so.

Gadomski Anne M, Scribani Melissa B. 2014. **Bronchodilators for bronchiolitis**. Cochrane Database of Systematic Reviews (6) http://onlinelibrary.wiley.com/doi/10.1002/14651858.CD001266.pub4/abstract

This review aimed to assess the effect of bronchodilators on clinical outcomes in infants aged 0–12 months with acute bronchiolitis. The review authors identified 30 RCTs comparing bronchodilators (other than epinephrine) with placebo, representing 1,192 infants. In 11 inpatient and 10 outpatient studies, bronchodilators did not improve oxygen saturation (mean difference (MD) −0.43, 95% CI −0.92 to 0.06, n = 1242). (Oxygen saturation is measured as %, normal saturation is in the range 95–100%) Outpatient bronchodilator treatment did not reduce the rate of hospitalization (11.9% in bronchodilator group versus 15.9% in placebo group, odds ratio (OR) 0.75, 95% CI 0.46 to 1.21, n = 710). Inpatient bronchodilator treatment did not reduce the duration of hospitalization (MD 0.06, 95% CI −0.27 to 0.39, n = 349). Adverse effects of bronchodilators included tachycardia, oxygen desaturation and tremors. The review authors concluded that bronchodilators such as albuterol or salbutamol do not improve oxygen saturation, do not reduce hospital admission after outpatient treatment, do not shorten the duration of hospitalization and do not reduce the time to resolution of illness at home. They stated that, given the adverse side effects and the expense of these treatments, bronchodilators are not useful in the routine management of

bronchiolitis. They also stated that their ability to draw conclusions was limited by the small sample sizes and the lack of standardized study design and validated outcomes across the studies, and that further trials with large sample sizes, standardized methodology across clinical sites and consistent assessment methods are needed to answer completely the question of efficacy.

Beggs S, Wong Zee H, Kaul S, et al. 2014. **High-flow nasal cannula therapy for infants with bronchiolitis**. Cochrane Database of Systematic Reviews (1) http://onlinelibrary.wiley.com/doi/10.1002/14651858.CD009609.pub2/abstract

Conventional treatment for bronchiolitis consists of supportive therapy with fluids, supplemental oxygen and respiratory support. The usual way oxygen is delivered is as a dry gas at 100% concentration via low-flow nasal prongs. An alternative is the use of heated, humidified, high-flow nasal cannula (HFNC) therapy which enables delivery of higher inspired gas flows of an air/oxygen blend, up to 12 L/min in infants and 30 L/min in children. This provides a degree of continuous positive airway pressure in a minimally invasive manner, and may reduce the need for invasive respiratory support with its added costs and associated adverse effects. This review aimed to effects of HFNC therapy compared with conventional respiratory support in the treatment of infants with bronchiolitis. Because only one small pilot RCT was identified the review authors concluded that there was insufficient evidence to determine the effectiveness of HFNC in this situation. The trial had 19 participants and compared HFNC with conventional treatment in infants aged < 24 months with a clinical diagnosis of bronchiolitis.

Ralston S, Comick A, Nichols E, et al. 2014. **Effectiveness of Quality Improvement in Hospitalization for Bronchiolitis: A Systematic Review**. Pediatrics 134(3) 571-81

This review looked at 14 studies (involving > 12,000 children) describing any active quality improvement (QI) intervention vs. usual care in hospitalised children < two years of age with acute viral bronchiolitis. Studies were deemed eligible for inclusion if their design was one of the following: cluster RCT, before-and-after study, cohort study, or QI report. The review authors extracted data from the studies and pooled it using a random effects model. Quality improvement interventions resulted in 16 fewer patients exposed to repeated doses of bronchodilators per 100 hospitalized (7 studies) (risk difference: 0.16, 95% CI 0.11 to 0.21) and resulted in 5.3 fewer doses of bronchodilator given per patient (95% CI 2.1 to 8.4). Interventions resulted in fewer hospitalized children exposed to steroids (5 per 100), chest radiography (9 per 100), and antibiotics (4 per 100). There were no significant harms reported. Benchmarks derived from the reported data were: repeated bronchodilator use, 16%; steroid use, 1%; chest radiography use, 42%; and antibiotic use, 17%. The studies' heterogeneity limited the reviewers' ability to classify specific characteristics of effective QI interventions. The reviewers concluded that the use of QI interventions results in lower rates of unnecessary care in children hospitalised with viral bronchiolitis.

Chen Y-J, Lee W-L, Wang C-M, et al. 2014. **Nebulized Hypertonic Saline Treatment Reduces Both Rate and Duration of Hospitalization for Acute Bronchiolitis in Infants: An Updated Meta-analysis**. Pediatrics & Neonatology, 55(6), 431-38. http://www.sciencedirect.com/science/article/pii/S1875957213002295

This systematic review included 11 studies, 10 of which were included in the Cochrane review below. There are minor numerical differences between the results of this review and the Cochrane review but the conclusions are similar except that this review, unlike the Cochrane review, found that nebulised hypertonic saline did significantly decrease the rate of hospitalisation: risk ratio 0.59, 95% CI 0.37 to 0.93, p = 0.02.

Zhang L, Mendoza-Sassi Raúl A, Wainwright C, et al. 2013. **Nebulised hypertonic saline solution for acute bronchiolitis in infants**. Cochrane Database of Systematic Reviews (7) http://onlinelibrary.wiley.com/doi/10.1002/14651858.CD006458.pub3/abstract

Nebulised hypertonic saline given to babies with bronchiolitis may reduce airway oedema and mucus plugging. This review aimed to assess the effects of nebulised hypertonic (≥ 3%) saline solution in infants up to 24 months of age with acute viral bronchiolitis, as indicated by RCTs or quasi-RCTs which used nebulised hypertonic saline alone or in conjunction with bronchodilators as an active intervention and nebulised 0.9% saline as a comparator. Eleven trials were included. These involved 1,090 infants with mild to moderate bronchiolitis, around half of whom were inpatients and half outpatients or emergency department patients. Patients treated with nebulised 3% saline had a significantly shorter mean length of hospital stay compared to those treated with nebulised 0.9% saline: mean difference (MD) −1.15 days, 95% CI −1.49 to −0.82, P < 0.00001). The hypertonic saline group also had a significantly lower post-inhalation clinical score than the 0.9% saline group in the first three days of treatment (day 1: MD −0.88, 95% CI −1.36 to −0.39, P = 0.0004; day 2: MD −1.32, 95% CI −2.00 to −0.64, P = 0.001; day 3: MD −1.51, 95% CI −1.88 to −1.14, P < 0.00001). The effects of improving clinical score were seen in both outpatients and inpatients. Four emergency department-based trials did not show any significant short-term effects (30 to 120 minutes) of up to three doses of nebulised 3% saline in improving clinical score and oxygen saturation. No trials reported significant adverse events related to hypertonic saline inhalation. The review authors concluded that nebulised hypertonic saline may significantly reduce the length of hospital stay among infants hospitalised with non-severe acute viral bronchiolitis and improve the clinical severity score in both outpatient and inpatient populations.

Fernandes Ricardo M, Bialy Liza M, Vandermeer B, et al. 2013. **Glucocorticoids for acute viral bronchiolitis in infants and young children**. Cochrane Database of Systematic Reviews (6) http://onlinelibrary.wiley.com/doi/10.1002/14651858.CD004878.pub4/abstract

Glucocorticoids (such as prednisolone or dexamethasone) have been used to treat bronchiolitis, based on the apparent similarities between bronchiolitis and asthma. Previous systematic reviews have not shown glucocorticoids to be clearly beneficial in acute viral bronchiolitis but recent large trials have added to the evidence base and suggested novel treatment approaches that` include glucocorticoids. Trials were eligible for inclusion in this review if they were RCTs comparing short-term systemic or inhaled glucocorticoids vs. placebo or another intervention in children < 24 months with acute bronchiolitis (first episode with wheezing). The review authors identified 17 eligible trials with a total of 2,596 participants. Three trials had low overall risk of bias. Compared to placebo, glucocorticoids did not significantly reduce outpatient admissions by days 1 and 7: pooled risk ratios (RRs) 0.92, 95% CI 0.78 to 1.08 and 0.86, 95% CI 0.7 to 1.06, respectively. They did

not reduce length of stay for inpatients (mean difference −0.18 days; 95% CI −0.39 to 0.04). Unadjusted results from a large factorial low risk of bias RCT found combined high-dose systemic dexamethasone and inhaled epinephrine reduced admissions by Day 7 (baseline risk of admission 26%; RR 0.65; 95% CI 0.44 to 0.95; number needed to treat 11; 95% CI 7 to 76), with no differences in short-term adverse effects. No other comparisons showed relevant differences in primary outcomes. The review authors concluded that current evidence does not support a clinically relevant effect of systemic or inhaled glucocorticoids on admissions or length of hospitalisation, but combined dexamethasone and epinephrine may reduce outpatient admissions (although results are exploratory and safety data limited). They stated that future research should further assess the efficacy, harms and applicability of combined therapy.

Anderson-James S, Marchant Julie M, Acworth Jason P, et al. 2013. **Inhaled corticosteroids for subacute cough in children**. Cochrane Database of Systematic Reviews (2)
http://onlinelibrary.wiley.com/doi/10.1002/14651858.CD008888.pub2/abstract

The aim of this review was to evaluate the efficacy of inhaled corticosteroids (ICS) in reducing the severity of cough in children with subacute cough. The only two relevant RCTs identified by the authors were conducted in infants with post acute bronchiolitis illness. Meta-analysis of data on 98 children indicated no significant difference between groups in the proportion of children 'not cured' at follow-up (primary outcome measure), with a pooled odds ratio of 0.61 (95% CI 0.24 to 1.55). The review authors concluded that there is currently no evidence to support the use of ICS for treatment of subacute cough in children. They noted that their ability to draw conclusions was limited by the small number of studies available for analysis and the size, quality and design of these studies. They stated that additional well-designed RCTs are needed.

Roqué i Figuls M, Giné-Garriga M, Granados Rugeles C, et al. 2012**. Chest physiotherapy for acute bronchiolitis in paediatric patients between 0 and 24 months old**. Cochrane Database of Systematic Reviews (2)
http://onlinelibrary.wiley.com/doi/10.1002/14651858.CD004873.pub4/abstract

This updated review's main aim was to determine the efficacy of chest physiotherapy in infants aged less than 24 months with acute bronchiolitis. A secondary aim was to determine the efficacy of different techniques of chest physiotherapy (for example, vibration and percussion and passive forced exhalation). The review included nine RCTs (891 participants), all comparing physiotherapy with no intervention. Five trials (246 participants) evaluated vibration and percussion techniques and four trials (645 participants) evaluated passive expiratory techniques. The review authors found no significant differences between intervention and control groups in the severity of disease (eight trials, 867 participants). Results were negative for both types of physiotherapy. They found no differences between groups in respiratory parameters (two trials, 118 participants), oxygen requirements (one trial, 50 participants), length of stay (five trials, 222 participants) or severe side effects (two trials, 595 participants). One trial (496 participants) showed differences in mild transient adverse effects (vomiting and respiratory instability). The review authors concluded that chest physiotherapy doesn't improve the severity of disease, respiratory parameters, or reduce length of hospital stay or oxygen requirements in hospitalised infants with acute bronchiolitis who are not on mechanical ventilation. Different chest physiotherapy modalities (vibration and percussion or passive expiratory techniques) have shown equally negative results.

Enriquez A, Chu IW, Mellis C, et al. 2012. **Nebulised deoxyribonuclease for viral bronchiolitis in children younger than 24 months**. Cochrane Database of Systematic Reviews (11)
http://onlinelibrary.wiley.com/doi/10.1002/14651858.CD008395.pub2/abstract

The sputum of infants with bronchiolitis has increased deoxyribonucleic acid (DNA) content, leading to mucous plugging and airway obstruction. This review aimed to evaluate the efficacy of nebulised recombinant human deoxyribonuclease (rhDNase), an enzyme that digests extracellular DNA, on the severity and duration of viral bronchiolitis in children aged < 24 months in the hospital setting. The review authors identified three RCTs (333 participants), all of which used 2.5 mL (1 mg/mL) of nebulised rhDNase compared with placebo either as a daily or a twice daily dose. Adjunctive therapy included nebulised salbutamol, steroids, supplemental oxygen, intravenous fluids or tube feeding, nasal washing, nasal decongestants and antibiotics. Two trials were multicentre trials in which all the participants had tested positive for respiratory syncytial virus. The other trial enrolled participants clinically diagnosed with bronchiolitis from a hospital in Italy. Overall, this review found no benefit from nebulised rhDNase in regard to clinically meaningful outcomes. Meta-analysis indicated that patients in the control group had a shorter duration of hospital stay (MD 0.50 days; 95% CI 0.10 to 0.90, P = 0.01) and better clinical score improvement (SMD −0.24; 95% CI -0.50 to 0.01, P = 0.06). The largest trial showed no difference in supplemental oxygen use or intensive care unit (ICU) admission. In one RCT, four out of 11 patients had atelectasis, a severe complication of bronchiolitis wherein the lung does not expand completely. Two of the four patients improved significantly after nebulised rhDNase. Trials found no differences between intervention and control groups in adverse events. In total 11 patients from both treatment groups suffered adverse effects, including temporary oxygen desaturation, temporary coughing, increased coughing, facial rash, hoarseness, dyspnoea and bad taste. The review authors concluded that the evidence did not support the use of nebulised rhDNase in children < 24 months of age hospitalised with acute bronchiolitis. They stated that it might have a role in severe bronchiolitis complicated by atelectasis but further clinical studies would need to be performed to confirm or refute this.

McCallum Gabrielle B, Morris Peter S, Chang Anne B. 2012. **Antibiotics for persistent cough or wheeze following acute bronchiolitis in children**. Cochrane Database of Systematic Reviews (12).
http://onlinelibrary.wiley.com/doi/10.1002/14651858.CD009834.pub2/abstract

Acute bronchiolitis is usually a self-limiting condition. Some children may have persistent symptoms such as cough and wheezing and present or re-present to secondary care. This review aimed to determine the effectiveness of antibiotics compared to a control (no treatment or placebo) for persistent respiratory symptoms (within six months) following acute bronchiolitis. Only one small study, with a high attrition rate, met the review's inclusion criteria. Thirty infants with respiratory syncytial virus-confirmed bronchiolitis were randomised to receive either a daily dose of oral clarithromycin 15 mg/kg or placebo for three weeks. Using an intention-to-treat analysis, there was no significant difference between groups for the proportion of children who had persistent symptoms (odds ratio (OR) 0.20; 95% CI 0.02 to 2.02) or re-

hospitalisation within six months (OR 0.11; 95% CI 0.01 to 1.29). There were no treatment studies of later commencement of antibiotics. The review authors concluded that there was insufficient evidence to indicate whether antibiotics should be used to treat or prevent persistent respiratory symptoms in the post-acute bronchiolitis phase. They stated that further RCTs are needed, particularly in areas where both acute and post-bronchiolitis morbidity is high such as in Indigenous communities in the US, New Zealand and Australia.

Jat Kana R, Chawla D. 2012. **Surfactant therapy for bronchiolitis in critically ill infants**. Cochrane Database of Systematic Reviews (9). http://onlinelibrary.wiley.com/doi/10.1002/14651858.CD009194.pub2/abstract

Bronchiolitis is one of the most common causes of respiratory failure in infants and some infants require intensive care and mechanical ventilation. There is no evidence for any effective treatment for bronchiolitis beyond supportive care. Abnormalities of surfactant quantity or quality (or both) have been observed in severe cases of bronchiolitis. Exogenous surfactant administration appears to improve the haemodynamics of the lungs and could be a potentially promising therapy for severe bronchiolitis. This review aimed to evaluate the efficacy of exogenous surfactant, compared to placebo, no intervention or standard care in reducing mortality and the duration of ventilation in infants and children with bronchiolitis requiring mechanical ventilation. Three small RCTs, with 79 participants, were included. Two trials had no placebo in the control arms and the third trial used air placebo. Two studies reported no mortality and the third did not mention it. The reviewers judged some of the included studies to have an unclear risk of bias but stated that none had a high risk of bias. Pooled analysis of data from the three trials indicated that duration of mechanical ventilation was not different between the groups (mean difference (MD) −63.04 hours, 95% CI −130.43 to 4.35 hours) but duration of intensive care unit (ICU) stay was less in the surfactant group than in the control group: MD −3.31 days, 95% CI −6.38 to −0.25 days). After excluding one trial which produced significant heterogeneity, the duration of mechanical ventilation and duration of ICU stay were found to be significantly lower in the surfactant group compared to the control group: MD −28.99 (95% CI −40.10 to −17.87 hours) and MD −1.81 (95% CI −2.42 to −1.19 days), respectively. Use of surfactant had favourable effects on oxygenation and CO_2 elimination. No adverse effects and no complications were seen in any of the three included studies. The review authors concluded that the available evidence was not sufficient to establish the effectiveness of surfactant therapy for critically ill infants with bronchiolitis who require mechanical ventilation.

Umoren R, Odey F, Meremikwu Martin M. 2011. **Steam inhalation or humidified oxygen for acute bronchiolitis in children up to three years of age**. Cochrane Database of Systematic Reviews (1) http://onlinelibrary.wiley.com/doi/10.1002/14651858.CD006435.pub2/abstract

Steam inhalation (or cool mist therapy) is commonly used to treat acute bronchiolitis in resource-constrained settings. This review aimed to evaluate the effect of steam inhalation or humidified oxygen in relieving respiratory distress, and any adverse effects it might have, in children up to three years old with acute bronchiolitis. Only one RCT eligible for inclusion was identified (156 children aged between seven weeks and 24 months with signs and symptoms of bronchiolitis). Participants were randomised into three groups: nebulised salbutamol, nebulised saline and mist in a tent. The results indicated a significant decrease in respiratory distress symptom (RDS) score in the nebulised salbutamol group but no significant decrease in RDS score in the mist in a tent group or in the nebulised saline group. The study did not report on adverse effects of the interventions. The review authors stated that, as only one RCT was analysed, it would be misleading to conclude that mist therapy is ineffective in children with bronchiolitis. They concluded that there is insufficient evidence to inform practice regarding using steam inhalation or mist therapy for acute bronchiolitis in children up to three years old.

Hartling L, Bialy Liza M, Vandermeer B, et al. 2011. **Epinephrine for bronchiolitis**. Cochrane Database of Systematic Reviews (6) http://onlinelibrary.wiley.com/doi/10.1002/14651858.CD003123.pub3/abstract

This review aimed to examine the efficacy of epinephrine (a bronchodilator that is often used to treat asthma) in the treatment of children aged < two years with acute viral bronchiolitis. It included 19 RCTs with a total of 2,256 participants. Epinephrine vs. placebo in outpatients showed a significant reduction in admissions at Day 1 (risk ratio (RR) 0.67; 95% CI 0.50 to 0.89) but not at Day 7 post-emergency department visit. There was no difference in length of stay (LOS) for inpatients. Epinephrine vs. salbutamol showed no differences in outpatients for admissions at Day 1 or Day 7. Inpatients receiving epinephrine had a significantly shorter LOS compared to salbutamol: mean difference −0.28 days, 95% CI −0.46 to −0.09). One large RCT showed a significantly shorter admission rate at Day 7 for epinephrine and steroid combined vs. placebo: RR 0.65, 95% CI 0.44 to 0.95). There were no important differences in adverse events. The review authors concluded that epinephrine is superior to placebo for short-term outcomes for outpatients, particularly in the first 24 hours of care. They stated that exploratory evidence from a single study suggests benefits of epinephrine and steroid combined for later time points, but that further research is required to confirm this finding. They found no evidence of effectiveness for repeated doses or prolonged use of epinephrine with or without dexamethasone in inpatients.

Harris KC, Anis AH, Crosby MC, et al. 2011. **Economic evaluation of palivizumab in children with congenital heart disease: a Canadian perspective**. Can J Cardiol, 27(4), 523.e11-5

In children with congenital heart disease (CHD), bronchiolitis due to respiratory syncytial virus (RSV) is associated with significant morbidity and mortality. Palivizumab is a monoclonal antibody that reduces the number of RSV-associated hospitalizations in children with CHD. This study aimed to assess cost savings and cost-effectiveness of palivizumab in children < two years old with hemodynamically significant CHD in a provincially administered RSV prophylaxis program. The study involved comparing a cohort of children who received palivizumab (N = 292) from 2003-2007 to a historical cohort of children (N = 412) from 1998-2003 who met the eligibility criteria for palivizumab prior to initiation of the prophylaxis program. Direct and indirect costs and benefits were determined. It was found that the direct and indirect costs in the historical cohort were $838 per patient season compared to $9130 per patient season in the palivizumab cohort. Risk of admission was reduced by 42%, and days in hospital were reduced by 83%. The incremental cost of the RSV prophylaxis program was $8292 per patient for one RSV season. The incremental cost to prevent one day of hospitalization was $15,514. The cost of palivizumab accounted for 87.9% of the cost of prophylaxis. The study authors concluded that palivizumab is clinically effective but that the cost was exceptionally high relative to the outcomes in this population. They stated that, given the financial constraints in a public health care setting, more strict criteria for patient selection or reduced drug costs would improve the cost-effectiveness of RSV prophylaxis.

Wang D, Bayliss S, Meads C. 2011. **Palivizumab for immunoprophylaxis of respiratory syncitial virus (RSV) bronchiolitis in high-risk infants and young children: a systematic review and additional economic modelling of subgroup analyses**. Health Technology Assessment (Winchester, England), 15(5).
http://www.journalslibrary.nihr.ac.uk/hta/volume-15/issue-5

This report is based on an analysis of thirteen studies, most of which were small and inadequately powered for the outcomes of interest. The aim was to use evidence from a systematic review of prognostic and hospitalisation studies to estimate the cost-effectiveness of palivizumab for RSV prophylaxis in different groups of children at high risk from RSV infection including children with and without chronic lung disease (CLD) or congenital heart disease (CHD). The authors concluded that, at a willingness-to-pay threshold of £30,000 per quality-adjusted life year, prophylaxis with palivizumab may be cost-effective for some sub groups. According to this criterion children without either CLD or CHD would need at least two additional risk factors apart from gestational age and birth age to justify prophylaxis but children with CHD or CLD would not necessarily need any apart from gestational age and birth age.

Other relevant publications

Oakley E, Borland M, Neutze J, et al. 2013. **Nasogastric hydration versus intravenous hydration for infants with bronchiolitis: a randomised trial**. The Lancet Respiratory Medicine, 1(2), 113-20

Hydration is one of the mainstays of treatment for bronchiolitis. This study aimed to determine whether intravenous hydration or nasogastric hydration is better for infants hospitalised with bronchiolitis. It was a multi-centre open RCT which enrolled infants aged 2–12 months admitted to hospitals in Australia and New Zealand with a clinical diagnosis of bronchiolitis. The mean length of stay for 381 infants assigned nasogastric hydration was 86·6 hours (SD 58·9) compared with 82·2 hours (SD 58·8) for 378 infants assigned intravenous hydration (absolute difference 4·5 hours, 95% CI −3·9 to 12·9, p=0·30). Rates of admission to intensive-care units, need for ventilatory support, and adverse events did not differ between groups. At randomisation, seven infants assigned nasogastric hydration were switched to intravenous hydration and 56 infants assigned intravenous hydration were switched to nasogastric hydration because the study-assigned method was unable to be inserted. For those infants who had data available for successful insertion, 275 (85%) of 323 infants in the nasogastric hydration group and 165 (56%) of 294 infants in the intravenous hydration group required only one attempt for successful insertion. The study authors concluded that both intravenous hydration and nasogastric hydration are appropriate means to hydrate infants with bronchiolitis. They noted that nasogastric insertion might require fewer attempts and have a higher success rate of insertion than intravenous hydration.

Trenholme AA, Byrnes CA, McBride C, et al. 2013. **Respiratory health outcomes 1 year after admission with severe lower respiratory tract infection**. Pediatric Pulmonology, 48(8), 772-9

Severe lower respiratory infection (LRI), such as severe bronchiolitis or pneumonia, is considered to be one precursor of protracted bronchitis, chronic moist cough (CMC), and chronic suppurative lung disease. The aim of this study was to determine and to describe the presence of respiratory morbidity in young children one year after being hospitalized with a severe LRI at Kidz First Children's Hospital in Counties Manukau. The children selected for inclusion in this study (n = 237) were chosen from 394 children aged < two years admitted from August 1, 2007 to December 23, 2007 and already enrolled in a prospective epidemiological study. They were included in this second study only if they had a diagnosis of severe bronchiolitis or of pneumonia with no comorbidities. Funding permitted 164 to be identified chronologically, of whom 131 were able to be contacted, and 94 agreed to be assessed by a paediatrician one year after their index admission. For each child, demographic information, medical history and responses to a respiratory questionnaire were recorded, and examination, pulse oximetry, and chest X-ray (CXR) were performed. The predetermined primary endpoints were; (i) history of CMC for at least 3 months, (ii) the presence of moist cough and/or crackles on examination in clinic, and (iii) an abnormal CXR when seen at a time of stability. Each CXR was read by two paediatric radiologists blind to the individuals' current health. Results indicated that 30% had a history of CMC, 32% had a moist cough and/or crackles on examination in clinic, and in 62% of those with a CXR it was abnormal. Of the 81 children with a readable follow-up X-ray, 11% had all three abnormal outcomes, and 74% had one or more abnormal outcomes. Three children had developed bronchiectasis on high resolution CT. (CT was not part of the study, but some children were noted to have had CT for clinical indications at some time during the year.) In summary, the majority of children with a hospital admission at < two years of age for severe bronchiolitis or pneumonia continued to have respiratory morbidity one year later when seen at a time of stability, and a small number had already sustained significant lung disease.

Trenholme A, Vogel A, Lennon D, et al. 2012. **Household characteristics of children under 2 years admitted with lower respiratory tract infection in Counties Manukau, South Auckland**. NZMJ, 125(1367)15-23.

The aim of this study was to describe the household characteristics of admissions for lower respiratory tract infection (LRI) in children aged < two years in Counties Manukau. The study involved prospective recruitment of all children aged < two years admitted with a primary diagnosis of LRI from August to December 2007 using a caregiver questionnaire. There were 580 admissions involving 465 children, 394 of whom had completed questionnaires (85% response rate). Sixty-four percent of admissions had a diagnosis of bronchiolitis and 26% of pneumonia. Relative risk of admission was 4.4 (95% CI 3.2 to 6.2) for Māori and 5.8 (95% CI 4.4–7.9) for Pacific peoples compared with European/others and 3.1 (95% CI 2.4–3.9) for the most deprived quintile compared with other quintiles. Longer total stay was more likely in children who were of younger age, premature, or of Māori or Pacific ethnicity. Household characteristics showed that 25% lived with seven or more other people, 33% lived with four or more children, 65% of children were exposed to cigarette smoke and 27% used no form of heating. The conclusions of this study were that among young children admitted to hospital with LRI there is a high rate of exposure to known avoidable risk factors such as smoking, lack of heating and large households in overcrowded conditions.

PNEUMONIA

Introduction

Pneumonia is inflammation of the lungs, usually as the result of a bacterial or viral infection. It often follows an upper respiratory infection. Children with community-acquired pneumonia may present with fever, tachypnoea (rapid breathing), breathlessness or difficulty breathing, cough, wheeze or chest pain. They may also have abdominal pain and/or vomiting and headache.[54] Severely affected children with pneumonia are admitted to hospital but less severely affected children can be safely managed at home. While a significant proportion of cases of pneumonia in children are due to viruses, in clinical practice there is no reliable way of distinguishing viral from bacterial pneumonia, and mixed infections are common, so guidelines recommend that all children with clinical signs of pneumonia should be given antibiotics.[54,55] Microbiological investigations are normally done only in patients with more severe disease and/or complications (such as lung abscess).

Streptococcus pneumoniae (S. pneumoniae) is the most common bacterial cause of pneumonia in children[54] and the organism is also a common cause of otitis media, bacterial meningitis and bacteraemia.[56] New Zealand introduced a pneumococcal conjugate vaccine (Prevenar, PCV7) in to the childhood immunisation schedule in June 2008.[57] The current schedule includes a 13-valent vaccine, Prevenar 13 (PCV13).[58] Invasive pneumococcal disease (IPV), where *S. pneumoniae* has been isolated from a usually sterile site (blood, pleural fluid or cerebrospinal fluid), has been a notifiable disease in New Zealand since October 2008.[57] There has been a dramatic fall in the rate of IPD in infants aged less than two years since the introduction of PCV7 from 104.8 per 100,000 in 2006 to 20.0 per 100,000 in 2013 and there has also been a significant reduction in the two to four years age group over the same period, from 18.3 to 8.5 per 100,000.[57]

While hospitalisations for pneumonia in young children in New Zealand have decreased since the introduction of PCV7, there are significant ethnic and socio-economic disparities.[59] Research done in Counties Manukau found that Māori and Pacific children were 4–5 times more likely to be admitted to hospital with lower respiratory infections (LRIs), including pneumonia, than European children and that children living in the most socioeconomically deprived deciles (deciles 9 and 10) were 1.4 times more likely to be admitted than children from other deciles.[59] Household characteristics of Counties Manukau children aged less than two years admitted to hospital with LRIs in 2007 indicated that 25% lived with seven or more other people, 33% lived with four or more children, 65% of children were exposed to cigarette smoke and 27% were in households that used no form of heating.[60]

Data sources and methods

Indicators

Deaths from pneumonia in 0–24 year olds
Hospitalisations for pneumonia in 0–24 year olds

Data sources

Numerator:
Deaths: National Mortality Collection
Hospitalisations: National Minimum Dataset
Denominator: Statistics NZ Estimated Resident Population (with linear extrapolation being used to calculate denominators between Census years).

Definition

Deaths: Deaths in 0–24 year olds where the main underlying cause of death was pneumonia (deaths per 100,000 population)
Hospitalisations: Acute and arranged hospitalisations for 0–24 year olds with a primary diagnosis of pneumonia (hospitalisations per 1,000 population). Refer to **Appendix 6** for the codes included.

Notes on interpretation

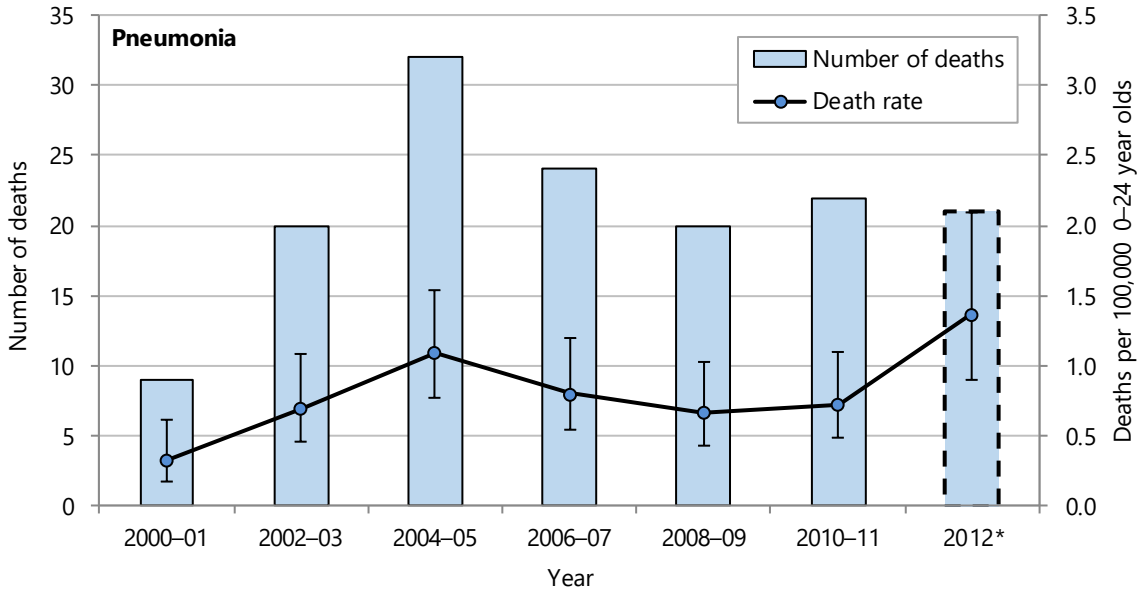
Note 1: An acute hospitalisation is an unplanned hospitalisation occurring on the day of presentation, while an arranged hospitalisation (referred to elsewhere in this report as a semi-acute hospitalisation) is a non-acute hospitalisation with an admission date less than seven days after the date the decision was made that the hospitalisation was necessary. A waiting list hospitalisation is a planned hospitalisation, where the admission date is seven or more days after the date the decision was made that the hospitalisation was necessary.
Note 2: **Appendix 3** outlines the limitations of the hospitalisation data used. The reader is advised to review this appendix before interpreting any trends based on hospitalisation data.

National trends and distribution

From 2000 to 2012 there were 148 deaths of 0–24 year olds with pneumonia as the underlying cause; there was year-to year variation and an overall *significant rise* in death rate **(Figure 81)**. The age-specific pneumonia death rate was highest in the first year of life (38 deaths per 100,000 infants aged under 1 year) and fell rapidly with increasing age to 0–2 deaths per 100,000 for each year of age from age three. District health boards in the Northern region and Waikato DHB had the highest pneumonia death rates per 100,000 0–24 year olds. Other DHBs had fewer than five pneumonia deaths over the five-year period.

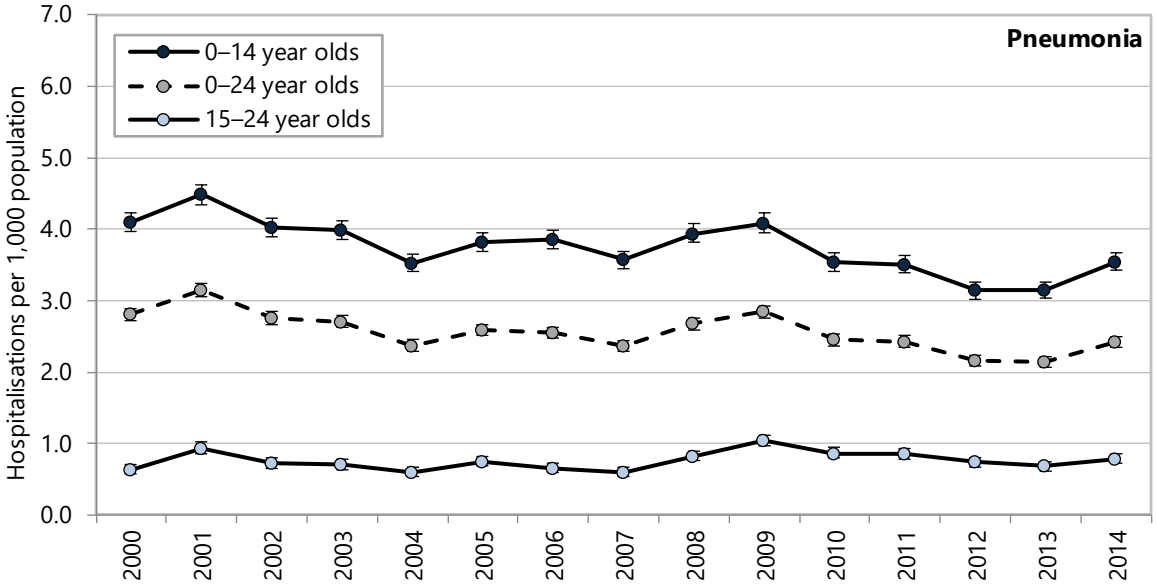
From 2000 to 2014 the pneumonia hospitalisation rate *fell significantly* from 2.81 to 2.42 hospitalisations per 1,000 0–24 year olds with some year-to-year fluctuations. The fall in rates was specific to 0–14 year olds; there was a *small but significant rise* in pneumonia hospitalisation rate for 15–24 year olds. Hospitalisation rates for 0–14 year olds were consistently much higher than rates for the older age group **(Figure 82)**.

Figure 81. Deaths due to pneumonia in 0–24 year olds, New Zealand, 2000–2012



Numerator: National Mortality Collection; Denominator: Statistics NZ Estimated Resident Population; Numbers of deaths are per two year period, with the exception of 2012; 2012* is a single year

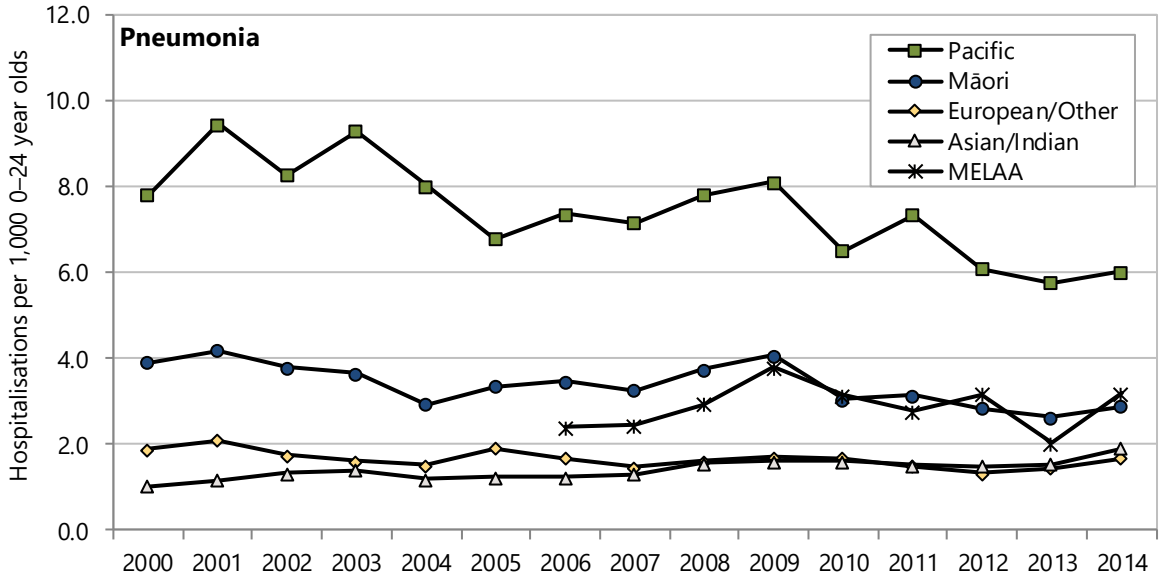
Figure 82. Hospitalisations for pneumonia in 0–24 year olds, by age group, New Zealand 2000–2014



Numerator: National Minimum Dataset (acute and arranged admissions); Denominator: Statistics NZ Estimated Resident Population

The fall in pneumonia hospitalisation rates from 2000 to 2014 was more marked for Māori and Pacific ethnic groups than for European/Other.For MELAA and Asian/Indian the rates rose slightly. Hospitalisation rates were consistently highest for Pacific, followed by Māori and MELAA with the lowest rates for Asian/Indian and European/Other **(Figure 83)**.

Figure 83. Hospitalisations due to pneumonia in 0–24 year olds, by ethnicity, New Zealand 2000–2014



Numerator: National Minimum Dataset (acute and arranged admissions); Denominator: Statistics NZ Estimated Resident Population; Rate is per 1,000 0–24 year olds

Distribution by primary diagnosis

Between 2010 and 2014 79.4% of hospitalisations had a primary diagnosis that was unspecified. The remaining pneumonia hospitalisations were attributed to specific and non-specific viruses or bacteria **(Table 77)**.

Table 77. Hospitalisations for pneumonia in 0–24 year olds, by primary diagnosis, New Zealand 2010–2014

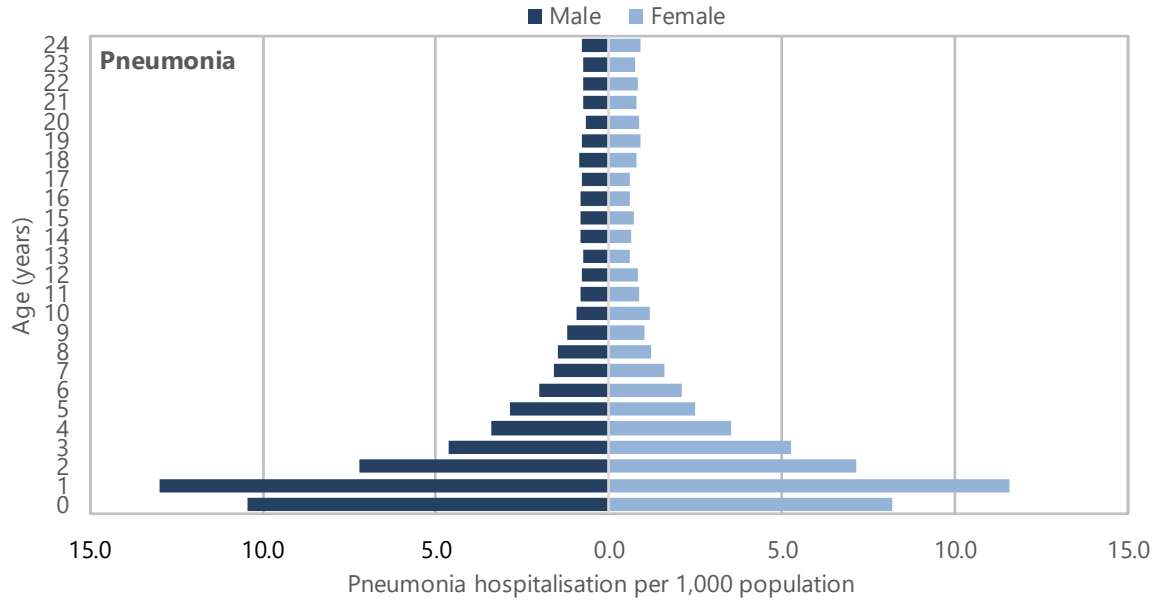
Primary diagnosis	Number: 2010–2014	Number: annual average	Rate per 1,000 0–24 year olds	95% CI	Per cent
Pneumonia in 0–24 year olds					
New Zealand					
Viral pneumonia, not elsewhere classified	2,236	447	0.29	0.28–0.30	12.6
Bacterial pneumonia, not elsewhere classified	801	160	0.10	0.10–0.11	4.5
Pneumonia due to *Streptococcus pneumoniae*	272	54	0.04	0.03–0.04	1.5
Influenza with pneumonia: other influenza virus	192	38	0.03	0.02–0.03	1.1
Pneumonia due to *Haemophilus influenzae*	110	22	0.01	0.01–0.02	0.6
Influenza with pneumonia: virus not identified	24	5	<0.01	...	0.1
Pneumonia due to other infectious organisms NEC	13	3	<0.01	...	0.1
Pneumonia, organism unspecified	14,084	2,817	1.84	1.81–1.87	79.4
Total	17,732	3,546	2.32	2.28–2.35	100.0

Numerator: National Minimum Dataset (acute and arranged admissions); Denominator: Statistics NZ Estimated Resident Population; Rates are per 1,000 0–24 year olds; NEC = not elsewhere classified

Distribution by demographic factors

Between 2010 and 2014 pneumonia hospitalisation rates were highest for one year olds and decreased rapidly with increasing age. The lowest rates were in 11–24 year olds. Male rates were higher than female at ages 0–1 years but there was little difference between genders from age two years **(Figure 84)**.

Figure 84. Hospitalisations for pneumonia in 0–24 year olds, by age and gender, New Zealand 2010–2014



Numerator: National Minimum Dataset (acute and arranged admissions); Denominator: Statistics NZ Estimated Resident Population; Rate is per 1,000 population

Between 2010 and 2014 there was disparity in pneumonia hospitalisation rates by NZDep2013 index of deprivation score, ethnicity, gender, and age group. Rates were *significantly higher* in areas with higher deprivation scores (NZDep deciles 3–10) compared with the lowest deprivation score areas (deciles 1–2). There was a strong gradient in pneumonia hospitalisation rates with increasing deprivation scores; rates were *significantly higher* in NZDep2103 deciles 9–10 compared with deciles 7–8, and in deciles 7–8 compared with deciles 5–6. Compared with European/Other, hospitalisation rates were *significantly higher* for Māori, Pacific and MELAA and this difference was greatest for Pacific; rates were *not significantly different* for Asian/Indian. Male rates were *significantly higher* than female rates. Hospitalisation rates were *significantly higher* for 0–4 year olds and 5–14 year olds compared with 15–24 year olds, and this difference was greatest for 0–4 year olds **(Table 78)**.

Table 78. Hospitalisations for pneumonia in 0–24 year olds, by demographic factor, New Zealand 2010–2014

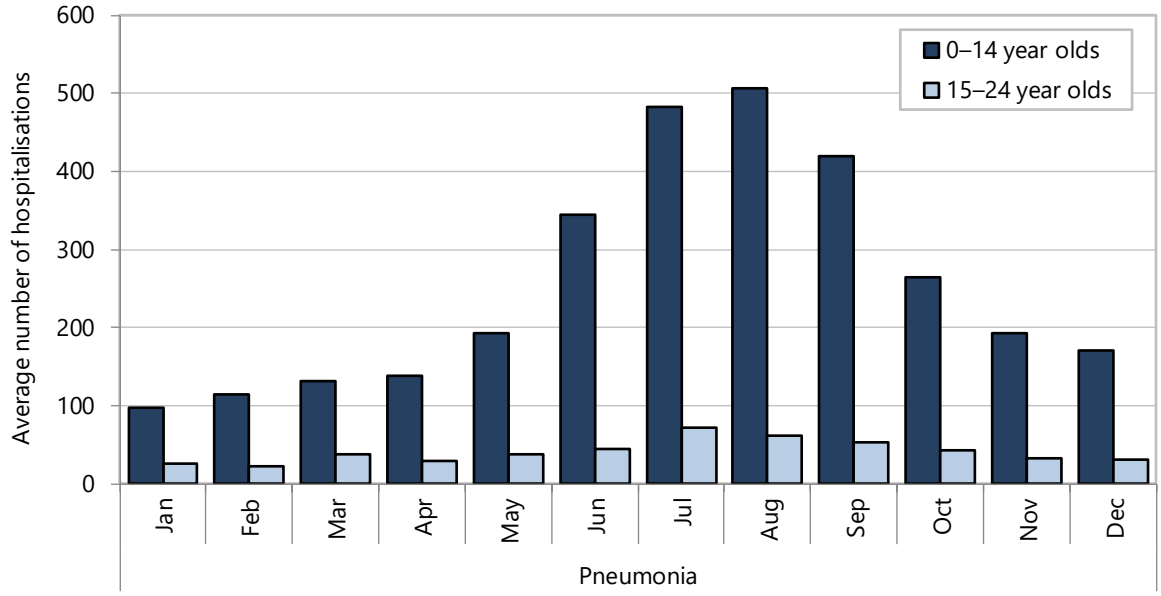
Variable	Number: 2010–2014	Rate per 1,000 0–24 year olds	Rate ratio	95% CI
Pneumonia in 0–24 year olds				
New Zealand				
NZDep2013 Index of deprivation quintile				
Deciles 1–2	1,930	1.38	1.00	
Deciles 3–4	2,128	1.60	1.16	1.09–1.24
Deciles 5–6	2,518	1.75	1.27	1.20–1.35
Deciles 7–8	3,683	2.27	1.65	1.56–1.75
Deciles 9–10	7,404	3.98	2.89	2.75–3.04
Prioritised ethnicity				
Māori	5,172	2.90	1.91	1.84–1.98
Pacific	4,437	6.33	4.16	4.00–4.32
Asian/Indian	1,512	1.61	1.06	1.00–1.12
MELAA	280	2.85	1.88	1.66–2.11
European/Other	6,284	1.52	1.00	
Gender				
Female	8,393	2.24	1.00	
Male	9,339	2.39	1.07	1.03–1.10
Age				
0–4 years	11,402	7.40	9.44	9.03–9.86
5–14 years	3,883	1.30	1.66	1.58–1.74
15–24 years	2,447	0.78	1.00	

Numerator: National Minimum Dataset; Denominator: Statistics NZ Estimated Resident Population; Rates are per 1,000 0–24 year olds; Rate ratios are unadjusted; Ethnicity is level 1 prioritised; Decile is NZDep2013

Distribution by season

There was seasonal variation in pneumonia hospitalisation rates, particularly for 0–14 year olds. The highest rates were observed in July–September and the lowest rates in January–February **(Figure 85)**.

Figure 85. Hospitalisations for pneumonia in 0–24 year olds, by age group and month of admission, New Zealand 2010–2014

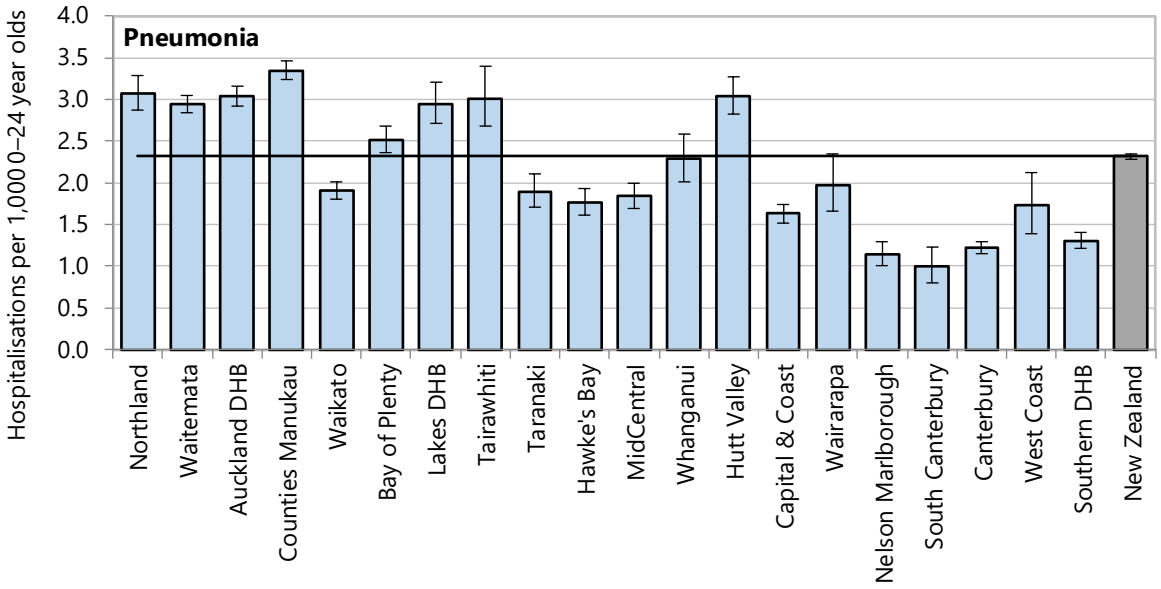


National Minimum Dataset; Number is annual average

Regional distribution

Between 2010 and 2014 pneumonia hospitalisation rates were *significantly higher* than the national rate in the Northland, Waitemata, Auckland, Counties Manukau, Bay of Plenty, Lakes, Tairawhiti and Hutt Valley DHBs and *significantly lower* in the Waikato, Taranaki, Hawke's Bay, MidCentral, Capital & Coast, Nelson Marlborough, South Canterbury, Canterbury, West Coast and Southern DHBs. In the remaining district health boards there was *no significant difference* from the national rate. **(Figure 86**, **Table 79)**.

Figure 86. Hospitalisations for pneumonia in 0–24 year olds, by district health board, New Zealand 2010–2014



Numerator: National Minimum Dataset (acute and arranged admissions); Denominator: Statistics NZ Estimated Resident Population; Rates are per 1,000 0–24 year olds

Table 79. Hospitalisations for pneumonia in 0–24 year olds, by district health board, New Zealand 2010–2014

DHB	Number: 2010–2014	Number: annual average	Rate per 1,000 0–24 year olds	Rate ratio	95% CI
Pneumonia					
0–24 year olds					
Northland	852	170	3.07	1.32	1.24–1.42
Waitemata	2,779	556	2.94	1.27	1.22–1.32
Auckland	2,380	476	3.04	1.31	1.26–1.37
Counties Manukau	3,252	650	3.35	1.44	1.39–1.50
Waikato	1,288	258	1.90	0.82	0.77–0.87
Bay of Plenty	886	177	2.51	1.08	1.01–1.16
Lakes	542	108	2.94	1.27	1.17–1.38
Tairawhiti	272	54	3.01	1.30	1.15–1.47
Taranaki	357	71	1.89	0.82	0.74–0.91
Hawke's Bay	478	96	1.76	0.76	0.70–0.83
MidCentral	548	110	1.84	0.79	0.73–0.86
Whanganui	239	48	2.28	0.98	0.87–1.12
Hutt Valley	746	149	3.04	1.31	1.22–1.41
Capital & Coast	823	165	1.63	0.70	0.66–0.75
Wairarapa	130	26	1.98	0.85	0.72–1.01
Nelson Marlborough	240	48	1.14	0.49	0.43–0.56
South Canterbury	85	17	1.00	0.43	0.35–0.53
Canterbury	1,010	202	1.22	0.53	0.49–0.56
West Coast	86	17	1.72	0.74	0.60–0.92
Southern	673	135	1.30	0.56	0.52–0.61
New Zealand	17,732	3,546	2.32	1.00	

Numerator: National Minimum Dataset (acute and arranged admissions); Denominator: Statistics NZ Estimated Resident Population; Rates are per 1,000 0–24 year olds

Northern region distribution and trends

Comparisons with New Zealand

Between 2010 and 2014 pneumonia hospitalisation rates were *significantly higher* than the national rate in all four Northern DHBs **(Table 80)**.

Table 80. Hospitalisations for pneumonia in 0–24 year olds, Northern DHBs vs New Zealand 2010–2014

DHB	Number: 2010–2014	Number: annual average	Rate per 1,000 population	Rate ratio	95% CI
Pneumonia					
0–24 year olds					
Northland	852	170	3.07	1.32	1.24–1.42
Waitemata	2,779	556	2.94	1.27	1.22–1.32
Auckland	2,380	476	3.04	1.31	1.26–1.37
Counties Manukau	3,252	650	3.35	1.44	1.39–1.50
New Zealand	17,732	3,546	2.32	1.00	
0–14 year olds					
Northland	724	145	3.99	1.18	1.10–1.27
Waitemata	2,514	503	4.48	1.33	1.27–1.38
Auckland	2,138	428	5.18	1.54	1.47–1.61
Counties Manukau	2,780	556	4.68	1.39	1.33–1.44
New Zealand	15,285	3,057	3.37	1.00	
15–24 year olds					
Northland	128	26	1.33	1.69	1.42–2.02
Waitemata	265	53	0.69	0.88	0.78–1.00
Auckland	242	48	0.65	0.83	0.73–0.95
Counties Manukau	472	94	1.25	1.59	1.44–1.76
New Zealand	2,447	489	0.78	1.00	

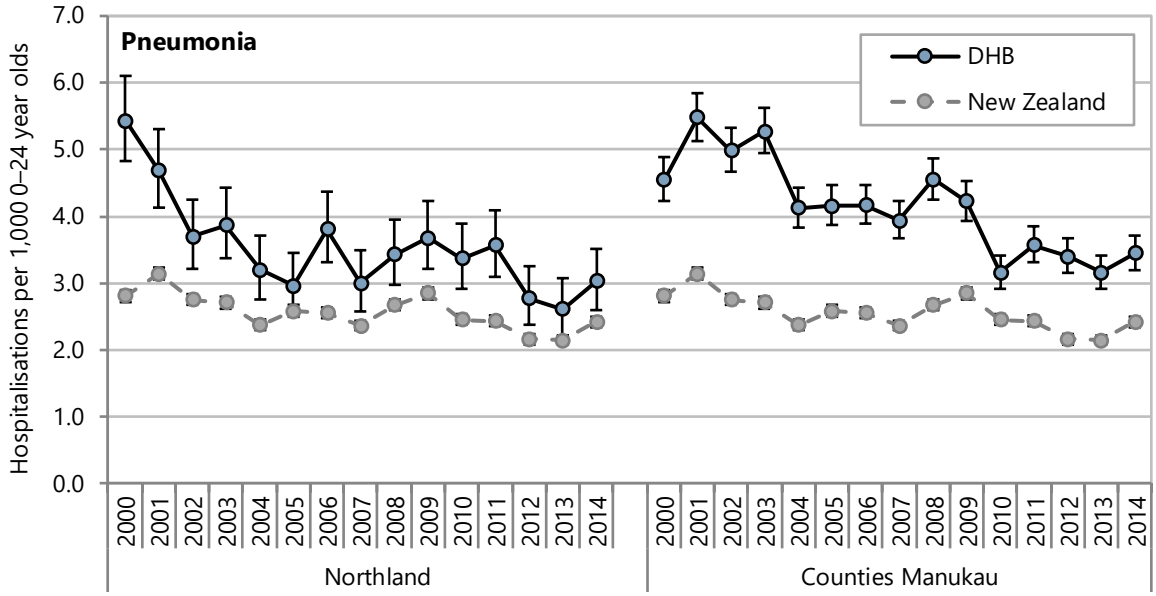
Numerator: National Minimum Dataset (acute and arranged admissions); Denominator: Statistics NZ Estimated Resident Population

Regional trends

From 2000 to 2014 the pneumonia hospitalisation rate *fell significantly* in Northland and Counties Manukau with some year-to-year fluctuations **(Figure 87**, **Figure 88)**.

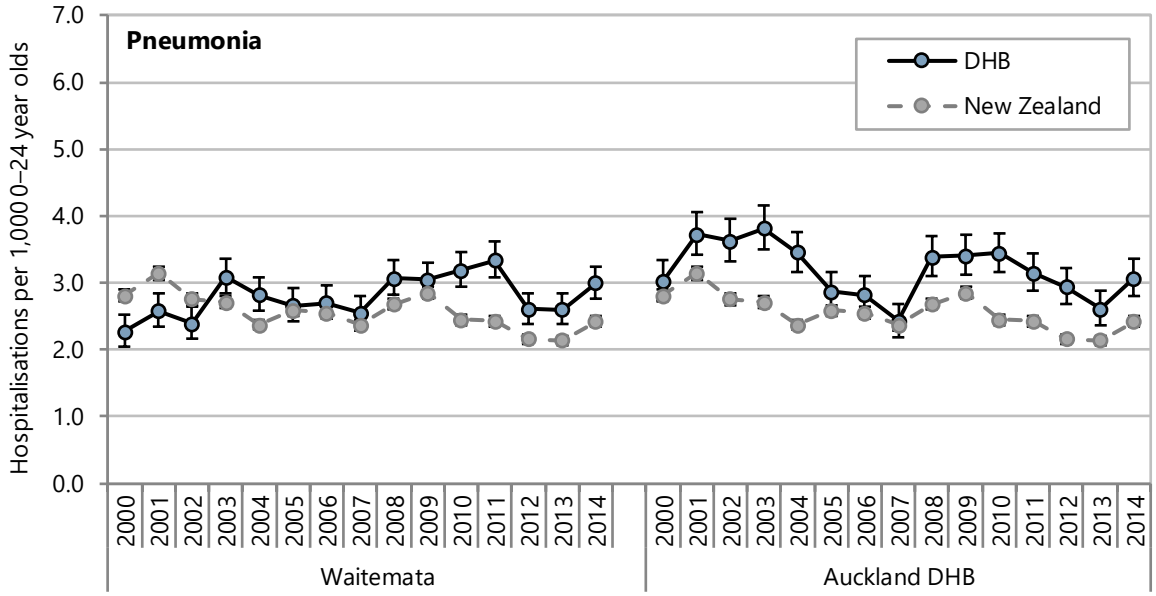
In Waitemata, Auckland and Counties Manukau DHBs hospitalisation rates were consistently highest for Pacific, followed by Māori with the lowest rates for Asian/Indian and European/Other, while in Northland rates were higher for Māori than for European/Other **(Figure 89**, **Figure 90)**.

Figure 87. Hospitalisation for pneumonia in 0–24 year olds, Northland and Counties Manukau DHBs vs New Zealand 2000–2014



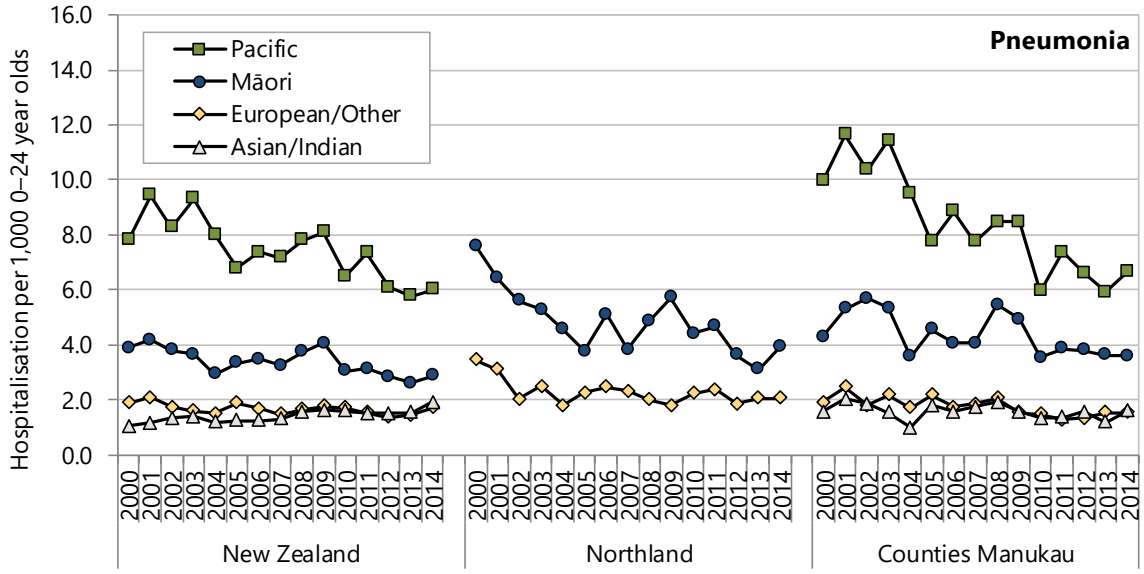
Numerator: National Minimum Dataset (acute and arranged admissions); Denominator: Statistics NZ Estimated Resident Population

Figure 88. Hospitalisation for pneumonia in 0–24 year olds, Waitemata and Auckland DHBs vs New Zealand 2000–2014



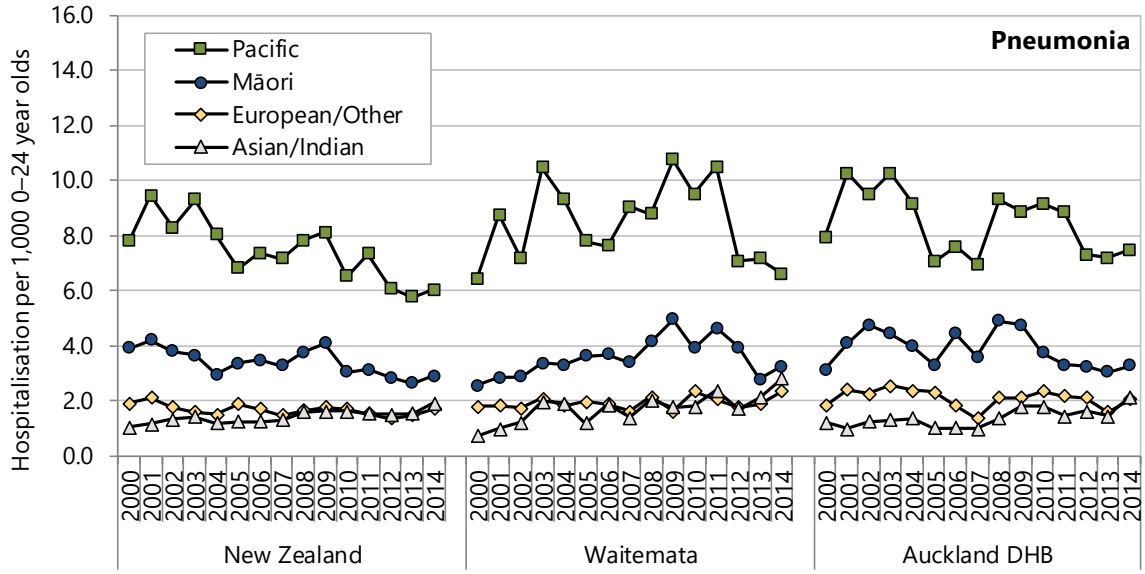
Numerator: National Minimum Dataset (acute and arranged admissions); Denominator: Statistics NZ Estimated Resident Population

Figure 89. Hospitalisations for pneumonia in 0–24 year olds, by ethnicity, Northland and Counties Manukau DHBs vs New Zealand 2000–2014



Numerator: National Minimum Dataset (acute and arranged admissions); Denominator: Statistics NZ Estimated Resident Population; Ethnicity is level 1 prioritised

Figure 90. Hospitalisations for pneumonia in 0–24 year olds, by ethnicity, Waitemata and Auckland DHBs vs New Zealand 2000–2014

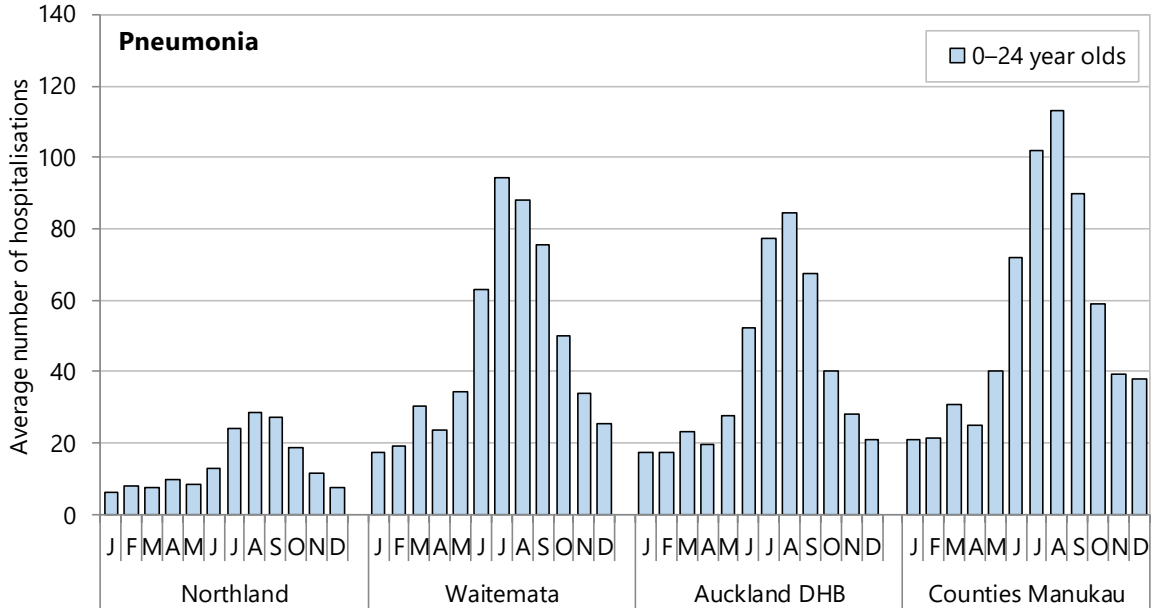


Numerator: National Minimum Dataset (acute and arranged admissions); Denominator: Statistics NZ Estimated Resident Population; Ethnicity is level 1 prioritised

Regional distribution by season

There was seasonal variation in pneumonia hospitalisation rates in all four Northern DHBs. The highest rates were observed in July–September and the lowest rates in January–February (**Figure 91**).

Figure 91. Average number of hospitalisations for pneumonia in 0–24 year olds, by month, Northern DHBs 2010–2014



National Minimum Dataset (acute and arranged admissions)

Evidence for good practice for the prevention and management of pneumonia in children and young people

Ministry of Health publications
Ministry of Health. 2014. **Immunisation Handbook 2014**. Wellington: Ministry of Health. http://www.health.govt.nz/publication/immunisation-handbook-2014 Chapter 15 of this handbook covers pneumococcal disease. It provides a summary of key information and more detailed information on bacteriology, clinical features, epidemiology, vaccines, the recommended immunisation schedule, contraindications and precautions, expected responses and adverse events following immunisation, and public health measures. The current immunisation schedule is for a 13-valent protein conjugate vaccine, PCV-13 (Prevenar 13) for healthy children aged under 5 years, at ages 6 weeks, 3, 5, and 15 months. High-risk children and adults (those who are immunocompromised e.g. due to chemotherapy, asplenia or having had an organ transplant) are entitled to receive additional doses of a 23-valent polysaccharide vaccine (Pneumonvax 23).
International guidelines
World Health Organization. 2014. **Revised WHO classification and treatment of childhood pneumonia at health facilities: evidence summaries**. Geneva: World Health Organization. http://apps.who.int/iris/bitstream/10665/137319/1/9789241507813_eng.pdf These guidelines set out a pneumonia control strategy suitable for use in countries with limited healthcare resources. They include a summary of WHO-approved recommendations and the evidence supporting them.
World Health Organization, The United Nations Children's Fund (UNICEF). 2013. **End preventable deaths: Global Action Plan for Prevention and Control of Pneumonia and Diarrhoea.** Geneva: World Health Organization, The United Nations Children's Fund (UNICEF). http://www.who.int/maternal_child_adolescent/documents/global_action_plan_pneumonia_diarrhoea/en/ This Action Plan offers a global perspective on the prevention of pneumonia and diarrhoea in children. It notes that worldwide these two diseases account for 29% of all deaths of children younger than five years of age. It states that effective measures for prevention of pneumonia are: exclusive breastfeeding for six months and continued breastfeeding with appropriate complementary feeding from six months; vaccination against the two most common bacterial causes of childhood pneumonia, *Streptococcus pneumoniae* and *Haemophilus influenzae* type b; vaccination against pertussis and measles (conditions in which pneumonia may be a complication); the use of standardised guidelines for identification and treatment of pneumonia, innovative demand creation activities to achieve behaviour change and sustain long-term preventive practices; water, sanitation and hygiene interventions, and reduction of household air pollution.
Harris M, Clark J, Coote N, et al. 2011. **British Thoracic Society guidelines for the management of community acquired pneumonia in children: update 2011**. Thorax, 66 Suppl 2, ii1-23. https://www.brit-thoracic.org.uk/document-library/clinical-information/pneumonia/paediatric-pneumonia/bts-guidelines-for-the-management-of-community-acquired-pneumonia-in-children-update-2011/ These guidelines from the British Thoracic society are an updated version of the 2002 guideline, incorporating new evidence. Recommendations in the guideline cover clinical features, investigations, severity assessment, general management, antibiotic management, complications, and follow-up. Each is accompanied by an evidence level (Ia to IVb) and a grade of recommendation (A to D). A summary of this guideline can be found on the National Guideline Clearinghouse website: http://www.guideline.gov/content.aspx?id=37287&search=pneumonia .
Bradley JS, Byington CL, Shah SS, et al. 2011. **The Management of Community-Acquired Pneumonia in Infants and Children Older Than 3 Months of Age: Clinical Practice Guidelines by the Pediatric Infectious Diseases Society and the Infectious Diseases Society of America**. Clinical Infectious Diseases, 53(7), 617-30. http://cid.oxfordjournals.org/content/53/7/e25.long#sec-145 These guidelines are intended for primary care and subspecialty providers caring for otherwise healthy infants ≥ 3 months and children with community-acquired pneumonia in both outpatient and inpatient settings. They cover site-of-care management, diagnosis, antimicrobial and adjunctive surgical therapy, and prevention. Recommendations are accompanied by an indication of the strength of recommendation and of the quality of the evidence. A summary of this Guideline can be found on the National Guideline Clearinghouse website: http://www.guideline.gov/content.aspx?id=34433&search=pneumonia+children .
Evidence-based medicine reviews
Lassi Zohra S, Imdad A, Bhutta Zulfiqar A. 2015. **Short-course versus long-course intravenous therapy with the same antibiotic for severe community-acquired pneumonia in children aged two months to 59 months**. Cochrane Database of Systematic Reviews (6). http://onlinelibrary.wiley.com/doi/10.1002/14651858.CD008032.pub2/abstract Hospital care for children with severe pneumonia places a significant burden on healthcare systems and families, particularly in low income countries where most deaths from pneumonia occur. The World Health Organization's 2014 recommendations for the treatment of childhood pneumonia (see above) recommend intravenous antibiotics for five days as a first-line treatment for severe childhood pneumonia. This review aimed to evaluate the efficacy of short-course (two to three days) vs. long-course (five days) intravenous therapy with the same antibiotic for severe community-acquired pneumonia in children aged two months to 59 months. The review authors did not identify any RCTs addressing this issue and they recommended that physicians should continue to treat severe childhood pneumonia according to the WHO recommendations until further evidence becomes available.
Laopaiboon M, Panpanich R, Swa Mya K. 2015. **Azithromycin for acute lower respiratory tract infections**. Cochrane Database of Systematic Reviews (3). http://onlinelibrary.wiley.com/doi/10.1002/14651858.CD001954.pub4/abstract

Acute lower respiratory infections (LRIs) include acute bronchitis, acute exacerbations of chronic bronchitis and pneumonia. Azithromycin is a macrolide antibiotic, structurally modified from erythromycin. It is noted for its activity against some gram-negative organisms associated with respiratory tract infections, particularly *Haemophilus influenzae*. This review aimed to compare the effectiveness of azithromycin to amoxicillin or amoxicillin/clavulanic acid (amoxiclav) in the treatment of LRTI, in terms of clinical failure, incidence of adverse events and microbial eradication. It included 16 RCTs or quasi-RCTs involving 2,648 participants (adults and children). It was possible to analyse data from 15 trials with 2,496 participants. Pooled analysis indicated no significant difference between antibiotic groups in the incidence of clinical failure on about days 10 to 14 risk ratio (RR), random-effects 1.09; 95% CI 0.64 to 1.85). A subgroup analysis in trials with acute bronchitis participants showed significantly lower clinical failure in the azithromycin group compared to the amoxicillin or amoxiclav group (RR random-effects 0.63; 95% CI 0.45 to 0.88). A sensitivity analysis showed that, in three adequately concealed studies, there was a non-significant reduction in clinical failure in azithromycin-treated participants (RR 0.55; 95% CI 0.25 to 1.21), compared to RR 1.32; 95% CI 0.70 to 2.49 in 12 studies with inadequate concealment. Twelve trials reported the incidence of microbial eradication and there was no significant difference between the two groups (RR 0.95; 95% CI 0.87 to 1.03). There were fewer adverse events in the azithromycin group: RR 0.76 (95% CI 0.57 to 1.00). The review authors concluded that it was unclear whether azithromycin is superior to amoxicillin or amoxiclav in treating acute LRTI but that, in patients with acute bronchitis with suspected bacterial cause, azithromycin tends to be more effective in terms of lower incidence of treatment failure and adverse events than amoxicillin or amoxiclav. They stated that most studies were of unclear methodological quality and had small sample sizes so further trials with adequate sample sizes and high methodological quality are needed.

Gardiner Samantha J, Gavranich John B, Chang Anne B. 2015. **Antibiotics for community-acquired lower respiratory tract infections secondary to Mycoplasma pneumoniae in children**. Cochrane Database of Systematic Reviews (1). http://onlinelibrary.wiley.com/doi/10.1002/14651858.CD004875.pub5/abstract

Mycoplasma pneumoniae (*M. pneumoniae*) is widely recognised as an important cause of community-acquired lower respiratory tract infection (LRTI) in children, accounting for 14% to 34% of cases. Pulmonary manifestations are typically tracheobronchitis or pneumonia but the organism is also implicated in wheezing episodes in both asthmatic and non-asthmatic individuals. Major paediatric textbooks offer conflicting advice regarding the use of antibiotics in children with *M. pneumoniae* infection. This review aimed to determine whether antibiotics are effective for treating LRTIs in children that are secondary to *M. pneumoniae* infection acquired in the community. Studies were eligible for inclusion in the review if they were RCTs comparing antibiotics commonly used for treating *M. pneumoniae* (i.e. macrolide, tetracycline or quinolone classes) vs. placebo, or antibiotics from any other class, in the treatment of children < 18 years of age with community-acquired LRTI secondary to *M. pneumoniae*. The review authors identified seven studies enrolling a total of 1,912 children. Data interpretation was significantly limited by the inability to extract data that specifically referred to children with LRTI caused by *M. pneumoniae*. There was only one study which compared antibiotics vs. placebo, funded by a drug company. This study did not distinguish between upper and lower respiratory infections in the analysis of results, although it did provide details on the number of *M. pneumoniae* infections. It found that significantly more children in the azithromycin group had 'clinical success' on follow up than the placebo group (100% vs. 77%). In the other studies, in the sub-group of children with *M. pneumoniae* infection (38 children in total), the comparison was a macrolide antibiotic vs. a non-macrolide antibiotic, usually amoxicillin clavulanate. There was insufficient data to analyse the efficacy of macrolide antibiotics in this group, but adverse effects were reported in 11% to 67% of children. The review authors concluded that the evidence was insufficient to draw any specific conclusions about the efficacy of antibiotics for community-acquired LRTIs secondary to *M. pneumoniae* in children, although they noted that one trial suggested that macrolides may be efficacious in some children. They stated that the use of antibiotics has to be balanced with possible adverse effects and that high-quality double-blinded RCTs are needed to assess the efficacy and safety of antibiotics for LRTI secondary to *M. pneumoniae* in children.

Lassi Zohra S, Kumar R, Das Jai K, et al. 2014. **Antibiotic therapy versus no antibiotic therapy for children aged two to 59 months with WHO-defined non-severe pneumonia and wheeze**. Cochrane Database of Systematic Reviews (5). http://onlinelibrary.wiley.com/doi/10.1002/14651858.CD009576.pub2/abstract

The World Health Organization (WHO) has developed case management guidelines based on simple clinical signs to help clinicians decide on the appropriate pneumonia treatment. These guidelines are designed to be useful in resource-poor settings where pulse oximetry, x-rays or laboratory tests may be unavailable. The WHO guidelines do not distinguish viral and bacterial pneumonia and recommend that children and infants who exhibit rapid breathing (> 50 breaths per minute or more in infants aged 2–12 months and > 40 in children aged 12 months to five years) and cough should be presumed to have non-severe pneumonia and treated with antibiotics. This review aimed to evaluate the efficacy of antibiotic therapy vs. no antibiotic therapy for children aged two to 59 months with WHO-defined non-severe pneumonia and wheeze. The review authors did not identify any relevant RCTs. They stated that there is a clear need for RCTs to address this question and that there is currently no evidence to support or challenge the WHO guidelines.

Chang Christina C, Cheng Allen C, Chang Anne B. 2014. **Over-the-counter (OTC) medications to reduce cough as an adjunct to antibiotics for acute pneumonia in children and adults**. Cochrane Database of Systematic Reviews (3). http://onlinelibrary.wiley.com/doi/10.1002/14651858.CD006088.pub4/abstract

Patients with pneumonia frequently find coughing distressing and so they may use over the counter (OTC) cough medications (mucolytics or cough suppressants). Although these may reduce cough severity, cough suppression might reduce airway clearance and cause harm. This aim of this updated review was to evaluate the efficacy of OTC cough medications as an adjunct to antibiotics in children and adults with pneumonia. The review authors identified no new RCTs published since the previous review. Previously, four RCTs with a total of 224 participants had been included. One involved children only and the other three involved adolescents or adults. The one study assessing an anti-tussive (cough suppressant) had no extractable pneumonia-specific data. The other studies assessed three different mucolytics; only two of these studies had extractable data. They indicated no significant difference between intervention and control groups for the primary outcome of 'not cured or improved'. A secondary outcome of 'not cured' was reduced for children: odds ratio (OR) 0.36, 95% CI 0.16 to 0.77; number needed to treat to benefit (NNTB) at day 10 = 5 (95% CI 3 to 16), and for adults: OR 0.32 (95% CI 0.13 to 0.75); NNTB at day 10 = 5 (95% CI 3 to 19). In a post hoc analysis combining data for children and adults, there was again no difference in the primary outcome of 'not cured or not improved' (OR 0.85, 95% CI 0.40 to 1.80) although mucolytics reduced the secondary outcome 'not cured' (OR 0.34, 95% CI 0.19 to 0.60; NNTB 4, 95% CI 3 to 8). The risk of bias was low or unclear. The review authors concluded that there was insufficient evidence to determine whether OTC medications for cough are beneficial for patients with pneumonia but that mucolytics may be beneficial. They stated that it is currently recommended that young children should not be given OTC cough medications containing codeine derivatives and antihistamines because of the known adverse events associated with these agents.

Hu Q-J, Shen Y-C, Jia L-Q, et al. 2014**. Diagnostic performance of lung ultrasound in the diagnosis of pneumonia: a bivariate meta-analysis**. International Journal of Clinical and Experimental Medicine 7(1) 115-21 http://www.ncbi.nlm.nih.gov/pmc/articles/PMC3902248/

Making a diagnosis of pneumonia is clinically challenging. Ultrasound examination can be performed with a portable device, and is user friendly, non-invasive and inexpensive. This review was to evaluate the overall diagnostic accuracy of chest ultrasound for pneumonia. It included nine prospective studies with 1080 subjects in total (44 with pneumonia and 436 controls). Most studies used chest x-ray or CT as a reference standard to diagnose pneumonia. The summary estimates for lung ultrasound in the diagnosis of pneumonia in the studies included were as follows: sensitivity, 0.97 (95% CI 0.93 to 0.99); specificity, 0.94 (95% CI 0.85 to 0.98); diagnostic odds ratio 507.99 (95% CI 128.11 to 2014.34); positive likelihood ratio, 15.62 (95% CI 6.31 to 38.68); negative likelihood ratio, 0.03 (95% CI 0.01 to 0.08); The area under the summary receiver operating characteristic curve was 0.99 (95% CI 0.98 to 1.00). Based on these results, the study authors concluded that lung ultrasound is capable of diagnosing pneumonia with a high degree of accuracy and is a promising attractive alternative to chest radiography and thoracic CT scan.

Loo JD, Conklin L, Fleming-Dutra KE, et al. 2014. **Systematic review of the effect of pneumococcal conjugate vaccine dosing schedules on prevention of pneumonia**. Pediatr Infect Dis J 33 Suppl 2 S140-51 http://www.ncbi.nlm.nih.gov/pmc/articles/PMC3944478/

Pneumococcal conjugate vaccines (PCVs) are known to provide protection against vaccine serotype pneumococcal pneumonia; but there is uncertainty regarding the optimum PCV dosing schedule. This review looked at studies published from 1994 to 2010 (supplemented post hoc with studies from 2011) documenting the effect of PCV dosing schedules on clinical and radiologically confirmed pneumonia, pneumococcal pneumonia and empyema among children of ages targeted to receive the vaccine. Data on 2- and 3-dose schedules were included. The review authors identified 42 primary citations that evaluated PCV schedules and pneumonia. Thirty-seven (88%) were from North America, Europe or Australia; 37 (88%) evaluated PCV7 and 1 (2%) PCV10. Two studies (both observational) compared multiple schedules within the study. They found evidence of reduced clinical and radiologically confirmed pneumonia incidence for all schedules, including 2 primary doses plus 1 booster (2 + 1, one nonrandomized trial, 5 observational studies), 3 primary doses (3+0, 5 randomized trials, 2 observational studies) and 3 primary doses plus 1 booster (3+1, 5 clinical trials, 24 observational studies) schedules. The magnitude of disease impact did not differ among schedules. Evidence for impact on pneumococcal pneumonia and empyema varied. The authors concluded that all schedules (2+1, 3+0 and 3+1) reduced clinical and radiologically confirmed pneumonia. Quantifying differences in pneumonia disease impact between schedules was difficult due to heterogeneity among studies in design, case definition and population. The authors stated that their findings support World Health Organization recommendations for 3-dose schedules administered as either 3+0 or 2+1 regimens. They also stated that pneumonia impact data are still needed on expanded serotype PCV products, developing country settings and the role for a booster dose.

Biondi E, McCulloh R, Alverson B, et al. 2014. **Treatment of mycoplasma pneumonia: a systematic review**. Pediatrics 133(6) 1081-90 http://pediatrics.aappublications.org/content/133/6/1081.long

Mycoplasma pneumoniae is a common cause of community-acquired pneumonia (CAP) and other community-acquired lower respiratory tract infections (CA-LRTIs), particularly in school-aged children and adolescents. Children with CA-LRTIs are commonly given antibiotics for M. pneumonia. This review aimed to evaluate the effect of treating *M. pneumoniae* in children with CA-LRTI. Studies were deemed eligible for inclusion in this review if they were RCTs or observational studies of children ≤17 years old with confirmed M. pneumonia and a diagnosis of CA-LRTI; and they had compared treatment regimens with and without a spectrum of activity against M. pneumonia. Sixteen articles detailing 17 studies were included. The most commonly selected primary outcome was symptomatic improvement. Nine studies examined M. pneumonia treatment in CA-LRTI secondary to *M. pneumoniae,* and 5 RCTs met criteria for meta-analysis. The pooled risk difference was not significant and demonstrated significant heterogeneity: risk difference 0.12 favouring treatment (95% confidence interval, −0.04 to 0.20). Limitations included substantial bias and subjective outcomes within the individual studies, difficulty interpreting testing modalities, and the inability to correct for mixed infections or timing of intervention. The review authors concluded that there was insufficient evidence to support or refute treatment of *M. pneumoniae* in CA-LRTI. They stated that there is a need for well-designed, prospective RCTs assessing the effect of treating *M. pneumoniae* in CA-LRTI.

Conklin L, Loo JD, Kirk J, et al. 2014. **Systematic review of the effect of pneumococcal conjugate vaccine dosing schedules on vaccine-type invasive pneumococcal disease among young children**. Pediatr Infect Dis J 33 Suppl 2 S109-18 http://www.ncbi.nlm.nih.gov/pmc/articles/PMC3944481/

Many countries have introduced pneumococcal conjugate vaccines (PCV) in recent years, using a variety of different schedules. This review aimed to assess the relative benefit of various PCV dosing schedules in preventing vaccine-type invasive pneumococcal disease (VT-IPD) in children, but it also provides an overview of studies on PCV effectiveness against VT-IPD. It included studies published in English from 1994 to 2010 (supplemented post hoc with studies from 2011) on PCV effectiveness against VT-IPD among children targeted to receive vaccine. Data on 2-dose and 3-dose primary series, both with and without a booster ("2+0," "2+1," "3+0" and "3+1"), were included. For observational studies using surveillance data or case counts, the study authors calculated percentage reduction in VT-IPD before and after PCV introduction. There were four RCTs and 31 observational studies reporting VT-IPD among young children. None evaluated a 2+0 complete series, seven (19%) evaluated 2+1, four (11%) 3+0 and 27 (75%) 3+1. Most (86%) studies were from North America or Europe. All but two studies evaluated PCV7; these two evaluated a 9-valent vaccine (PCV9). No studies evaluated PCV10 or PCV13. Only one study (observational) directly compared 2 schedules (3+0 vs. 3+1); results supported the use of a booster dose. In clinical trials, vaccine efficacy ranged from 65% to 71% with 3+0 and 83% to 94% with 3+1. Surveillance data and case counts demonstrated reductions in VT-IPD of up to 100% with 2+1 (6 studies) or 3+1 (17 studies) schedules and up to 90% with 3+0 (2 studies). Reductions were observed as early as one year after PCV introduction. The review authors concluded that the available data support the use of 2+1, 3+0 and 3+1 schedules, although most data regarding PCV impact on VT-IPD among young children are from high-income countries using 3+1. They stated that it is difficult to discern differences between schedules for impact on VT-IPD based on available data.

Chaves Gabriela SS, Fregonezi Guilherme AF, Dias Fernando AL, et al. 2013. **Chest physiotherapy for pneumonia in children**. Cochrane Database of Systematic Reviews (9). http://onlinelibrary.wiley.com/doi/10.1002/14651858.CD010277.pub2/abstract

Chest physiotherapy is commonly used in the treatment of pneumonia to help eliminate mucus and secretions, remove airway obstructions, reduce airway resistance, enhance gas exchange and reduce the work of breathing. This review aimed to assess the effectiveness of chest physiotherapy, in relation to time until clinical resolution, in children (from birth up to 18 years old) of either gender with any type of

pneumonia. It included three RCTs (involving 255 child inpatients) comparing chest physiotherapy of various types (conventional chest physiotherapy, positive expiratory pressure and continuous positive airway pressure) with no chest physiotherapy. Outcomes measured were: duration of hospital stay, time to clinical resolution, change in adventitious sounds, change in chest X-ray and duration of cough in days. Two studies found a significant improvement in respiratory rate and oxygen saturation but the third failed to show that standardised respiratory physiotherapy and positive expiratory pressure decreased the time to clinical resolution and the duration of hospital stay. No adverse effects of the interventions were reported. The review authors could not pool data from the studies because of the different characteristics of the trials, such as the duration of treatment, levels of severity, types of pneumonia and the techniques used, as well as differences in their statistical presentation. They considered that two of the included studies had a low risk of bias and the other had an overall unclear risk of bias. They concluded that their review did not provide conclusive evidence to justify the use of chest physiotherapy in children with pneumonia owing to lack of data as a result of the small number of studies and differences in statistical presentation between studies.

Hemilä H, Louhiala P. 2013**. Vitamin C for preventing and treating pneumonia**. Cochrane Database of Systematic Reviews (8) http://onlinelibrary.wiley.com/doi/10.1002/14651858.CD005532.pub3/abstract

This review aimed to assess the prophylactic (preventive) and therapeutic effects of vitamin C on pneumonia. Selection criteria were placebo controlled trials (to assess therapeutic effect) and controlled trails with or without a placebo (to assess prophylactic effect). The review authors identified three prophylactic trials in which 37 cases of community-acquired pneumonia were recorded in 2,335 people. Only one of these was satisfactorily randomised, double-blind and placebo controlled. Two trials involved military recruits and the third, boys at boarding school in the UK during WW2. All three trials found a statistically significant (80% or greater) reduction in pneumonia incidence in the vitamin C group. The authors identified two therapeutic trials involving 197 patients with community-acquired pneumonia. One of these was satisfactorily randomised, double-blind and placebo-controlled. It involved elderly people in the UK and it found lower mortality and reduced severity in the vitamin C group although the benefit was restricted to the most ill patients. The other therapeutic trial, which involved adult patients with a wide age range in the former Soviet Union, found a dose-dependent reduction in the duration of pneumonia with two vitamin C doses. The authors identified one prophylactic trial in severely burned hospital patients. Thirteen out of 37 patients developed hospital-acquired pneumonia and one-day administration of vitamin C did not affect pneumonia incidence. None of the studies included in the review found adverse effects of vitamin C. The review authors concluded that further research should investigate the prophylactic use of vitamin C in populations which have a high incidence of pneumonia and low dietary vitamin C intakes, and the therapeutic use of vitamin C in pneumonia patients with low plasma vitamin C levels. They stated that the current evidence is too weak to support prophylactic vitamin C to prevent pneumonia in the general population but that it may be reasonable to consider therapeutic vitamin C supplementation in pneumonia patients with low plasma vitamin C levels because the costs and risks of such therapy are low.

Lodha R, Kabra Sushil K, Pandey Ravindra M. 2013. **Antibiotics for community-acquired pneumonia in children**. Cochrane Database of Systematic Reviews (6) http://onlinelibrary.wiley.com/doi/10.1002/14651858.CD004874.pub4/abstract

Although studies have suggested that many cases of pneumonia in children are caused by viruses, it can be impractical to undertake investigations to try to determine whether a child with clinical diagnosis of pneumonia does or does not have a bacterial infection before prescribing antibiotics, especially in low-income countries where mortality from pneumonia in children is high. The World Health Organization (WHO) recommends that, in countries with high rates of pneumonia fatalities, children with clinically-diagnosed pneumonia should be given empirical treatment with antibiotics. The aim of this review was to identify effective antibiotic drug therapies for community-acquired pneumonia (CAP) of varying severity in children by comparing various antibiotics. Twenty-nine RCTs involving 14,188 children were included in this review. All compared multiple antibiotics: none compared antibiotic to placebo. Seventeen studies were of good quality with adequate allocation concealment, including five which were double blind and 12 which were unblinded. More than one study compared co-trimoxazole with amoxicillin, oral amoxicillin with injectable penicillin/ampicillin and chloramphenicol with ampicillin/penicillin and the studies were of good quality, suggesting the evidence for these comparisons was of high quality compared to other comparisons. In ambulatory settings, for treatment of WHO defined non-severe CAP, amoxicillin compared with co-trimoxazole had similar failure rates (odds ratio (OR) 1.18, 95% CI 0.91 to 1.51) and cure rates (OR 1.03, 95% CI 0.56 to 1.89). These figures were derived from three studies involving 3,952 children.

In children with severe pneumonia without hypoxaemia, oral antibiotics (amoxicillin/co-trimoxazole) compared with injectable penicillin had similar failure rates (OR 0.84, 95% CI 0.56 to 1.24), hospitalisation rates (OR 1.13, 95% CI 0.38 to 3.34) and relapse rates (OR 1.28, 95% CI 0.34 to 4.82). Six studies involved 4331 children < 18 years of age.

In very severe CAP, death rates were higher in children receiving chloramphenicol compared to those receiving penicillin plus gentamicin (OR 1.25, 95% CI 0.76 to 2.07, one study involving 1116 children) and compared to those receiving ampicillin plus gentamicin (OR 1.65, 95% CI 0.99 to 2.77, one study with 958 participants).

The review authors' conclusions were as follows. For outpatient treatment of pneumonia, amoxicillin is an alternative to co-trimoxazole and, based on limited data, co-amoxyclavulanic acid and cefpodoxime may be alternative second-line drugs. Children with severe pneumonia but without hypoxaemia can be treated as outpatients with amoxicillin. For children hospitalised with severe and very severe CAP, penicillin/ampicillin plus gentamycin is superior to chloramphenicol. The other alternative drugs for such patients are co-amoxyclavulanic acid and cefuroxime. Until more studies are available, these drugs can be used as second-line therapies. These recommendations apply to countries with high case fatalities due to pneumonia in children without underlying morbidities and where point of care tests for identification of causative agents for pneumonia are not available. The review authors stated that there is a need for more studies with radiographically confirmed pneumonia in larger patient populations and similar methodologies to compare newer antibiotics.

Lamberti LM, Zakarija-Grkovic I, Fischer Walker CL, et al. 2013. **Breastfeeding for reducing the risk of pneumonia morbidity and mortality in children under two: a systematic literature review and meta-analysis**. BMC Public Health 13 Suppl 3 S18 http://www.biomedcentral.com/1471-2458/13/S3/S18

Suboptimal breastfeeding of infants and young children (< two years of age) is associated with a higher risk of pneumonia morbidity and mortality. The aim of this systematic review and meta-analysis was to quantify the protective effects of breastfeeding exposure against pneumonia incidence, prevalence, hospitalizations and mortality. The review authors used random effects meta-analyses to generate pooled effect estimates by outcome, age and exposure level. There were 10 studies included in the analysis, seven prospective cohort studies and three case control studies. By WHO region, the included studies were conducted in Latin America (n=5), South Asia (n=4), Africa (n=2) and the Western Pacific (n=1), with one study located in three different locations. Suboptimal breastfeeding elevated the risk of pneumonia morbidity and mortality outcomes across age groups. In particular, pneumonia mortality was higher among not breastfed

compared to exclusively breastfed infants 0–5 months of age (relative risk (RR): 14.97; 95% CI: 0.67 to 332.74) and among not breastfed compared to breastfed infants and young children 6–23 months of age (RR: 1.92; 95% CI: 0.79 to 4.68). The review authors stated that their results highlight the importance of breastfeeding during the first 23 months of life as a key intervention for reducing pneumonia morbidity and mortality.

Das RR, Singh M, Panigrahi I, et al. 2013. **Vitamin D supplementation for the treatment of acute childhood pneumonia: a systematic review**. ISRN Pediatr 2013 Article ID 459160 http://www.hindawi.com/journals/isrn/2013/459160/

Studies have found an increased incidence of vitamin D deficiency in children with pneumonia. This review reports that there have been only two RCTs comparing vitamin D3 with placebo in children ≤ five years with pneumonia. One trial, involving 503 outpatient children in Afghanistan, used a single 100,000 unit of oral vitamin D3 at the onset of pneumonia. There was no significant difference in the mean (±SD) number of days to recovery between the vitamin D3 and placebo arms (4.74 ± 2.22 vs. 4.98 ± 2.89, P = 0.17). Another trial, involving 200 child inpatients in India, used oral vitamin D3 (1000 IU for children aged <one year and 2000 IU for >one year) for five days in children with severe pneumonia. Median duration of resolution of severe pneumonia was similar in the two groups (intervention, 72 hours, 95% CI 64.7 to 79.3; placebo, 64 hours, 95% CI 55.2 to 72.8). Duration of hospitalization and time to resolution of tachypnea, chest retractions, and inability to feed were also comparable between the two groups. The review authors concluded that oral vitamin D supplementation does not help children aged < five years with acute pneumonia.

Wang K, Gill P, Perera R, et al. 2012. **Clinical symptoms and signs for the diagnosis of Mycoplasma pneumoniae in children and adolescents with community-acquired pneumonia**. Cochrane Database of Systematic Reviews (10) http://onlinelibrary.wiley.com/doi/10.1002/14651858.CD009175.pub2/abstract

Mycoplasma pneumoniae (*M. pneumoniae*) is a significant cause of community-acquired pneumonia (CAP) in children and adolescents. Treatment with macrolide antibiotics is recommended. It is difficult to diagnose *M. pneumoniae* based on clinical symptoms and signs. Diagnostic uncertainty can result in inappropriate antibiotic prescribing, which may worsen clinical prognosis and increase antibiotic resistance. This review had two aims: (i) to assess the diagnostic accuracy of symptoms and signs in the clinical recognition of *M. pneumoniae* in children and adolescents with CAP; and (ii) to assess the influence of potential sources of heterogeneity on the diagnostic accuracy of symptoms and signs in the clinical recognition of *M. pneumoniae*. The seven studies included in the review (1491 hospitalised children in total) were selected because they were peer-reviewed published studies which prospectively and consecutively recruited children with CAP from any healthcare setting, confirmed the presence of *M. pneumoniae* using serology with or without other laboratory methods and reported data on clinical symptoms and signs in sufficient detail to construct 2 x 2 tables. Overall, the reviewers considered these studies to be of moderate quality. In two studies the presence of chest pain more than doubled the probability of *M. pneumoniae*. Wheeze was 12% more likely to be absent in children with *M. pneumoniae* (pooled positive likelihood ratio (LR+) 0.76, 95% CI 0.60 to 0.97; pooled negative likelihood ratio (LR−) 1.12, 95% CI 1.02 to 1.23). Sensitivity analysis showed that the presence of crepitations was associated with *M. pneumoniae*, but this finding was of borderline statistical significance (pooled LR+ 1.10, 95% CI 0.99 to 1.23; pooled LR− 0.66, 95% CI 0.46 to 0.96). The reviewers concluded that *M. pneumoniae* cannot be reliably diagnosed in children and adolescents with CAP on the basis of clinical symptoms and signs and that further high quality large scale research in primary care settings is needed to help develop prediction rules based on epidemiological data as well as clinical and baseline patient characteristics.

Pneumococcal vaccines WHO position paper - 2012 - recommendations. Vaccine 30(32) 4717-8

This article presents the World Health Organization (WHO) recommendations on the use of pneumococcal vaccines excerpted from the Pneumococcal vaccines WHO position paper - 2012 published in the Weekly Epidemiological Record. It focusses on the currently available 10-valent and 13-valent conjugate vaccines and their introduction and use in national immunization programmes. It also deals with the 23-valent polysaccharide vaccine, though in less detail than is provided in the April 2008 position paper which remains valid. Footnotes to this paper provide a number of core references including references to grading tables that assess the quality of scientific evidence for a few key conclusions. WHO recommends PCV be included in childhood immunisation programmes worldwide, using either 3 primary doses (3p+0 schedule) or, as an alternative, 2 primary doses plus a booster (2p+1 schedule) for infants from as early as six weeks of age. All the WHO vaccine position papers, including the full position paper on pneumococcal vaccines, a summary, key points and references can be found on the following web page: http://www.who.int/immunization/documents/positionpapers/en/

Tan K, Lai Nai M, Sharma A. 2012. **Surfactant for bacterial pneumonia in late preterm and term infants**. Cochrane Database of Systematic Reviews (2) http://onlinelibrary.wiley.com/doi/10.1002/14651858.CD008155.pub2/abstract

Pulmonary surfactant is a lipoprotein complex secreted by type II pneumocytes in the lungs. Its lowers the surface tension of the air water interface and is an important part of the host defences against respiratory infections. Bacterial pneumonia in late preterm or term newborn infants often results in surfactant deficiency or dysfunction. This review sought to assess the effect of exogenous surfactant treatment on mortality and pulmonary complications in infants with bacterial pneumonia. The review authors did not identify any relevant RCTs and so they concluded that there is no evidence from RCTs to support or refute the efficacy of surfactant in near-term and term infants with proven or suspected bacterial pneumonia. They stated that RCTs are still required to answer this question.

Haider Batool A, Lassi Zohra S, Ahmed A, et al. 2011. **Zinc supplementation as an adjunct to antibiotics in the treatment of pneumonia in children 2 to 59 months of age**. Cochrane Database of Systematic Reviews (10) http://onlinelibrary.wiley.com/doi/10.1002/14651858.CD007368.pub2/abstract

Zinc deficiency is associated with decreased immunocompetence and it may be an underlying cause of increased infant mortality in malnourished children in low-income countries. This review aimed to evaluate the effect of zinc supplementation, as an adjunct to antibiotics, in the treatment of pneumonia (indicated by clinical recovery) in children aged two to 59 months. It included four RCTs involving 3,267 children aged two to 35 months. Analysis showed that zinc supplementation in addition to antibiotic therapy in children with severe and non-severe pneumonia was not associated with a statistically significant effect on time-to-clinical recovery (hazard ratio 1.02; 95% CI 0.93 to 1.11). In children with severe pneumonia, zinc supplementation as an adjunct to antibiotic therapy was not associated with a significant effect on time-to-recovery from tachypnoea (respiratory rate > 50 breaths per minute) (hazard ratio 1.13; 95% CI 0.82 to 1.57) and time-to-recovery from chest in-drawing (hazard ratio 1.08; 95% CI 0.88 to 1.31) as compared to the control group. Zinc supplementation in children with severe pneumonia also had no significant effect on time-to-hospital discharge as compared to the control group (hazard ratio 1.04; 95% CI 0.89 to 1.22). The review authors concluded that the available evidence was insufficient to recommend the use of zinc as an adjunct to standard antibiotic therapy for pneumonia in children aged two to 35 months.

Weir K, McMahon S, Chang AB. 2012. **Restriction of oral intake of water for aspiration lung disease in children**. Cochrane Database Systematic Reviews (9) http://onlinelibrary.wiley.com/doi/10.1002/14651858.CD005303.pub3/abstract

Children who have difficulty with feeding and swallowing due to a variety of complex medical conditions, such as neurological conditions and abnormal anatomy, may be at risk of aspirating food and liquid into their lungs. This may result in respiratory problems, including pneumonia. To prevent aspiration, food and fluids may be restricted, and children may be given texture-modified diets and thickened fluids. Young children often refuse thickened fluids, thus causing a management dilemma for parents and health professionals. This review aimed to evaluate the efficacy of restriction of oral water ingestion on the pulmonary status of children with thin fluid aspiration demonstrated on a modified barium swallow study. The review authors were unable to identify any RCTs addressing this issue. They therefore concluded that there is currently no evidence to support a strict approach of full restriction of oral water intake or to support a more liberal approach of allowing oral water ingestion in children with primary aspiration of thin fluids.

Rozenbaum MH, van Hoek AJ, Fleming D, et al. 2012. **Vaccination of risk groups in England using the 13 valent pneumococcal conjugate vaccine: economic analysis**. BMJ 345 e6879 http://www.bmj.com/content/345/bmj.e6879.long

The aim of this economic evaluation was to estimate the cost effectiveness of vaccinating people with high risk conditions in England against invasive pneumococcal disease using the 13 valent pneumococcal conjugate vaccine. The population considered were people aged ≥ two years at increased risk of invasive pneumococcal disease due to chronic kidney disease; splenic dysfunction; HIV infection; a compromised immune system; chronic heart, liver, or respiratory disease; or diabetes. Outcome measures for the analysis were costs, gains in life years and quality adjusted life years (QALYs), and incremental cost effectiveness ratios. The study authors noted that, due to increasing indirect protection resulting from the vaccination of infants with the 13-valent pneumococcal vaccine, the burden of disease preventable by vaccinating high risk people aged > two years will diminish over time. They stated that, under base case assumptions (no overall impact on non-bacteraemic pneumonia* and assuming the high-risk vaccination programme would be launched two to three years after the infant programme) the incremental cost effectiveness ratio was estimated to be more than £30,000 per QALY gained for most risk groups. If, however, the vaccine does offer protection against non-bacteraemic pneumococcal pneumonia or the vaccine was introduced at the same time as the infant 13 valent pneumococcal conjugate vaccination programme then vaccinating high risk people would (more) likely be cost effective. Sensitivity analyses indicated that the cost effectiveness was particularly sensitive to vaccine efficacy estimates and assumed herd benefits. The study authors concluded that under base case assumptions it is unlikely that a programme to vaccinate high risk individuals against pneumococcal disease could be considered cost effective. They stated that uncertainty could be substantially reduced by ascertaining the effectiveness of the 13 valent pneumococcal conjugate vaccine against non-bacteraemic pneumococcal pneumonia, particularly in at risk groups.

*Bacteraemic pneumonia (where pneumococcal bacteria have spread to the bloodstream) has a much higher mortality than non-bacteraemic pneumonia (where the infection is confined to the respiratory system).

Chen Y, Li K, Pu H, et al. 2011. **Corticosteroids for pneumonia. Cochrane Database of Systematic Reviews** (3) http://onlinelibrary.wiley.com/doi/10.1002/14651858.CD007720.pub2/abstract

Corticosteroids can affect immune regulation, carbohydrate metabolism, protein catabolism, electrolyte balance and stress response. They are used to treat a variety of inflammatory diseases but it is unclear whether they are beneficial for patients with pneumonia. This review aimed to assess the efficacy and safety of corticosteroids in the treatment of pneumonia. It included six RCTs involving 437 participants. Methodological quality was high in two studies and poor in three. All studies had small numbers of participants. Two small studies provided weak evidence that corticosteroids did not significantly reduce mortality (Peto odds ratio (OR) 0.26, 95% CI 0.05 to 1.37), but did accelerate the resolution of symptoms and time to clinical stability, and decrease the relapse rate for the disease. Steroids can improve oxygenation and reduce the need for mechanical ventilation in patients with severe pneumonia. There was no significant difference between treatment groups in the time to discharge from the intensive care unit (ICU). There were insufficient data to report the time to pneumonia resolution and rate of admission to ICU. Serious adverse events were rare. In total from the 437 participants, three patients had adverse events. These were arrhythmia, upper gastrointestinal bleeding and malignant hypertension. The review authors concluded that, in most patients with pneumonia, corticosteroids are generally beneficial for accelerating the time to resolution of symptoms but that the evidence from the included studies was not strong enough to make any recommendations. They did, however recommend steroids for children with pneumonia due to *M. pneumoniae* because corticosteroids can significantly relieve clinical symptoms and prevent relapse of the disease.

A number of recent Cochrane reviews deal with the prevention or treatment of pneumonia in particular situations (such in association with ventilator use) or in particular patient groups (such as patients with AIDS or cystic fibrosis). The titles and links of these reviews are listed below.

Ewald H, Raatz H, Boscacci R, et al. 2015. **Adjunctive corticosteroids for Pneumocystis jiroveci pneumonia in patients with HIV infection**. Cochrane Database of Systematic Reviews (4). http://onlinelibrary.wiley.com/doi/10.1002/14651858.CD006150.pub2/abstract

Berton Danilo C, Kalil Andre C, Teixeira Paulo José Z. 2014. **Quantitative versus qualitative cultures of respiratory secretions for clinical outcomes in patients with ventilator-associated pneumonia**. Cochrane Database of Systematic Reviews (10). http://onlinelibrary.wiley.com/doi/10.1002/14651858.CD006482.pub4/abstract

Bo L, Li J, Tao T, et al. 2014. **Probiotics for preventing ventilator-associated pneumonia**. Cochrane Database of Systematic Reviews (10). http://onlinelibrary.wiley.com/doi/10.1002/14651858.CD009066.pub2/abstract

Regan Kate H, Bhatt J. 2014. **Eradication therapy for Burkholderia cepacia complex in people with cystic fibrosis**. Cochrane Database of Systematic Reviews (10). http://onlinelibrary.wiley.com/doi/10.1002/14651858.CD009876.pub2/abstract

Stern A, Green H, Paul M, et al. 2014. **Prophylaxis for Pneumocystis pneumonia (PCP) in non-HIV immunocompromised patients**. Cochrane Database of Systematic Reviews (10). http://onlinelibrary.wiley.com/doi/10.1002/14651858.CD005590.pub3/abstract

Burgess L, Southern Kevin W. 2014. **Pneumococcal vaccines for cystic fibrosis**. Cochrane Database of Systematic Reviews (8). http://onlinelibrary.wiley.com/doi/10.1002/14651858.CD008865.pub3/abstract

Amin R, Waters V. 2014. **Antibiotic treatment for Stenotrophomonas maltophilia in people with cystic fibrosis**. Cochrane Database of Systematic Reviews (4). http://onlinelibrary.wiley.com/doi/10.1002/14651858.CD009249.pub3/abstract

Kabra Sushil K, Lodha R. 2013. **Antibiotics for preventing complications in children with measles**. Cochrane Database of Systematic Reviews (8). http://onlinelibrary.wiley.com/doi/10.1002/14651858.CD001477.pub4/abstract

Shi Z, Xie H, Wang P, et al. 2013. **Oral hygiene care for critically ill patients to prevent ventilator-associated pneumonia**. Cochrane Database of Systematic Reviews (8) http://onlinelibrary.wiley.com/doi/10.1002/14651858.CD008367.pub2/abstract

Horsley A, Jones Andrew M. 2012. **Antibiotic treatment for Burkholderia cepacia complex in people with cystic fibrosis experiencing a pulmonary exacerbation**. Cochrane Database of Systematic Reviews (10) http://onlinelibrary.wiley.com/doi/10.1002/14651858.CD009529.pub2/abstract

Other relevant publications

Vogel AM, Trenholme AA, Stewart JM, et al. 2013. **Impact of pneumococcal vaccine on hospital admission with lower respiratory infection in children resident in South Auckland, New Zealand**. N Z Med J 126(1378) 26-35

This study aimed to assess the change in admission rates for all lower respiratory infection (LRIs), including pneumonia, for children residing in the Counties Manukau DHB, following the introduction of the 7-valent pneumococcal conjugate vaccine (PCV-7) in June 2008. It found that pneumonia, but not bronchiolitis, admissions have been declining since 2001. There was a significant decrease in pneumonia admissions after PCV7 introduction (incidence risk ratio pre vs. post PCV7 (IRR) 1.51, 95% CI 1.08 to 1.77), additional to the gradual decline since 2001. Post PCV introduction, there was a significant decline for Pacific children (IRR 1.70, 95% CI 1.39 to 2.07) but not for Māori children (IRR 1.05, 95% CI 0.78 to 1.40). Māori and Pacific children were found to be at increased risk of admission with LRI compared to European children (relative risk (RR) 4.6, 95% CI 4.3 to 5.0 and 5.0, 95% CI 3.7 to 5.3, respectively) as were those living in Decile 9, 10 compared with those from other deciles (RR 1.43, 95% CI 1.36 to 1.50). The study authors concluded that admissions for pneumonia in young children had declined following the introduction of PCV7 but there had been less impact for Māori children in Counties Manukau DHB.

ASTHMA

Introduction

Asthma is the most common non-communicable disease in children.[61] The diagnosis is a clinical one, based on recurrent episodes of asthma symptoms (more than one of breathlessness, wheezing, chest tightness and cough).[62] It is important to understand that there are many different causes of wheezing in children and that, especially in pre-school children and infants, the commonest clinical pattern is episodes of wheezing, cough and difficulty breathing in association with viral upper respiratory infections.[62] Most of these children will stop having recurrent chest symptoms by school age[62] and so clinicians have become increasingly reluctant to diagnose very young children with asthma. Nevertheless, a high proportion of children diagnosed with chronic asthma in later childhood had their first symptoms and signs of the disorder in their preschool years.[63]

The causes of asthma are not well understood.[61] The strongest risk factors for developing asthma are a genetic predisposition (family history of asthma and/or other allergic diseases such as eczema and allergic rhinitis) together with environmental exposure to inhaled substances and particles that may provoke allergic reactions or irritate the airways, such as house dust mites, pet dander, pollen, mould, and tobacco smoke.[61] Asthma can also be triggered by cold air, exercise and psychological distress.[61] The prevalence of asthma in New Zealand is one of the highest in the world.[64] There are ethnic disparities in asthma prevalence[65] and hospitalisation rates.[66] Although primary prevention of asthma will not be possible until the causes of asthma are better understood, better treatment through improved access to primary care, and educational interventions for parents, children and healthcare providers, has the potential to reduce asthma morbidity and hospitalisation rates.[62]

The following section reports on deaths due to asthma and hospitalisations for asthma and wheeze in children and young people, using information from the National Minimum Dataset and the National Mortality Collection. It concludes with a brief overview of evidence-based reviews and guidelines which consider the most effective interventions for preventing or managing asthma in children and young people.

Data sources and methods

Indicators

Deaths from asthma or wheeze in 0–24 year olds
Hospitalisations for asthma or wheeze in 0–24 year olds

Data sources

Numerator: *Deaths*: National Mortality Collection
Hospitalisations: National Minimum Dataset
Denominator: Statistics NZ estimated resident population (with linear extrapolation being used to calculate denominators between Census years).

Definition

Deaths: Deaths of 0–24 year olds with where the main underlying cause of death was asthma or wheeze (per 100,000 age-specific population)
Hospitalisations: Acute and arranged hospitalisations of 0–24 year olds with a primary diagnosis of asthma or wheeze (per 1,000 age-specific population). Refer to **Appendix 6** for the codes included.

Notes on interpretation

Note 1: In 2013, a number of changes were made to the ICD-10-AM codes included in this indicator. The changes included broadening asthma to include wheeze to take into account a shift in the way paediatricians were diagnosing asthma in preschool children. As a result, the rates in this section are not directly comparable with those presented in NZCYES reports prior to 2013.
Note 2: An acute hospitalisation is an unplanned hospitalisation occurring on the day of presentation, while an arranged hospitalisation (referred to elsewhere in this report as a semi-acute hospitalisation) is a non-acute hospitalisation with an admission date less than seven days after the date the decision was made that the hospitalisation was necessary.
Note 3: **Appendix 3** describes the National Minimum Dataset and outlines the limitations of the data utilised from this data collection. The reader is advised to review this appendix before interpreting any patterns.

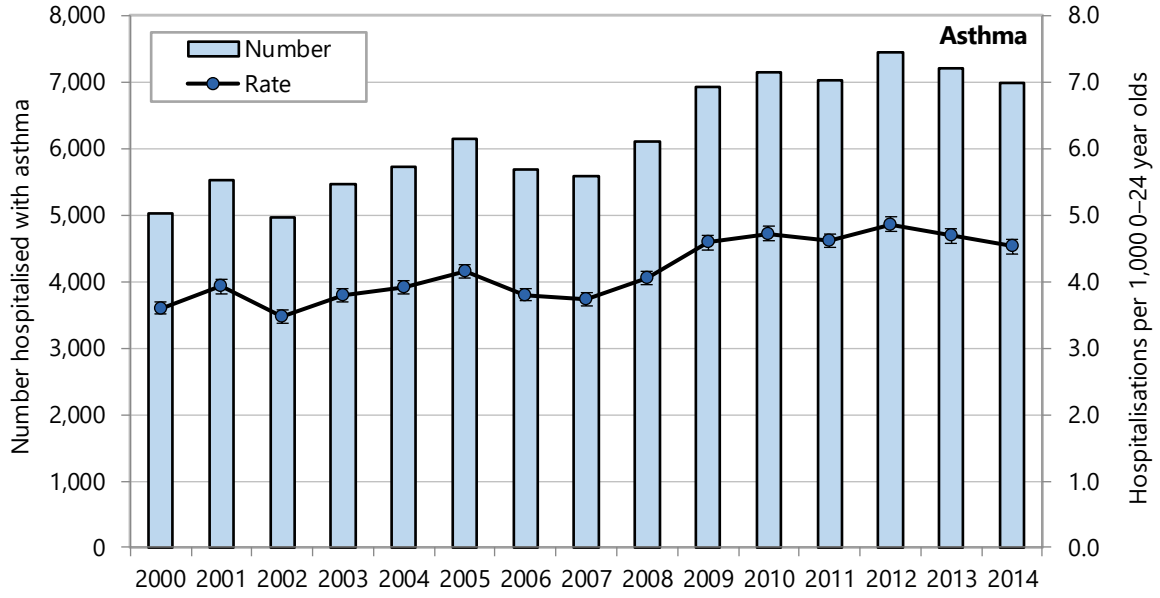
National trends and distribution

There were 24 deaths of 0–24 year olds from 2008 to 2012 with asthma as the underlying cause, an average of 4.8 deaths per year. The number of hospitalisations for asthma increased from 5020 in 2000 to 6982 in 2014. There was a *significant rise* in rate from 3.60 hospitalisations per 1,000 0–24 year olds in 2000 to 4.71 hospitalisations per 1,000 0–24 year olds in 2010 with fairly stable rates since then **(Figure 92)**. From 2000 to

2014 the rise in hospitalisation rates was specific to 0–14 year olds (4.67 to 6.86 hospitalisations per 1,000) whereas there was a *significant fall* in hospitalisation rates for 15–24 year olds from 1.81 to 1.15 hospitalisations per 1,000 **(Figure 93)**.

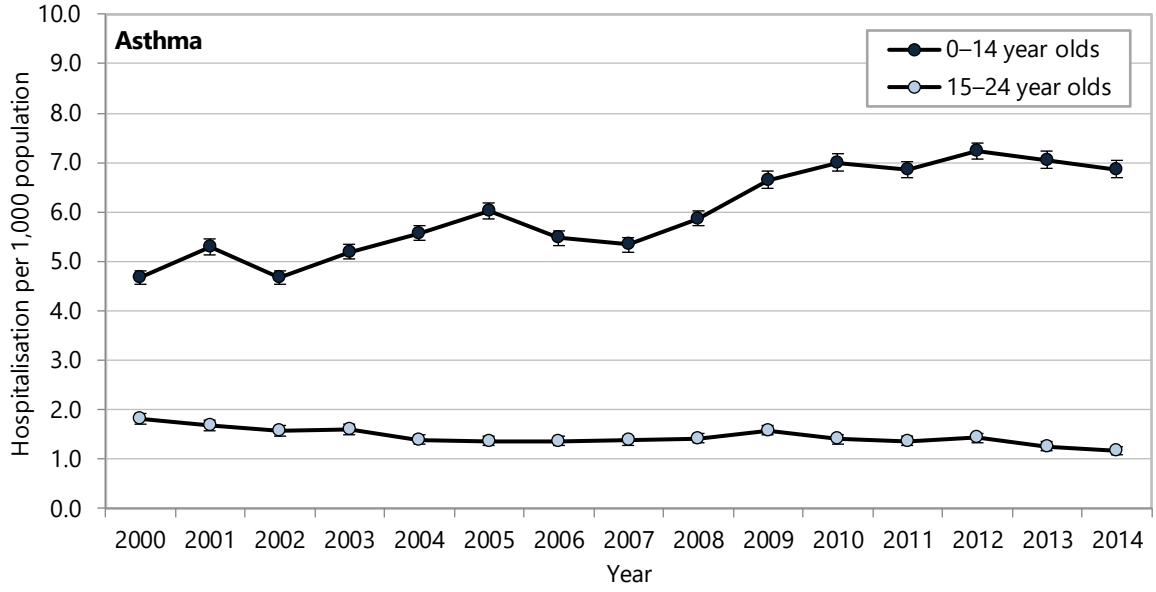
The rise in asthma hospitalisation rates over time was seen in all ethnic groups. Hospitalisation rates were consistently highest for Pacific; Māori and MELAA rates were consistently higher than European/Other and Asian/Indian rates **(Figure 94)**.

Figure 92.Hospitalisations for asthma in 0–24 year olds, New Zealand 2000–2014



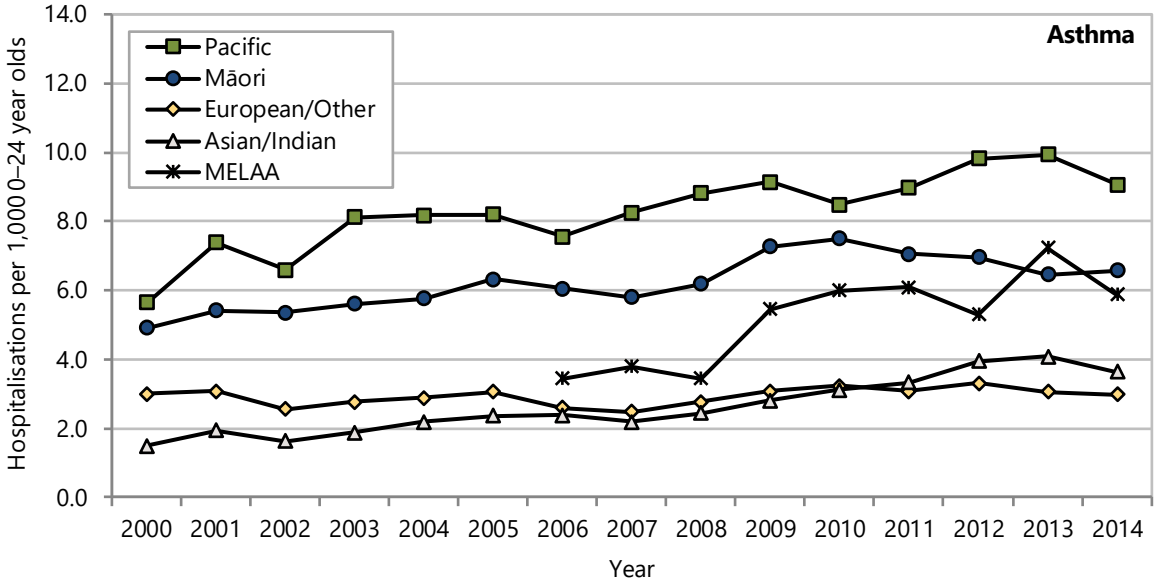
Numerator: National Minimum Dataset (acute and arranged admissions); Denominator: Statistics NZ Estimated Resident Population

Figure 93. Hospitalisations for asthma in 0–24 year olds, by age group, New Zealand 2000–2014



Numerator: National Minimum Dataset (acute and arranged admissions); Denominator: Statistics NZ Estimated Resident Population. Rate is per 1,000 age-specific population

Figure 94. Hospitalisations for asthma in 0–24 year olds, by ethnicity, New Zealand 2000–2014



Numerator: National Minimum Dataset (acute and arranged admissions); Denominator: Statistics NZ Estimated Resident Population

Primary diagnosis

Between 2010 and 2014 the most common primary diagnoses for hospitalisations in the section were asthma and wheeze. The diagnosis of wheeze occurred mainly in 0–14 year olds, where it accounted for 31.5% of hospitalisations. In 15–24 year olds asthma was the diagnosis in 94.8% of hospitalisations **(Table 81)**.

Table 81. Hospitalisations for asthma in 0–24 year olds, by primary diagnosis, New Zealand 2010–2014

Primary diagnosis	Number: 2010–2014	Number: annual average	Rate per 1,000 0–24 year olds	95% CI	Per cent
Asthma and wheeze					
0–24 year olds					
Asthma	24,752	4,950	3.24	3.20–3.28	69.1
Status asthmaticus	1,047	209	0.14	0.13–0.15	2.9
Wheeze	10,003	2,001	1.31	1.28–1.33	27.9
Total	35,802	7,160	4.68	4.63–4.73	100.0
0–14 year olds					
Asthma	20,853	4,171	4.60	4.54–4.67	65.8
Status asthmaticus	864	173	0.19	0.18–0.20	2.7
Wheeze	9,973	1,995	2.20	2.16–2.25	31.5
Total	31,690	6,338	7.00	6.92–7.07	100.0
15–24 year olds					
Asthma	3,899	780	1.25	1.21–1.29	94.8
Status asthmaticus	183	37	0.06	0.05–0.07	4.5
Wheeze	30	6	0.01	0.01–0.01	0.7
Total	4,112	822	1.32	1.28–1.36	100.0

Numerator: National Minimum Dataset (acute and arranged admissions); Denominator: Statistics NZ Estimated Resident Population

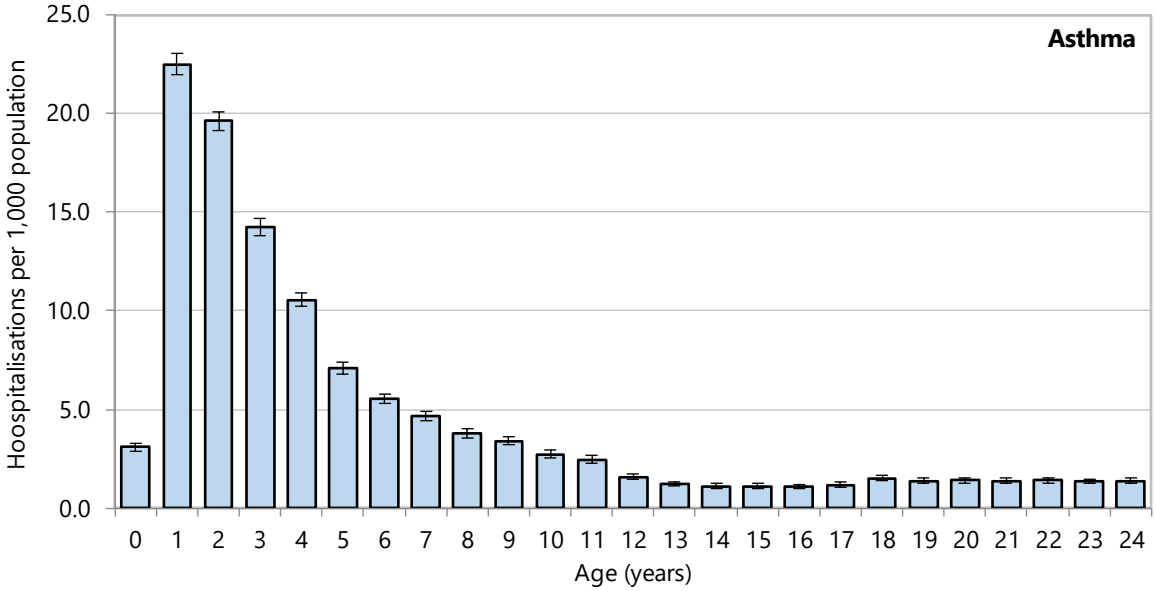
Distribution by demographic factors

Between 2010 and 2014 the asthma hospitalisation rate was highest for one year olds, *fell significantly* with increasing age to age 13 years after which rates remained similar with increasing age **(Figure 95)**. There was disparity in asthma hospitalisation rates by age, with the highest rate in 0–4 year olds (14 hospitalisations per 1,000 1–4 year olds) which was 10.64 (95% CI 10.30–11.00) times higher than the rate for 15–24 year olds; the rate of 3.37 per 1,000 5–14 year olds was 2.56 (95% CI 2.47–2.66) times higher than the rate for 15–24 year olds.

For 0–14 year olds there was disparity in asthma hospitalisation rates by NZDep2013 index of deprivation score, ethnicity and gender. There was a consistent social gradient with a significant increase in rate between each quintile of NZDep2013 scores compared with the quintile below. Compared with European/Other, rates were *significantly higher* for Māori, Pacific, Asian/Indian and MELAA. Male rates were *significantly higher* than female rates **(Table 82).**

For 15–24 year olds there was similar disparity by NZDep2013 index of deprivation score. Compared with European/Other, asthma hospitalisation rates were *significantly higher* for Māori, Pacific and MELAA and *significantly lower* for Asian/Indian. There was *no significant difference* between male and female rates in this older age group **(Table 82)**.

Figure 95. Hospitalisations for asthma in 0–24 year olds, by age, New Zealand 2010–2014



Numerator: National Minimum Dataset (acute and arranged admissions); Denominator: Statistics NZ Estimated Resident Population; Rate is per 1,000 age-specific population

Table 82. Hospitalisations for asthma in 0–24 year olds, by age group and demographic factor, New Zealand 2010–2014

Variable	Number: 2010–2014	Rate per 1,000 0–24 year olds	Rate ratio	95% CI
Asthma				
0–14 year olds				
NZDep2013 Index of deprivation quintile				
Deciles 1–2	3,599	4.13	1.00	
Deciles 3–4	4,245	5.26	1.27	1.22–1.33
Deciles 5–6	5,201	6.08	1.47	1.41–1.54
Deciles 7–8	7,282	7.75	1.88	1.80–1.95
Deciles 9–10	11,209	10.62	2.57	2.48–2.67
Prioritised ethnicity				
Māori	10,728	9.31	1.98	1.93–2.04
Pacific	5,860	13.47	2.87	2.78–2.96
Asian/Indian	3,225	6.77	1.44	1.39–1.50
MELAA	528	9.49	2.02	1.85–2.20
European/Other	11,308	4.69	1.00	
Gender				
Female	12,380	5.61	1.00	
Male	19,309	8.32	1.48	1.45–1.52
15–24 year olds				
NZDep2013 Index of deprivation quintile				
Deciles 1–2	355	0.67	1.00	
Deciles 3–4	431	0.83	1.24	1.07–1.42
Deciles 5–6	650	1.12	1.67	1.47–1.90
Deciles 7–8	1,012	1.49	2.23	1.97–2.51
Deciles 9–10	1,639	2.04	3.05	2.72–3.42
Prioritised ethnicity				
Māori	1,571	2.49	2.60	2.43–2.79
Pacific	628	2.36	2.47	2.25–2.71
Asian/Indian	181	0.39	0.41	0.35–0.48
MELAA	71	1.67	1.75	1.38–2.22
European/Other	1,647	0.96	1.00	
Gender				
Female	2,800	1.83	1.00	
Male	1,312	0.83	0.45	0.42–0.48

Numerator: National Minimum Dataset (acute and arranged admissions); Denominator: Statistics NZ Estimated Resident Population; Rates are per 1,000 age-specific population; Rate ratios are unadjusted; Ethnicity is level 1 prioritised; Decile is NZDep2013

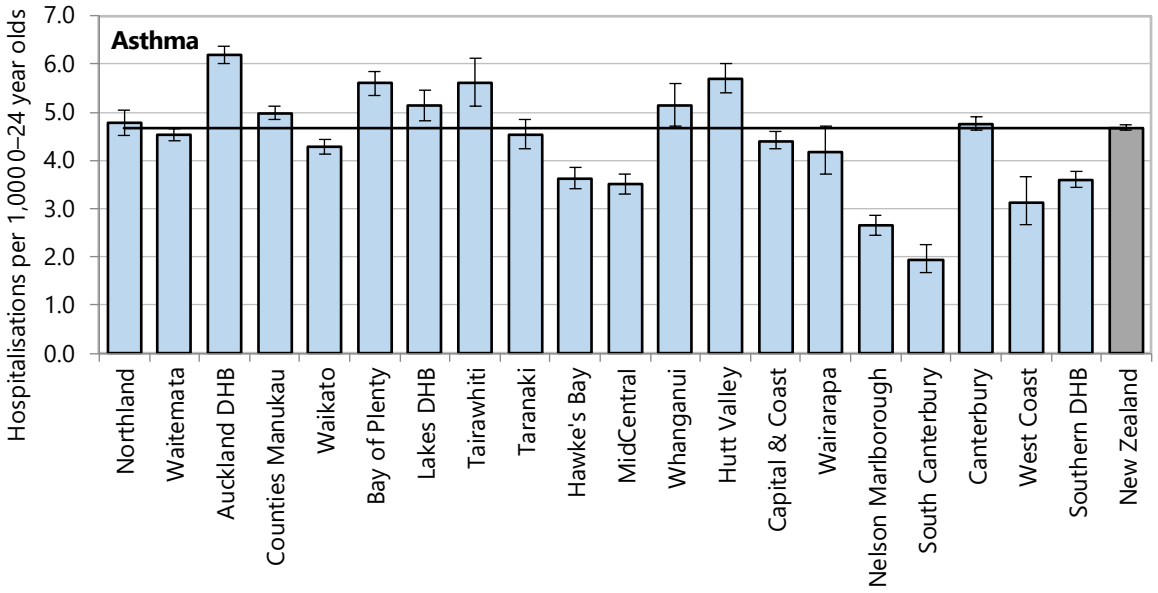
Distribution by season

The lowest rates of asthma hospitalisation were in January with no clear seasonal variation through the rest of the year.

Distribution by region

Between 2010 and 2014 asthma hospitalisation rates for 0–24 year olds were *significantly higher* than the national rate in the Auckland, Counties Manukau, Bay of Plenty, Lakes, Tairawhiti, Whanganui and Hutt Valley DHBs and significantly lower in the Waikato, Hawke's Bay, MidCentral, Nelson Marlborough, South Canterbury, West Coast and Southern DHBs. In the remaining district health boards there was *no significant difference* from the national rate **(Figure 96**, **Table 83)**.

Figure 96. Hospitalisations for asthma in 0–24 year olds, by district health board, New Zealand 2010–2014



Numerator: National Minimum Dataset (acute and arranged hospitalisations); Denominator: Statistics NZ Estimated Resident Population

Table 83. Hospitalisations for asthma in 0–24 year olds, by district health board, New Zealand 2010–2014

DHB	Number: 2010–2014	Number: annual average	Rate per 1,000 0–24 year olds	Rate ratio	95% CI
Asthma					
0–24 year olds					
Northland	1,329	266	4.78	1.02	0.97–1.08
Waitemata	4,281	856	4.53	0.97	0.94–1.00
Auckland	4,848	970	6.19	1.32	1.28–1.36
Counties Manukau	4,844	969	4.99	1.07	1.03–1.10
Waikato	2,908	582	4.29	0.92	0.88–0.95
Bay of Plenty	1,975	395	5.60	1.20	1.14–1.25
Lakes	946	189	5.14	1.10	1.03–1.17
Tairawhiti	506	101	5.61	1.20	1.10–1.31
Taranaki	855	171	4.54	0.97	0.91–1.04
Hawke's Bay	982	196	3.63	0.77	0.73–0.83
MidCentral	1,043	209	3.50	0.75	0.70–0.80
Whanganui	538	108	5.14	1.10	1.01–1.20
Hutt Valley	1,399	280	5.70	1.22	1.15–1.28
Capital & Coast	2,225	445	4.41	0.94	0.90–0.98
Wairarapa	275	55	4.18	0.89	0.79–1.01
Nelson Marlborough	555	111	2.65	0.57	0.52–0.62
South Canterbury	165	33	1.94	0.41	0.36–0.48
Canterbury	3,946	789	4.76	1.02	0.99–1.05
West Coast	156	31	3.13	0.67	0.57–0.78
Southern	1,859	372	3.60	0.77	0.73–0.81
New Zealand	35,802	7,160	4.68	1.00	

Numerator: National Minimum Dataset (acute and arranged hospitalisations); Denominator: Statistics NZ Estimated Resident Population

Northern region distribution and trends

Comparisons with New Zealand

Between 2010 and 2014 asthma hospitalisation rates for 0–24 year olds were *significantly higher* than the national rate in Auckland and Counties Manukau, DHBs. Rates for 0–14 year olds were *significantly higher* in Auckland DHB and *significantly lower* in Northland and Waitemata DHBs. Rates for 15–24 year olds were *significantly higher* in Northland, Waitemata, and Counties Manukau DHBs and *significantly lower* in Auckland DHB. The following rates were *not significantly different* from the national rate: Northland and Waitemata 0–24 year olds, and Counties Manukau 0–14 year olds **(Table 84)**.

Table 84. Hospitalisations for asthma in 0–24 year olds, by age group, Northern DHBs vs New Zealand 2010–2014

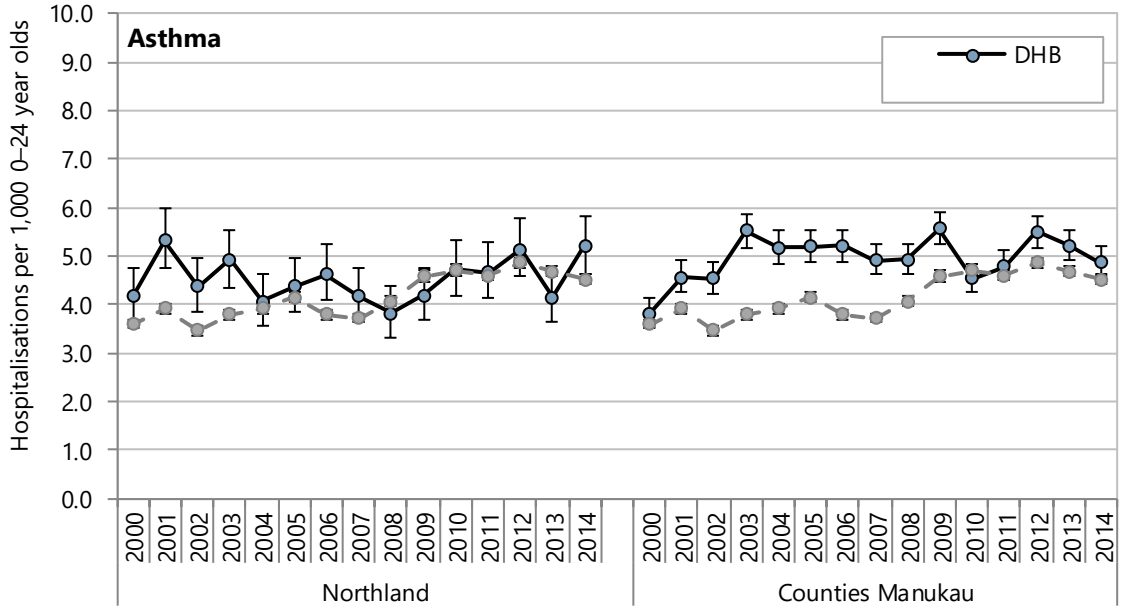
DHB	Number: 2010–2014	Number: annual average	Rate per 1,000 population	Rate ratio	95% CI
Asthma					
0–24 year olds					
Northland	1,329	266	4.78	1.02	0.97–1.08
Waitemata	4,281	856	4.53	0.97	0.94–1.00
Auckland	4,848	970	6.19	1.32	1.28–1.36
Counties Manukau	4,844	969	4.99	1.07	1.03–1.10
New Zealand	35,802	7,160	4.68	1.00	
0–14 year olds					
Northland	1,175	235	6.48	0.93	0.87–0.98
Waitemata	3,697	739	6.58	0.94	0.91–0.97
Auckland	4,408	882	10.69	1.53	1.48–1.58
Counties Manukau	4,123	825	6.94	0.99	0.96–1.03
New Zealand	31,690	6,338	7.00	1.00	
15–24 year olds					
Northland	154	31	1.60	1.21	1.03–1.42
Waitemata	584	117	1.52	1.16	1.06–1.26
Auckland	440	88	1.19	0.90	0.82–0.99
Counties Manukau	721	144	1.91	1.45	1.34–1.57
New Zealand	4,112	822	1.32	1.00	

Numerator: National Minimum Dataset (acute and arranged admissions); Denominator: Statistics NZ Estimated Resident Population

Regional trends

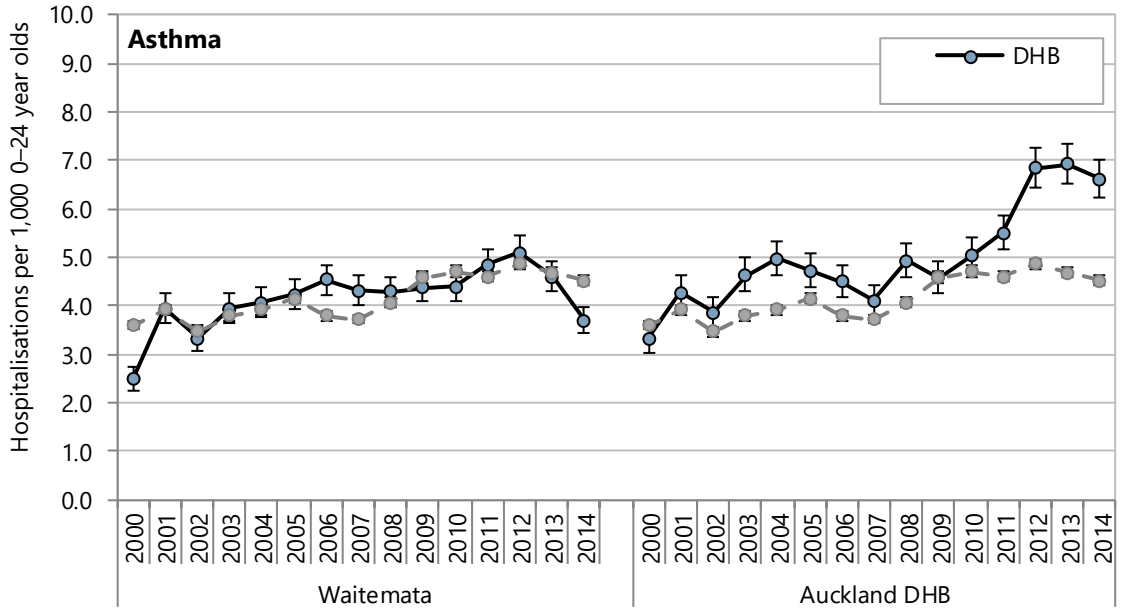
From 2000 to 2014 the asthma hospitalisation rates for 0–24 year olds rose in Auckland DHB while rates in the other Northern DHBs were variable **(Figure 97, Figure 98)**.

Figure 97.Hospitalisations for asthma in 0–24 year olds, Northland and Counties Manukau DHBs vs New Zealand 2000–2014



Numerator: National Minimum Dataset (acute and arranged admissions), Denominator: Statistics NZ Estimated Resident Population

Figure 98. Hospitalisations for asthma in 0–24 year olds, Waitemata and Auckland DHBs vs New Zealand 2000–2014

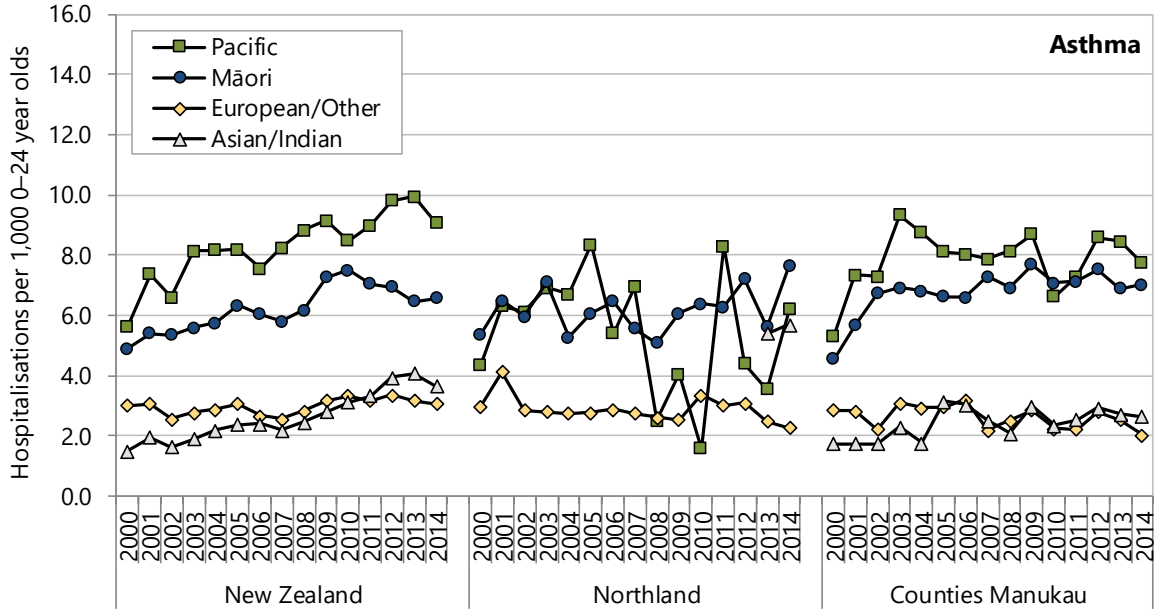


Numerator: National Minimum Dataset (acute and arranged admissions), Denominator: Statistics NZ Estimated Resident Population

In Waitemata, Auckland and Counties Manukau DHBs from 2000 to 2014, asthma hospitalisation rates for 0–24 year olds were consistently highest for Pacific, next highest for Māori, and lowest for European/Other and Asian/Indian (these last two groups had similar rates). In Northland, Māori hospitalisation rates were consistently higher than European/Other rates while Pacific and Asian/Indian rates were highly variable (due to small numbers) **(Figure 99**, **Figure 100)**.

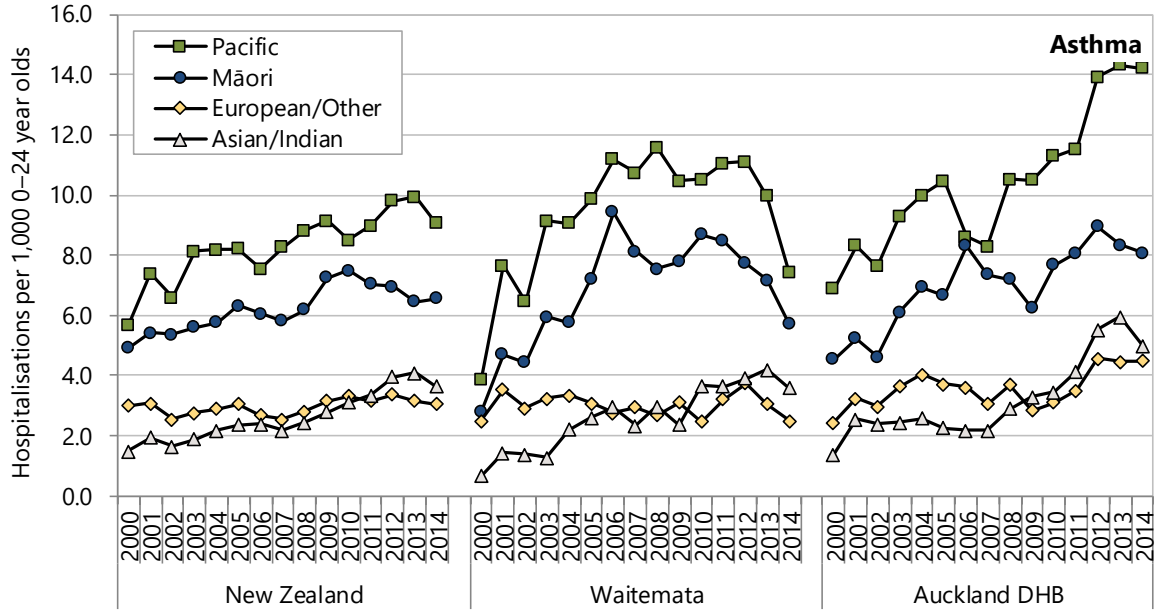
In Northland no clear trends by ethnicity were apparent, while in Auckland hospitalisation rates for asthma rose in all ethnic groups. In Waitemata, hospitalisation rates were steady in European/Other, rose in Asian/Indian, and rose in the early 2000s but fell over recent years in Pacific and Māori. In Counties Manukau, rates were steady in all ethnic groups from 2002 onwards **(Figure 99**, **Figure 100)**.

Figure 99. Hospitalisations for asthma in 0–24 year olds, by ethnicity, Northland and Counties Manukau DHBs vs New Zealand 2000–2014



Numerator: National Minimum Dataset (acute and arranged admissions); Denominator: Statistics NZ Estimated Resident Population; Caution: rates in Northland DHB for Pacific are affected by small numbers for some years and rates for Asian/Indian are suppressed prior to 2013 due to small numbers

Figure 100. Hospitalisations for asthma in 0–24 year olds, by ethnicity, Waitemata and Auckland DHBs vs New Zealand 2000–2014

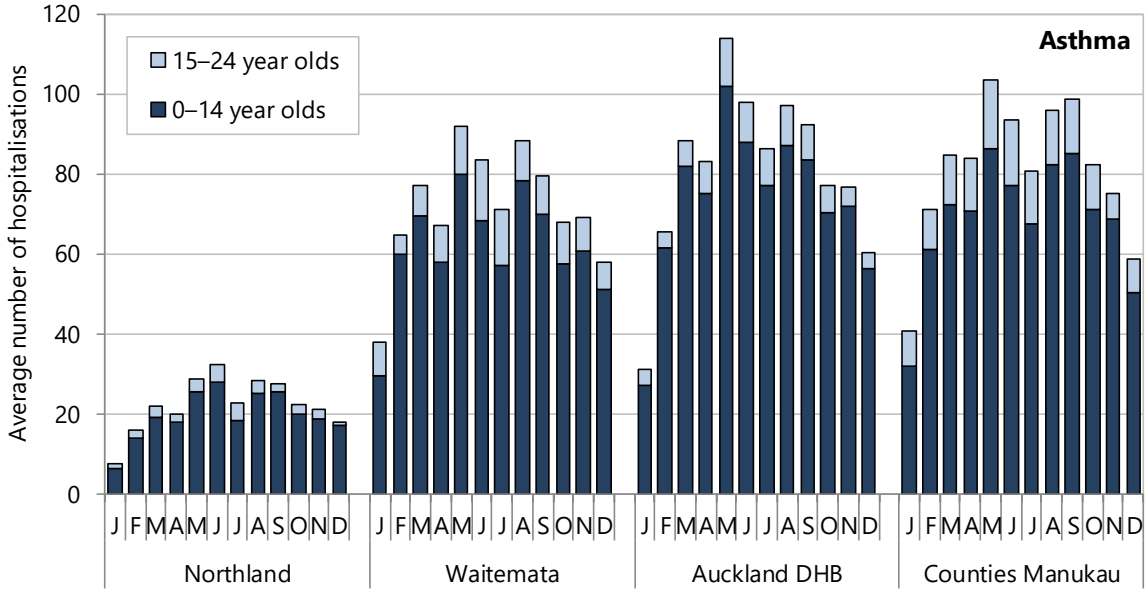


Numerator: National Minimum Dataset (acute and arranged admissions); Denominator: Statistics NZ Estimated Resident Population

Regional distribution by season

In the Northern DHBs, while no consistent seasonal variations in asthma hospitalisations in 0–14 year olds were evident, the number of hospitalisations was generally lower in December and January.

Figure 101. Average number of hospitalisations for asthma in 0–24 year olds, by month and age group, Northern DHBs 2010–2014



Numerator: National Minimum Dataset (acute and arranged admissions)

Evidence for good practice for the prevention and management of asthma

International guidelines
Global Initiative for Asthma. 2015. **Global Strategy for Asthma Management and Prevention**. http://www.ginasthma.org/documents/4 This report is intended as a guide for health professionals and policymakers. It is based on current best evidence and medical knowledge. Report chapters cover definition, description and diagnosis of asthma, assessment, treatment, asthma exacerbations, asthma-COPD overlap syndrome, asthma in children five years and younger, primary prevention of asthma, and implementing asthma management strategies into health systems. Treatment recommendations are accompanied by evidence grades and references. Regarding primary prevention in children five years and younger, the report suggests that parents enquiring about how to reduce the risk of their child developing asthma can be advised that: children should not be exposed to environmental tobacco smoke before or after birth, vaginal delivery is preferred if possible (to expose the infant to the mother's vaginal microflora), breastfeeding is advised (for reasons other than prevention of allergy and asthma) and the use of broad-spectrum antibiotics in the first year of life should be discouraged. The GINA website has a number of other useful resources, including pocket guides for asthma management and prevention, and the appendix to the Global Strategy. These can be found here: http://www.ginasthma.org/documents/1. It is necessary to download and save the documents to be able to navigate them more easily.
British Thoracic Society, Scottish Intercollegiate Guidelines Network. 2014. **British guideline on the management of asthma: A national clinical guideline**. London, Edinburgh: British Thoracic Society, Scottish Intercollegiate Guidelines Network. https://www.brit-thoracic.org.uk/document-library/clinical-information/asthma/btssign-asthma-guideline-2014/ This guideline provides best practice recommendations, based on current evidence, for the management of asthma in adults (including pregnant women), adolescents and children. Recommendations in the guideline cover diagnosis and monitoring, supported self-management, non-pharmacological management, pharmacological management, inhaler devices, acute asthma, difficult asthma, asthma in pregnancy, occupational asthma and organisation and delivery of care. Recommendations are accompanied by a grade indicating the strength of the supporting evidence. A quick reference version of the guideline can be found here: https://www.brit-thoracic.org.uk/document-library/clinical-information/asthma/btssign-asthma-guideline-quick-reference-guide-2014/ Supporting material for the guideline, and patient information resources, can be found on the SIGN website: http://www.sign.ac.uk/guidelines/fulltext/141/index.html .
Chung KF, Wenzel SE, Brozek JL, et al. 2014. **International ERS/ATS guidelines on definition, evaluation and treatment of severe asthma**. Eur Respir J, 43(2), 343-73. http://erj.ersjournals.com/content/43/2/343.long This guideline defines severe asthma as asthma that requires treatment with high dose inhaled corticosteroids plus a second controller and/or systemic corticosteroids to prevent it becoming "uncontrolled" or that remains "uncontrolled" despite this therapy. A Task force supported by the American Thoracic Society and the European Respiratory Society performed a literature review and then held an expert committee discussion which used the GRADE approach to develop specific clinical recommendations on the evaluation and treatment of severe asthma in children and adults. The Task Force stated that severe asthma is a heterogenous condition with various phenotypes. They made specific recommendations on the use of sputum eosinophil count and exhaled nitric oxide to guide therapy as well as treatment with anti IgE antibody, methotrexate, macrolide antibiotics, antifungal agents and bronchial thermoplasty. These are set out in a table which gives, for each recommendation, the strength of recommendation, the quality of evidence and also brief discussion of values and preferences and explanatory remarks.
Lougheed MD, Lemiere C, Ducharme FM, et al. 2012. **Canadian Thoracic Society 2012 guideline update: diagnosis and management of asthma in preschoolers, children and adults**. Can Respir J, 19(2), 127-64. http://www.pulsus.com/journals/abstract.jsp?sCurrPg=journal&jnlKy=4&atlKy=10569&isuKy=1021&isArt=t This guideline update from the Canadian Thoracic Society addresses four clinical questions: the role of non-invasive measurements of airway inflammation for the adjustment of anti-inflammatory therapy; the initiation of adjunct therapy to corticosteroids (ICS) for uncontrolled asthma; the role of a single inhaler of an ICS/long-acting beta-agonist combination as a reliever, and as a reliever and a controller; and the escalation of controller medication for acute loss of asthma control as part of a self-management action plan. The guideline panel formally assessed and graded the evidence and made 34 recommendations.
Sveum R, Bergstrom J, Brottman G, et al. 2012. **Diagnosis and Management of Asthma**. Bloomington, MN: Institute for Clinical Systems Improvement. https://www.icsi.org/guidelines__more/catalog_guidelines_and_more/catalog_guidelines/catalog_respiratory_guidelines/asthma/ This guideline covers asthma diagnosis, and emergent, inpatient and outpatient management of acute and chronic asthma, in all patients over five years of age who present with asthma-like symptoms or have been diagnosed with asthma. The guideline presents two algorithms, one for general asthma management and one for emergency department or inpatient management, accompanied by annotations which explain and provide supporting information for the steps in the algorithms. Recommendations are accompanied by references and indications of evidence quality.
The **Cincinnati Children's Hospital Medical Center** has produced a number of **Best Evidence Statements** relating to asthma. Recommendations are accompanied by an indication of level of evidence and a strength of recommendation, and a discussion/summary of the evidence related to the recommendation. Links to these Best Evidence Statements are given below. Use of a clinical pathway in decreasing albuterol frequency in all patients up to 18 years of age admitted to the hospital with a diagnosis of asthma or reactive airway disease. (2011) Pediatric Patients with Wheezing: Oxygen versus Air Nebulization (2011) Management of acute exacerbation of asthma in children: (2010) Care Guideline | Highlights | Inpatient Order Set

Using formal communication to collaborate with schools to decreased patient admissions/Emergency Department visits and missed school days and improve ACT scores for children with asthma (2012)

Culturally Sensitive Asthma Education (2013)

Evidence-based medicine reviews

There are now hundreds of Cochrane reviews relating to asthma in children, therefore it has not been possible to summarise them all here. The recent Cochrane reviews that have been included deal mostly with more general non-pharmacological interventions.

Sauni R, Verbeek Jos H, Uitti J, et al. 2015. **Remediating buildings damaged by dampness and mould for preventing or reducing respiratory tract symptoms, infections and asthma**. Cochrane Database of Systematic Reviews (2) http://onlinelibrary.wiley.com/doi/10.1002/14651858.CD007897.pub3/abstract

Moisture damage is a common problem in homes, workplaces and public buildings such as schools. The resulting dampness and mould has been associated with respiratory symptoms, asthma and respiratory infections in the buildings' occupants. This review aimed to determine the effectiveness of repairing buildings damaged by dampness and mould in reducing or preventing respiratory symptoms, asthma and respiratory infections. It included 12 studies with a total of 8,028 participants: two RCTs (294 participants), one cluster RCT (4,407 participants), and nine controlled before and after (CBA) studies (3,327 participants). Interventions varied from thorough renovation to cleaning only. There was moderate to low quality evidence that repairing houses decreased asthma-related symptoms and respiratory infections in adults. For children, there was no difference between those whose houses were repaired and those who received information only in the number of asthma days or asthma-related emergency department visits (one study, moderate quality evidence). One CBA study provided very low quality evidence that asthma-related and other respiratory symptoms decreased after repairing a mould-damaged office building, and another CBA study found no difference between full and partial repair of houses. For children in schools, the evidence regarding an effect of mould remediation on respiratory symptoms was inconsistent. Out of many symptom measures only respiratory infections might have decreased after intervention. For staff in schools, there was very low quality evidence that asthma-related and other respiratory symptoms were similar in staff in mould-damaged schools and staff in undamaged schools, both before and after intervention. The review authors stated that better research is needed, preferably with a cluster-RCT design and more validated outcome measures.

National Institute for Health and Care Excellence (NICE). 2014. **Measuring fractional exhaled nitric oxide concentration in asthma: NIOX MINO, NIOX VERO and NObreath**. London: National Institute for health and Care Excellence. http://www.nice.org.uk/guidance/dg12

Nitric oxide is produced in the lungs and is present in exhaled air. It has been shown to act as a vasodilator, bronchodilator, neurotransmitter and inflammatory mediator in the lungs and airways. Fractional exhaled nitric oxide (FeNO) has been proposed as non-invasive marker of airway inflammation in people with asthma. FeNO levels are raised in people with asthma and can be lowered with corticosteroid treatment. The purpose of this evaluation was to evaluate the clinical and cost effectiveness of measuring FeNO in the diagnosis and management of asthma. Three devices for measuring FeNO were evaluated: NIOX MINO, NIOX VERO and NObreath. A systematic review was carried out to identify evidence on the equivalence of FeNO devices (analytical validity), evidence of the diagnostic accuracy of FeNO testing for asthma diagnosis and evidence for the efficacy of FeNO-guided asthma management. A decision analytical model and a Markov model were developed to assess the cost effectiveness of measuring FeNO in the diagnosis and management of asthma. The review identified 27 studies comparing NIOX MINO, NIOX VERO and NObreath with other devices, 24 studies relevant to the diagnostic accuracy of FeNO devices, four studies on FeNO-guided asthma management in adults and five studies on FeNO-guided asthma management in children.

The NICE recommendations are:

(1) FeNO testing is recommended as an option to help diagnose asthma in adults and children: who, after initial clinical examination, are considered to have an intermediate probability of having asthma (as defined in the British guideline on the management of asthma 2012) **and** when FeNO testing is intended to be done in combination with other diagnostic options according to the British guideline on the management of asthma (2012). Further investigation is recommended for people whose FeNO test result is negative because a negative result does not exclude asthma.

(2) FeNO measurement is recommended as an option to support asthma management (in conjunction with the British guideline on the management of asthma 2012) in people who are symptomatic despite using inhaled corticosteroids.

National Institute for Health and Care Excellence. 2013. **Omalizumab for treating severe persistent allergic asthma (review of technology appraisal guidance 133 and 201)**. London: National Institute for Health and Care Excellence. http://www.nice.org.uk/guidance/ta278

Omalizumab (Xolair, Novartis) is a monoclonal antibody that binds to IgE. It is used as an add-on therapy in children over six years of age, adolescents and adults with severe persistent allergic asthma that is not well controlled despite high dose inhaled corticosteroid plus long-acting beta-2 agonist therapy. The NICE assessment group identified 11 RCTs, comparing omalizumab with placebo, in its efficacy review. Nine included only adolescents and adults, one children only, and one people between the ages of six and 20 years. The trials were considered to be generally of high quality. The assessment group also reviewed data from observational studies to support evidence from the trials, particularly data on longer-term response to omalizumab and corticosteroid sparing. They also reviewed six published cost-effectiveness studies and developed their own economic model from the perspective of the UK NHS. The assessment group's model indicated that, for both children and adults, omalizumab add-on treatment was both more costly and more effective than standard care alone. The Assessment Group calculated that the annual average cost of omalizumab for children was £8455 plus administration costs of £268 in the first year and £151 in subsequent years, and the cost for adults and adolescents was £8056 plus administration costs of £260 in the first year and £146 in subsequent years. The Appraisal Committee considered the data on the clinical and cost-effectiveness of omalizumab, the value placed on this therapy by patients and clinicians, and the cost to the NHS. The key conclusion of the Appraisal Committee was that omalizumab be recommended as a treatment option for severe persistent confirmed allergic IgE-mediated asthma as an add-on to optimised standard therapy in people aged six years and older who need continuous or frequent oral corticosteroid treatment (defined as four or more courses in the previous year), only if the manufacturer makes omalizumab available with the discount agreed in the patient access scheme.

Omalizumab was added to the pharmaceutical schedule in New Zealand in October 2014 (requiring special authority).

Okelo SO, Butz AM, Sharma R, et al. 2013. **Interventions to modify health care provider adherence to asthma guidelines. Comparative effectiveness review No. 95. (Prepared by Johns Hopkins University Evidence-based**

Practice Center under Contract No. 290-2007-10061-I.) AHRQ Publication No. 13-EHC022-EF. Rockville, MD: Agency for Healthcare Research and Quality. http://www.ncbi.nlm.nih.gov/books/NBK144097/

This review was designed to synthesise the published literature on the effects of interventions designed to improve health care providers' adherence to asthma guidelines on: (1) health care process outcomes; (2) clinical outcomes; and (3) health care processes that subsequently impact clinical outcomes. Seventy-three studies were eligible for inclusion. Thirty-four were RCTs, 29 were pre-post, and the other 10 were of various non-randomised designs. All took place in primary care settings. The studies assessed eight types of intervention: decision support, organizational change, feedback and audit, clinical pharmacy support, education only, quality improvement (QI)/pay-for-performance, multicomponent, and information only. Health care process outcomes included prescription of asthma controller medication (n=41), provision of an asthma action plan (n=18), prescription of a peak flow meter (n=17), and self-management education (n=12). Clinical outcomes included emergency department (ED) visits (n=30) and hospitalizations (n=27), use of short-acting β2 agonists (n=9), missed school days (n=8), lung function tests (n=6), symptom days (n=6), quality of life (n=5), and urgent doctor visits (n=5).

The review authors identified four critical outcomes for which 68 studies provided information. They reported the following results: there was moderate evidence for increased prescriptions of asthma controller medications following decision support, feedback and audit, and clinical pharmacy support interventions and low grade evidence for organizational change and multicomponent interventions. Moderate evidence supported the use of decision support and clinical pharmacy interventions to increase provision of patient self-education/asthma action plans; for the same outcome, low grade evidence supported the use of organizational change, feedback and audit, education only, quality improvement, and multicomponent interventions. Moderate grade evidence supported the use of decision support tools to reduce ED visits/hospitalizations while low grade evidence suggested there is no benefit associated with organizational change, education only, and QI/pay-for-performance. Organizational change interventions provided no benefit for lost days of work/school. The evidence for the remainder of interventions was insufficient or low in strength.

The review authors concluded that there was low-to moderate evidence to support to support the use of decision support tools, feedback and audit, and clinical pharmacy support to improve the adherence of health care providers to asthma guidelines, as measured through health care process outcomes, and to improve clinical outcomes. They stated that health care provider-targeted interventions need to be further evaluated with a focus on standardized measures of outcomes and more rigorous study designs.

Azad MB, Coneys JG, Kozyrskyj AL, et al. 2013. **Probiotic supplementation during pregnancy or infancy for the prevention of asthma and wheeze: systematic review and meta-analysis**. BMJ, 347, f6471. http://www.bmj.com/content/347/bmj.f6471.long

Commensal gut bacteria stimulate the development of the neonatal immune system. Disruption of the gut biota due to factors such as caesarean delivery, lack of breastfeeding and antibiotic use is thought to play a role in the development of allergic disorders, including asthma. Probiotics are live micro-organisms ingested either in fermented foods such as yoghurt, or as dietary supplements. This review aimed to evaluate the association between probiotic supplementation during pregnancy or infancy with childhood asthma and wheeze. The review authors identified 20 eligible RCTs involving 4866 children. The trials varied in type and duration of probiotic supplement used, and duration of follow up. Only five trials had follow up of participants beyond age six years (median 24 months), and none were powered to detect asthma as the primary outcome. Most were at high (10 trials) or unclear (nine trials) risk of bias, mainly due to attrition. Overall, 10.7% of participants had doctor-diagnosed asthma, 33.3% had incident wheeze and 13.9% respiratory tract infection. Among 3257 infants enrolled in nine trials contributing asthma data, the risk ratio of doctor diagnosed asthma in participants randomised to receive probiotics was 0.99 (95% CI 0.81 to 1.21, I^2=0%). The risk ratio of incident wheeze was 0.97 (95% CI 0.87 to 1.09, I^2=0%, 9 trials, 1949 infants). Among 1364 infants enrolled in six trials, the risk ratio of lower respiratory tract infection after probiotic supplementation was 1.26 (0.99 to 1.61, I^2=0%). The review authors concluded that there was no evidence to support a protective association between perinatal use of probiotics and doctor diagnosed asthma or childhood wheeze, and that further research is needed to determine the role of probiotics in preventing asthma.

Cates Christopher J, Rowe Brian H. 2013. **Vaccines for preventing influenza in people with asthma**. Cochrane Database of Systematic Reviews (2) http://onlinelibrary.wiley.com/doi/10.1002/14651858.CD000364.pub4/abstract

In many countries influenza vaccination is recommended for people with asthma as observational studies have indicated that influenza infection can be associated with asthma exacerbations. This review aimed to assess the efficacy and safety of influenza vaccination in children and adults with asthma. It included 18 RCTs. Most trials studied inactivated virus vaccines, but four studied intranasal live vaccines. All the studies included some outcome measures for asthma exacerbation in the early post-vaccination period, but only six looked for late outcomes to assess the vaccines' efficacy in protecting against asthma exacerbations related to influenza infection. One parallel group trial, involving 696 children, was able to assess the protective effects of influenza vaccination. It found no significant reduction in the number, duration or severity of influenza-related asthma exacerbations over the influenza season. Two cross-over trials, involving 1526 adults and 712 children measured adverse effects of inactivated influenza vaccination in the first two weeks after vaccination. There was no clinically important increase in asthma exacerbations among those who had received the vaccine compared to those who had received a placebo (risk difference 0.014; 95% CI −0.010 to 0.037). Two small studies (17 adults and 48 children) compared live attenuated (intranasal) vaccination vs. placebo and found no significant differences in asthma exacerbations or measures of lung function. One study on 2229 children over six years of age compared live attenuated vaccine (intranasal) vs. trivalent inactivated vaccine (intramuscular) and found no significant differences in asthma exacerbations. The review authors concluded that there is still uncertainty about the degree of protection vaccination provides against influenza-related asthma exacerbations but evidence from more recently published RCTs of inactivated split-virus vaccines indicates that there is no significant increase in asthma exacerbations immediately after vaccination in adults or children over three years of age. They stated that they were unable to address concerns regarding possible increased wheezing and hospital admissions in infants given live intranasal vaccination.

Carson Kristin V, Chandratilleke Madhu G, Picot J, et al. 2013. **Physical training for asthma**. Cochrane Database of Systematic Reviews (9). http://onlinelibrary.wiley.com/doi/10.1002/14651858.CD001116.pub4/abstract

This review aimed to use evidence from RCTs (involving people over the age of eight years) to obtain a better understanding of the effects of physical training on the respiratory and general health of people with asthma. Twenty-one studies (772 participants) were included in the review. Physical training was found to be well tolerated with no adverse effects reported. No studies reported worsening of asthma symptoms after physical training. Physical training was associated with marked improvement in cardiovascular fitness, as indicated by a statistically and clinically significant increase in maximum oxygen uptake (mean difference (MD) 4.92 mL/kg/min; 95% CI 3.98 to 5.87; P < 0.00001; eight studies, 267 participants), but there were no statistically significant effects on forced expiratory volume in one second (FEV1), forced vital capacity (FVC), minute ventilation at maximal exercise (VE_{max}) or peak expiratory flow rate (PEFR). Meta-analysis of data from four studies indicated a statistically significant increase in maximum heart rate, which was still significant after a sensitivity analysis and removal of two

studies (MD 3.67 bpm; 95% CI 0.90 to 3.44; P = 0.01). Due to diverse reporting measures, it was not possible to pool studies' results for quality of life, but there was some evidence to suggest that physical training may have positive effects on quality of life with four studies reporting a statistically and clinically significant benefit. The review authors concluded that physical training produced significant improvement in maximum oxygen uptake, but not in other measures of pulmonary function. They stated that it was well tolerated by study participants and therefore people with asthma should be encouraged to participate in physical activity without fear of exacerbating their asthma symptoms. They stated that more research is need to understand how physical activity impacts asthma management.

Beggs S, Foong Yi C, Le Hong Cecilia T, et al. 2013. **Swimming training for asthma in children and adolescents aged 18 years and under**. Cochrane Database of Systematic Reviews (4).
http://onlinelibrary.wiley.com/doi/10.1002/14651858.CD009607.pub2/abstract

Observational studies have suggested that swimming is an ideal form of physical activity to improve fitness and decrease the burden of disease in asthma. This review aimed determine the effectiveness and safety of swimming training as an intervention for asthma in children and adolescents aged 18 years and under. Studies were eligible for inclusion if they were RCTs or quasi-RCTs of children and adolescents comparing swimming training with usual care, a non-physical activity, or physical activity other than swimming. There were eight such trials (all RCTs), involving 262 participants aged between five and 18 years. In seven studies swimming training varied from 30 to 90 minutes, two to three times a week, over six to 12 weeks and in one study swimming training was 30 minutes six times per week. The comparison was usual care in seven studies and golf in one. There were no statistically significant effects seen in studies comparing swimming training with usual care or another physical activity for the primary outcomes: quality of life, asthma control, asthma exacerbations or use of corticosteroids for asthma. Compared to usual care, swimming training had a clinically meaningful effect on exercise capacity as measured by maximal oxygen consumption during a maximum effort exercise test (VO2 max) (two studies, n = 32), with a mean increase of 9.67 mL/kg/min; 95% CI 5.84 to 13.51. A difference of equivalent magnitude was found when other measures of exercise capacity were also pooled (four studies, n = 74), giving a standardised mean difference (SMD) 1.34; 95% CI 0.82 to 1.86. Swimming training was associated with small increases in resting lung function parameters of varying statistical significance; mean difference (MD) for FEV1 % predicted 8.07; 95% CI 3.59 to 12.54. In sensitivity analyses, by risk of attrition bias or use of imputed standard deviations, there were no important changes in effect sizes. Unknown chlorination status of pools limited subgroup analyses. Based on limited data, there were no adverse effects on asthma control or occurrence of exacerbations. The review authors stated that their review indicated that swimming training is well-tolerated in children and adolescents with stable asthma, and it increases lung function (moderate strength evidence) and cardio-pulmonary fitness (high strength evidence). They stated that there was no evidence that swimming training is associated with adverse effects in young people under eighteen years with stable asthma of any severity. They also stated that they could not determine whether swimming is better than any other form of physical activity, and that further adequately powered trials with longer follow-up periods are needed to better assess the long-term benefits of swimming.

The following non-pharmacological interventions have been the subject of Cochrane reviews (date in brackets) which found that there was insufficient evidence to determine whether or not the intervention was beneficial for asthma:

- **Vitamins C and E for asthma and exercise-induced bronchoconstriction.** (2014). http://onlinelibrary.wiley.com/doi/10.1002/14651858.CD010749.pub2/abstract
- **Written emotional disclosure for asthma** (2014) http://onlinelibrary.wiley.com/doi/10.1002/14651858.CD007676.pub2/abstract
- **Vitamin C for asthma and exercise-induced bronchoconstriction**. (2013)http://onlinelibrary.wiley.com/doi/10.1002/14651858.CD010391.pub2/abstract
- **Smartphone and tablet self management apps for asthma**. (2013) http://onlinelibrary.wiley.com/doi/10.1002/14651858.CD010013.pub2/abstract
- **Breathing exercises for adults with asthma**. (2013) http://onlinelibrary.wiley.com/doi/10.1002/14651858.CD001277.pub3/abstract
- **Prebiotics in infants for prevention of allergy**. (2013) http://onlinelibrary.wiley.com/doi/10.1002/14651858.CD006474.pub3/abstract (two studies, 226 infants)
- **Monosodium glutamate avoidance for chronic asthma in adults and children**.(2012) http://onlinelibrary.wiley.com/doi/10.1002/14651858.CD004357.pub4/abstract
- **Maternal dietary antigen avoidance during pregnancy or lactation, or both, for preventing or treating atopic disease in the child**. (2012) http://onlinelibrary.wiley.com/doi/10.1002/14651858.CD000133.pub3/abstract
- **Alexander technique for chronic asthma**. (2012) http://onlinelibrary.wiley.com/doi/10.1002/14651858.CD000995.pub2/abstract
- **Weight loss interventions for chronic asthma**. (2012) http://onlinelibrary.wiley.com/doi/10.1002/14651858.CD009339.pub2/abstract

The following non-pharmacological interventions have been the subject of Cochrane reviews (date in brackets) which found that the available evidence either did not clearly indicate that an intervention was beneficial or harmful, or did not clearly indicate that one intervention was better than another (for asthma outcomes):

- **Interventions for managing asthma in pregnancy**. (2014) http://onlinelibrary.wiley.com/doi/10.1002/14651858.CD010660.pub2/abstract
- **Dehumidifiers for chronic asthma**.(2013) http://onlinelibrary.wiley.com/doi/10.1002/14651858.CD003563.pub2/abstract
- **Inspiratory muscle training for asthma**. (2013) http://onlinelibrary.wiley.com/doi/10.1002/14651858.CD003792.pub2/abstract
- **Nurse versus physician-led care for the management of asthma**. (2013) http://onlinelibrary.wiley.com/doi/10.1002/14651858.CD009296.pub2/abstract
- **Optimal duration of exclusive breastfeeding**. (2012) http://onlinelibrary.wiley.com/doi/10.1002/14651858.CD003517.pub2/abstract This review found that exclusive breastfeeding for six months did not reduce the risk of atopic eczema, asthma or allergies. Pooled data from three observational studies in developed countries indicated a risk ratio for asthma at 5–7 years in children exclusively breastfed for six months vs. 3–4 months (with mixed breastfeeding thereafter) of 1.02, 95% CI 0.72 to 1.44.
- **Ionisers for chronic asthma**. (2012) http://onlinelibrary.wiley.com/doi/10.1002/14651858.CD002986.pub2/abstract

- **Primary care based clinics for asthma**.(2012) http://onlinelibrary.wiley.com/doi/10.1002/14651858.CD003533.pub2/abstract (three RCTs, 466 participants)
- **Home-based educational interventions for children with asthma**.(2011) http://onlinelibrary.wiley.com/doi/10.1002/14651858.CD008469.pub2/abstract

Other relevant publications

Jones B, Ingham TR, Reid S, et al. 2015. **He māramatanga huangō: Asthma health literacy for Māori children in New Zealand**. Wellington: University of Otago. http://asthmafoundation.org.nz/maori-health/he-maramatanga-huango-report/

This report, prepared for the Ministry of Health and the Asthma Foundation, was the result of a project intended to inform health policy, service delivery and resource development by: (1) examining the health literacy demands on both whānau (family) and health providers regarding asthma management, (2) investigating and identifying health literacy barriers and facilitators, (3) identifying gaps in and issues with asthma health literacy skills and knowledge and (4) making recommendations to improve health literacy, in order to improve asthma outcomes for Māori children. The project used a kaupapa Māori research methodology with a mixed methods approach. The study found that the health literacy demands of managing a child with asthma are complex and multi-faceted. The study authors concluded that the predominant barriers to optimal health literacy for Māori children with asthma are structural, endemic to the acute care model of health care delivery that currently predominates. They presented their recommendations under four headings: Mātauranga (Knowledge), Whakaakoako (Teaching Strategies), Whakawhanake (Workforce development) and Te Anga (Model of care). Under each heading there is an overarching recommendation and recommended actions, according to a three-level hierarchy: Health Systems (macro level), Health Organisations (meso level), and Health Professionals (micro level).

The following paper describes the research with Māori families that informed the above report.

Jones B, Ingham TR, Cram F, et al. 2013. **An indigenous approach to explore health-related experiences among Māori parents: the Pukapuka Hauora asthma study**. BMC Public Health, 13, 228. http://www.ncbi.nlm.nih.gov/pmc/articles/PMC3608319/?report=classic.

Mogasale V, Vos T. 2013. **Cost-effectiveness of asthma clinic approach in the management of chronic asthma in Australia**. Aust N Z J Public Health, 37(3), 205-10

Asthma control is less than ideal in Australia, despite the availability of effective drugs. One of the strategies recommended to improve asthma management is effective self-management. Self-management has four components: asthma education, self-monitoring of symptoms, regular review of asthma severity and treatment by a medical practitioner, and a written asthma plan. This study aimed to compare cost-effectiveness of an asthma clinic that would provide education, promotion of self-monitoring of symptoms, regular review of treatment by a medical practitioner and a written asthma action plan, to current practice in Australia. The researchers used a decision tree model to evaluate the benefits of asthma clinics under three scenarios: 1) the intervention reduces only emergency department visits; 2) in addition, it leads to a reduction in days out of role (e.g. absences from school or work); and 3) it also reduces unplanned general practitioner visits and hospitalisations. They used evidence from existing published studies for asthma incidence, duration, treatment practices, and health-seeking behaviours. Costs for one year were estimated based on an Australian asthma clinic trial. The results of the model indicated that the estimated $274 million annual cost of asthma clinics was much greater than the potential cost savings of $11 million resulting from reduced emergency department visits, and an overall potential cost saving of $85 million resulting from decreased GP visits and hospitalisations. The incremental cost-effective ratio (ICER) was $24,000 if a reduction in days out of role was quantified as a health benefit in estimating disability-adjusted life years (DALY). If a potential $85 million in cost-savings from decreased emergency department visits, GP visits and hospitalisation was taken into account, the ICER dropped to $17,000 per DALY averted. The study authors concluded that an asthma clinic as an intervention for improving self-management might be cost-effective in Australia if multiple benefits could be achieved.

Gillies TD, Tomlin AM, Dovey SM, et al. 2013. **Ethnic disparities in asthma treatment and outcomes in children aged under 15 years in New Zealand: analysis of national databases**. Primary Care Respiratory Journal, 22(3), 312–8.

Previous research has indicated that Māori and Pacific children are more likely to be hospitalised for asthma than children of other ethnicities and that Māori children are less likely to be prescribed preventive medicines. This study aimed to determine whether the poorer asthma outcomes for Māori and Pacific children are associated with less optimal asthma treatment and lower adherence to guidelines. The study authors used the pharmaceutical claims database to identify children aged <15 years who were dispensed ≥ two asthma medicines during 2011 (80,514 children). They measured the number of children dispensed oral steroids ≥ two times and hospital admissions with a primary diagnosis of asthma and compared asthma treatment steps and hospitalisation by age and ethnicity. The results were as follows: 16.0% of children were dispensed asthma medicines, 9.2% were dispensed medicine ≥ two times, 3.6% of children were hospitalised at least once for asthma and 98.9% of admissions were acute. Māori (OR 1.46, 95% CI 1.41 to 1.51) and Pacific children (OR 2.38, 95% CI 2.28 to 2.47) were more likely to remain on the lowest step of treatment (and not be given inhaled corticosteroids or long-acting β_2-agonists). At all steps of treatment, Māori and Pacific children had higher rates of oral steroid use. In all age groups, more Māori children (5.1%, OR 1.88, 95% CI 1.73 to 2.04) and Pacific children (5.6%, OR 2.05, 95% CI 1.84 to 2.29) were hospitalised for asthma than children of other ethnicities (2.8%). The study authors suggested that these results may indicate less frequent use of GP services by Māori and Pacific children until symptoms become severe (possibly because of cost), and that a lack of understanding of medicines, ineffective communication with healthcare providers, and other cultural issues can lead to a lack of adherence to prescribed treatment in Māori and Pacific peoples which may result in a failure to pick up prescribed medicines or not receiving the correct number of repeat dispensings.

Silvers KM, Frampton CM, Wickens K, et al. 2012. **Breastfeeding protects against current asthma up to 6 years of age**. Journal of Pediatrics, 160(6), 991-6.e1.

This paper reports on the association between breastfeeding and wheezing and current asthma in children aged 2–6 years in the New Zealand Asthma and Allergy Cohort Study. This study enrolled 1105 infants at birth. Detailed information about infant feeding was collected via questionnaires at birth, and at 3, 6 and 15 months. This was used to calculated duration of any and exclusive breastfeeding. Information about wheezing and current asthma was collected at 2, 3, 4, 5, and 6 years. Logistic regression was used to model associations between breastfeeding and outcomes, with and without adjustment for confounders. After adjustment for confounders, each month of exclusive breastfeeding was associated with significant reductions in current asthma from 2 to 6 years (all, $P < .03$). Current asthma at 2, 3, and 4 years was also reduced by each month of any breastfeeding (all, $P < .005$). In atopic children, exclusive breastfeeding for ≥3 months reduced current asthma at ages 4, 5, and 6 by 62%, 55%, and 59%, respectively. The study authors concluded that breastfeeding, particularly exclusive breastfeeding, protects against current asthma up to six years. They noted that, while exclusive breastfeeding reduced risk of current asthma in all children to age six, the degree of protection beyond three years was greater in atopic children.

Kristiansen J, Hetutu E, Manukia M, et al. 2012. **An evaluation of a pictorial asthma medication plan for Pacific children**. New Zealand Medical Journal, 125(1354), 42-50. http://www.nzma.org.nz/journal/read-the-journal/all-issues/2010-2019/2012/vol-125-no-1354/article-kristiansen

Pacific children are disproportionately affected by asthma. They have a higher asthma prevalence, more severe acute symptoms and more frequent hospitalisations. The precise reasons for these disparities are uncertain but evidence suggests that Pacific families lack understanding of asthma medicines and how to recognise worsening asthma. The authors of this study developed a web-based tool, www.pamp.co.nz which health professionals can use to produce personalised pictorial asthma resources in English and three Pacific languages. In this study, resources were provided to families with face-to-face education at a general practice or inpatient setting in West Auckland. A questionnaire about the resources was completed after six weeks, and an audit regarding use after six months. Data from 48 children were analysed (Samoan, n=31). Forty-five English and 22 first language versions (Samoan, Tongan, Tuvaluan) of the resources were used. The median time to questionnaire completion was 48 days. The pictorial asthma medication plan was acceptable to families, effective at reinforcing the importance of 'everyday' inhalers, and a reminder for regular use; the signs and symptoms sheets were informative and improved self-efficacy; 93% of families were using the resources after six months. An increase in 'everyday' inhaler use was observed after education. The study authors concluded that the resources were effective at improving inhaler knowledge and supporting symptom recognition. They stated that the characteristics of their resources, in particular their 'less-is–more' approach, pictorial format, and first language availability, may benefit children of other ethnicities.

Crengle S, Robinson E, Grant C, et al. 2011. **Pharmacological management of children's asthma in general practice: findings from a community-based cross-sectional survey in Auckland, New Zealand**. New Zealand Medical Journal, 124(1346), 44-56. https://www.nzma.org.nz/journal/read-the-journal/all-issues/2010-2019/2011/vol-124-no-1346/article-crengle

While there is some evidence that the prevalence of asthma symptoms is higher in Māori and Pacific children than in European children, ethnic differences in prevalence are not believed to be the sole reason for the significantly higher asthma hospitalisation rates of Māori children. The aim of this study was to describe the pharmacological management of asthma in New Zealand children and assess whether there were ethnic differences in pharmacological management. The study involved a cross-sectional survey of caregivers of asthmatic children in Auckland. Children were eligible for the survey if they were aged two to 14 years, and had experienced asthma symptoms in the 12 months prior to interview; and they had a doctor diagnosis of asthma or had experienced wheeze or whistling in the chest. The survey sample (n = 583) included the caregivers of 221 Māori, 173 Pacific, and 189 European/other children. Interviewers collected data on socio-demographic variables, and on medications received and medication delivery devices used in the 12 months prior to interview. Descriptive and logistic regression analyses were undertaken to investigate ethnic differences in pharmacologic management. There were no ethnic differences in spacer use. Eighty per cent of children under seven years of age and 34% of children seven years or over used spacers. Māori (58%) and Pacific (65%) were significantly ($p<0.0001$) more likely to have been given a nebuliser than European/other children (34%). Most children (96%) received inhaled beta-agonists and there were no ethnic differences for these medications. Overall, 69% of children had received inhaled corticosteroids (ICS) and there were no significant ethnic differences in receipt of these medications, but only 68–78% of children in the moderate, severe, and very severe morbidity groups reported inhaled corticosteroids use in the previous 12 months, suggesting that this group is being under-treated. Analyses stratified by morbidity suggested that Māori and Pacific children who had experienced severe morbidity in the previous 12 months were less likely to have received ICS. The study authors concluded that some aspects of the pharmacological management of asthma are more consistent with recommendations in evidence-based guidelines than previously reported in NZ, but that there is still room for improvement, particularly with respect to the use of inhaled corticosteroids among children who experience significant morbidity, the use of nebulisers, and the use of spacer devices. They stated that asthma outcomes could be further improved by implementing clinical quality assurance activities that support PHOs and providers to monitor and improve the delivery of evidence-based asthma care.

Websites

PHARMAC. 2010. **Space to breathe**. http://www.spacetobreathe.co.nz/

This website provides information about asthma and its management for people with asthma, their families and carers, and health practitioners.

The Asthma Foundation http://asthmafoundation.org.nz/

The Asthma Foundation website provides information and downloadable resources related to asthma and other respiratory conditions. These included booklets, fact sheets, posters and management plans. There is guidance for schools on asthma policy (under the education tab).

BRONCHIECTASIS

Introduction

Bronchiectasis is a lung condition in which the bronchi are distended and often thick-walled. These bronchial changes are associated with accumulation of mucus and frequent bacterial infections which can lead to further inflammatory destruction of the bronchial tree. Although in adults these changes are permanent there is at least the potential for the condition to be reversible in children. Many children with bronchiectasis have a clinical history of repeated lower respiratory tract infections.[67] The main symptom of bronchiectasis is a persistent wet cough lasting for 4 weeks or more that does not respond to antibiotics. Other symptoms that may be present include shortness of breath with exercise, recurrent chest infections (even if these do respond to antibiotic treatment), growth failure, or abnormalities of the shape of the chest wall of or the fingertips (the clinical sign of 'clubbing').[68]

Children with bronchiectasis typically have a preceding history of recurrent chest infections and the condition is strongly associated with socioeconomic disadvantage.[69] The number of New Zealand children known to have bronchiectasis increased almost threefold between 2000 and 2008, and is much higher than the reported incidence rates in Finland and the UK. Pacific and Māori children are disproportionately affected by bronchiectasis compared with European and other children.[70] Prevention of bronchiectasis includes reducing the risk of respiratory infections, and also ensuring follow up a few weeks after acute chest infections to enable early detection of ongoing disease.[71]

The following section reports on deaths and hospitalisations for bronchiectasis in children and young people using information from the National Mortality Collection and the National Minimum Dataset. It concludes with a brief overview of evidence-based reviews and guidelines which consider the most effective interventions for preventing or managing bronchiectasis in children and young people.

Data sources and methods

Indicators

Deaths from (non-cystic fibrosis) bronchiectasis in 0–24 year olds
Hospitalisations for (non-cystic fibrosis) bronchiectasis in 0–24 year olds

Data sources

Numerator: *Deaths:* National Mortality Collection
Hospitalisations: National Minimum Dataset

Denominator: Statistics NZ Estimated Resident Population (with linear extrapolation being used to calculate denominators between Census years)

Definition

Deaths: Deaths of 0–24 year olds where the main underlying cause of death was bronchiectasis (deaths per 100,000 age-specific population) and excludes records where cystic fibrosis is listed as a contributory cause

Hospitalisations: Acute and arranged hospitalisations of 0–24 year olds with a primary diagnosis of bronchiectasis (hospitalisations per 100,000 age-specific population) and excludes records where cystic fibrosis is listed in any of the first 15 diagnoses

Acute and arranged hospitalisations of 0–24 year olds with a diagnosis of bronchiectasis (hospitalisations per 100,000 age-specific population) in any of the first 15 diagnoses and excludes records where cystic fibrosis is listed in any of the first 15 diagnoses. Refer to **Appendix 6** for the codes included.

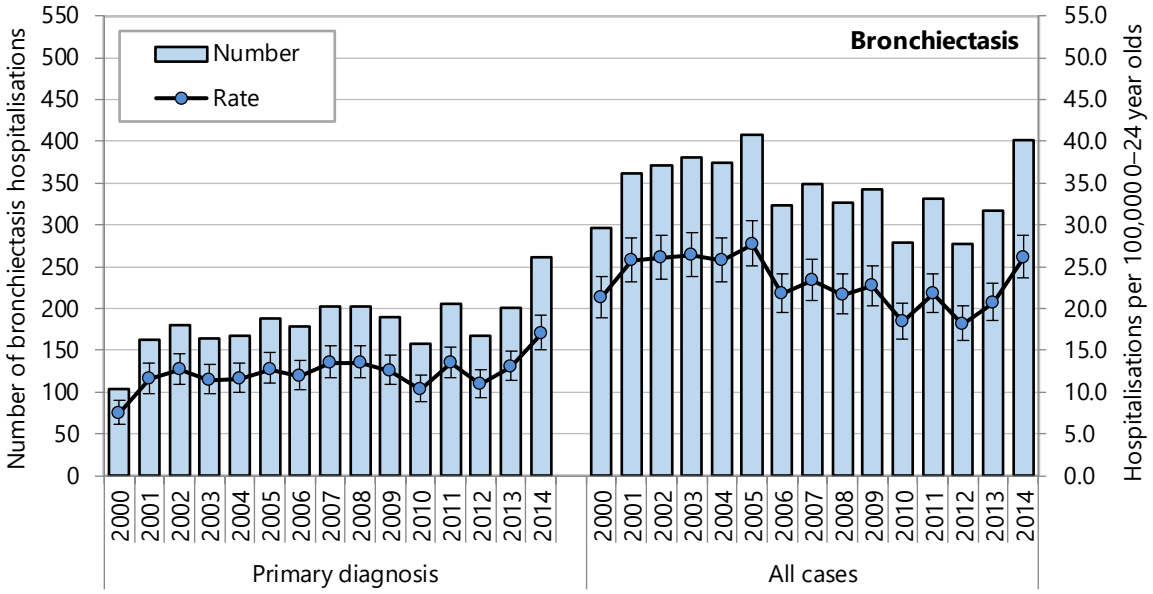
Notes on interpretation

Note 1: Unless otherwise specified, this analysis focuses on hospitalisations of 0–24 year olds with bronchiectasis listed in any of the first 15 diagnoses (rather than on the subset of hospitalisations where bronchiectasis was listed only as the primary diagnosis). The rationale for this wider focus is that many 0–24 year olds with bronchiectasis will not be hospitalised for bronchiectasis per se, but rather for one of its predisposing conditions or resulting complications.
Note 2. The rationale for excluding bronchiectasis cases where cystic fibrosis is also documented arises from the differing aetiology of cystic fibrosis and non-cystic fibrosis bronchiectasis and also that bronchiectasis typically develops over time in people with cystic fibrosis.
Note 3. An acute hospitalisation is an unplanned hospitalisation occurring on the day of presentation, while an arranged hospitalisation (referred to elsewhere in this report as a semi-acute hospitalisation) is a non-acute hospitalisation with an admission date less than seven days after the date the decision was made that the hospitalisation was necessary.
Note 4. **Appendix 3** describes the National Minimum Dataset and outlines the limitations of the data utilised from this data collection. The reader is advised to review this before interpreting any trends.

National trends and distribution

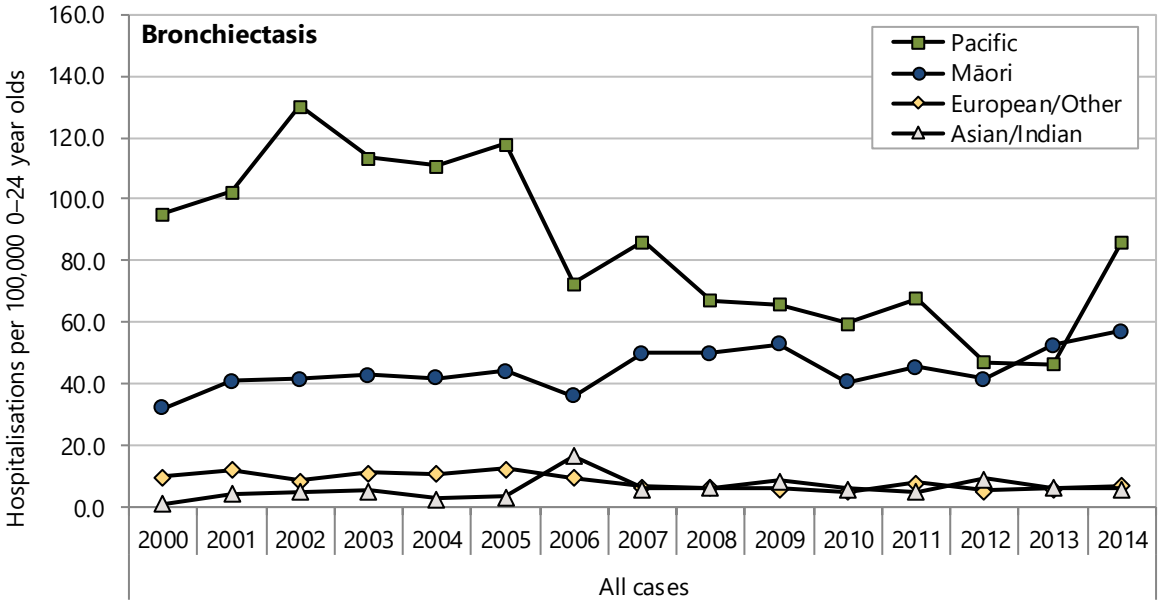
In New Zealand from 2008 to 2012 there were six deaths of 0–24 year olds where bronchiectasis was the main underlying cause. From 2000 to 2014 the number of hospitalisations of 0–24 year olds with bronchiectasis as a primary diagnosis increased from 104 to 262, and for any diagnosis from 296 to 402. There was an overall *significant rise* in hospitalisation rates for bronchiectasis which was more marked for bronchiectasis as a primary diagnosis than any diagnosis **(Figure 102)**. Bronchiectasis hospitalisation rates (any diagnosis) increased for all ethnic groups from 2000–2014 and this increase was most marked for Māori and Pacific. Rates were generally highest for Pacific, and Pacific and Māori rates were consistently higher than Asian/Indian and European/Other **(Figure 103)**.

Figure 102. Hospitalisations for bronchiectasis in 0–24 year olds, New Zealand 2000–2014



Numerator: National Minimum Dataset (acute and arranged admissions, cystic fibrosis cases excluded); Denominator: Statistics NZ Estimated Resident Population; All cases include bronchiectasis listed in any of first 15 diagnoses

Figure 103. Hospitalisations for bronchiectasis in 0–24 year olds, by ethnicity, New Zealand 2000–2014

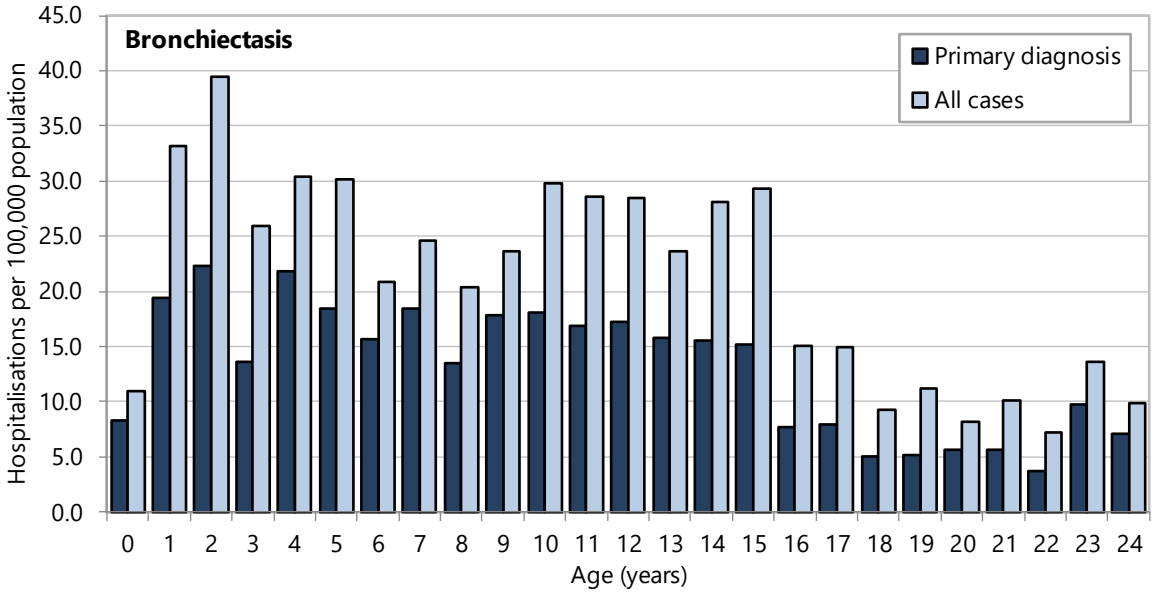


Numerator: National Minimum Dataset (acute and arranged admissions, cystic fibrosis cases excluded); Denominator: Statistics NZ Estimated Resident Population; All cases include bronchiectasis listed in any of first 15 diagnoses; Ethnicity is level 1 prioritised

Distribution by demographic factors

Between 2010 and 2014 bronchiectasis hospitalisation rates were highest for 1–2 year olds and then tended to fall slowly with increasing age with the lowest rates in 16–24 year olds **(Figure 104)**. There was disparity in bronchiectasis hospitalisation rates (any diagnosis) by NZDep2013 index of deprivation score, ethnicity and age between 2010 and 2014. Rates were *significantly lower* in areas with the lowest deprivation scores (NZDep2013 deciles 1–2) compared with higher deprivation scores (deciles 3–10). There was a strong gradient in bronchiectasis hospitalisation rates with increasing deprivation scores; rates were *significantly higher* in NZDep2013 deciles 9–10 compared with deciles 7–8, and in deciles 7–8 compared with deciles 5–6. Compared with European/Other, rates were *significantly higher* for Māori, Pacific and MELAA with *no significant difference* for Asian/Indian. Bronchiectasis rates in the 0–4 and 5–14 age groups were *significantly higher* than in the 15–24 age group. There was *no significant difference* between male and female bronchiectasis hospitalisation rates **(Table 85)**. Disparities were the same for bronchiectasis as primary diagnosis.

Figure 104. Hospitalisations for bronchiectasis in 0–24 year olds, by age at discharge, New Zealand 2010–2014



Numerator: National Minimum Dataset (acute and arranged admissions, cystic fibrosis cases excluded); Denominator: Statistics NZ Estimated Resident Population; All cases include bronchiectasis listed in any of first 15 diagnoses

Table 85. Hospitalisations for bronchiectasis in 0–24 year olds, New Zealand 2010–2014

Variable	Number: 2010–2014	Rate per 100,000 0–24 year olds	Rate ratio	95% CI
Bronchiectasis in 0–24 year olds				
New Zealand				
NZDep2013 Index of deprivation quintile				
Deciles 1–2	98	6.99	1.00	
Deciles 3–4	122	9.18	1.31	1.01–1.71
Deciles 5–6	153	10.65	1.52	1.18–1.96
Deciles 7–8	294	18.15	2.60	2.07–3.26
Deciles 9–10	938	50.43	7.22	5.86–8.89
Prioritised ethnicity				
Māori	847	47.51	7.94	6.89–9.15
Pacific	431	61.50	10.28	8.79–12.0
Asian/Indian	61	6.50	1.09	0.82–1.44
MELAA	17	17.33	2.90	1.77–4.74
European/Other	247	5.98	1.00	
Gender				
Female	746	19.94	1.00	
Male	860	22.00	1.10	1.00–1.22
Age group (years)				
0–4	433	28.10	2.19	1.91–2.50
5–14	772	25.84	2.01	1.78–2.27
15–24	401	12.85	1.00	

Numerator: National Minimum Dataset (acute and arranged admissions, diagnosis listed within the first 15 diagnoses; cystic fibrosis cases excluded); Denominator: Statistics NZ Estimated Resident Population; Rates are per 100,000 0–24 year olds; Rate ratios are unadjusted; Ethnicity is level 1 prioritised; Decile is NZDep2013

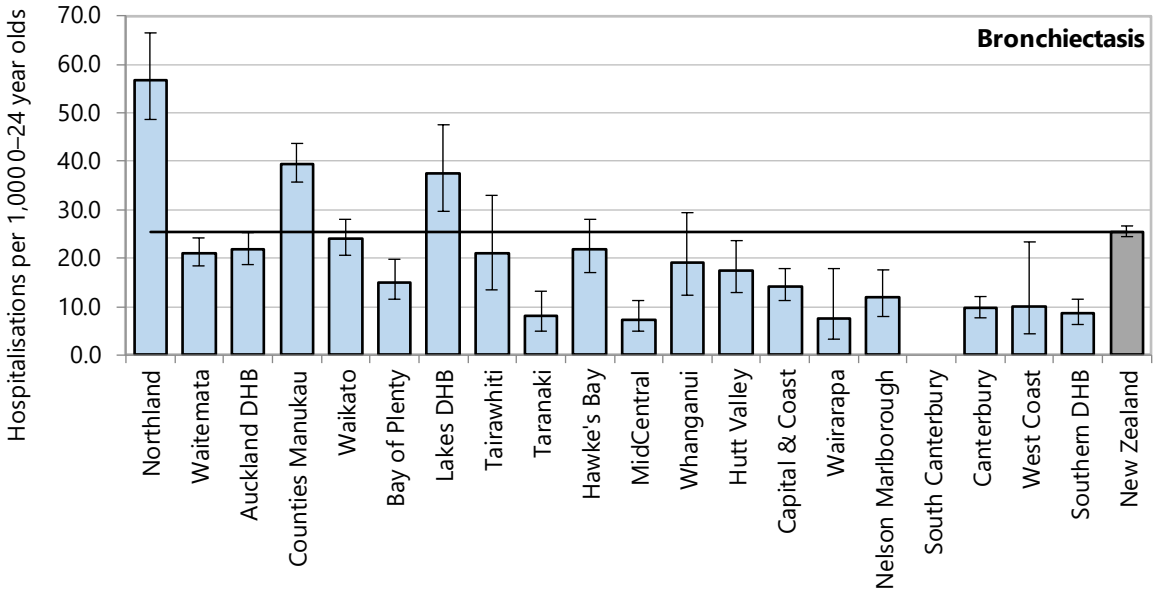
Distribution by season

Between 2010 and 2014 bronchiectasis hospitalisation rates were lowest from December to February with no other seasonal variation.

Distribution by region

Between 2010 and 2014 bronchiectasis hospitalisation rates were *significantly higher* than the national rate in the Northland, Counties Manukau and Lakes DHBs, *not significantly different* in the Auckland, Waikato, Tairawhiti, Hawke's Bay and Whanganui DHBs, and *significantly lower* in the remaining district health boards. **(Figure 105, Table 86)**.

Figure 105. Hospitalisations for bronchiectasis in 0–24 year olds, by district health board, New Zealand 2010–2014



Numerator: National Minimum Dataset (acute and arranged admissions; diagnosis listed within the first 15 diagnoses);
Denominator: Statistics NZ Estimated Resident Population; Rates are per 100,000 0–24 year olds

Table 86. Hospitalisations for bronchiectasis in 0–24 year olds, by district health board, New Zealand 2010–2014

DHB	Number: 2010–2014	Number: annual average	Rate per 100,000 0–24 year olds	Rate ratio	95% CI
Bronchiectasis in 0–24 year olds					
Northland	158	32	56.87	2.71	2.30–3.19
Waitemata	199	40	21.06	1.00	0.87–1.16
Auckland	171	34	21.83	1.04	0.89–1.22
Counties Manukau	384	77	39.53	1.88	1.68–2.10
Waikato	163	33	24.05	1.15	0.98–1.35
Bay of Plenty	53	11	15.04	0.72	0.54–0.94
Lakes	69	14	37.46	1.78	1.40–2.27
Tairawhiti	19	4	21.05	1.00	0.64–1.58
Taranaki	15	3	7.96	0.38	0.23–0.63
Hawke's Bay	59	12	21.78	1.04	0.80–1.35
MidCentral	22	4	7.39	0.35	0.23–0.54
Whanganui	20	4	19.10	0.91	0.59–1.41
Hutt Valley	43	9	17.51	0.83	0.62–1.13
Capital & Coast	72	14	14.27	0.68	0.54–0.86
Wairarapa	5	1	7.60	0.36	0.15–0.87
Nelson Marlborough	25	5	11.92	0.57	0.38–0.84
South Canterbury	0	..	..	..	..
Canterbury	80	16	9.66	0.46	0.37–0.58
West Coast	5	1	10.03	0.48	0.20–1.15
Southern	44	9	8.52	0.41	0.30–0.55
New Zealand	1,606	321	20.99	1.00	

Numerator: National Minimum Dataset (acute and arranged admissions; diagnosis listed within the first 15 diagnoses);
Denominator: Statistics NZ Estimated Resident Population

Northern region distribution and trends

Comparisons with New Zealand

Between 2010 and 2014 hospitalisation rates for bronchiectasis were *significantly higher* than the national rate in Northland and Counties Manukau DHBs, *significantly lower* in Waitemata DHB and *not significantly different* from the national rate in Auckland DHB **(Table 87)**.

Table 87. Hospitalisations for bronchiectasis in 0–24 year olds, Northern DHBs vs New Zealand 2010–2014

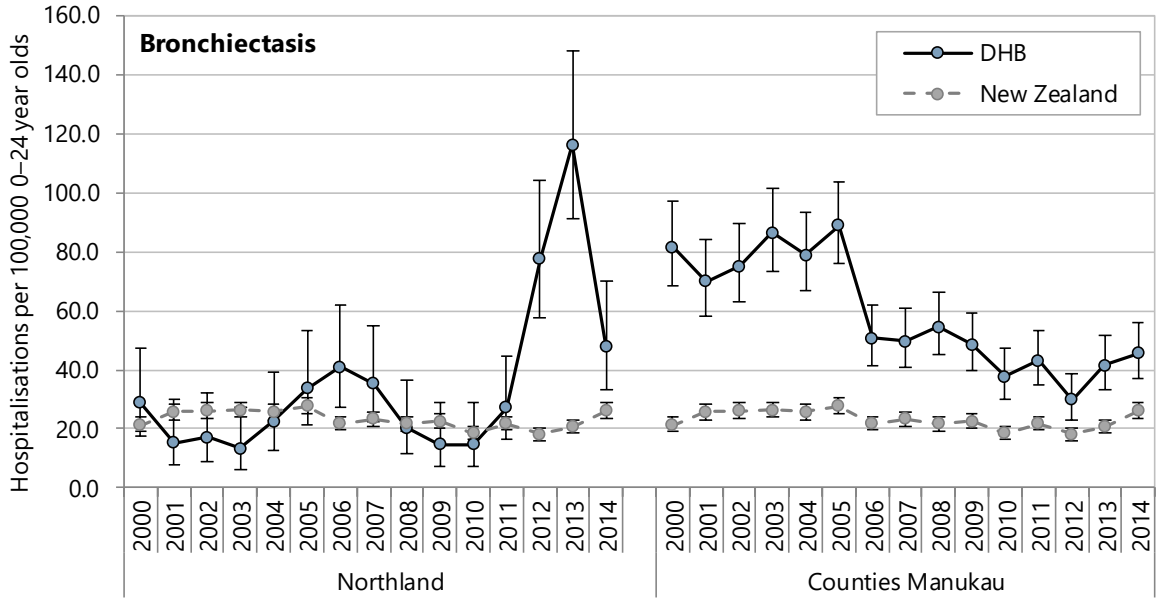
DHB	Number: 2010–2014	Number: annual average	Rate per 100,000 0–24 year olds	Rate ratio	95% CI
Bronchiectasis in 0–24 year olds					
Northland	158	32	56.87	2.71	2.30–3.19
Waitemata	199	40	21.06	1.00	0.87–1.16
Auckland	171	34	21.83	1.04	0.89–1.22
Counties Manukau	384	77	39.53	1.88	1.68–2.10
New Zealand	1,606	321	20.99	1.00	

Numerator: National Minimum Dataset (acute and arranged admissions, cystic fibrosis cases excluded); Denominator: Statistics NZ Estimated Resident Population; Rates are per 100,000 0–24 year olds; All cases encompasses a diagnosis listed within the first 15 diagnoses

Regional trends

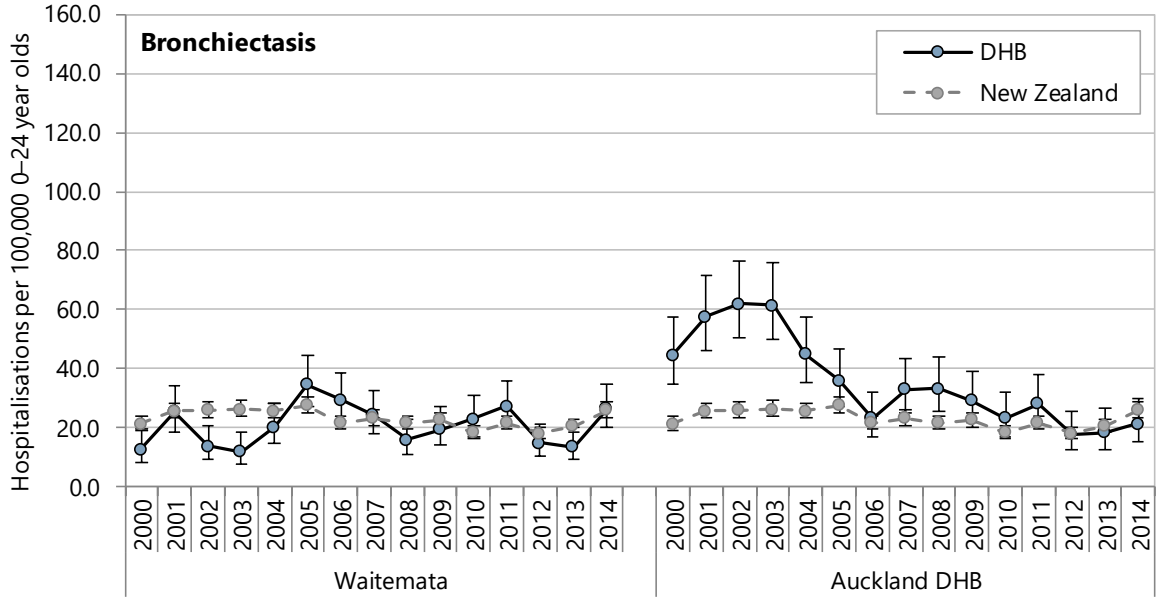
From 2000 to 2014 bronchiectasis hospitalisations in 0–24 year olds generally declined in Auckland and Counties Manukau, while rates in Waitemata fluctuated from year to year, and rates in Northland also fluctuated from year to year but were higher than usual in 2012 and 2013 **(Figure 106**, **Figure 107)**.

Figure 106. Hospitalisations due to bronchiectasis in 0–24 year olds, Northland and Counties Manukau DHBs vs New Zealand 2000–2014



Numerator: National Minimum Dataset (acute and arranged admissions, cystic fibrosis cases excluded); Denominator: Statistics NZ Estimated Resident Population; All cases encompasses bronchiectasis listed in any of first 15 diagnoses

Figure 107. Hospitalisations due to bronchiectasis in 0–24 year olds, Waitemata and Auckland DHBs vs New Zealand 2000–2014



Numerator: National Minimum Dataset (acute and arranged admissions, cystic fibrosis cases excluded); Denominator: Statistics NZ Estimated Resident Population; All cases encompasses bronchiectasis listed in any of first 15 diagnoses

Evidence for good practice for the prevention and management of bronchiectasis

New Zealand guidelines
Edwards E. 2008. **Starship Children's Health clinical guideline: Cough - Investigation of chronic cough &/or confirmed bronchiectasis**. http://www.adhb.govt.nz/starshipclinicalguidelines/_Documents/Cough%20-%20Investigation%20of%20Chronic.pdf accessed 13 October 2015.
This clinical guideline lists the important questions to include in the clinical history of a child with chronic cough and algorithms for initial and secondary investigations. The electronic version of the guideline is dated 2008, and is the version currently in use. It is a very practical and clinically focussed guideline.
Chang AB, et al. 2015. **Chronic suppurative lung disease and bronchiectasis in children and adults in Australia and New Zealand Thoracic Society of Australia and New Zealand guidelines**. http://www.thoracic.org.au/imagesDB/wysiwyg/BEposstatement_2014_revised_TSANZ_website_v3_wrFINAL.pdf accessed 13 October 2015.
These guidelines cover both bronchiectasis and chronic suppurative lung disease (CSLD) which are overlapping clinical syndromes. The recommendations were based on a comprehensive review of evidence available in 2013 and a table summarising the levels of evidence is provided (pages 17–21). Chest high-resolution computed tomography scan (c-HRCT) remains the diagnostic gold standard, preferably reconstructed from a multi-detector (MDCT) scan as this is substantially more likely to detect bronchiectasis if present. Specialist advice should be sought before ordering c-HRCT for children, for whom specific protocols are required to ensure the lowest possible radiation exposure to obtain adequate assessment. Recommended baseline investigations include a sweat test in all children to see if cystic fibrosis is an underlying cause. Antibiotic treatment to reduce bacterial load has a central role in management of bronchiectasis and CSLD, and choice of antibiotic should be based on outcomes of investigations together with knowledge about local patterns of antimicrobial sensitivity and resistance. Long-term antibiotics should not be prescribed routinely, but may be indicated in selected patients. Regular exercise, optimal nutrition and eliminating exposure to environmental tobacco smoke are all important in management, together with vaccinations according to the National Immunisation Schedule as well as timely annual influenza vaccine. The aim of management is to optimise general wellbeing, maintain good symptom control, optimise lung function and quality of life, reduce the frequency of exacerbations and prevent excessive decline in lung function.
International guidelines
M C Pasteur, et al. 2010. **British Thoracic Society guideline for non-CF bronchiectasis**. Thorax, 65(Supplement 1), i1-i58.
The British Thoracic Society guideline for non-CF bronchiectasis has been accredited by the National Institute for Health and Care Excellence (NICE) in the UK. The purpose of the guideline is to identify relevant studies in non-cystic fibrosis bronchiectasis and provide management guidelines based on published studies where possible or a consensus view, as well as to identify gaps in knowledge and identify areas for future study. The guideline covers all ages, and has specific reference to children including the importance of investigating chronic cough in children, considering an underlying immune deficiency when bronchiectasis is diagnosed, indications for bronchoscopy (when bronchiectasis affects a single lobe of the lung to exclude a foreign body), clinical features suggesting possible underlying cystic fibrosis or allergic bronchopulmonary aspergillosis (persistent isolation of *Staphylococcus aureus* and/or *Pseudomonas aeruginosa*), the importance of normal growth and development as management goals for children with bronchiectasis, recommendation for all children with bronchiectasis to be followed up by secondary care services, and specific antibiotic regimes for children with *Pseudomonas aeruginosa or MRSA infection* or infection with pathogens with multiple resistant patterns.
Hill AT, et al. 2011. **Primary care summary of the British Thoracic Society Guideline on the management of non-cystic fibrosis bronchiectasis**. Primary Care Respiratory Journal, 20, 135.
This paper summarises the key recommendations from the British Thoracic Society (BTS) guideline for non-cystic fibrosis bronchiectasis that are relevant to primary care. In particular the possibility of bronchiectasis in children who present with a chronic, productive cough or with asthma which responds poorly to treatment, incomplete resolution of a severe pneumonia, or recurrent pneumonia, pertussis-like illness failing to resolve after six months, persistent and unexplained respiratory clinical signs or symptoms especially in children with structural or functional disorders of the oesophagus and upper respiratory tract or unexplained haemoptysis. The paper also highlights specific advice from the BTS about antibiotic use in primary care and criteria for admission to hospital.
Evidence-Based Medicine Reviews
Al Subie H & Fitzgerald DA. 2012. **Non-cystic fibrosis bronchiectasis**. Journal of Paediatrics and Child Health, 48(5), 382-88.
The authors provide a detailed summary of the definition, epidemiology, aetiology, clinical presentation, investigation and treatment of bronchiectasis in children with reference to their clinical experience in Australia. A recurrent chest infection was the most common reason that children found to have bronchiectasis were referred to a specialist service (77% of children with bronchiectasis); other common reasons for referral were chronic cough (35%) and recurrent wheeze (10%). The key practice points in this article are that chronic or recurrent wet cough must not be ignored, that chest radiograph is not sensitive in diagnosing early bronchiectasis and high-resolution CT scan is required, that it is worthwhile to distinguish between generalised suppurative lung disease (SLD), which may indicate an underlying abnormality such as primary ciliary dyskinesia or cystic fibrosis, and localised SLD which is more suggestive of an inhaled foreign body or congenital malformation of the airway, and the importance of looking for the clinical sign of clubbing of the fingers which is a frequent early sign of SLD.

Welsh Emma J, et al. 2015. **Interventions for bronchiectasis: an overview of Cochrane systematic reviews**. Cochrane Database of Systematic Reviews doi:10.1002/14651858.CD010337.pub2 http://onlinelibrary.wiley.com/doi/10.1002/14651858.CD010337.pub2/pdf

A review of Cochrane reviews to provide an overview of evidence about interventions for adults and children with non-cystic fibrosis bronchiectasis. Data were extracted from nine reviews, which covered 40 trials. Only three trials included children. All reviews were high quality, but the trials themselves were often small and not of high quality. The authors looked at all interventions and categorised them as pharmacological or non-pharmacological. Primary outcomes were frequency or duration of exacerbations, measured lung function and quality of life using validated measures, with a range of secondary outcomes. Airway clearance techniques showed a statistically significant benefit in forced expiratory volume for children. Long-term antibiotics were associated with significantly lower sputum leukocyte and purulence scores and with significantly reduced sputum volume in small paediatric trials. Macrolide maintenance therapy was effective and safe in reducing bronchiectasis exacerbations for children and adults, but did not reduce the need for hospitalisation when exacerbations occurred. There were no studies on the effectiveness of mucolytics for children with bronchiectasis. Long-term antibiotics, inhaled corticosteroids and mucolytics are priority clinical areas for research to improve outcomes for people, particularly for children, with bronchiectasis. It is important that standardised endpoints are used in future research including measurement of exacerbations, quality of life and lung function.

Other relevant publications

Munro KA, et al. 2011. **Do New Zealand children with non-cystic fibrosis bronchiectasis show disease progression?** Pediatr Pulmonol, 46(2), 131-8.

This case series reviewed the electronic clinical records of 91 children on the bronchiectasis database at Starship Children's Health, Auckland, who had been followed for at least five years since diagnosis. Six of the children died either from bronchiectasis (2) or co-morbidities (4). There was a 'did not attend' rate of 28% for the cohort. The main finding was that almost half (45%) had declining lung function over time despite follow-up in a tertiary level hospital respiratory clinic. Rapid decline in lung function was associated with female gender, Māori ethnicity, living in an area with a high NZDep score, and physical deformities of the fingers (clubbing) or chest wall.

Singleton RJ, et al. 2014. **Indigenous children from three countries with non-cystic fibrosis chronic suppurative lung disease/bronchiectasis**. Pediatr Pulmonol, 49(2), 189-200.

180 Australian Aboriginal and Torres Strait Islander, Alaska Native, NZ Māori and NZ Pacific children aged 0.5–8 years with CSLD or bronchiectasis were recruited to a case series observational study with up to five years of follow-up. Household crowding and high levels of exposure to environmental tobacco smoke were evident in all groups. A high proportion of study children were born at less than 36 weeks gestation and all children had at least one previous acute lower respiratory infection (ALRI) (91% had been hospitalised) with a median of 10 previous infections and some children with more than 40. The children were very young at the time of their ALRI (median age 3.7 months) and had a median of four ALRIs in the first year of life. The authors conclude that measures to prevent premature birth and to reduce ALRIs are important equity issues to reduce bronchiectasis in indigenous children.

Valery PC, et al. 2013. **Long-term azithromycin for Indigenous children with non-cystic-fibrosis bronchiectasis or chronic suppurative lung disease (Bronchiectasis Intervention Study): a multicentre, double-blind, randomised controlled trial**. Lancet Respir Med, 1(8), 610-20.

Between 2008 and 2010 the researchers enrolled 89 Indigenous Australian, Māori and Pacific children aged 1–8 years with either bronchiectasis or chronic suppurative lung disease into a multi-centre, double-blind, randomised, parallel group, placebo-controlled comparing azithromycin (30 mg/kg) or placebo once a week for 12-24 months (mean treatment duration 20.7 months standard deviation 5.7 months). Children receiving azithromycin had significantly lower exacerbation rates (incidence rate ratio 0·50; 95% CI 0·35–0·71; p<0·0001) and the study drugs were well tolerated with no serious adverse events being attributed to the intervention. There needs to be further investigation to determine the clinical consequences of the observation that children in the azithromycin group developed significantly higher carriage of azithromycin-resistant bacteria (19 of 41, 46%) than those receiving placebo (four of 37, 11%; p=0·002).

Websites

Ministry of Health. 2015. **Bronchiectasis**. http://www.health.govt.nz/your-health/conditions-and-treatments/diseases-and-illnesses/bronchiectasis accessed 13 October 2015.

This website provides patient- and family-centred information about bronchiectasis. Key points are the importance of seeking medical attention for coughs that won't go away, having a management plan for bronchiectasis, eligibility for free influenza vaccination and the importance of a smokefree home and regular exercise for children with bronchiectasis. Actions tō prevent bronchiectasis include smoking cessation during pregnancy, breastfeeding, healthy balanced diet, warm and dry housing and childhood immunisation.

Kidshealth. 2014. **Bronchiectasis**. http://www.kidshealth.org.nz/bronchiectasis-bx accessed 13 October 2015.

This website provides information about bronchiectasis and detail about commonly-used diagnostic tests, types of treatment, and what to expect at outpatient appointments and if a child is admitted to hospital with bronchiectasis.

Health Navigator New Zealand. 2015. Bronchiectasis. http://www.healthnavigator.org.nz/health-topics/bronchiectasis/ accessed 13 October 2015.

The Health Navigator NZ website helps patients and parents find reliable health information and self-help resources. There are also links from this webpage for health professionals.

COMMON COMMUNICABLE DISEASES

PERTUSSIS

Introduction

Pertussis (whooping cough) is a highly contagious acute respiratory tract infection caused by the bacterium *Bordetella pertussis*. It is spread by aerosol droplets. "Classic" pertussis follows an incubation period of a few days to a few weeks and is recognised as having three stages: a catarrhal stage with a runny nose and sneezing (1–2 weeks), a paroxysmal stage (2–6 weeks) in which prolonged bursts of uninterrupted coughing are followed by a characteristic inspiratory whoop, and a convalescent stage (≥ 2 weeks). Young infants in their first few months of life, who make up more than 90% of the fatalities from pertussis, do not display the classic stages and initially apnoea and cyanosis may be the only signs of the disease. Young infants suspected of having pertussis need hospitalisation and the most severely affected can require intubation, drug-induced paralysis and ventilation.[72]

Routine pertussis vaccination began in New Zealand in 1960 and the current schedule recommends vaccination at six weeks, three months, and five months of age with booster doses at four years and 11 years, and during pregnancy at 28 to 38 weeks' gestation.[58] Neither vaccination nor natural disease provides complete or lifelong immunity.[72] Immunity wanes over time, and *Bordetella pertussis* is endemic in the older child and adult population so there is always the potential for an incompletely vaccinated infant to be infected by an older person who may not have any symptoms other than a persistent cough and may not be especially unwell.[58] The fact that neither natural infection nor vaccination provides long term immunity is the reason why pertussis epidemics continue to recur in two to five-yearly epidemic cycles, just as they did before routine immunisation. Now, despite these recurrences, there are much lower rates of disease. New Zealand had a pertussis epidemic from 2011 to 2014 with several hundred infant hospitalisations and three deaths.[73]

Besides improving coverage and timeliness of infant vaccination, which is the most important strategy, the Global Pertussis Initiative recommends universal preschool booster doses, universal adolescent immunisation, universal adult immunisation, selective immunisation of new mothers, family, and close contacts of newborns (the "cocoon strategy"), selective immunisation of healthcare workers, and selective immunisation of childcare workers.[74,75]

The following section reviews pertussis rates in infants aged less than one year using information from the National Minimum Dataset and Mortality Collection. The section concludes with a brief overview of policy and evidence-based review documents which consider interventions to reduce pertussis at the population level.

Data sources and methods

Indicators

Deaths from pertussis in infants
Hospitalisations for pertussis in infants

Data sources

Numerator: *Deaths*: National Mortality Collection
Hospitalisations: National Minimum Dataset
Denominator: Birth Registration Dataset

Definition

Pertussis or whooping cough was used to identify hospitalisations and deaths. This includes:
Whooping cough due to *Bordetella pertussis*
Whooping cough due to *Bordetella parapertussis*
Whooping cough due to other *Bordetella* species
Whooping cough, unspecified

Deaths: Deaths of infants (up to one year old) where the main underlying cause of death was pertussis (per 100,000 age-specific population)

Hospitalisations: Acute and arranged hospitalisations of infants (up to one year old) with a primary diagnosis of pertussis (per 1,000 age-specific population). Refer to **Appendix 6** for the codes included.

Rate

Deaths per 100,000 age-specific population
Hospitalisations per 1,000 age-specific population

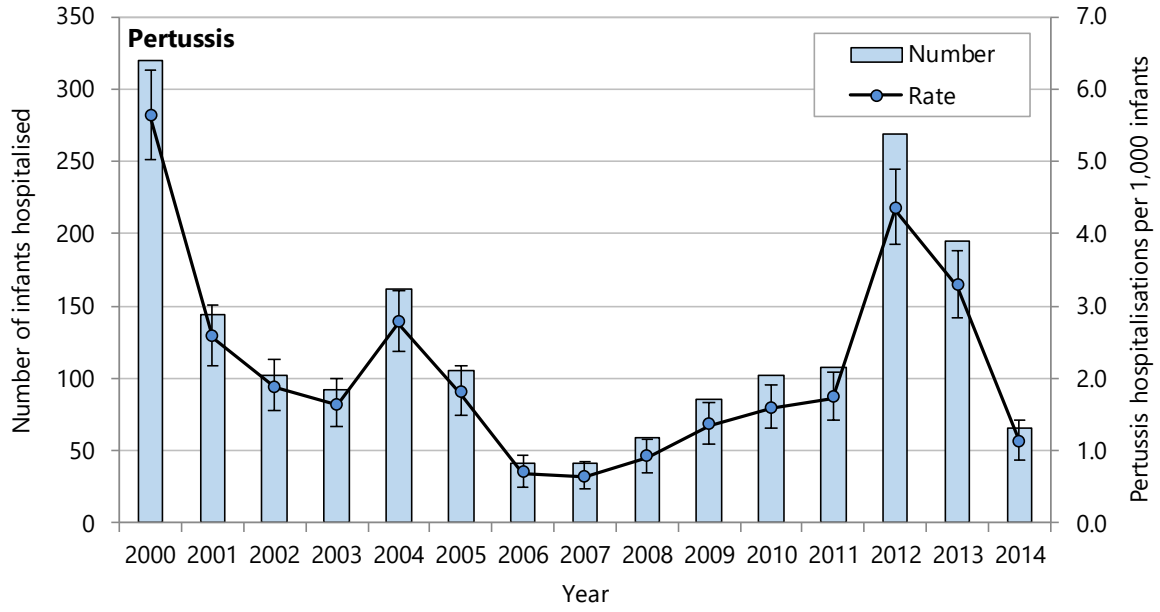
Notes on interpretation

Note 1: An acute hospitalisation is an unplanned hospitalisation occurring on the day of presentation, while an arranged hospitalisation (also referred toas a semi-acute hospitalisation) is a non-acute hospitalisation with an admission date less than seven days after the date the decision was made that the hospitalisation was necessary.
Note 2: **Appendix 3** describes the National Minimum Dataset and outlines the limitations of the data utilised from this collection. The reader is advised to review this appendix before interpreting any trends.

National trends and distribution

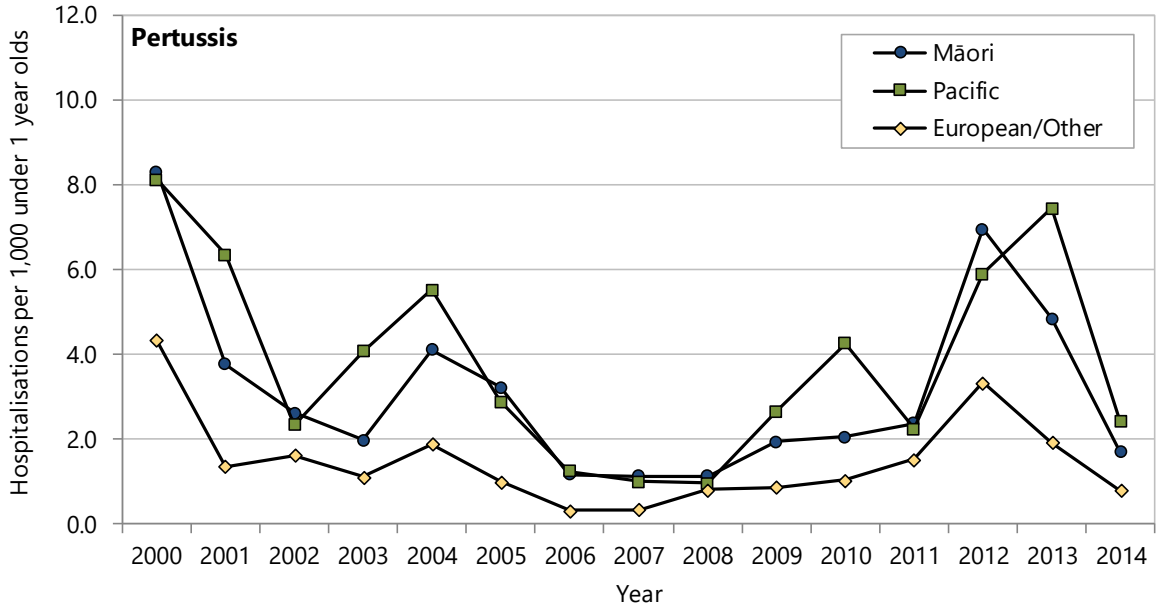
Between 2000 and 2014, hospitalisations for pertussis in infants fluctuated, with peaks occurring in 2000, 2004 and 2012. Rates reached their lowest point in 2007, after which rates rose gradually until 2011, increased sharply in 2012 and then fell sharply in each of the following two years. **(Figure 108)**. During this period hospitalisations for pertussis were consistently higher for Pacific and Māori than European/Other **(Figure 109)**.

Figure 108. Hospitalisations for pertussis in under 1 year olds, New Zealand 2000–2014



Numerator: National Minimum Dataset (acute and arranged admissions); Denominator: Birth Registration Dataset

Figure 109. Hospitalisations for pertussis in under 1 year olds, by ethnicity, New Zealand 2000–2014



Numerator: National Minimum Dataset (acute and arranged admissions); Denominator: Birth Registration Dataset; Rates are per 1,000 infants; Asian/Indian rates suppressed due to small numbers

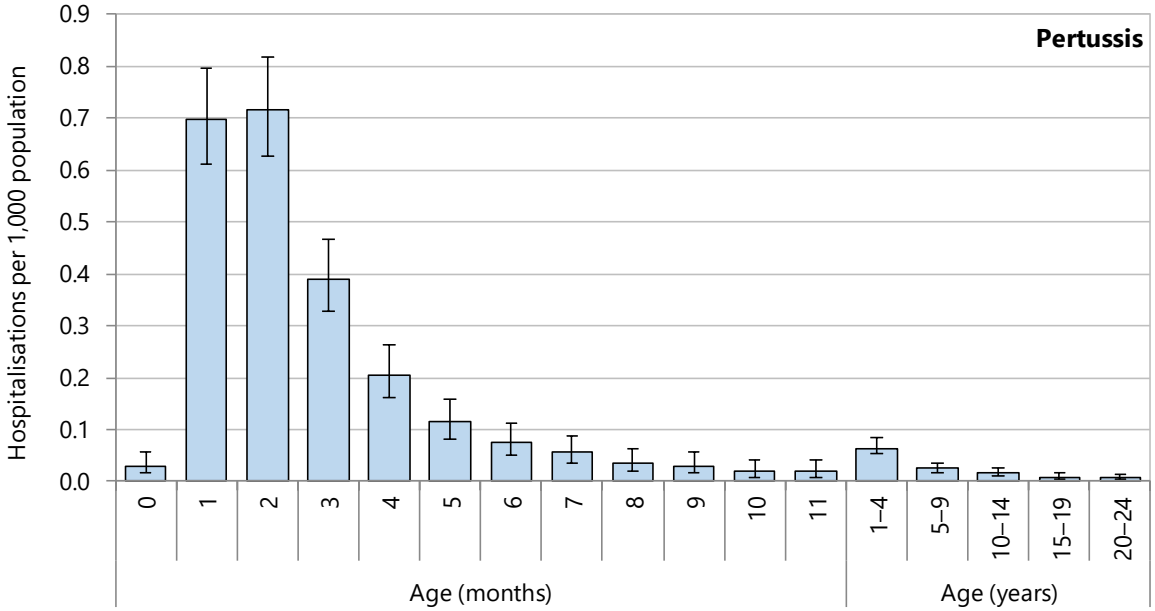
Distribution by demographic factors

Between 2010 and 2014 hospitalisation rates for pertussis were highest in infants aged one and two months. Rates then declined rapidly with increasing age **(Figure 110)**.

During the same period, hospitalisation rates for pertussis were *significantly lower* for infants in areas with the lowest NZDep2013 scores (NZDep2013 deciles 1–2) compared with areas with higher scores (deciles 3–10).

Rates were *significantly higher* for Pacific and Māori and *significantly lower* for Asian/Indian compared with European/Other, whereas rates for MELAA were *not significantly different.* There was *no significant difference* by gender **(Table 88)**.

Figure 110. Hospitalisations for pertussis in 0–24 year olds, by age, New Zealand 2010–2014



Numerator: National Minimum Dataset (acute and arranged admissions); Denominators: under 1 year: Birth registration Dataset; 1–24 years: Statistics NZ Estimated Resident Population

Table 88. Hospitalisations of under 1 year olds for pertussis, by demographic factors, New Zealand 2010–2014

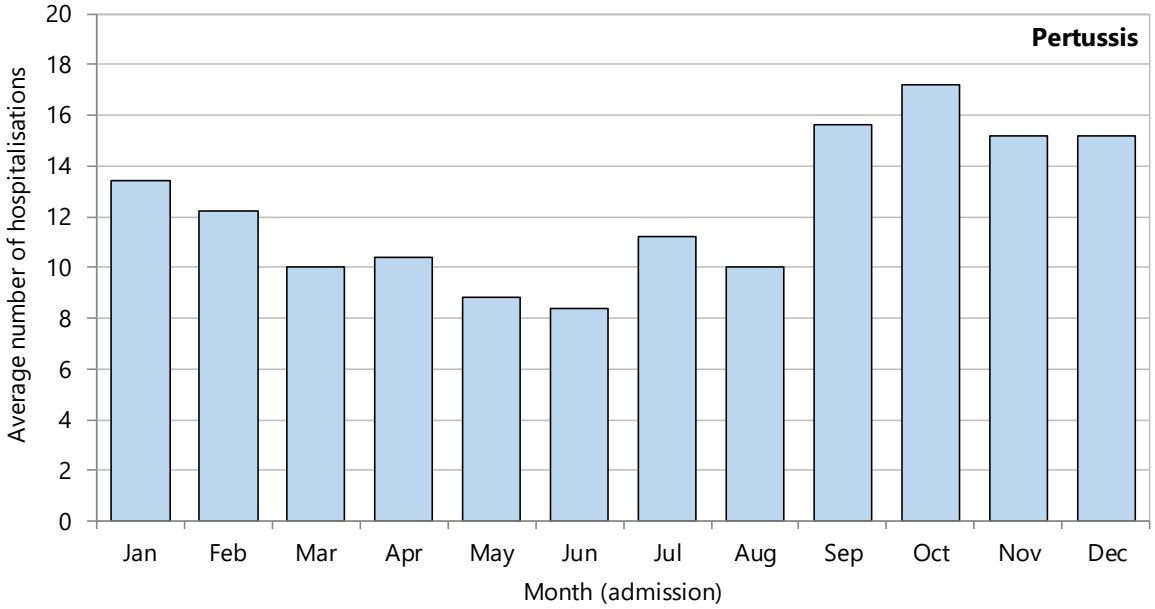
Variable	Number: 2010–2014	Rate per 1,000 under one year olds	Rate ratio	95% CI
Pertussis in under 1 year olds				
New Zealand				
NZDep2013 Index of deprivation quintile				
Deciles 1–2	37	0.82	1.00	
Deciles 3–4	72	1.45	1.77	1.19–2.63
Deciles 5–6	107	1.90	2.31	1.59–3.36
Deciles 7–8	169	2.51	3.05	2.14–4.36
Deciles 9–10	352	4.03	4.91	3.50–6.88
Prioritised ethnicity				
Māori	318	3.59	2.09	1.77–2.47
Pacific	151	4.44	2.58	2.11–3.17
Asian/Indian	23	0.55	0.32	0.21–0.49
MELAA	10	1.84	1.07	0.57–2.02
European/Other	236	1.72	1.00	
Gender				
Female	379	2.54	1.00	
Male	359	2.28	0.90	0.78–1.04

Numerator: National Minimum Dataset (acute and arranged admissions); Denominator: Birth Registration Dataset; Rates are per 1,000 infants; Rate ratios are unadjusted; Ethnicity is level 1 prioritised; Decile is NZDep2013

Distribution by season

Between 2010 and 2014 there were slightly more hospitalisations for pertussis in infants aged under one year during the last four months of the year **(Figure 111)**.

Figure 111. Average number of hospitalisations for pertussis in under 1 year olds, by month, New Zealand 2010–2014

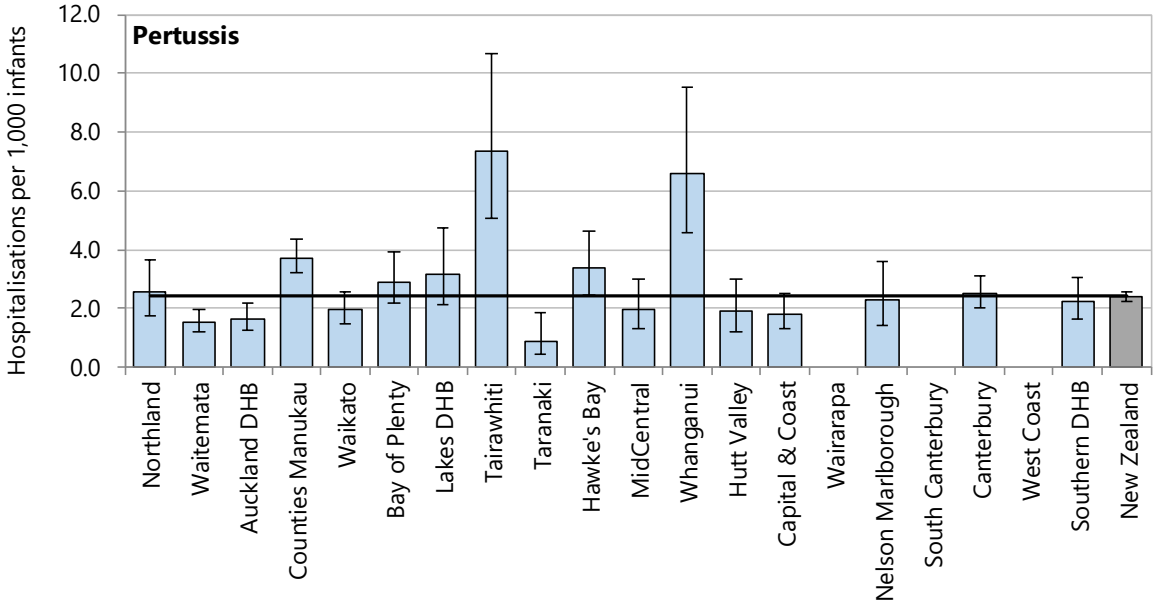


National Minimum Dataset (acute and arranged admissions); Number is annual average

Distribution by region

In Counties Manukau, Tairawhiti, Hawke's Bay, and Whanganui during 2010–2014, hospitalisations for pertussis in infants were *significantly higher* than the national rate, while in Waitemata, Auckland, and Taranaki, rates were *significantly lower*. While rates in a number of other DHBs also differed from the national rate, in no other cases did these differences reach statistical significance. **(Figure 112**, **Table 89)**.

Figure 112. Under one year olds hospitalised for pertussis, by district health board, New Zealand 2010–2014



Numerator: National Minimum Dataset (acute and arranged admissions); Denominator: Birth Registration Dataset; Rates suppressed for Wairarapa, South Canterbury and West Coast due to small numbers

Table 89. Under one year olds hospitalised for pertussis, by district health board, New Zealand 2010–2014

DHB	Number: 2010–2014	Number: annual average	Rate per 1,000 under one year olds	Rate ratio	95% CI
Pertussis in under one year olds					
Northland	29	6	2.54	1.06	0.73–1.53
Waitemata	60	12	1.52	0.63	0.49–0.82
Auckland	53	11	1.65	0.69	0.52–0.91
Counties Manukau	159	32	3.73	1.55	1.31–1.84
Waikato	53	11	1.96	0.81	0.62–1.07
Bay of Plenty	42	8	2.91	1.21	0.89–1.65
Lakes	24	5	3.18	1.32	0.88–1.99
Tairawhiti	27	5	7.36	3.06	2.09–4.49
Taranaki	7	1	0.90	0.37	0.18–0.79
Hawke's Bay	38	8	3.39	1.41	1.02–1.95
MidCentral	22	4	1.97	0.82	0.54–1.25
Whanganui	28	6	6.59	2.74	1.88–3.99
Hutt Valley	19	4	1.91	0.79	0.50–1.25
Capital & Coast	34	7	1.80	0.75	0.53–1.05
Wairarapa	<5	s	s	s	s
Nelson Marlborough	18	4	2.27	0.95	0.59–1.51
South Canterbury	<5	s	s	s	s
Canterbury	77	15	2.50	1.04	0.82–1.32
West Coast	<5	s	s	s	s
Southern	40	8	2.24	0.93	0.68–1.28
New Zealand	738	148	2.40	1.00	

Numerator: National Minimum Dataset (acute and arranged admissions); Denominator: Birth Registration Dataset; s: suppressed due to small numbers

Northern region distribution and trends

Comparison with New Zealand

Between 2010 and 2014 hospitalisation rates for pertussis in infant less than one year old were *significantly higher* than the national rate in the Counties Manukau, *significantly lower* in the Waitemata and Auckland DHBs, and *not significantly different* from the national rate in Northland (**Table 90**).

Table 90. Hospitalisations for pertussis in under one year olds, Northern DHBs vs New Zealand 2010–2014

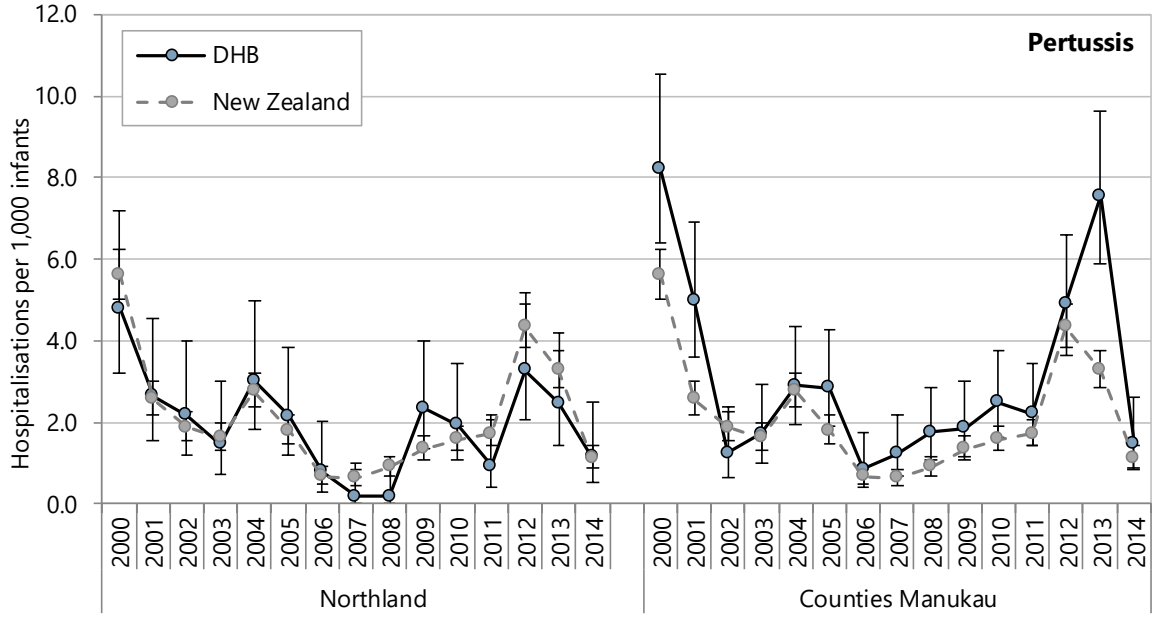
DHB	Number: 2010–2014	Number: annual average	Rate per 1,000 <1 year olds	Rate ratio	95% CI
Pertussis in under one year olds					
Northland	29	5.8	2.54	1.06	0.73–1.53
Waitemata	60	12.0	1.52	0.63	0.49–0.82
Auckland	53	10.6	1.65	0.69	0.52–0.91
Counties Manukau	159	31.8	3.73	1.55	1.31–1.84
New Zealand	738	147.6	2.40	1.00	

Numerator: National Minimum Dataset (acute and arranged admissions); Denominator: Birth Registration Dataset

Regional trends

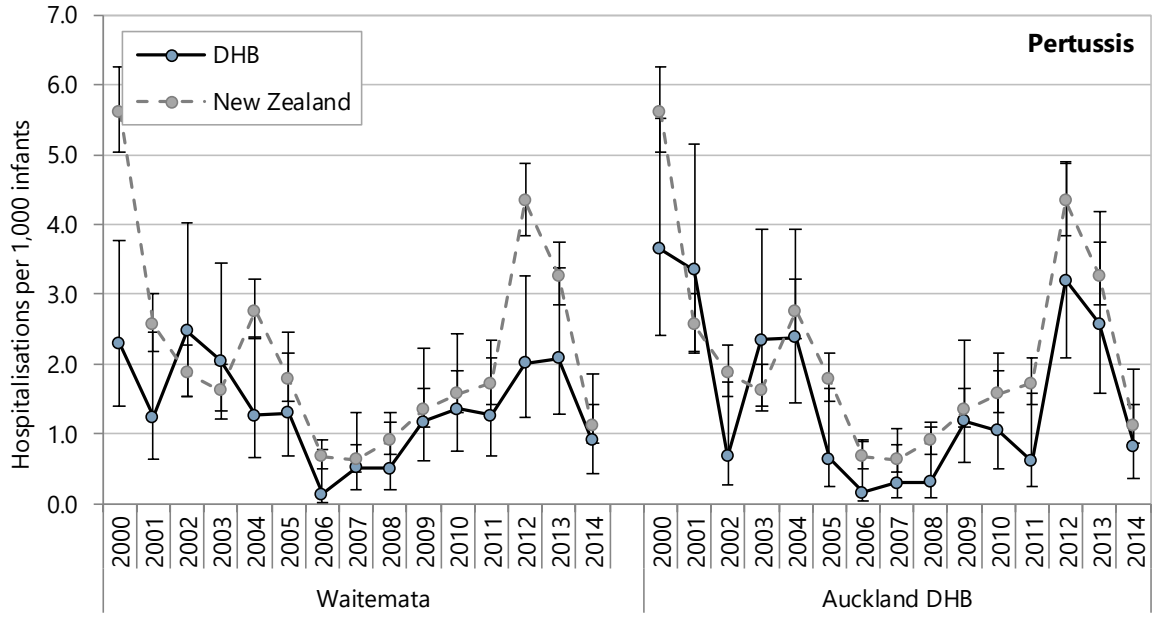
In the Northern DHBs, from 2000 to 2014 trends in hospitalisations for pertussis in infants aged less than one year were similar to the national trend, with peaks in 2000, 2003–2004 and 2012–2013. There was considerable year to year variations in hospitalisation rates (**Figure 113**, **Figure 114**).

Figure 113. Hospitalisations for pertussis in under one year olds, Northland and Counties Manukau DHBs vs New Zealand 2000–2014



Numerator: National Minimum Dataset (acute and arranged admissions); Denominator: Birth Registration Dataset

Figure 114. Hospitalisations for pertussis in under one year olds, Waitemata and Auckland DHBs vs New Zealand 2000–2014



Numerator: National Minimum Dataset (acute and arranged admissions); Denominator: Birth Registration Dataset

Evidence for good practice for the prevention and management of pertussis

Ministry of Health documents
Ministry of Health. 2014. **Immunisation Handbook 2014**. Wellington: Ministry of Health. **http://www.health.govt.nz/publication/immunisation-handbook-2014** Chapter 14 of this handbook provides key information on pertussis, its clinical features and epidemiology, the available vaccines, the immunisation schedule, contraindications and precautions, expected responses and adverse events, and public health measures. The immunisation schedule specifies a primary course of pertussis vaccine given as DTaP-IPV-HepB/Hib (Infanrix-hexa) at ages 6 weeks, 3 months and 5 months, followed by a dose of DTaP-IPV (Infanrix-IPV) at age 4 years. A further booster is given at age 11 years (school year 7) as Tdap (Boostrix). Pregnant women should receive a dose of Tdap (funded) from 28 to 38 weeks' gestation. This should be given during each pregnancy. Combined tetanus, diphtheria and pertussis immunisation is recommended, but not funded for lead maternity carers and other health care workers who work in neonatal units or are exposed to infants, household contacts of newborns including older siblings (for whom update vaccines are funded) and mothers shortly after delivery, and early childhood workers. A ten yearly booster dose is recommended for those with on-going contact with infants.
Ministry of Health. 2012. **Communicable Disease Control Manual**. Wellington: Ministry of Health. **http://www.health.govt.nz/publication/communicable-disease-control-manual-2012** Pertussis is a notifiable disease. This manual sets out the standard practice that public health services would normally follow in regard to the prevention and control of notifiable diseases. The chapter on pertussis covers epidemiology, case definition, laboratory testing, notification, management of cases and contacts, other control measures, and reporting. The references include guidelines from other countries, including the US, the UK and Australia.
Ministry of Health. 2007. **Direct Laboratory Notification of Communicable Diseases National Guidelines**. Wellington: Ministry of Health. http://www.health.govt.nz/publication/direct-laboratory-notification-communicable-diseases-national-guidelines The purpose of these guidelines is to inform those working in the health sector, so that they can fulfil their legislative requirements under Section 74AA of the Health Act 1956 with respect to notifying a Medical Officer of Health (and a territorial authority for some conditions) when a notifiable disease case is suspected and when it is confirmed by laboratory testing. Many of the infectious diseases covered in this report are notifiable diseases including acute gastroenteritis (in some situations only), meningitis, vaccine preventable diseases (including pertussis), tuberculosis and rheumatic fever.
Evidence-based medicine reviews
Zhang L, Prietsch Sílvio OM, Axelsson I, et al. 2014. **Acellular vaccines for preventing whooping cough in children**. Cochrane Database of Systematic Reviews (9) http://onlinelibrary.wiley.com/doi/10.1002/14651858.CD001478.pub6/abstract The first pertussis vaccines were made from killed whole pertussis bacteria. Concerns about the possible association of these vaccines with neurological disorders led to the development of acellular vaccines which contain up to five *Bordetella* pertussis antigens. These vaccines were developed in the 1970s and widely used and tested in Japan in the 1980s.This updated review included six efficacy trials (46,283 participants) and 52 safety trials (136,541 participants) of acellular pertussis vaccines. Multi-component vaccines (≥ 3 antigens) had efficacy ranging from 84% to 85% in preventing typical whooping cough and 71% to 78% in preventing mild pertussis disease. One and two-component vaccines had efficacy ranging from 59% to 75% against typical whooping cough and 41% to 58% against mild pertussis disease. The review authors concluded that multi-component acellular vaccines are more effective than low-efficacy whole cell vaccines but may be less effective than high efficacy whole cell vaccines. However acellular vaccines were followed by significantly fewer local and systemic adverse events than whole cell vaccines both for the primary series and the booster doses.
Wang K, Bettiol S, Thompson Matthew J, et al. 2014. **Symptomatic treatment of the cough in whooping cough**. Cochrane Database of Systematic Reviews (9) http://onlinelibrary.wiley.com/doi/10.1002/14651858.CD003257.pub5/abstract A characteristic feature of whooping cough is coughing paroxysms that may last for over a minute and be followed by gasping for air that produces the classic inspiratory whoop. Much of the morbidity associated with pertussis is due to the effects of the paroxysmal cough. This review aimed to assess the efficacy and safety of interventions to reduce the severity of paroxysmal cough in whooping cough in children and adults. Studies were eligible for inclusion if they were RCTs or quasi-RCTs of any intervention (excluding antibiotics and vaccines) for cough suppression. Twelve trials were included, with a total of 578 participants. Trial sample sizes ranged from nine to 135. Ten trials (448 participants) involved children and two (130 participants) adolescents and adults. Only three trials were considered to be of high methodological quality (one trial each of diphenhydramine, pertussis immunoglobulin and montelukast). The trials in the review did not show a statistically significant benefit for any of the interventions. The review authors concluded that there was insufficient evidence to draw any conclusions about the effectiveness of interventions for the cough in whooping cough. They stated that more high quality trials are needed.
Bar-On Edna S, Goldberg E, Hellmann S, et al. 2012. **Combined DTP-HBV-HIB vaccine versus separately administered DTP-HBV and HIB vaccines for primary prevention of diphtheria, tetanus, pertussis, hepatitis B and Haemophilus influenzae B (HIB)**. Cochrane Database of Systematic Reviews (4) http://onlinelibrary.wiley.com/doi/10.1002/14651858.CD005530.pub3/abstract Combining childhood vaccines reduces the number of visits and injections, and patient discomfort, thus increasing compliance and optimising disease prevention. This review compared the effectiveness of combined DTP-HBV-HIV vaccines with separate DTP-HBV and HIB vaccinations. The reviewers did not identify any studies providing data on the prevention of disease i.e. the incidence of diphtheria, tetanus, pertussis and *H. influenzae* type B after vaccination. The 20 included RCTs or quasi-randomised clinical trials compared vaccination with combined DTP-HBV-HIB vaccine (with or without polio vaccine) with separate DTP-HBV and HIB vaccinations and assessed the outcomes immunogenicity (5874 participants) and reactogenicity (adverse events, 5232 participants). There were no significant differences found in immunogenicity for pertussis, diphtheria, polio and tetanus but two studies found less immunologic response for HBV and HIB after the combined vaccines. Serious adverse events were comparable (mainly hospitalisation and acute bronchiolitis). Minor adverse events were more common after the combined vaccine. The authors stated that the studies' results were inconclusive due to uncertain risk of bias and studies not using intention-to-treat analysis and therefore they were unable to conclude that the responses elicited by the combined vaccines were either different from, or equivalent to, those

elicited by the separate vaccines. They stated that studies addressing clinical end points whenever possible, using correct methodology and a large enough sample size, should be conducted.

Altunaiji Sultan M, Kukuruzovic Renata H, Curtis Nigel C, et al. 2007. **Antibiotics for whooping cough (pertussis)**. Cochrane Database of Systematic Reviews (3) http://onlinelibrary.wiley.com/doi/10.1002/14651858.CD004404.pub3/abstract

It is commonly recommended that people with whooping cough and their contacts take erythromycin for 14 days but this regimen is often unpopular with patients due to gastrointestinal side effects. This review aimed to assess the risks and benefits of antibiotic treatment of whooping cough, and contact prophylaxis against whooping cough, in children and adults. Thirteen trials (RCTs and quasi-RCTs) of variable quality were included, with 2197 participants in total. Eleven trials investigated treatment regimens and two investigated prophylaxis regimens. Ten of the treatment studies compared one antibiotic with another and one compared antibiotics vs. no treatment. The two prophylaxis studies compared antibiotics with placebo. Results from the treatment studies indicated that, for eradicating *Bordetella pertussis* (*B. pertussis*) from the nasopharynx, short-term antibiotics (azithromycin for three to five days, or clarithromycin or erythromycin for seven days) were as effective as long-term (erythromycin for 10 to 14 days) (risk ratio (RR) 1.01; 95% CI 0.98 to 1.04), but had fewer side effects (RR 0.66; 95% CI 0.52 to 0.83). Trimethoprim/sulphamethoxazole for seven days was also effective. There were no differences between short and long term antibiotics in clinical outcomes or microbiological relapse, When used to prevent infection in contacts older than six months of age, antibiotics did not significantly improve clinical symptoms, nor reduce the number of people developing culture-positive *B. pertussis*. Antibiotics had side effects. These varied between antibiotics. In their conclusions, the review authors stated that, although antibiotics were effective in eliminating *B. pertussis,* they did not make any difference to the subsequent clinical course of the illness. They reported that there was insufficient evidence to determine the benefits of prophylactic antibiotics for pertussis contacts. They cautioned that the review's conclusions were based on a limited number of trials, some of which had small numbers of participants.

Other relevant publications

Kiedrzynski T, Bissielo A, Suryaprakash M, et al. 2015. **Whooping cough-where are we now? A review**. N Z Med J 128(1416) 21-7

This paper describes the recent trends in pertussis and vaccine uptake in New Zealand, based on analysis of notifications and immunisation registration data since 2011. It notes that, despite having >90% immunisation coverage at 12 months, New Zealand experienced a large pertussis epidemic from 2011 to 2014 with several hundred infant hospitalisations and three deaths. It highlights the current risk for infants in the first months after birth and the crucial role a pertussis booster in pregnancy could play. It also aims to show that protection of infants by the current vaccine can be improved by timely immunisation even in a situation of improving overall uptake rates that are nearing the national target of 95%. It states that pertussis vaccination should be offered to all mothers between 28 and 38 weeks of pregnancy and that further improvements are still possible in coverage at 6 months, particularly in Māori and but also in Pacific populations, and in more deprived populations.

Lugnér AK, van der Maas N, van Boven M, et al. 2013. **Cost-effectiveness of targeted vaccination to protect new-borns against pertussis: Comparing neonatal, maternal, and cocooning vaccination strategies**. Vaccine 31(46) 5392-97

Pertussis disease is a severe disease in infants aged less than six months, who are too young to have received any or all of their vaccinations. Strategies to protect neonates include vaccinating neonates, vaccinating their mothers directly after birth (cocooning), or vaccinating the mother during pregnancy (maternal vaccination). This paper reports on a study which investigated the cost-effectiveness of these three strategies in the Netherlands. Costs for health care utilisation and productivity losses, as well as impact on quality of life were calculated for a 10-year vaccination programme, assuming that vaccine-induced immunity lasts 5 years. Cocooning was the most cost-effective strategy, costing €89,000 per QALY, followed by maternal vaccination (€126,000 per QALY) then neonatal vaccination (€318,000 per QALY); however none of these strategies would be cost-effective when judged by (unofficial) thresholds for cost-effectiveness of preventive health interventions in the Netherlands (€20,000–€50,000/QALY).

Philipson K, Goodyear-Smith F, Grant CC, et al. 2013. **When is acute persistent cough in school-age children and adults whooping cough? A prospective case series study**. Br J Gen Pract 63(613) e573-9. http://www.ncbi.nlm.nih.gov/pmc/articles/PMC3722834/

Most patients with pertussis infection presenting in primary care have been vaccinated, therefore their signs and symptoms are subtle and it is difficult for clinicians to distinguish pertussis from other causes of acute persistent cough. This paper reports on a study conducted in Auckland which aimed to estimate the proportion of school-aged children and adults <50 years of age identified in general practice with acute persistent cough who had recent infection with *B. pertussis* and to determine whether there are symptoms that predict *B. pertussis* infection. The study used an oral fluid-based assay (measurement of IgG antibodies to pertussis toxin) as the diagnostic test for *B. pertussis* infection, and so a secondary aim of the study was to demonstrate the applicability of this test to the primary care setting. In total 226 participants were enrolled: 70 children aged 5–16 years (31%) and 156 adults (69%). Oral fluid samples were obtained from 225 participants. Ten per cent (23/225) had recent *B. pertussis* infection: a greater proportion of children than adults (17% versus 7%, P = 0.003). Neither cough duration nor any individual symptom discriminated between those with and without recent *B. pertussis* infection. They study authors concluded that pertussis is a common cause of acute persistent cough in primary care and that distinguishing pertussis from other causes of acute persistent cough is clinically difficult. They stated that an oral fluid based diagnostic test, which is less invasive than other diagnostic approaches (e.g. blood sampling), has high acceptability in primary care.

Websites

The Institute of Environmental Science and Research Ltd (ESR). 2015. **Pertussis report**. https://surv.esr.cri.nz/surveillance/PertussisRpt.phps

These reports include information on the descriptive epidemiology of pertussis cases reported in New Zealand. Pertussis is a notifiable disease in New Zealand and these reports use data available from EpiSurv, the national notifiable disease database.

Auckland Regional Public Health Service**. Pertussis (Whooping cough)** http://www.arphs.govt.nz/health-information/communicable-disease/pertussis-whooping-cough#.VdVbcPmqpBc

This website has a variety of useful information and resources relating to pertussis, including advice for health professionals, information for cases and contacts, information for schools and early childhood centres, posters, and video and audio recordings.

MENINGOCOCCAL DISEASE

Introduction

Neisseria meningitis bacteria can cause a serious invasive disease that begins suddenly as a flu-like illness and rapidly progresses to potentially fatal septicaemia and in severe cases to shock and multi-organ failure. Children with meningococcal disease typically experience acute fever, malaise, nausea, myalgia, arthralgia and prostration with a rash in about two-thirds of cases. Infants present with less-specific features.[76] There are several serogroups of meningococci; groups B and C are the important types seen in children and young adults in New Zealand.[58]

Highest age-specific rates of meningococcal disease are seen in infants aged under one year and children aged one to four years with a secondary peak in notification rates at age 15–19 years. Infection rates are consistently higher for Māori and for Pacific people, with the highest rates of all observed in Māori infants aged under one year.[58] About 15% of the New Zealand population carry *N. meningitidis* in the nasopharynx without any outward symptoms. The events that cause invasive meningococcal disease are poorly understood but include a combination of factors related to the organism, the susceptible child and the external environment. There tends to be a seasonal pattern with more cases in winter and spring.[76] Early detection and prompt follow-up of contacts with antibiotics to reduce nasopharyngeal carriage of *N. meningitidis* are key components of control of meningococcal disease. Living in crowded dwellings and exposure to environmental tobacco smoke are also risk factors and can be addressed through social planning and effective health promotion.[77]

The following section reports on deaths and hospitalisations for meningococcal disease in children and young people using information from the National Mortality Collection and the National Minimum Dataset. It concludes with a brief overview of evidence-based reviews and guidelines which consider the most effective interventions for preventing or managing this condition in children and young people.

Data sources and methods

Indicators

Deaths from meningococcal disease in 0–24 year olds
Hospitalisations for meningococcal disease in 0–24 year olds

Data sources

Numerator:
Deaths: National Mortality Collection
Hospitalisations: National Minimum Dataset
Denominator: Statistics NZ Estimated Resident Population (with linear extrapolation being used to calculate denominators between Census years)

Definition

Meningococcal disease includes: meningococcal meningitis; Waterhouse-Friderichsen syndrome; acute meningococcaemia; chronic meningococcaemia; meningococcaemia unspecified; meningococcal heart disease; other meningococcal infections; and meningococcal infection unspecified
Deaths: Deaths of 0–24 year olds with where the main underlying cause of death was meningococcal disease (deaths per 100,000 age-specific population)
Hospitalisations: Acute and arranged hospitalisations of 0–24 year olds with a primary diagnosis of meningococcal disease (hospitalisations per 100,000 age-specific population)
Refer to **Appendix 6** for the codes included.

Notes on interpretation

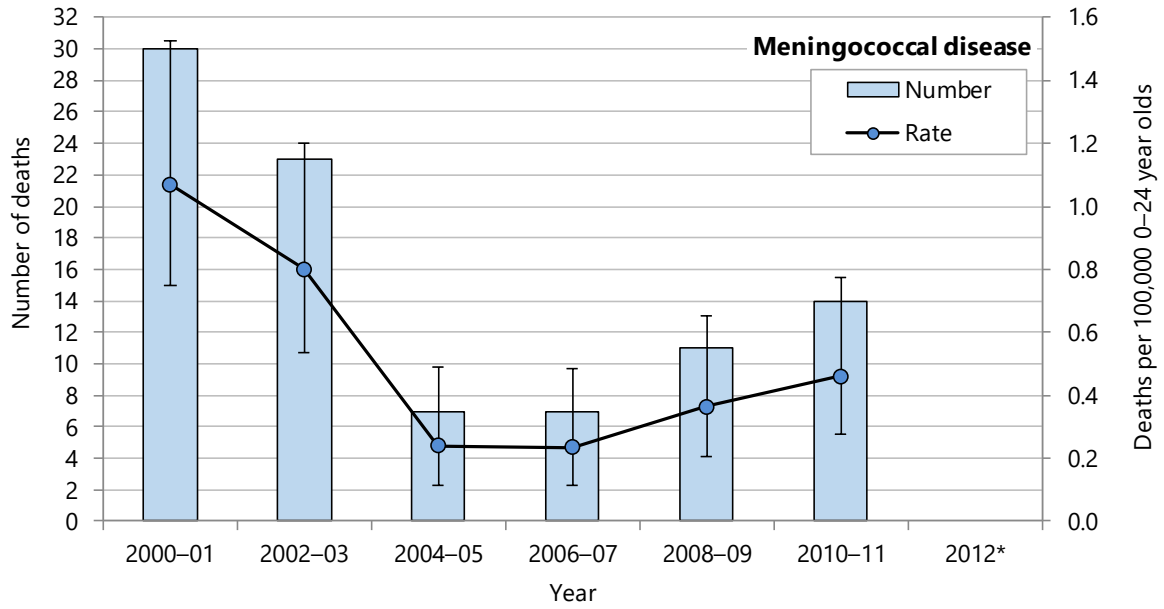
Note 1: While in the datasets used it was not possible to break down the cases identified by strain, it was likely that a mix of group B and C strains predominated. The ESR review of meningococcal disease notifications during 2011 found that of the 100 notified cases where the strain type was identified (92.6% of all notifications), 37.0% were group B:P1.7-2,4 and 27.0% were group C:P1.5-1,10-8.[78]
Note 2: An acute admission is an unplanned hospitalisation occurring on the day of presentation, while an arranged admission (also referred to as a semi-acute admission) is a non-acute hospitalisation with an admission date less than seven days after the date the decision was made that the hospitalisation was necessary.
Note 3: **Appendix 3** outlines the limitations of the data utilised from the National Minimum Dataset. The reader is advised to review this appendix before interpreting any trends.

National trends and distribution

From 2008 to 2012 there were 28 deaths of 0–24 year olds with meningococcal disease as the underlying cause. The death rate varied from year to year **(Figure 115)**. From 2000 to 2014 the hospitalisation rate for

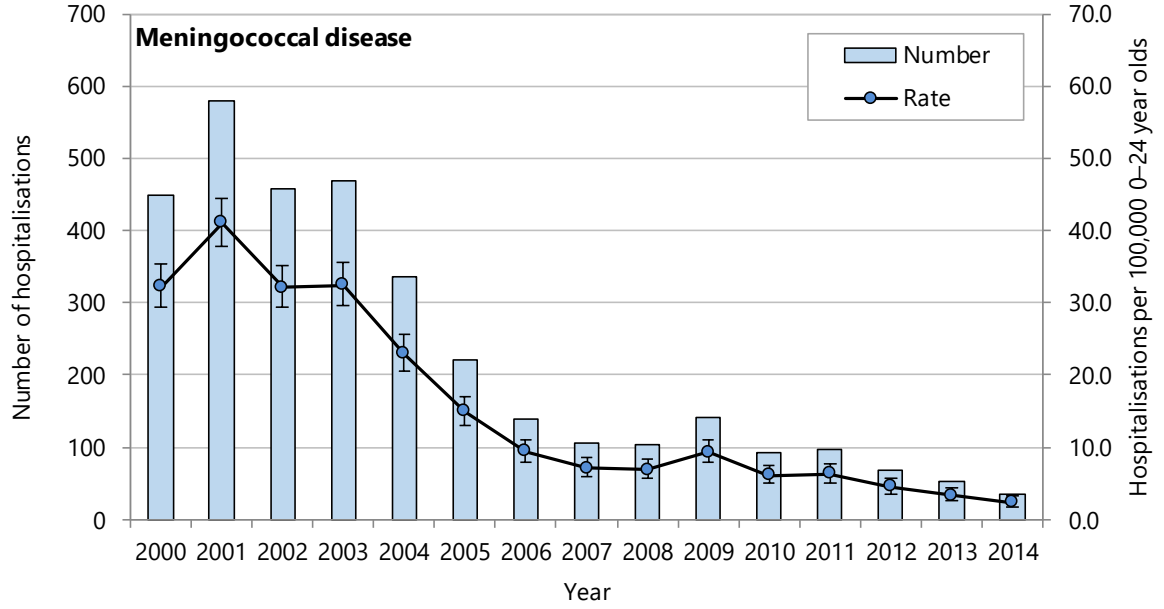
meningococcal disease in 0–24 year olds declined rapidly during the early-mid 2000s, and continued to decline overall, albeit at a much slower rate, over subsequent years **(Figure 116)**. Rates for all ethnic groups fell over the period and ethnic differences reduced considerably as Pacific and Māori rates fell to a greater degree than European rates **(Figure 117)**.

Figure 115. Deaths due to meningococcal disease in 0–24 year olds, New Zealand 2000–2012



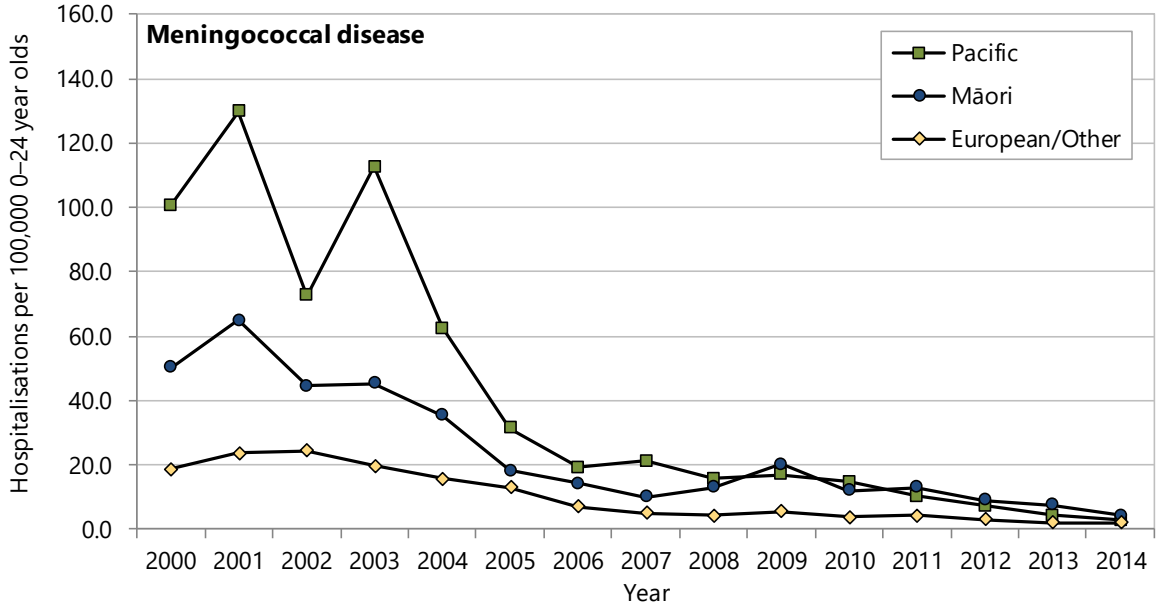
Numerator: National Mortality Collection; Denominator: Statistics NZ Estimated Resident Population; Numbers of deaths are per two year period, with the exception of 2012; * 2012 is a single year

Figure 116. Hospitalisations for meningococcal disease in 0–24 year olds, New Zealand 2000–2014



Numerator: National Minimum Dataset (acute and arranged admissions); Denominator: Statistics NZ Estimated Resident Population

Figure 117. Hospitalisations for meningococcal disease in 0–24 year olds, by ethnicity, New Zealand 2000–2014

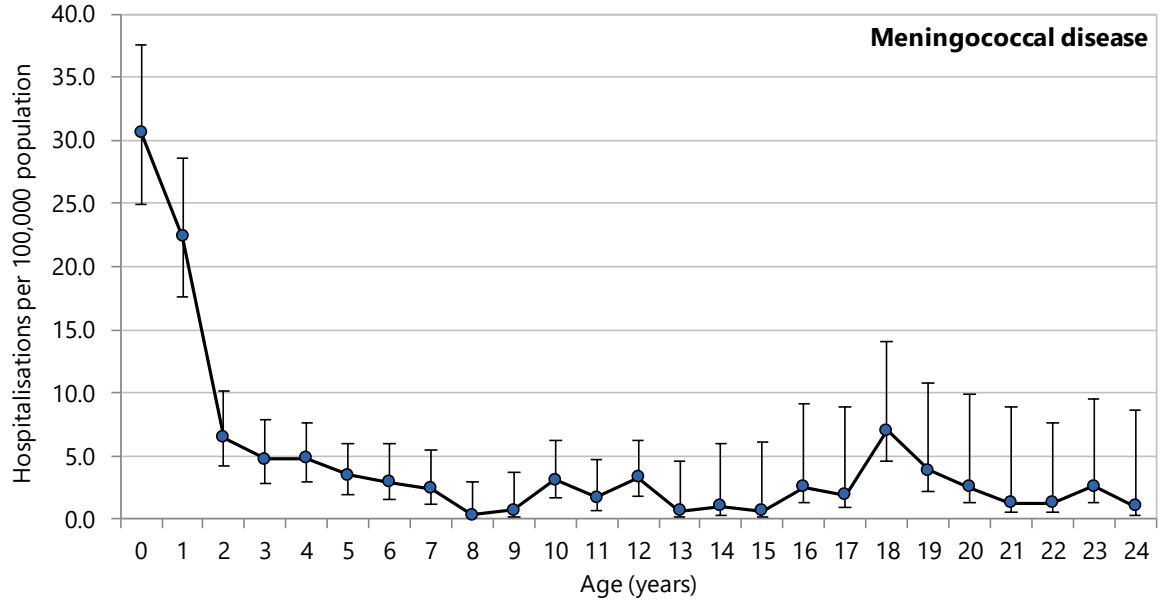


Numerator: National Minimum Dataset (acute and arranged admissions); Denominator: Statistics NZ Estimated Resident Population; Asian/Indian rates suppressed due to small numbers

Distribution by demographic factors

Between 2010 and 2014 hospitalisations rates for meningococcal disease were highest in infants under one year, and next highest in one year olds. Rates in other age groups were much lower **(Figure 118)**. Rates for meningococcal disease were *significantly higher* for 0–4 year olds compared with 15–24 year olds, for Pacific and Māori compared with European/Other, and for those living in areas with higher deprivation scores (NZDep2013 deciles 3–10) compared with those in deciles 1–2 **(Table 91)**.

Figure 118. Hospitalisations for meningococcal disease in 0–24 year olds, by age at discharge, New Zealand 2010–2014



Numerator: National Minimum Dataset (acute and arranged admissions); Denominator: Statistics NZ Estimated Resident Population

Table 91. Hospitalisations for meningococcal disease in 0–24 year olds, by demographic factor, New Zealand 2010–2014

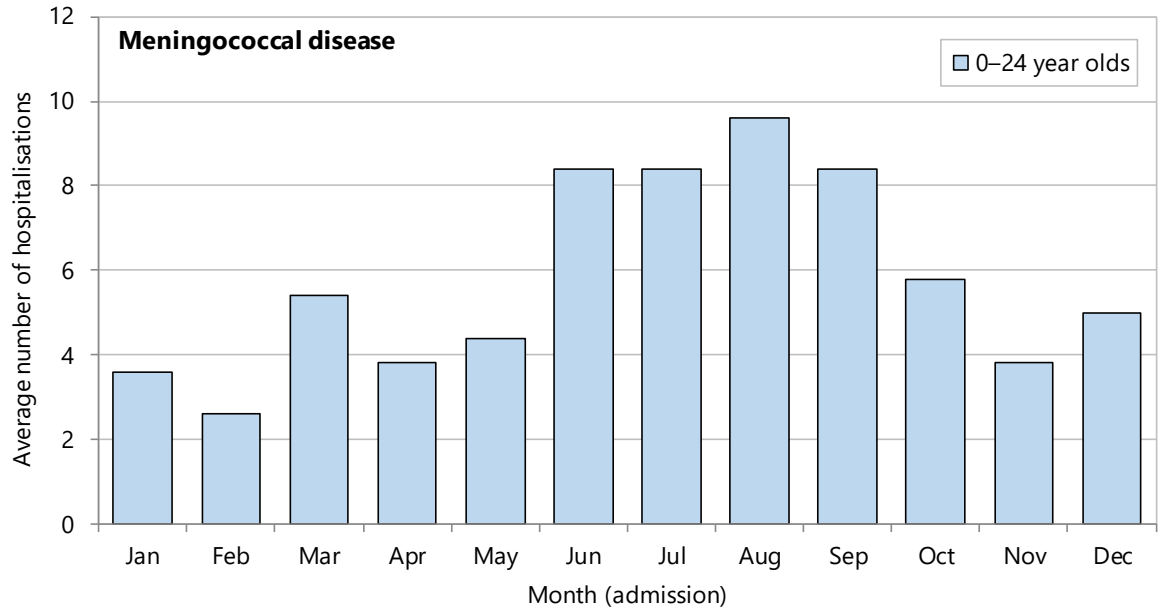
Variable	Number: 2010–2014	Rate per 100,000 0–24 year olds	Rate ratio	95% CI
Meningococcal disease in 0–24 year olds				
New Zealand				
NZDep2013 Index of deprivation quintile				
Deciles 1–2	23	1.64	1.00	
Deciles 3–4	41	3.08	1.88	1.13–3.13
Deciles 5–6	55	3.83	2.33	1.43–3.80
Deciles 7–8	66	4.07	2.48	1.55–3.99
Deciles 9–10	159	8.55	5.21	3.37–8.07
Prioritised ethnicity				
Māori	160	8.97	3.04	2.40–3.85
Pacific	54	7.71	2.61	1.89–3.59
Asian/Indian	7	0.75	0.25	0.12–0.54
MELAA	<5	s	s	s
European/Other	122	2.95	1.00	
Gender				
Female	164	4.38	1.00	
Male	182	4.66	1.06	0.86–1.31
Age group (years)				
0–4	210	13.63	5.52	4.25–7.17
5–14	59	1.97	0.80	0.57–1.12
15–24	77	2.47	1.00	

Numerator: National Minimum Dataset (acute and arranged admissions); Denominator: Statistics NZ Estimated Resident Population; Rates are per 100,000 0–24 year olds; Rate ratios are unadjusted; Ethnicity is level 1 prioritised; Decile is NZDep2013

Distribution by season

There was seasonal variation in meningococcal hospitalisation rates, particularly for 0–14 year olds. The highest rates were observed in June–September and the lowest rates in January–February **(Figure 119)**.

Figure 119. Average number of hospitalisations for meningococcal disease in 0–24 year olds, by admission month, New Zealand 2010–2014

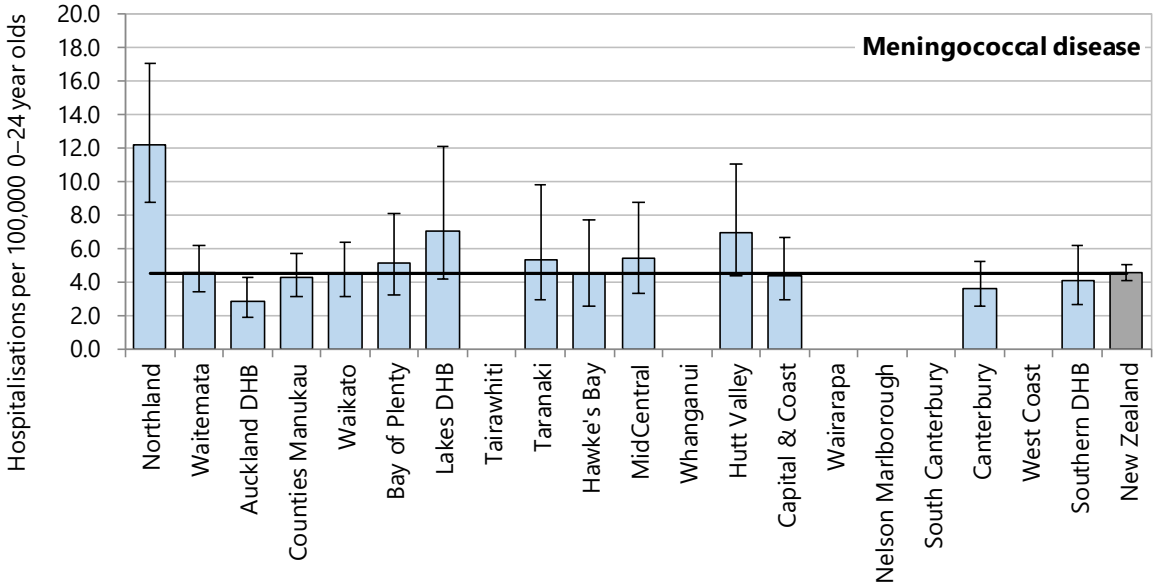


Numerator: National Minimum Dataset (acute and arranged admissions); Number is annual average

Distribution by region

Between 2010 and 2014 hospitalisation rates for meningococcal disease were *significantly higher* than the national rate in Northland DHB, while rates in the Auckland and Nelson Marlborough DHBs were *significantly lower*. In remaining district health boards there was *no significant difference* from the national rate. **(Figure 120**, **Table 92)**.

Figure 120. Hospitalisations for meningococcal disease in 0–24 year olds, by district health board, New Zealand 2010–2014



Numerator: National Minimum Dataset (acute and arranged admissions); Denominator: Statistics NZ Estimated Resident Population; Rates are per 100,000 0–24 year olds; Rates suppressed due to small numbers for Tairawhiti, Whanganui, Wairarapa, Nelson Marlborough, South Canterbury and West Coast DHBs

Table 92. Hospitalisations for meningococcal disease in 0–24 year olds, by district health board, New Zealand 2010–2014

DHB	Number: 2010–2014	Number: annual average	Rate per 100,000 0–24 year olds	Rate ratio	95% CI
Meningococcal disease in 0–24 year olds					
Northland	34	7	12.24	2.71	1.90–3.85
Waitemata	43	9	4.55	1.01	0.73–1.38
Auckland	22	4	2.81	0.62	0.40–0.96
Counties Manukau	41	8	4.22	0.93	0.68–1.29
Waikato	30	6	4.43	0.98	0.67–1.42
Bay of Plenty	18	4	5.11	1.13	0.70–1.81
Lakes	13	3	7.06	1.56	0.90–2.71
Tairawhiti	<5	s	s	s	s
Taranaki	10	2	5.31	1.17	0.63–2.20
Hawke's Bay	12	2	4.43	0.98	0.55–1.74
MidCentral	16	3	5.37	1.19	0.72–1.96
Whanganui	<5	s	s	s	s
Hutt Valley	17	3	6.92	1.53	0.94–2.49
Capital & Coast	22	4	4.36	0.96	0.63–1.48
Wairarapa	<5	s	s	s	s
Nelson Marlborough	<5	s	s	s	s
South Canterbury	<5	s	s	s	s
Canterbury	30	6	3.62	0.80	0.55–1.16
West Coast	<5	s	s	s	s
Southern	21	4	4.07	0.90	0.58–1.40
New Zealand	346	69	4.52	1.00	

Numerator: National Minimum Dataset (acute and arranged admissions); Denominator: Statistics NZ Estimated Resident Population; Rates are per 100,000 0–24 year olds

Northern region distribution and trends

Comparison with New Zealand

Between 2010 and 2014, meningococcal hospitalisation rates for 0–24 year olds were *significantly higher* than the national rate in Northland, *significantly lower* in Auckland, and *not significantly different* from the national rate in Waitemata and Counties Manukau **(Table 93)**.

Table 93. Hospitalisations for meningococcal disease in 0–24 year olds, Northern DHBs vs New Zealand 2010–2014

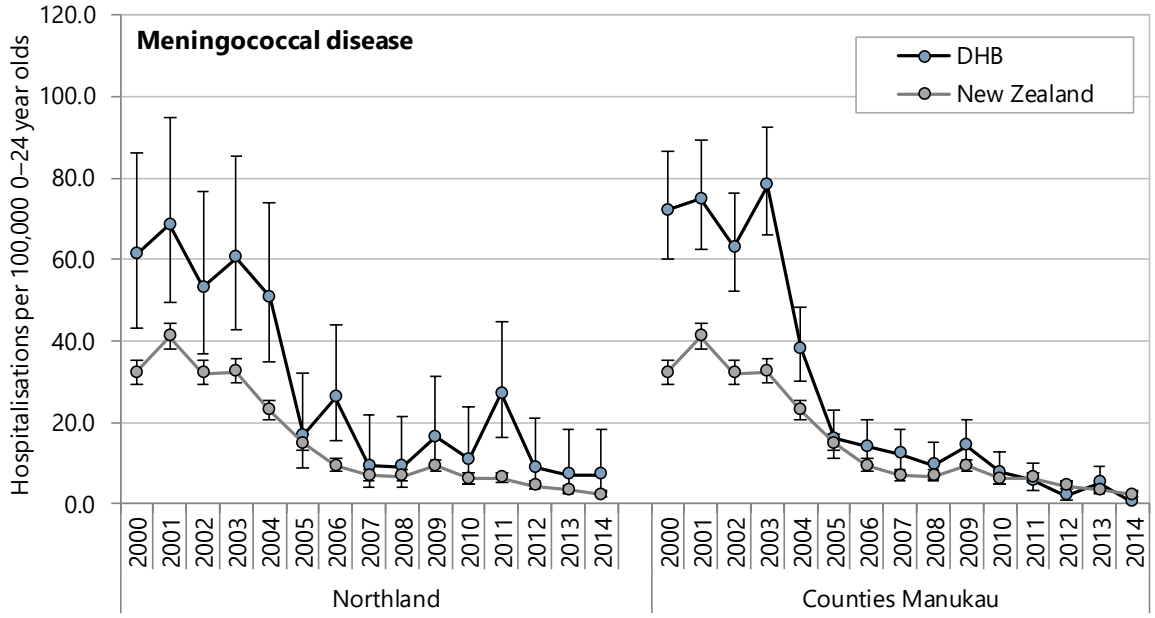
DHB	Number: 2010–2014	Number: annual average	Rate per 100,000 0–24 year olds	Rate ratio	95% CI
Meningococcal disease in 0–24 year olds					
Northland	34	7	12.24	2.71	1.90–3.85
Waitemata	43	9	4.55	1.01	0.73–1.38
Auckland	22	4	2.81	0.62	0.40–0.96
Counties Manukau	41	8	4.22	0.93	0.68–1.29
New Zealand	346	69	4.52	1.00	

Numerator: National Minimum Dataset (acute and arranged admissions); Denominator: Statistics NZ Estimated Resident Population

Regional trends

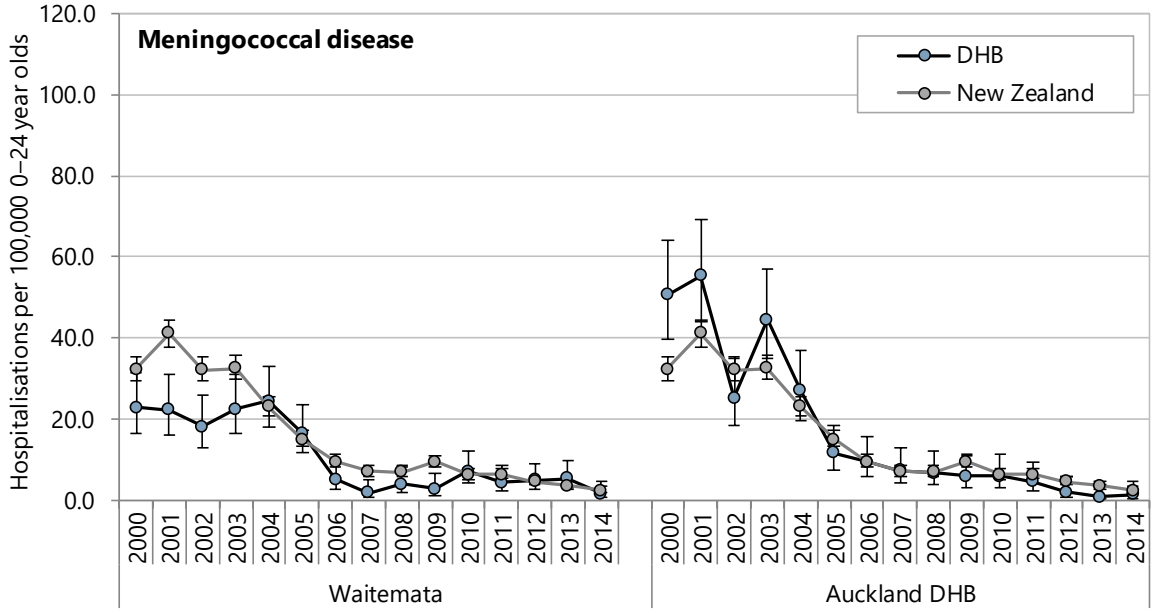
From 2000 to 2014 the hospitalisation rates for meningococcal disease in 0–24 year olds fell in all four Northern DHBs, as they did in New Zealand as a whole **(Figure 121**, **Figure 122)**.

Figure 121. Hospitalisations for meningococcal disease in 0–24 year olds, Northland and Counties Manukau DHBs vs New Zealand 2000–2014



Numerator: National Minimum Dataset (acute and arranged admissions); Denominator: Statistics NZ Estimated Resident Population

Figure 122. Hospitalisations for meningococcal disease in 0–24 year olds, Waitemata and Auckland DHBs vs New Zealand 2000–2014



Numerator: National Minimum Dataset (acute and arranged admissions); Denominator: Statistics NZ Estimated Resident Population

Evidence for good practice for the prevention and management of meningococcal disease

Ministry of Health publications
Ministry of Health. 2012. **Communicable Disease Control Manual 2012**. Wellington: Ministry of Health. http://www.health.govt.nz/publication/communicable-disease-control-manual-2012 *The Communicable Disease Control Manual* seeks to describe the standard practice that public health services would normally follow in regard to the prevention and control of notifiable diseases. It is intended to be used alongside other best practice guidelines including the *Immunisation Handbook*. Invasive meningococcal disease is a notifiable condition and attending medical practitioners or laboratories must immediately notify the local medical officer of health of suspected cases even before confirmation has been obtained. Key steps in management include administering parenteral antibiotics as soon as the diagnosis is suspected, and public health follow-up of all household and other close contacts who have had unprotected contact with respiratory droplets from the affected child. Cases should be kept isolated (droplet precautions) until 24 hours after the start of antibiotic treatment. Antibiotic prophylaxis should be provided to contacts as soon as possible and ideally within 24 hours.
Ministry of Health. 2014. **Immunisation Handbook 2014**. Wellington: Ministry of Health. Details about meningococcal disease are provided on pages 313–340. There is currently no meningococcal vaccine funded in the routine New Zealand immunisation schedule. Polysaccharide and conjugate meningococcal vaccines (that protect against serogroups A, C, Y, and W135) are funded in special circumstances including children with functional asplenia or who require splenectomy, with immunodeficiency including HIV, complement deficiency or following solid organ transplant, and close contacts of meningococcal cases. Children who are travelling to high risk countries including travel to the Hajj are recommended to have a meningococcal vaccine, as are young adults living in communal accommodation like school or university hostels. There is no group B vaccine available in New Zealand. Management of organisational or community outbreaks is the responsibility of the medical officer of health and the Ministry of Health, and may include a funded vaccination programme for a defined population.
Ministry of Health. 2014. **Meningococcal B immunisation programme and MeNZB vaccine**. http://www.health.govt.nz/our-work/preventative-health-wellness/immunisation/immunisation-programme-decisions/meningococcal-b-immunisation-programme-and-menzbtm-vaccine accessed 28 October 2015. This webpage provides a succinct summary of the meningococcal vaccination programme offered in New Zealand between 2004 and 2011. More than 1.1 million young New Zealanders received the MeNZB vaccine and the number of people developing meningococcal disease due to the then epidemic strain of serogroup B reduced from over 300 cases in 2001 to less than 30 cases in 2010, meaning that vaccination is no longer needed to control the epidemic. The epidemic waned faster than expected and as the MeNZB™ vaccine was developed specifically to curb the epidemic of this particular strain of meningococcal disease it is no longer available in New Zealand.
International guidelines
National Institute for Health and Care Excellence. 2015. **Bacterial meningitis and meningococcal septicaemia overview.** http://pathways.nice.org.uk/pathways/bacterial-meningitis-and-meningococcal-septicaemia accessed 28 October 2015. This NICE pathway covers diagnosis and management of bacterial meningitis and meningococcal septicaemia in children and young people (under 16 years) in primary and secondary care. Control of meningococcal disease is both a clinical and public health priority in the UK where serogroup B meningococcus is now the most common cause of bacterial meningitis and septicaemia in children and young people aged 3 months and older. Introduction of *Haemophilis influenza* type b, pneumococcal, and serogroup C meningococcal vaccines have dramatically affected the epidemiology of these conditions in the UK over the past two decades. The paths in the pathway include symptoms and signs, pre-hospital management and management of meningococcal disease. There is a particularly helpful path on long-term management and immune testing after an episode of meningococcal disease which emphasises the importance of audiological assessment within four to six weeks after discharge from hospital. Immune testing is not generally required except in a few specific circumstances.
Evidence-based medicine reviews
Zalmanovici Trestioreanu A, et al. 2013. **Antibiotics for preventing meningococcal infections.** Cochrane Database of Systematic Reviews doi:10.1002/14651858.CD004785.pub5 http://onlinelibrary.wiley.com/doi/10.1002/14651858.CD004785.pub5/abstract This systematic review studied the effectiveness of different antibiotics to prevent infection and eradicate asymptomatic *Neisseria meningitidis* carriage among household contacts of people with invasive meningococcal infection. The review included 19 studies with a total of 2531 randomised participants, and five studies with a total of 4354 cluster-randomised participants. Most studies were of high quality. As there were no cases of meningococcal disease during the follow-up of all these individuals, the end point of eradication of *N. meningitidis* was used. Compared with placebo, ciprofloxacin, rifampicin and penicillin were effective at eradicating *N. meningitidis* at one to two weeks following treatment. Although ceftriaxone was not compared with placebo, it was more effective than rifampicin at one to two weeks following treatment. Side effects were reported for 18 of the studies, and these were all mild in nature including nausea, diarrhoea, headaches, dizziness and pain at the injection site. Drug-resistant isolates were seen in some contacts treated with

rifampicin, which may mean that this antibiotic in inappropriate to use in an outbreak. All of the antibiotics recommended for prophylactic use in New Zealand were found to be effective in this systematic review.

Other relevant publications

Sarfatti A & Nadel S. 2015. **Management of meningococcal disease.** Paediatrics and Child Health (United Kingdom), 25(5), 203-09.

This article provides an overview of the management of meningococcal disease with an international perspective. Early recognition and treatment is vital to improve outcome of invasive meningococcal disease which remains an important cause of childhood sickness and death. Introduction of serogroup C vaccine into the routine vaccination schedule in the UK and other countries has been associated with a dramatic reduction in the incidence of disease. The impact of a recently developed serogroup B meningococcal vaccine is yet to be determined.

Websites

Ministry of Health. 2015. **Meningococcal disease.** http://www.health.govt.nz/your-health/conditions-and-treatments/diseases-and-illnesses/meningococcal-disease accessed 28 October 2015.

This webpage provides information about meningococcal disease for New Zealand families. It includes a 3 minute video interview with the parents of an 18-year-old woman who died from meningococcal disease.

Ministry of Health. 2014. **Meningococcal** http://www.health.govt.nz/our-work/diseases-and-conditions/meningococcal accessed 28 October 2015.

This webpage provides information about meningococcal disease for health professionals and includes a link to a helpful page of frequently asked questions about the condition.

HealthEd. 2013. **Meningococcal disease: Information for health professionals**. https://www.healthed.govt.nz/resource/meningococcal-disease-information-health-professionals accessed 28 October 2015.

This webpage provides information for health professionals about the symptoms and signs of meningococcal disease plus detailed information about recommended antibiotics, together with links to a patient information leaflet. Free copies of the A3 poster and the patient information leaflet can be ordered through the website.

TUBERCULOSIS

Introduction

The overall rate of active tuberculosis (TB) in New Zealand is low compared with many countries, although TB remains one of the most common notifiable infectious diseases.[58] TB is a chronic bacterial infection caused by *Mycobacterium complex*, including *M .tuberculosis* or *M. bovis.* The lung is the most common site of infection, but any organ can be affected. Young children with active TB may present with symptoms of fever, lassitude and cough, while older children and adults may present with loss of appetite, fatigue, weight loss, chills, night sweats, cough, blood in sputum or chest pain. The disease may be active or latent; the risk of progression from latent to active TB disease is much higher for children than for healthy adults.[79]

Most children with TB are infected as a result of contact with an infectious adult in their family although there have been outbreaks of TB among New Zealand children in the past.[80,81] Children aged under 15 years account for 7–14% of all notified cases; this proportion varies significantly by ethnicity such that children account for 25% of TB cases in Pacific peoples, 14% of cases in Māori, 5% in Europeans and 4% in 'Others'. The very youngest children appear to be most susceptible, with just over half the cases of childhood TB occurring in children aged under 5 years.[79] In all countries TB mostly affects the poorest and most vulnerable communities and in Auckland the notification rates in the least affluent parts of the region are 60 times higher than notification rates in the most affluent.[79] The most common risk factor for TB infection is contact with a known case of TB.[79] Vaccination can protect neonates and infants at high risk from severe forms of TB disease.[58] The mainstay of tuberculosis control in New Zealand is early identification of people with the disease and public health follow-up of cases and contacts.[79]

As there have only been two deaths during the period 2000 to 2014, the following section reports on hospitalisations for TB in children and young people using information from the National Minimum Dataset. It concludes with a brief overview of evidence-based reviews and guidelines which consider the most effective interventions for preventing or managing TB in children and young people.

Data sources and methods

Indicator

Hospitalisations for tuberculosis in 0–24 year olds

Data sources

Numerator: National Minimum Dataset
Denominator: Statistics NZ Estimated Resident Population (with linear extrapolation being used to calculate denominators between Census years)

Definition

Acute and arranged hospitalisations of 0–24 year olds with a primary diagnosis of tuberculosis (hospitalisations per 100,000 0–24 year olds). Refer to **Appendix 6** for the codes included.

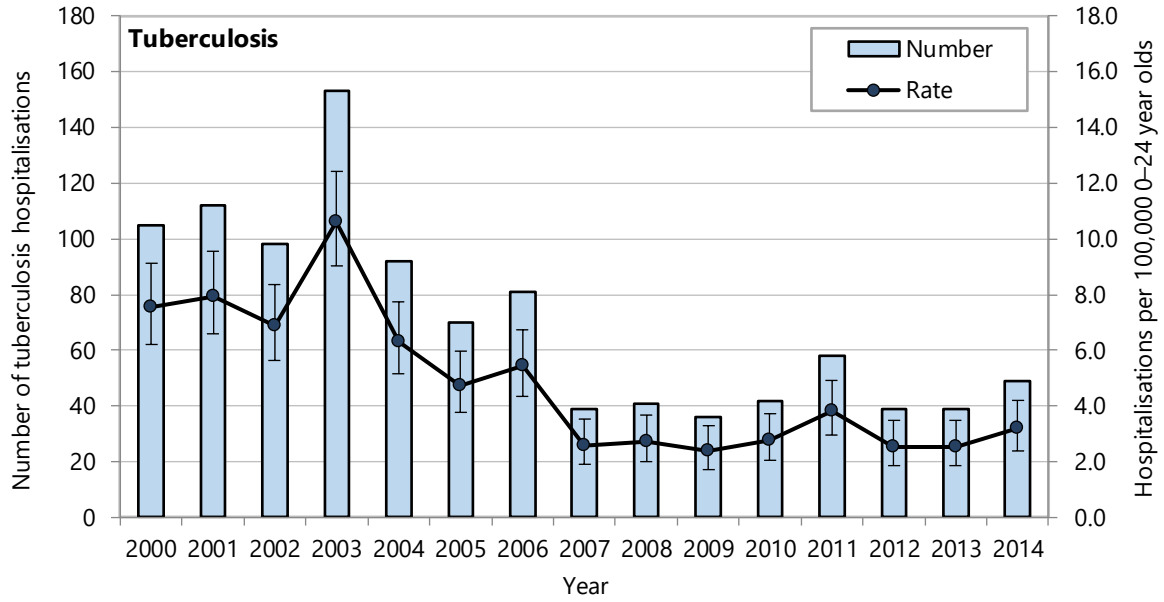
Notes on interpretation

Note 1: An acute admission is an unplanned hospitalisation occurring on the day of presentation, while an arranged admission (also referred to as a semi-acute admission) is a non-acute hospitalisation with an admission date less than seven days after the date the decision was made that the hospitalisation was necessary
Note 2: **Appendix 3** outlines the limitations of the data utilised from the National Minimum Dataset. The reader is advised to review this appendix before interpreting any trends.

National trends and distribution

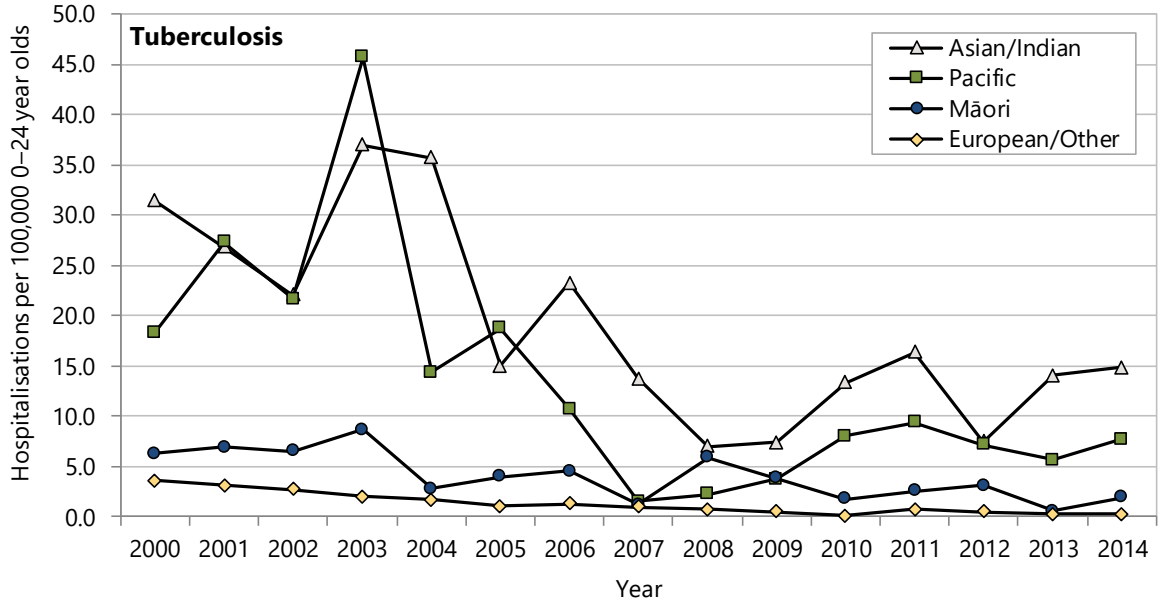
The hospitalisation rate for tuberculosis in 0–24 year olds declined from 2003 to 2007 and remained steady from 2007 onwards **(Figure 123)**. While there was year to year variation, rates generally declined for all ethnic groups from 2003 to 2007. From 2007–2008 onwards rates rose somewhat for Pacific and Asian/Indian children and young people while Māori and European rates were variable **(Figure 124)**.

Figure 123. Hospitalisations for tuberculosis in 0–24 year olds, New Zealand 2000–2014



Numerator: National Minimum Dataset (acute and arranged admissions); Denominator: Statistics NZ Estimated Resident Population

Figure 124. Hospitalisations for tuberculosis in 0–24 year olds, by ethnicity, New Zealand 2000–2014

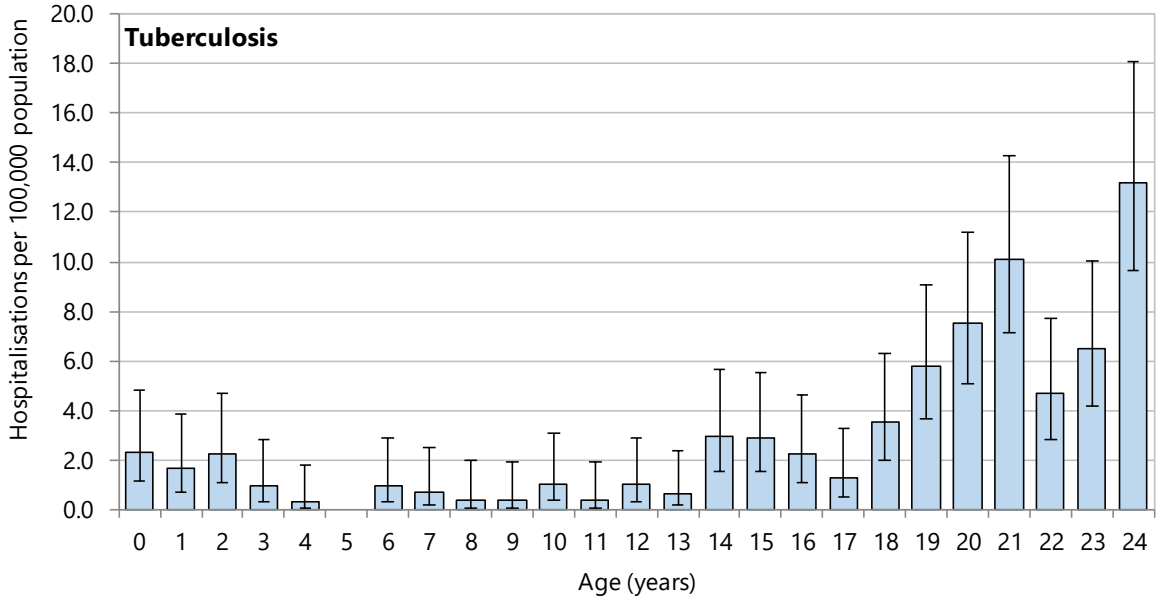


Numerator: National Minimum Dataset (acute and arranged admissions); Denominator: Statistics NZ Estimated Resident Population; Caution: rates are subject to small number effect, particularly European/Other from 2009

Distribution by demographic factors

Between 2010 and 2014 tuberculosis hospitalisation rates for 0–24 year olds were highest amongst those in their late teens and early twenties **(Figure 125)**. There were disparities in tuberculosis hospitalisation rates by NZDep2013 index of deprivation score, ethnicity and age. Rates were *significantly lower* in areas with the lowest deprivation scores (NZDep2013 deciles 1−2) compared with higher deprivation scores (deciles 5−10). Compared with European/Other, rates were *significantly higher* for Māori, Pacific, Asian/Indian, and MELAA. Rates were *significantly higher* for young people aged 15–24 than for younger children **(Table 94)**.

Figure 125. Hospitalisations for tuberculosis in 0–24 year olds, by age New Zealand 2010–2014



Numerator: National Minimum Dataset (acute and arranged admissions); Denominator: Statistics NZ Estimated Resident Population

Table 94. Hospitalisations for tuberculosis in 0–24 year olds, by demographic factor, New Zealand 2010–2014

Variable	Number: 2010–2014	Rate per 100,000 0–24 year olds	Rate ratio	95% CI
Tuberculosis in 0–24 year olds				
New Zealand				
NZDep2013 Index of deprivation quintile				
Deciles 1–2	13	0.93	1.00	
Deciles 3–4	21	1.58	1.70	0.85–3.40
Deciles 5–6	42	2.92	3.15	1.69–5.87
Deciles 7–8	51	3.15	3.40	1.85–6.24
Deciles 9–10	99	5.32	5.74	3.22–10.24
Prioritised ethnicity				
Māori	35	1.96	16.22	6.35–41.39
Pacific	53	7.56	62.47	25.0–156.27
Asian/Indian	124	13.22	109.16	44.65–266.89
MELAA	10	10.20	84.21	28.78–246.37
European/Other	5	0.12	1.00	
Gender				
Female	109	2.91	1.00	
Male	118	3.02	1.04	0.80–1.34
Age group (years)				
0–4	23	1.49	0.26	0.17–0.40
5–14	25	0.84	0.15	0.10–0.22
15–24	179	5.74	1.00	

Numerator: National Minimum Dataset (acute and arranged admissions); Denominator: Statistics NZ Estimated Resident Population; Rates are per 100,000 0–24 year olds; Rate ratios are unadjusted; Ethnicity is level 1 prioritised; Decile is NZDep2013

Distribution by season

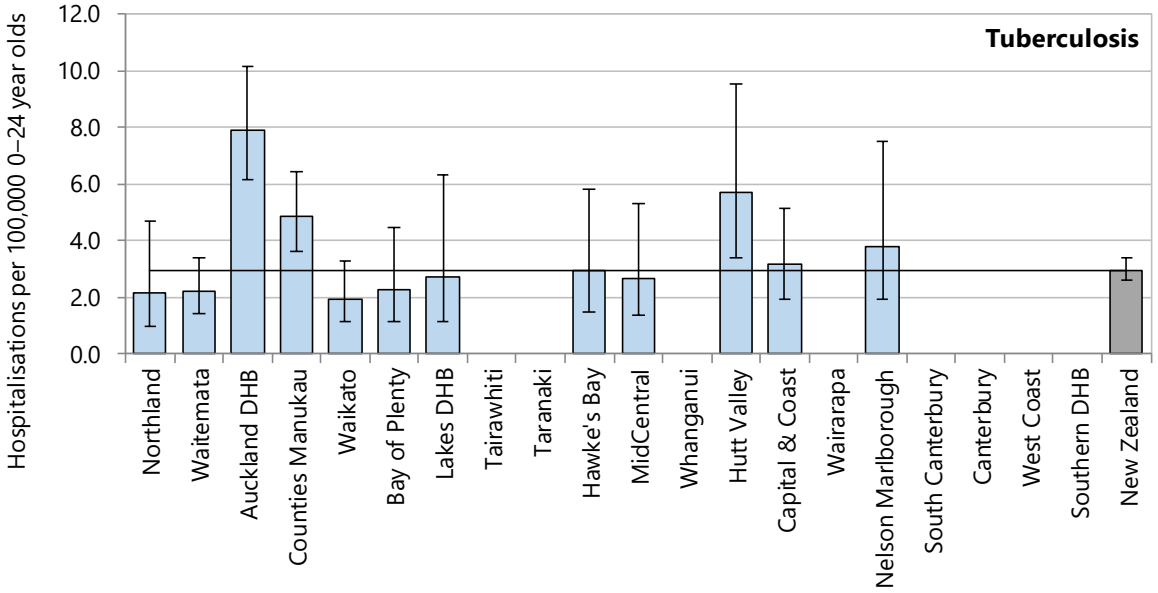
There were no consistent seasonal variations in hospitalisations for tuberculosis in 0–24 year olds.

Distribution by region

Between 2010 and 2014 hospitalisation rates for tuberculosis in 0–24 year olds were *significantly higher* than the national rate in the Auckland, Counties Manukau and Hutt Valley DHBs. While rates in a number of other

DHBs also differed from the national rate, in no other cases did these differences reach statistical significance **(Figure 126)**. In addition it should be noted that most DHBs had very small numbers of hospitalisations per year. Only Auckland and Counties Manukau had an average number of hospitalisations per year of more than five **(Table 95)**.

Figure 126. Hospitalisations for tuberculosis in 0–24 year olds, by district health board, New Zealand 2010–2014



Numerator: National Minimum Dataset (acute and arranged admissions); Denominator: Statistics NZ Estimated Resident Population; rates suppressed for Taranaki, Whanganui, Wairarapa, Canterbury, and Southern DHBs due to numbers less than 5

Table 95. Hospitalisations for tuberculosis in 0–24 year olds, by district health board, New Zealand 2010–2014

DHB	Number: 2010–2014	Number: annual average	Rate per 100,000 0–24 year olds	Rate ratio	95% CI
Tuberculosis in 0–24 year olds					
Northland	6	1	2.16	0.73	0.32–1.64
Waitemata	21	4	2.22	0.75	0.48–1.17
Auckland	62	12	7.92	2.67	2.01–3.53
Counties Manukau	47	9	4.84	1.63	1.19–2.23
Waikato	13	3	1.92	0.65	0.37–1.13
Bay of Plenty	8	2	2.27	0.77	0.38–1.55
Lakes	5	1	2.71	0.91	0.38–2.22
Tairawhiti	0	..	..	..	..
Taranaki	<5	s	s	s	s
Hawke's Bay	8	2	2.95	1.00	0.49–2.01
MidCentral	8	2	2.69	0.91	0.45–1.83
Whanganui	<5	s	s	s	s
Hutt Valley	14	3	5.70	1.92	1.12–3.30
Capital & Coast	16	3	3.17	1.07	0.64–1.77
Wairarapa	<5	s	s	s	s
Nelson Marlborough	8	2	3.82	1.29	0.64–2.60
South Canterbury	0	..	..	..	..
Canterbury	<5	s	s	s	s
West Coast	0	..	..	..	..
Southern	<5	s	s	s	s
New Zealand	227	45	2.97	1.00	

Numerator: National Minimum Dataset (acute and arranged admissions); Denominator: Statistics NZ Estimated Resident Population

Northern region distribution and trends

Comparison with New Zealand

Between 2010 and 2014 tuberculosis hospitalisation rates for 0–24 year olds were *significantly higher* than the national rate in Auckland and Counties Manukau DHBs, while rates were *not significantly different* in Northland and Waitemata **(Table 96)**.

Table 96. Hospitalisations for tuberculosis in 0–24 year olds, Northern DHBs vs New Zealand 2010–2014

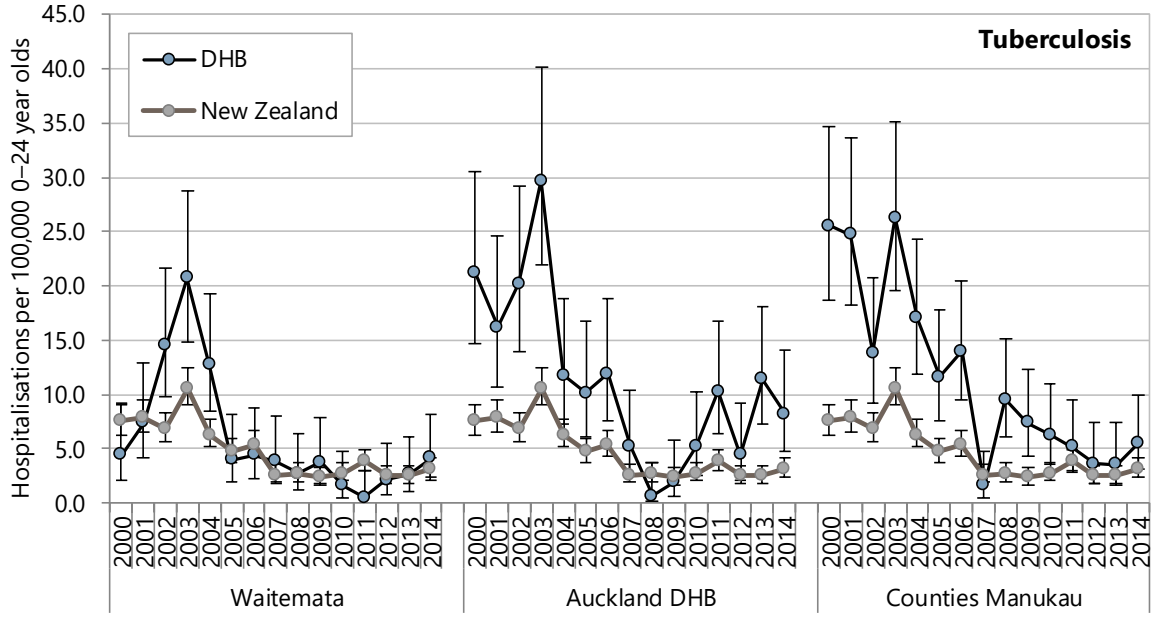
DHB	Number: 2010–2014	Number: annual average	Rate per 100,000 0–24 year olds	Rate ratio	95% CI
Tuberculosis in 0–24 year olds					
Northland	6	1	2.16	0.73	0.32–1.64
Waitemata	21	4	2.22	0.75	0.48–1.17
Auckland	62	12	7.92	2.67	2.01–3.53
Counties Manukau	47	9	4.84	1.63	1.19–2.23
New Zealand	227	45	2.97	1.00	

Numerator: National Minimum Dataset (acute and arranged admissions); Denominator: Statistics NZ Estimated Resident Population

Regional trends

While there was large year to year variation between 2000 and 2014, the hospitalisation rate for tuberculosis in all four Northern DHBs exhibited a general downward trend **(Figure 127)**.

Figure 127. Hospitalisations for tuberculosis in 0–24 year olds, Northern DHBs vs New Zealand 2000–2014



Numerator: National Minimum Dataset (acute and arranged admissions); Denominator: Statistics NZ Estimated Resident Population; Rates for Northland DHB suppressed due to small numbers

Evidence for good practice for the control of tuberculosis

Ministry of Health Publications
Ministry of Health. 2014. **Immunisation Handbook 2014**. Wellington: Ministry of Health. http://www.health.govt.nz/publication/immunisation-handbook-2014 accessed 22 October 2015 Details about TB and Bacillus Calmette-Guérin (BCG) vaccination for TB are provided on pages 471–488. Neonatal BCG vaccine should be offered to infants at increased risk of TB, for example those who will be living in a house or family/whānau with a person with either current TB or a history of TB, who will be living for 3 months or longer in a country with a TB rate ≥40 per 100,000 before they reach age five years, or whose parents or caregivers have lived in such countries for six months or more in the past 5 years. Funded BCG vaccination may be offered to at-risk people if they are tuberculin skin test- or interferon gamma release assay (IGRA)-negative, including contacts of active TB cases aged under 5 years, immigrants aged under 5 years from countries with a rate ≥40 per 100,000, health care workers and laboratory staff depending on their risk of exposure, and people exposed to animals that are likely to be infected. BCG immunisation in New Zealand may legally be performed only by gazetted BCG vaccinators.
Ministry of Health. 2012. **Communicable Disease Control Manual 2012**. Wellington: Ministry of Health. http://www.health.govt.nz/publication/communicable-disease-control-manual-2012 accessed 23 October 2015 The Communicable Disease Control Manual seeks to describe the standard practice that public health services would normally follow in regard to the prevention and control of notifiable diseases. It is intended to be used alongside other best practice guidelines including the *Immunisation Handbook* and *Guidelines for tuberculosis control in New Zealand.* The lifetime risk of developing active TB following infection is 5–10% in adults although higher in children, or in those with a predisposing medical condition and immunosuppression (e.g. HIV). The main means of transmission of infection is by inhalation of airborne droplets; infection after drinking contaminated unpasteurised milk or milk products is infrequent. Index cases should be considered infectious from onset of cough or three months before diagnosis, and the risk of transmission usually reduces to negligible levels 2–4 weeks after commencing effective treatment. The manual outlines reporting responsibilities, notification procedure, and key aspects of case management including isolation precautions, management of contacts and counselling for all affected people.
New Zealand guidelines
Ministry of Health. 2010. **Guidelines for tuberculosis control in New Zealand 2010**. http://www.health.govt.nz/publication/guidelines-tuberculosis-control-new-zealand-2010 accessed 13 October 2015 These guidelines were published in 2010 and the Ministry of Health notes that recent evidence suggests that the guidance given for treatment of tuberculosis, particularly in Chapter 3 needs to be revised. Any treatment concerns should be discussed with an appropriate clinician (respiratory / infectious diseases / paediatric) rather than relying on the guidelines. However the document still provides useful information about the epidemiology and surveillance of tuberculosis (TB) in New Zealand, detailed information about the clinical features, investigation (including laboratory methods and standards) and assessment of TB. Specific circumstances, settings and population groups are also considered including HIV associated TB, contact investigation, TB in correctional facilities, infection control including in hospital settings, and people from countries with a high incidence of TB. Chapter 5 addresses TB in children. Although optimal treatment regimens and dosages are not known for children, most children have good outcomes on current regimens. Most child cases of TB are the result of transmission of infection from a close family member, and the treatment regimen is based on drug sensitivity testing from the adult case. Most TB in children occurs within a year of infection, and children have a higher risk than adults of developing severe disease especially if the child is aged under two years or has HIV infection or other immunocompromising condition.
International Guidelines
National Institute for Health and Care Excellence. 2015. **Tuberculosis overview**. http://pathways.nice.org.uk/pathways/tuberculosis accessed 23 October 2015 This NICE pathway, designed to be interactive and used on-line, brings together guidance, quality standards and materials to support commissioning of TB services, preventing spread of TB, and diagnosing and managing active TB. There is also a link to the NICE pathway on antimicrobial stewardship. The downloadable PDF includes a helpful glossary. Hard-to-reach groups include children from any ethnic background whose social circumstances, language, culture or lifestyle, or those of their parents or carers, make it difficult to recognise the clinical onset of TB, access diagnostic and treatment services, have treatment administered by a parent or carer or attend regular clinic appointments. This group includes unaccompanied minors, children whose parents are hard-to-reach, children whose parents are in prison, and looked-after children. Within the interactive pathway there are links to guidance about screening for latent TB in children who have been in close contact with people with sputum-smear-positive TB several by age group from neonates through to 5 years and older and by BCG vaccination status. There is also guidance about immigrant screening children from high-incidence countries. This is a good place to quickly find guidance, particularly about prevention of spread to TB, for very specific population groups of children.
World Health Organization. 2014. **Guidance for national tuberculosis programmes on the management of tuberculosis in children**. Geneva: World Health Organization. http://www.who.int/tb/publications/childtb_guidelines/en/ accessed 23 October 2015 While designed for countries where TB is endemic at a high level, the principles of TB treatment in children (page 33) remain relevant in all countries: Cure the child of TB, prevent death, relapse and transmission of TB, prevent development and transmission of drug-resistant TB, and achieve all this with minimal toxicity. Medication dosages for children need to take into account the risk of drug-induced hepatotoxicity with isoniazid or pyrazinamide and optic neuritis due to ethambutol. The WHO revised dosage recommendations have

an excellent safety profile based on systematic review of available evidence and underpin the recommendations for children in *Guidelines for tuberculosis control in New Zealand*.

Evidence-Based Medicine Reviews

Bose A, et al. 2014. **Intermittent versus daily therapy for treating tuberculosis in children**. Cochrane Database of Systematic Reviews doi:10.1002/14651858.CD007953.pub2 http://onlinelibrary.wiley.com/doi/10.1002/14651858.CD007953.pub2/abstract

Treatment for TB includes a combination of drugs given daily for six at least months. Although the World Health Organization currently recommends treatments, some national governments recommend twice- or thrice-weekly doses for children with TB as this is more convenient. The authors undertook a systematic literature review to compare the effectiveness and safety of intermittent compared with daily TB treatment. They found only four randomised trials that compared twice-weekly treatment with daily doses of anti-TB drugs including a total of 563 children aged five months to 15 years. The trials were small, and did not detect a difference between twice-weekly or daily treatment in the number of children who were cured, died, relapsed, reported taking most or all of the drugs, or had adverse effects. They concluded that trials conducted to date are insufficient to support or refute the use of intermittent twice- or thrice-weekly, short-course treatment regimens over daily short-course treatment in children with TB.

M'Imunya James M, et al. 2012. **Patient education and counselling for promoting adherence to treatment for tuberculosis**. Cochrane Database of Systematic Reviews doi:10.1002/14651858.CD006591.pub2 http://onlinelibrary.wiley.com/doi/10.1002/14651858.CD006591.pub2/abstract

Because non-adherence to treatment can lead to prolonged infectivity and increase morbidity and mortality from TB, the authors undertook a systematic review to evaluate the effects of patient education or counselling on treatment completion in people requiring treatment for active or latent TB. They identified three randomised controlled trials with a total of 1437 participants and found that educational or counselling interventions may improve completion of treatment. In a trial in children from Spain telephone counselling or home visits by nurses increased completion of treatment from 65% to 94% or 95%. Both interventions were superior to counselling by physicians at the TB clinic.

Other Relevant Publications

World Health Organization. 2014. **Global tuberculosis report 2014**. World Health Organization. http://apps.who.int/iris/bitstream/10665/137094/1/9789241564809_eng.pdf accessed 23 October 2015

This comprehensive report provides an international perspective on TB, which remains one of the world's deadliest communicable diseases responsible for a total of 1.5 million deaths in 2013. Estimating global TB incidence in children is technically difficult The report has a supplement highlighting progress in surveillance of and responses to multidrug-resistant TB. The WHO post-2015 global TB strategy was approved by all Member States in May 2014 and includes targets of 95% reduction in TB deaths and 90% reduction in TB incidence by 2035 together with a target of zero catastrophic costs for TB-affected families by 2020.

Websites

Institute of Environmental Science and Research. 2015. **Public Health Surveillance: Information for New Zealand public health action**. https://surv.esr.cri.nz/index.php accessed 23 October 2015

This website provides detailed surveillance data for all notifiable diseases in New Zealand, including TB.

Ministry of Health. 2015. **Tuberculosis**. http://www.health.govt.nz/your-health/conditions-and-treatments/diseases-and-illnesses/tuberculosis accessed 23 October 2015

This website provides consumer information about TB with links to brochures about TB and BCG vaccination in English and other languages.

RHEUMATIC FEVER AND HEART DISEASE

Introduction

Acute rheumatic fever (RF) is an autoimmune reaction that occurs two to three weeks after a throat infection with the bacterium *Streptococcus pyogenes* also known as group A *Streptococcus* (GAS).[76,82] It causes an illness that mainly affects the heart, joints, brain and skin. If a person experiences several attacks of RF they may develop rheumatic heart disease (RHD). Damage to the heart valves can cause serious health problems and may require cardiac surgery. The primary episode usually occurs in children aged 5–15 years and consequently interventions are usually targeted on this group.[83] A child with RF will usually present with sore or swollen joints and may also have a skin rash, fever, stomach pains and jerky movements.[84]

Although acute RF appears to have been virtually eradicated from most 'developed' countries, rates in New Zealand remain some of the highest reported in a developed country. Observed inequality between ethnic groups has increased over time with much higher rates for Pacific and for Māori compared with non-Māori non-Pacific children aged 5–14 years.[83] Reducing the incidence of RF by two-thirds is one of the results set by the Government as part of the priority to support vulnerable children through delivery of better public services.[85] Effective strategies to address the multiple determinants of RF include prevention of transmission of GAS infections, for example, by addressing household crowding and socioeconomic factors that predispose to it, and early detection and treatment of GAS infections through improved community awareness and capacity, for example, by improving health literacy, health service access and early diagnosis and treatment. All patients presenting with sore throat should be assessed for the presence or absence of significant risk factors for rheumatic fever. Patients are considered to be at high risk if they have a personal, family or household history of rheumatic fever, or meet two or more of the following criteria: Māori or Pacific ethnicity, age 3-35 years or living in crowded circumstances or in lower socioeconomic areas of the North Island. High risk patients presenting in primary care or emergency departments should have a throat swab if follow-up is possible and be started on 10 days of empiric penicillin or amoxicillin or given a single dose of IM benzathine penicillin, while high risk patients identified in school sore throat clinics should have a throat swab and, only if this is positive for group A streptococcus (GAS), be given 10 days of antibiotics.[86] Patients not considered to be at high risk may not require either throat swabbing or antibiotics unless they have severe symptoms or are at increased risk of spreading GAS.[86] Early diagnosis of acute RF can reduce the risk of severe rheumatic heart disease especially if there is good follow-up for antibiotic prophylaxis (secondary prevention) for those with a diagnosis of acute RF.[76] Monthly injections of long-acting benzathine penicillin G can prevent RF recurrences and must be continued for 10 years after diagnosis or until age 21 (whichever is the longer) or until age 30 or even life-long in the presence of carditis or established RHD.[87] Annual influenza vaccination is recommended and funded for children aged over 6 months who have RHD.[58] Because RF is a notifiable disease the attending medical practitioner is expected to notify the local medical officer of health of suspected initial or recurrent cases of acute RF within seven days, and not wait for a confirmed diagnosis.[76]

The following section reports on deaths and hospitalisations for rheumatic fever and rheumatic heart disease in children and young people using information from the National Mortality Collection and the National Minimum Dataset. It concludes with a brief overview of evidence-based reviews and guidelines which consider the most effective interventions for preventing or managing these conditions in children and young people.

Data sources and methods

Indicators

Deaths of 0–24 year olds due to acute rheumatic fever or rheumatic heart disease
Hospitalisations of 0–24 year olds for acute rheumatic fever of rheumatic heart disease

Data sources

Numerator:
Deaths National Mortality Collection
Hospitalisations National Minimum Dataset
Denominator: Statistics NZ Estimated Resident Population (with linear extrapolation being used to calculate denominators between Census years).

Definition

Deaths: Deaths of 0–24 year olds where the main underlying cause of death was acute rheumatic fever or rheumatic heart disease
Hospitalisations: Acute and arranged hospitalisations of 0–24 year olds with a diagnosis of acute rheumatic fever or chronic rheumatic heart disease (hospitalisations per 100,000 population). Refer to **Appendix 6** for the codes included.

Notes on interpretation

Note 1: Unless otherwise specified, this analysis focuses on all hospitalisations of 0–24 year olds with either acute rheumatic fever (as primary diagnosis) or chronic rheumatic heart disease listed in any of the first 15 diagnoses. The rationale for this wider focus for chronic rheumatic heart disease was that many 0–24 year olds with chronic rheumatic heart disease will not be hospitalised for their heart disease per se, but rather for one of its resulting complications. For example, during 2005–2009 only 39.0% of hospitalisations for 0–24 year olds with rheumatic heart disease had this listed as the primary diagnosis, with 11.8% being admitted for pregnancy and childbirth, and 11.0% for other cardiovascular diagnoses. These data in this section may differ from data reported elsewhere.

Note 2: An acute admission is an unplanned hospitalisation occurring on the day of presentation, while an arranged admission (also referred to as a semi-acute hospitalisation) is a non-acute hospitalisation with an admission date less than seven days after the date the decision was made that the hospitalisation was necessary.

Note 3: **Appendix 3** describes the National Minimum Dataset and outlines the limitations of the data utilised from this collection. The reader is advised to review this appendix before interpreting any trends.

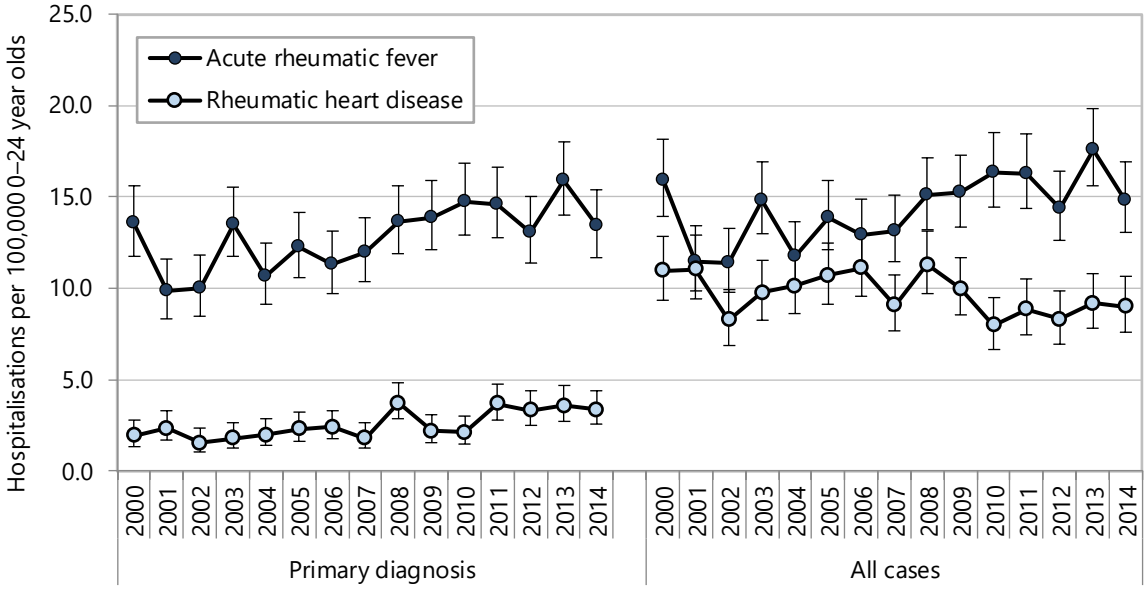
Note 4: All data presented are based on counts of hospitalisations (not individuals) and some individuals may have had multiple hospitalisations.

National trends and distribution

From 2008 to 2012 there were nine deaths of 0–24 year olds with acute rheumatic fever or rheumatic heart disease as the underlying cause.

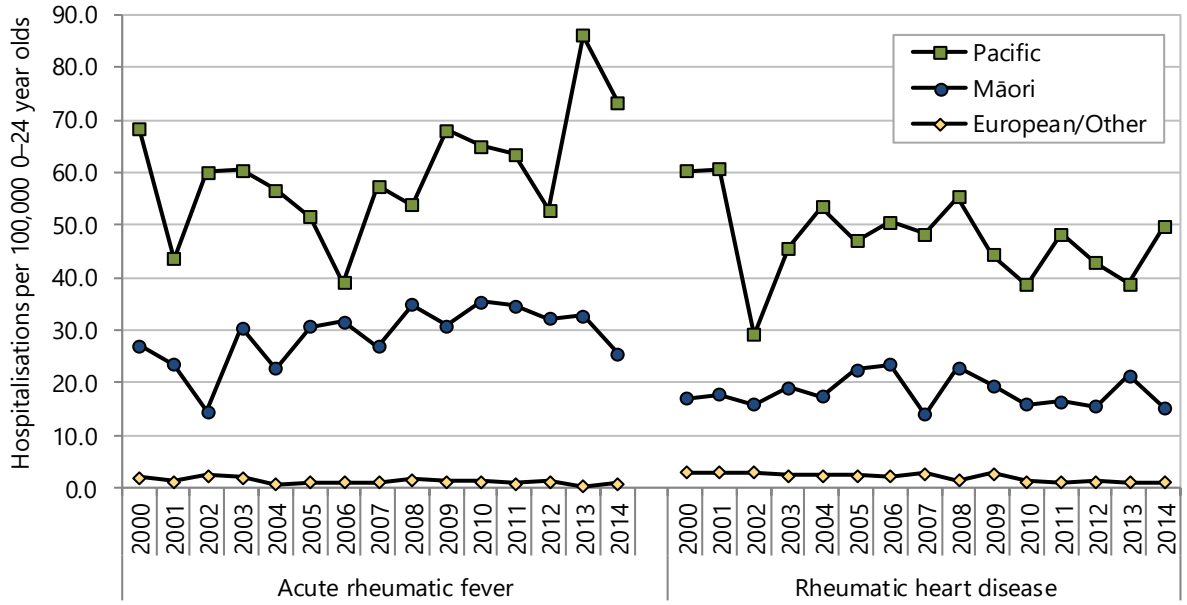
From 2000 to 2014 the hospitalisation rates for 0–24 year olds with a primary or any diagnosis of acute rheumatic fever and a primary or any diagnosis of rheumatic heart disease were stable with year-to-year fluctuations **(Figure 128).** Similar patterns over time were observed for all ethnic groups but rates were consistently highest in Pacific children and young people, and next highest in Māori **(Figure 129).**

Figure 128. Hospitalisations for acute rheumatic fever and rheumatic heart disease in 0–24 year olds, New Zealand 2000–2014



Numerator: National Minimum Dataset (acute and arranged admissions); Denominator: Statistics NZ Estimated Resident Population; 'All cases' corresponds to hospitalisations with the condition listed in any of the first 15 diagnoses

Figure 129. Hospitalisations for acute rheumatic fever and rheumatic heart disease in 0–24 year olds, by ethnicity, New Zealand 2000–2014



Numerator: National Minimum Dataset (acute and arranged admissions); Denominator: Statistics NZ Estimated Resident Population; Acute rheumatic fever is primary diagnosis; Chronic rheumatic heart disease is listed in any of the first 15 diagnoses; Asian/Indian rates suppressed due to small numbers

Distribution by demographic factors

Between 2010 and 2014 acute rheumatic fever hospitalisation rates for 0–24 year olds were low in preschool children, rose rapidly with increasing age from 5 years to peak at 10 years, then fell until 16 years, after which they did not vary much with age **(Figure 130)**. Hospitalisation rates for rheumatic heart disease followed a similar pattern but with a broader, less pronounced, peak over the age range 8–14 years **(Figure 130)**.

Pacific and Māori hospitalisation rates for acute rheumatic fever followed a similar pattern by age to the overall rate. Pacific rates were higher than Māori rates at all ages. Rates for European and Asian/Indian children and young people were so low that no clear pattern by age was apparent **(Figure 131).**

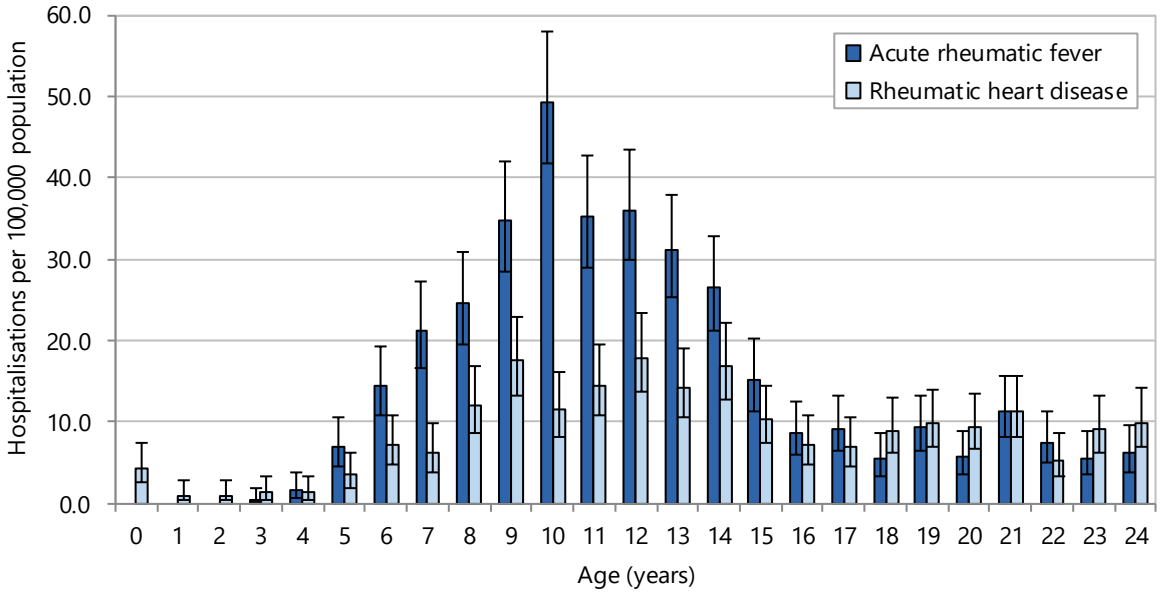
Pacific hospitalisations for rheumatic heart disease peaked over the age range 8–14 years, but no clear pattern with age could be seen in Māori (except that hospitalisations were low in under 6 year olds). Rates for European and Asian/Indian children and young people were so low that no clear pattern by age was apparent **(Figure 132)**.

Between 2010 and 2014 there were disparities in acute rheumatic fever hospitalisation rates by NZDep2013 index of deprivation score, ethnicity, gender and age. Rates were *significantly higher* in areas with the highest deprivation score (deciles 9–10) compared to all other areas. Rates were *significantly lower* in areas with the lowest deprivation scores (NZDep2013 deciles 1–2) compared with areas with higher deprivation scores (deciles 3–10). Compared with European/Other, rates were *significantly higher* for Pacific and Māori. Male rates were *significantly higher* than female rates. Compared to rates for 15–24 year olds, rates were *significantly lower* in 0–4 year olds and *significantly higher* in 5–14 year olds (**Table 97**Numerator: National Minimum Dataset (acute and arranged admissions); Denominator: Statistics NZ Estimated Resident Population; Chronic rheumatic heart disease in any of the first 15 diagnoses; Rates are per 100,000 population; Asian/Indian and European/Other rates suppressed due to small numbers
Table 97).

There were also disparities in rheumatic heart disease by NZDep2013 index of deprivation score, ethnicity, and age. Rates were *significantly higher* in areas with the highest deprivation score (deciles 9–10) compared to all other areas and in deciles 7–8 compared to deciles 1–4 and *significantly lower* in areas with the lowest deprivation scores (NZDep2013 deciles 1–2) compared with areas with higher deprivation scores (deciles 5–10). Compared with European/Other, rates were *significantly higher* for Pacific and Māori. Compared to rates for 15–24 year olds, rates were *significantly lower* in 0–4 year olds and *significantly higher* in 5–14 year olds (**Table 97**Numerator: National Minimum Dataset (acute and arranged admissions); Denominator: Statistics NZ Estimated Resident Population; Chronic rheumatic heart disease in any of the first 15 diagnoses; Rates are per 100,000 population; Asian/Indian and European/Other rates suppressed due to small numbers

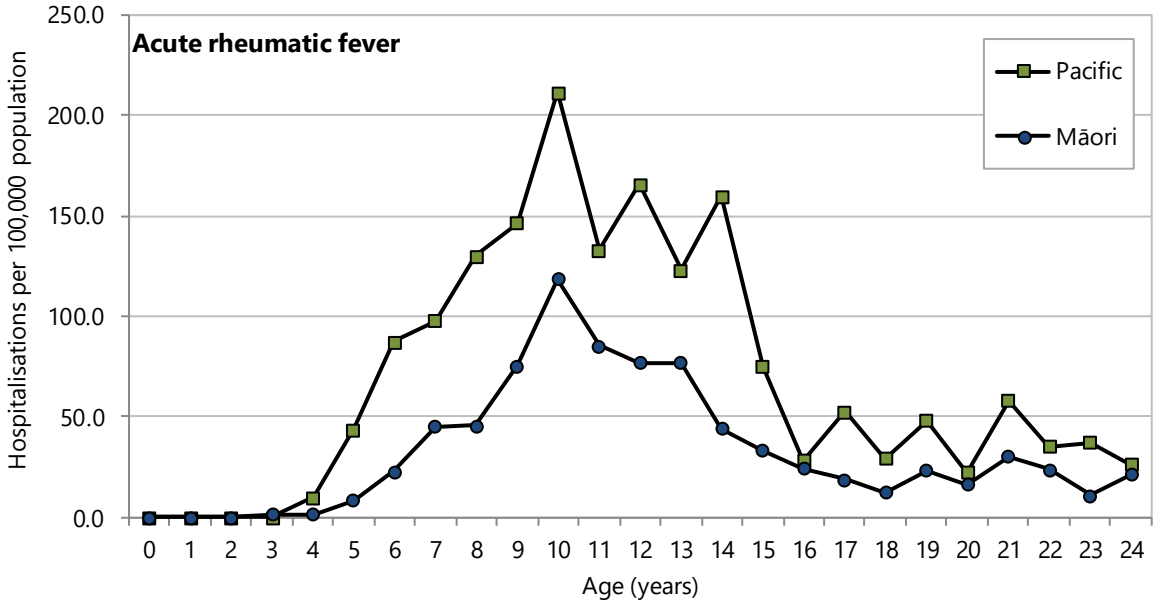
Table 97).

Figure 130. Hospitalisations for acute rheumatic fever and rheumatic heart disease in 0–24 year olds, by age, New Zealand 2010–2014



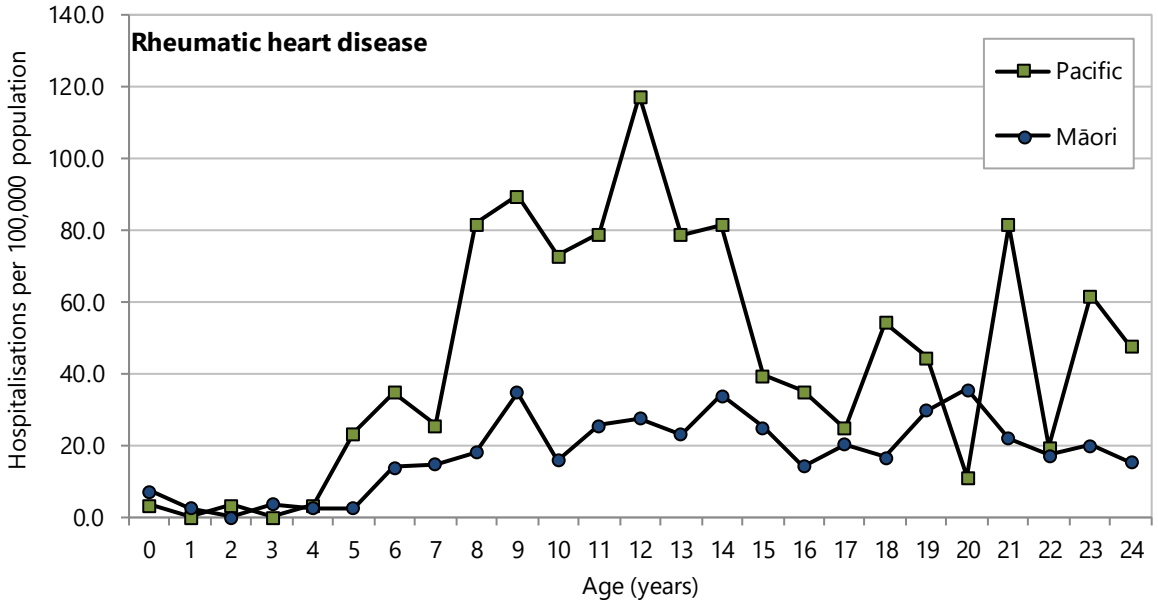
Numerator: National Minimum Dataset (acute and arranged admissions); Denominator: Statistics NZ Estimated Resident Population; Acute rheumatic fever is primary diagnosis; Chronic rheumatic heart disease is listed in any of the first 15 diagnoses; Rates are per 100,000 age-specific population

Figure 131. Hospitalisations for acute rheumatic fever in 0–24 year olds, by age and ethnicity, New Zealand 2000–2014



Numerator: National Minimum Dataset (acute and arranged admissions); Denominator: Statistics NZ Estimated Resident Population; Rates are per 100,000 population; Asian/Indian and Europen/Other rates are suppressed due to small numbers

Figure 132. Hospitalisations for rheumatic heart disease in 0–24 year olds, by age and ethnicity, New Zealand 2010–2014



Numerator: National Minimum Dataset (acute and arranged admissions); Denominator: Statistics NZ Estimated Resident Population; Chronic rheumatic heart disease in any of the first 15 diagnoses; Rates are per 100,000 population; Asian/Indian and European/Other rates suppressed due to small numbers

Table 97. Hospitalisations for acute rheumatic fever and rheumatic heart disease in 0–24 year olds, by demographic factor, New Zealand 2010–2014

Variable	Number: 2010–2014	Rate per 100,000 population	Rate ratio	95% CI
0–24 year olds				
Acute rheumatic fever				
NZDep2013 Index of deprivation quintile				
Deciles 1–2	18	1.28	1.00	
Deciles 3–4	46	3.46	2.70	1.56–4.65
Deciles 5–6	87	6.05	4.72	2.84–7.84
Deciles 7–8	207	12.78	9.96	6.15–16.12
Deciles 9–10	854	45.91	35.78	22.43–57.06
Prioritised ethnicity				
Māori	636	35.68	30.78	23.02–41.16
Pacific	521	74.35	64.15	47.86–85.98
Asian/Indian	8	0.85	0.74	0.35–1.55
MELAA	0	..	..	..
European/Other	49	1.16	1.00	
Gender				
Female	516	13.89	1.00	
Male	699	18.05	1.30	1.16–1.46
Age				
0–4 years	6	0.40	0.04	0.02–0.09
5–14 years	904	30.17	3.06	2.68–3.48
15–24 years	305	9.88	1.00	
Rheumatic heart disease				
NZDep2013 Index of deprivation quintile				
Deciles 1–2	13	0.93	1.00	
Deciles 3–4	19	1.43	1.54	0.76–3.12
Deciles 5–6	47	3.27	3.53	1.91–6.52
Deciles 7–8	118	7.28	7.86	4.43–13.93
Deciles 9–10	443	23.82	25.70	14.80–44.61
Prioritised ethnicity				
Māori	301	16.88	14.57	10.77–19.70
Pacific	306	43.67	37.68	27.87–50.94
Asian/Indian	5	0.53	0.46	0.18–1.15
MELAA	0	..	..	..
European/Other	49	1.16	1.00	
Gender				
Female	345	9.28	1.00	
Male	318	8.21	0.88	0.76–1.03
Age				
0–4 years	27	1.80	0.20	0.14–0.30
5–14 years	361	12.05	1.35	1.16–1.58
15–24 years	275	8.90	1.00	

Numerator: National Minimum Dataset (acute and arranged admissions); Denominator: Statistics NZ Estimated Resident Population; Acute rheumatic fever is primary diagnosis; Chronic rheumatic heart disease is listed in any of the first 15 diagnoses; Rate ratios are unadjusted; Ethnicity is level 1 prioritised; Decile is NZDep2013

Distribution by season

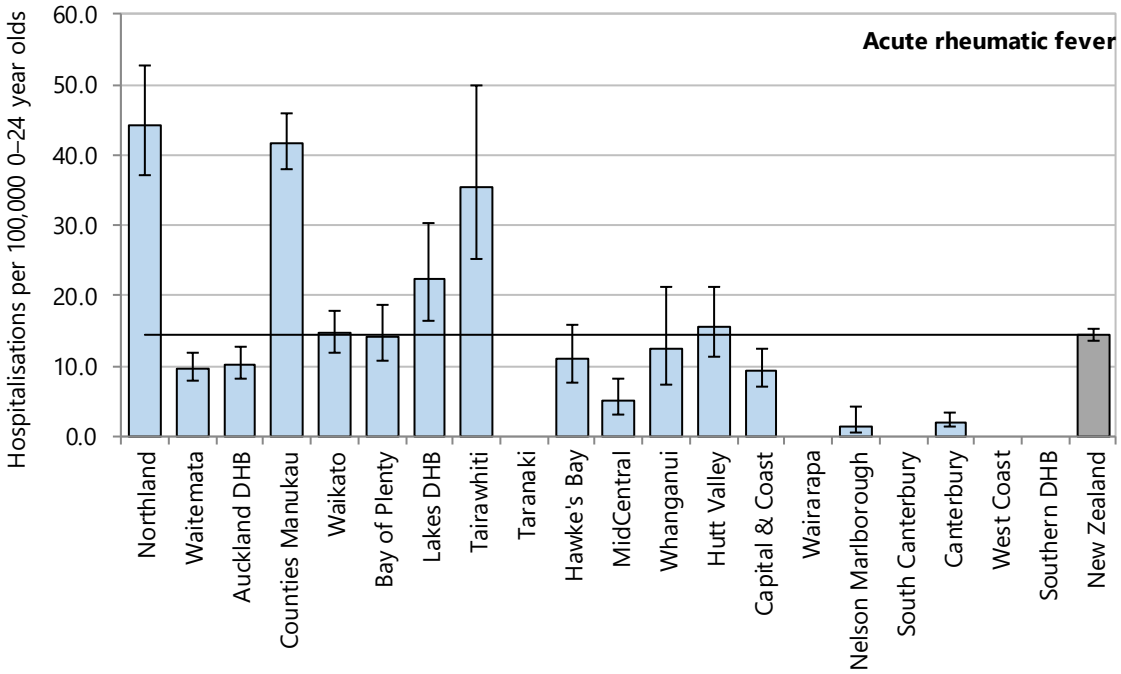
There was no clear seasonal pattern in hospitalisations for either acute rheumatic fever or rheumatic heart disease.

Distribution by region

Acute rheumatic fever

Between 2010 and 2014 hospitalisations for acute rheumatic fever were *significantly higher* than the national rate in the Northland, Counties Manukau, Lakes and Tairawhiti DHBs, and *significantly lower* in the Waitemata, Auckland, Taranaki, MidCentral, Capital & Coast, Wairarapa, Nelson Marlborough, Canterbury, South Canterbury, West Coast and Southern DHBs. While rates in a number of other DHBs also differed from the New Zealand rate, in no other cases did these differences reach statistical significance. **(Figure 133**, **Table 98)**.

Figure 133. Hospitalisations for acute rheumatic fever in 0–24 year olds, by district health board, New Zealand 2010–2014



Numerator: National Minimum Dataset (acute and arranged admissions); Denominator: Statistics NZ Estimated Resident Population

Table 98. Hospitalisations for acute rheumatic fever in 0–24 year olds, by district health board, New Zealand 2010–2014

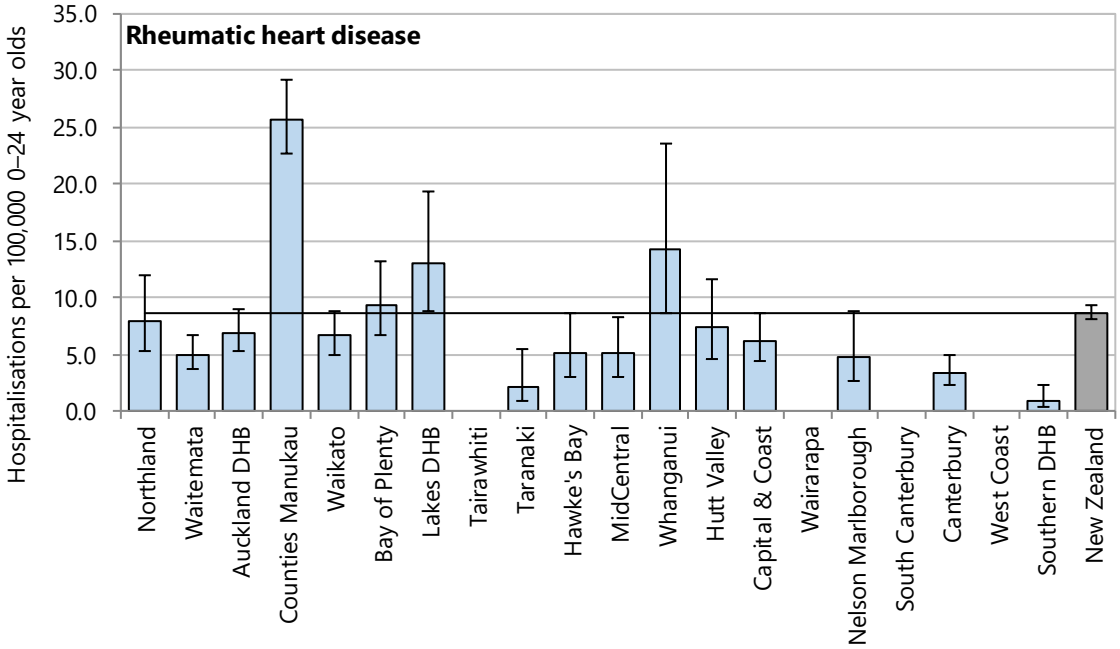
DHB	Number: 2010–2014	Number: annual average	Rate per 100,000 population	Rate ratio	95% CI
Rheumatic fever					
0–24 year olds					
Northland	123	25	44.27	3.09	2.56–3.72
Waitemata	91	18	9.63	0.67	0.54–0.83
Auckland	80	16	10.21	0.71	0.57–0.89
Counties Manukau	406	81	41.80	2.91	2.60–3.27
Waikato	99	20	14.61	1.02	0.83–1.25
Bay of Plenty	50	10	14.19	0.99	0.75–1.31
Lakes	41	8	22.26	1.55	1.14–2.12
Tairawhiti	32	6	35.46	2.47	1.74–3.51
Taranaki	<5	s	s	s	s
Hawke's Bay	30	6	11.08	0.77	0.54–1.11
MidCentral	15	3	5.04	0.35	0.21–0.58
Whanganui	13	3	12.41	0.87	0.50–1.50
Hutt Valley	38	8	15.47	1.08	0.78–1.49
Capital & Coast	47	9	9.32	0.65	0.49–0.87
Wairarapa	<5	s	s	s	s
Nelson Marlborough	<5	s	s	s	s
South Canterbury	0	..	..	..	..
Canterbury	17	3	2.05	0.14	0.09–0.23
West Coast	<5	s	s	s	s
Southern	<5	s	s	s	s
New Zealand	1,097	219	14.34	1.00	

Numerator: National Minimum Dataset (acute and arranged admissions); Denominator: Statistics NZ Estimated Resident Population; Rate ratios are unadjusted; s: suppressed due to small numbers

Rheumatic heart disease

Between 2010 and 2014 hospitalisations for rheumatic heart disease were *significantly higher* than the national rate in the Counties Manukau and Tairawhiti DHBs, while rates were *significantly lower* in the Waitemata, MidCentral, Canterbury, and Southern DHBs. While rates in a number of other DHBs also differed from the national rate, in no other DHB did these differences reach statistical significance and some DHBs had very small numbers. **(Table 99**, **Figure 134)**.

Figure 134. Hospitalisations for rheumatic heart disease in 0–24 year olds, by district health board, New Zealand 2010–2014



Numerator: National Minimum Dataset (acute and arranged admissions); Denominator: Statistics NZ Estimated Resident Population; Chronic rheumatic heart disease is listed in any of the first 15 diagnoses

Table 99. Hospitalisations for rheumatic heart disease in 0–24 year olds, by district health board, New Zealand 2010–2014

DHB	Number: 2010–2014	Number: annual average	Rate per 100,000 population	Rate ratio	95% CI
Rheumatic heart disease					
0–24 year olds					
Northland	22	4	7.92	0.91	0.60–1.40
Waitemata	47	9	4.97	0.57	0.43–0.77
Auckland	54	11	6.89	0.80	0.60–1.05
Counties Manukau	250	50	25.74	2.97	2.57–3.43
Waikato	45	9	6.64	0.77	0.57–1.04
Bay of Plenty	33	7	9.36	1.08	0.76–1.53
Lakes	24	5	13.03	1.50	1.00–2.26
Tairawhiti	24	5	26.59	3.07	2.04–4.61
Taranaki	<5	s	s	s	s
Hawke's Bay	14	3	5.17	0.60	0.35–1.01
MidCentral	15	3	5.04	0.58	0.35–0.97
Whanganui	15	3	14.32	1.65	0.99–2.76
Hutt Valley	18	4	7.33	0.85	0.53–1.35
Capital & Coast	31	6	6.14	0.71	0.49–1.02
Wairarapa	<5	s	s	s	s
Nelson Marlborough	10	2	4.77	0.55	0.29–1.03
South Canterbury	<5	s	s	s	s
Canterbury	28	6	3.38	0.39	0.27–0.57
West Coast	0	..	..	..	..
Southern	5	1	0.97	0.11	0.05–0.27
New Zealand	663	133	8.67	1.00	

Numerator: National Minimum Dataset (acute and arranged admissions); Denominator: Statistics NZ Estimated Resident Population; Rate ratios are unadjusted; Chronic rheumatic heart disease is listed in any of the first 15 diagnoses

Northern region distribution and trends

Comparison with New Zealand

Between 2010 and 2014 hospitalisation rates for acute rheumatic fever were *significantly higher* than the national rate in the Northland and Counties Manukau DHBs and *significantly lower* in the Waitemata and Auckland DHBs. While similar patterns were evident for rheumatic heart disease, only for Waitemata and Counties Manukau DHBs did these differences reach statistical *significance* **(Table 100)**.

Table 100. Hospitalisations for Rheumatic fever and heart disease in 0–24 year olds, Northern DHBs vs New Zealand 2010–2014

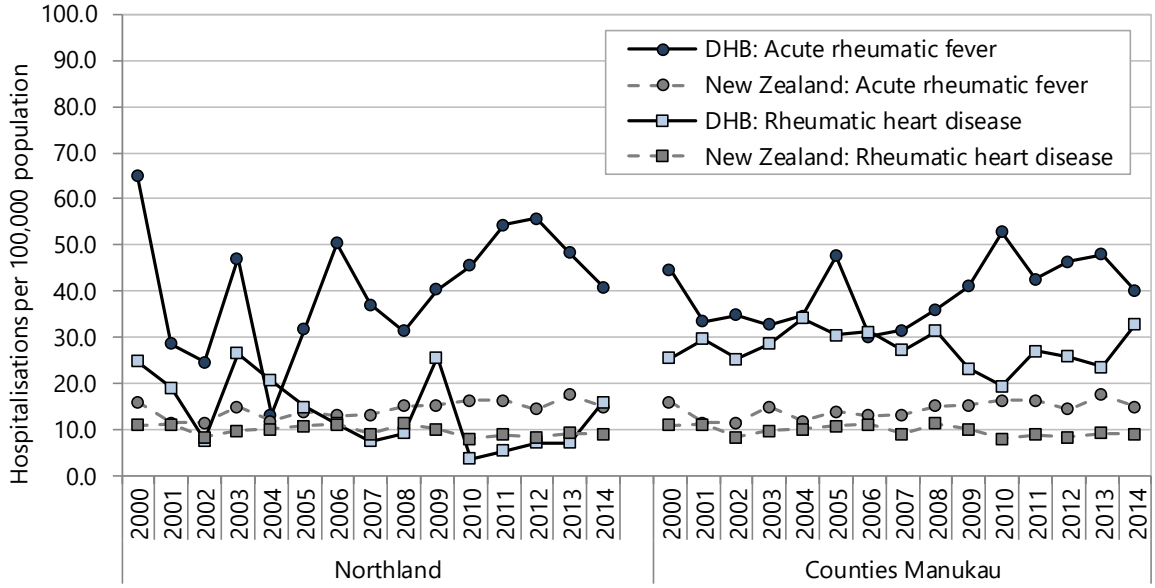
DHB	Number: 2010–2014	Number: annual average	Rate per 100,000 population	Rate ratio	95% CI
0–24 year olds					
Rheumatic fever					
Northland	123	25	44.27	3.09	2.56–3.72
Waitemata	91	18	9.63	0.67	0.54–0.83
Auckland	80	16	10.21	0.71	0.57–0.89
Counties Manukau	406	81	41.80	2.91	2.60–3.27
New Zealand	1,097	219	14.34	1.00	
Rheumatic heart disease					
Northland	22	4	7.92	0.91	0.60–1.40
Waitemata	47	9	4.97	0.57	0.43–0.77
Auckland	54	11	6.89	0.80	0.60–1.05
Counties Manukau	250	50	25.74	2.97	2.57–3.43
New Zealand	663	133	8.67	1.00	

Numerator: National Minimum Dataset (acute and arranged admissions); Denominator: Statistics NZ Estimated Resident Population; Acute rheumatic fever is primary diagnosis; Chronic rheumatic heart disease is listed in any of the first 15 diagnoses

Regional trends

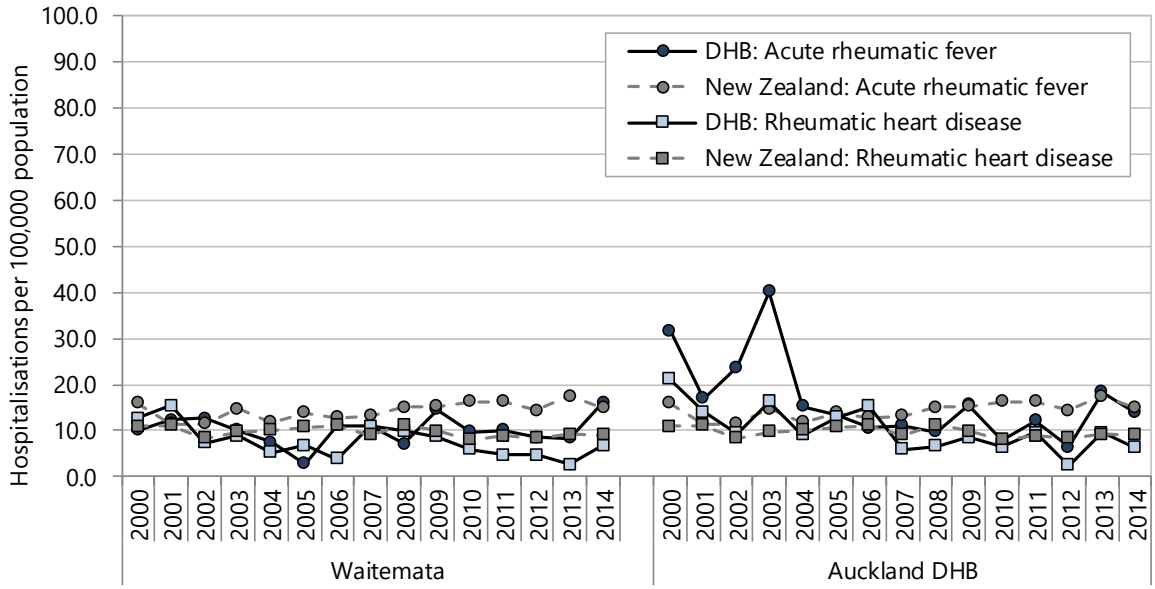
While year-to-year fluctuations in the hospitalisation rates for acute rheumatic fever and for rheumatic heart disease were observed in the Northern DHBs, hospitalisation rates for acute rheumatic fever in Northland, and rates for both acute rheumatic fever and rheumatic heart disease in Counties Manukau, tended to be well above national rates **(Figure 135, Figure 136)**.

Figure 135. Hospitalisations for acute rheumatic fever and rheumatic heart disease in 0–24 year olds, Northland and Counties Manukau DHBs vs New Zealand 2000–2014



Numerator: National Minimum Dataset (acute and arranged admissions); Denominator: Statistics NZ Estimated Resident Population; Acute rheumatic fever is primary diagnosis; Chronic rheumatic heart disease is listed in any of the first 15 diagnoses; Caution: some rates affected by small numbers

Figure 136. Hospitalisations for acute rheumatic fever and rheumatic heart disease in 0–24 year olds, Waitemata and Auckland DHBs vs New Zealand 2000–2014



Numerator: National Minimum Dataset (acute and arranged admissions); Denominator: Statistics NZ Estimated Resident Population; Acute rheumatic fever is primary diagnosis; Chronic rheumatic heart disease is listed in any of the first 15 diagnoses; Caution: some rates affected by small numbers

Evidence for good practice for the prevention and management of rheumatic fever

Ministry of Health publications
Ministry of Health. 2015. **Rheumatic fever**. http://www.health.govt.nz/our-work/diseases-and-conditions/rheumatic-fever accessed 30 October 2015. This section provides information about what is being done by the Ministry of Health through the Rheumatic Fever Prevention Programme (RFPP) and also by the health sector to address RF. It includes the latest media updates and provides links to information for health professionals. It includes links to RF resources developed in partnership with the Health Promotion Agency http://www.health.govt.nz/our-work/diseases-and-conditions/rheumatic-fever/rheumatic-fever-resources accessed 30 October 2015. From 1 July 2017, the government will invest ongoing funding of $5 million each year to continue with proven RF prevention initiatives. This webpage provides links to RF plans for each of the 11 DHBs in high incidence areas http://www.health.govt.nz/our-work/diseases-and-conditions/rheumatic-fever/district-health-board-rheumatic-fever-prevention-plans
New Zealand Guidelines Group. 2011. **Rheumatic fever: a systematic review of the literature on health literacy, overcrowding and rheumatic fever**. Wellington: Ministry of Health. http://www.health.govt.nz/publication/rheumatic-fever-systematic-review-literature-health-literacy-overcrowding-and-rheumatic-fever The NZ Guidelines Group (NZGG) undertook systematic reviews of the literature to establish if health literacy/health education and interventions to reduce overcrowding and improve housing quality were effective in reducing GAS infections and rheumatic fever. The authors included relevant systematic reviews, meta-analyses, randomised controlled trials, cohort, case-control and cross-sectional studies involving children aged 5–15 years. Four NZ case studies are also included. Studies were of varying quality and not all could be fully appraised. Key factors in effective education and literacy programmes include multimodal approaches, collaboration between health and education sectors, addressing barriers to accessing health practitioners, and culturally appropriate information in local languages ideally coming from the local community, church and educational leaders and lay health workers. Within NZ endorsement by Māori and Pacific leadership is important for ensuring acceptance of RF prevention education, and Māori and Pacific networks are key partners in resource development and dissemination. NZGG recommend establishment of processes and structures that "allow programme providers and stakeholders to consolidate and share resources, innovations and key learnings" (p.44). Decreasing overcrowding is likely to improve health in general and as a consequence to lead to a decrease in rheumatic fever incidence. NZGG note that improvements in health literacy and primordial prevention in the form of decreased overcrowding and improved housing quality will only be effective within a wider prevention programme that includes case detection and registration and effective primary and secondary prophylaxis.
New Zealand Guidelines Group. 2011. **Management of Group A Streptococcal Sore Throat**. Wellington: New Zealand Guidelines Group. http://www.health.govt.nz/system/files/documents/publications/12041320sore20throat20final20to20the20ministry.pdf The purpose of this evidence review is to provide an evidence-based summary of current New Zealand and overseas evidence to inform best practice in the management of people with GAS throat infection (pharyngitis) especially with the aim of preventing more acute RF. There are several key messages from the report: Antibiotics should be initiated as soon as possible as there is no evidence to support current practice of delaying treatment by up to nine days and there is no evidence to support any other recommendation about the timing of treatment. Children at high risk of developing rheumatic fever should continue to receive empiric (immediate) antibiotic treatment and the presence of GAS should continue to be confirmed by laboratory culture. Where an intervention is planned in a school population, all consented children should be swabbed before and after the intervention, regardless of symptoms, to allow evaluation of programme effectiveness. There is reliable evidence about the efficacy of rapid antigen diagnostic tests, which give a result much faster than swabbing and testing, however there are also concerns about the heterogeneity between studies .and the potential false positives if this is used as a front-line test. Once daily amoxicillin is the first choice for antibiotic treatment for a GAS throat infection. Amoxicillin is likely to achieve better compliance than Penicillin V because of once daily dosing and ability to be taken with food compared with more frequent dosing and the requirement to take it on an empty stomach.
Ministry of Health. 2015. **Using practitioner supply orders and standing orders in the rheumatic fever prevention programme: Guidance for sore throat management services**. Wellington: Ministry of Health. http://www.health.govt.nz/system/files/documents/publications/using-practitioner-supply-orders-and-standing-orders-rheumatic-fever-prevention-programme-feb15-v5.pdf A practitioner supply order is a written order for the supply of community pharmaceuticals. This document provides guidance for the dispensing and supply of antibiotics in RFPP sore throat management services including school-based programmes, rapid response clinics and other clinics that are part of the RFPP and will help health practitioners to meet the requirements of the Medicines Act 1981 and Medicines Regulations 1984. In the context of the RFPP a practitioner supply order enables a practitioner to order quantities of certain antibiotics in excess of the usual limits set by the PHARMAC Pharmaceutical Schedule, to ensure medical supplies are available for patients with suspected or confirmed GAS throat infections. The document includes advice for medical practitioners, pharmacists, and people working under a standing order. Appendices detail the recommended antibiotics with dosages, and provide a template for RFPP standing orders.
Litmus Ltd. 2013. **Implementation and Formative Evaluation of the Rheumatic Fever Prevention Programme: Final Report**. Wellington: Litmus LTD. http://www.health.govt.nz/publication/implementation-and-formative-evaluation-rheumatic-fever-prevention-programme

This report was prepared for the Ministry of Health and evaluates the first 18 months of the rheumatic fever prevention programme (RFPP) from 1 July 2011 to 31 December 2012. The evaluation used a mixed-methods approach including: literature and documentation review; interviews and focus groups with RFPP providers interviews and parents/caregivers as well as a survey of parents/caregivers; review of monitoring data; and case studies of four RFPP sites. The report found that there had been a positive response to the RFPP roll-out, with enthusiastic local providers rising to the challenge of implementing school throat swabbing services and community awareness raising in short timeframes. The report also identified a number of aspects to be considered to maximise the effectiveness, consistency and sustainability of activities across the RFPP sites, including better linkage to existing DHB and local child health strategies and better integration with primary care and with other health and social service providers. Key informants often cautioned that the mix of RFPP activities would not adequately address the primordial causes of RF (poverty, crowded housing, lack of access to culturally competent primary care) and there were also questions raised about cost-effectiveness of the RFPP.

Ministry of Social Development documents

Ministry of Social Development. 2011. **Delivering better public services: Supporting vulnerable children result action plan.** Wellington: Ministry of Social Development http://www.msd.govt.nz/documents/about-msd-and-our-work/work-programmes/better-public-services/supporting-vulerable-children/supporting-vulnerable-children-result-action-plan.pdf

This results action plan provides the context for the Government target to reduce the incidence of rheumatic fever to 1.4 cases per 100,000 people by June 2017. This target is part of supporting vulnerable children, which is a component of the Government priority to deliver better public services within tight financial constraints. The key actions are to provide throat swabbing and treatment to children at high risk; raise community and health sector awareness of the disease; improve knowledge of rheumatic fever through surveillance and research; and work across Government agencies to address risk factors like housing conditions and hygiene in schools. The result action plan outlines the expected pattern of disease if the five-year goal is met, as well as ways the results will be measured and reported.

New Zealand guidelines

Heart Foundation of New Zealand. 2014. **Group A Streptococcal Sore Throat Management Guideline. 2014 Update**. Auckland: Heart Foundation of New Zealand.
http://www.heartfoundation.org.nz/uploads/sore_throat_guideline_14_10_06_FINAL-revised.pdf

This guideline aims to maximise diagnosis and management of pharyngitis in those who are at greatest risk of developing rheumatic fever, while minimising investigations and antibiotic use in those who are at the lowest risk, with the overall goal of RF prevention. Both the sore throat management and household sore throat management algorithm have been updated. The population at high risk for RF is defined as those individuals who have a personal, family or household history of RF, or who have two or more of the following criteria; Māori or Pacific ethnicity, age 3-35 years, living in crowded circumstances or in lower socioeconomic areas of the North Island. Correct treatment of GAS pharyngitis will substantially reduce the occurrence of ARF in populations at high risk. Throat swabbing remains the gold standard for diagnosing GAS pharyngitis and rapid antigen diagnostic tests are not currently recommended. Confirmed or suspected GAS pharyngitis in high risk populations should be treated as soon as possible; it is not safe to wait up to nine days as previously recommended. Courses of oral antibiotics for GAS pharyngitis should be of 10 days duration as there is no evidence that shorter courses prevent the subsequent development of RF. Throat swabbing is also recommended for symptomatic contacts of a patient with GAS pharyngitis, particularly if they are school-aged. Some symptomatic GAS positive patients may require isolation for 24 hours after starting antibiotics if there is a high risk of spread of infection. There are specific recommendations for outbreaks of GAS pharyngitis within a household or in another group setting. Given the lack of clarity in the literature on certain aspects of (GAS) pharyngitis the report recommends research on 14 specific research questions. An algorithms for sore throat management is available as a standalone document from http://www.heartfoundation.org.nz/programmes-resources/health-professionals/guidelines-and-position-statements

Heart Foundation of New Zealand. 2015. **New Zealand Guidelines for Rheumatic Fever: Diagnosis, Management and Secondary Prevention of Acute Rheumatic Fever and Rheumatic Heart Disease: 2014 Update.** Auckland: Heart Foundation of New Zealand. http://www.heartfoundation.org.nz/uploads/HF2227A_Rheumatic_Fever_Guideline_v3.pdf

This guideline has been developed by the Heart Foundation of New Zealand and the Cardiac Society of Australia and New Zealand to identify and present the evidence for best practice in acute rheumatic fever (ARF) diagnosis, identify the standard of care that should be available to all people in New Zealand and areas where current management strategies may not be in line with available evidence, and ensure that high-risk populations receive the same standard of care as that available to other New Zealanders. It is recommended that the NZ criteria are used for the diagnosis of RF (a table on page 15 shows how these differ from the revised Jones criteria 1992 and Australian high risk criteria). The guideline details initial and ongoing management of acute RF, secondary prevention including prophylaxis in general and in specific circumstances such as in pregnancy, on oral contraceptives and in patients on anticoagulant medication. The comprehensive section on rheumatic heart disease considers oral health care, pregnancy and childbirth, anticoagulation, prevention of infective endocarditis and indications for cardiac surgery. There is no formal screening programme for RHD in NZ, however the WHF guidelines (see below) can be used to diagnose RHD by echocardiogram following clinical scenarios such as investigation of a heart murmur, history suggestive of past acute RF, or chance finding on echocardiography for other indications. Algorithms for use of echocardiography in acute RF and duration of secondary prophylaxis are available as standalone documents from http://www.heartfoundation.org.nz/programmes-resources/health-professionals/guidelines-and-position-statements

International guidelines

Remenyi B, et al. 2012. **World Heart Federation criteria for echocardiographic diagnosis of rheumatic heart disease--an evidence-based guideline**. Nature Reviews Cardiology, 9, 297-309.

Since 2004 the WHO has recommended echocardiographic screening for RHD in high-risk populations; a global consequence has been the observation that prevalence of RHD is much higher than previously thought. An international advisory group of 21 experts in rheumatic

heart disease from six continents worked together to define the minimum echocardiographic criteria for a diagnosis of RHD in individuals without a clear history of acute RF. The guidelines are important to overcome systematic differences in the approaches to diagnosis and reporting of RHD that had developed over time, based on the differing experiences and disease patterns between localities. The guidelines address the full spectrum of RHD from normal, to borderline to definite RHD with subcategories of the latter two groups, and were developed on the basis of the best available evidence. A formal consensus process was used to reach agreement where evidence was insufficient in itself. Criteria are provided for individuals aged 20 years or younger, and for those aged over 20 years. Criteria are based on the type of portable echocardiographic machines that are available in relatively resource-poor and remote settings (2D, continuous-wave, and colour-Doppler echocardiography). The current value of applying the guidelines is to establish the epidemiology of RHD; further research is needed to determine whether a screening programme can reduce the burden of RHD. In particular there is uncertainty about the natural history of subclinical disease detected by echocardiography where there is no clinical heart murmur.

Evidence-based medicine reviews

Webb RH, et al. 2015. **Acute rheumatic fever**. BMJ, 351, h3443.

The authors searched Medline and the Cochrane Database of Systematic Reviews to collate and summarise what is currently known about RF. The journal article summarises the diagnostic criteria, management of the various symptoms of acute RF, long term complications, antibiotic prophylaxis and public health implications. References are provided to educational resources for patients, families and health professionals. Questions for future research include improving knowledge about the pathogenesis of RF, better estimation of the global burden of the disease, assessing the possible role of screening high-risk populations for RHD, cost-effectiveness of throat swabbing programmes, and questions about potential efficacy of a GAS vaccine to prevent acute RF and RHD or for immune modulatory therapies to improve cardiac outcomes and prevent the need for surgery.

Cilliers A, et al. 2015. **Anti-inflammatory treatment for carditis in acute rheumatic fever**. Cochrane Database of Systematic Reviews doi:10.1002/14651858.CD003176.pub3 http://onlinelibrary.wiley.com/doi/10.1002/14651858.CD003176.pub3/pdf

Although it is clear that antibiotic treatment can prevent the development of RF and antibiotic prophylaxis can prevent recurrence, the role of anti-inflammatory treatment for established active carditis is less certain. Carditis is the most serious major manifestation of RF which may culminate in chronic valvular disease and can lead to heart failure and, ultimately, death. This systematic review included eight randomised controlled trials involving 996 people; six of the trials included children. Researchers compared several steroidal agents versus aspirin, placebo or no treatment. There was little evidence of any benefit when corticosteroids or intravenous immunoglobulins were used to reduce the risk of heart valve lesions in patients with acute RF. Most of the trials were completed over 40 years ago and there was substantial risk of bias, so results should be viewed with caution. New randomised controlled trials are needed in patients with acute RF to assess the effects of corticosteroids such as oral prednisone and intravenous methylprednisolone and the effects of other new anti-inflammatory a gents, using contemporary echocardiography techniques to provide more objective and precise assessments of cardiac outcomes.

Spinks A, et al. 2013. **Antibiotics for sore throat**. Cochrane Database of Systematic Reviews doi:10.1002/14651858.CD000023.pub4 http://onlinelibrary.wiley.com/doi/10.1002/14651858.CD000023.pub4/pdf

A systematic review of 27 randomised placebo-controlled trials with a total of 12,835 cases of sore throat found that antibiotics shortened the duration of pain symptoms by about one day and reduced the chance of developing RF by more than two-thirds in communities where that complication was common. Very few of these studies included children. The studies were of moderate to high quality; however most were conducted more than 30 years ago when patterns of disease and of antibiotic resistance were different from the present time. Based on the results of this review the use of antibiotics to treat sore throats may be justified to reduce the incidence of RF in high-prevalence settings, but in other settings there is a balance to be made between modest symptom reduction and the hazards of antimicrobial resistance. More trials are needed that involve children, and in high-income countries we need better prognostic studies to further define which patients are most likely to develop complications of sore throat and therefore benefit from antibiotic treatment.

Esposito S, et al. 2015. **Geoepidemiological hints about Streptococcus pyogenes strains in relationship with acute rheumatic fever.** Autoimmunity Reviews, 14(7), 616-21.

Group A Streptococcus causes a wide array of syndromes, including acute RF and GAS isolates can be serotyped using serotype specific antisera against the M protein. Although the epidemiological relationship between peculiar GAS strains and acute RF epidemics is complex, types M5 and M18 are particularly associated with acute RF. Newer genotyping methods (*emm*-typing) allows scientists to distinguish between GAS strains that were identical based on M-typing. Over 200 *emm* genotypes have been documented so far, and many studies have shown variability of *emm* genotypes in different countries of the world. The association with RF for each strain is variable depending on the design of studies, year of observation, seasonal variations, country involved, patients' age and gender. This area of laboratory research is important because surveillance of disease-causing *emm* genotypes in communities with high rates of acute rheumatic fever could contribute to design of a potential vaccine against GAS infections.

Other relevant publications

Saxena A. 2014. **Increasing detection of rheumatic heart disease with echocardiography**. Expert Review of Medical Devices, 11(5), 491-97.

This article reviewed data on echocardiographic screening from several countries including India and summarised the current understanding of unresolved issues relevant to the significance and management of subclinical RHD detected by echocardiography in asymptomatic patients. The author notes that RHD is estimated to affect over 20 million people worldwide with the vast majority of these people living in developing countries. Screening for RHD has been recommended by the WHO since 2004. Conventionally, auscultation of the chest with a stethoscope has been used for diagnosing RHD, but this method has limitations and may not detect mild cases. A large number of studies

have reported echocardiographic screening for RHD over the last several years. Most of these studies report an almost 10-fold higher prevalence of RHD by echocardiography as compared to conventional method of auscultation. Early diagnosis of such mild cases may be important as instituting secondary prophylaxis in such cases may reduce the burden of the disease. However, several concerns remain about the significance and natural history of these minor valvular changes detected by echocardiography. Whether secondary prophylaxis will reverse these abnormalities is also unclear. Long term follow up studies are required to answer some of these concerns.

Websites

Ministry of Health. 2015. **Rheumatic fever**. http://www.health.govt.nz/your-health/conditions-and-treatments/diseases-and-illnesses/rheumatic-fever accessed 29 October 2015.

Information for families and communities about the symptoms of RF, ways to prevent it, and important actions for children who have had RF (e.g. monthly penicillin injections, and precautions before dental procedures. Includes links to videos and transcripts of interviews of children with RF and their parents as well as to the Ministry of Health RF website http://rheumaticfever.health.govt.nz/ All of the RF videos are available at http://www.health.govt.nz/our-work/diseases-and-conditions/rheumatic-fever/rheumatic-fever-resources/rheumatic-fever-campaign-online-videos

Ministry of Health. 2015. **Sore throat clinics**. https://www.health.govt.nz/your-health/conditions-and-treatments/diseases-and-illnesses/sore-throat/sore-throat-clinics accessed 29 October 2015.

This patient information page provides details of the free clinics where Māori or Pacific children aged 4–19 years in the Northland, Auckland, Lakes, Waikato, Bay of Plenty, Gisborne/East Coast, Hawke's Bay, Porirua or Hutt Valley areas can have a sore throat checked at no charge.

Kidshealth. 2015. **Rheumatic fever**. http://www.kidshealth.org.nz/rheumatic-fever accessed 30 October 2015

This webpage provides information for parents and caregivers of children with RF and rheumatic heart disease. It describes conditions, explains that a child will usually need to stay in hospital for one to two weeks, or longer if their heart is affected, and provides advice about caring for the child when they return home, ensuring monthly penicillin injections continue until advised to stop by a doctor (usually at age 21 or 30), and key points to prevent further episodes of RF.

National Heart Foundation. **Rheumatic fever**. http://www.heartfoundation.org.nz/know-the-facts/conditions/rheumatic-fever accessed 30 October 2015

This is a further webpage with information for the public about RF and rheumatic heart disease. It includes a link to a booklet about RF, published in 2012 and currently under revision, which is available in English, Tongan and Samoan.

SERIOUS SKIN INFECTIONS

Introduction

Serious skin infections are bacterial infections of the skin or subcutaneous tissue which require hospitalisation and often require invasive treatment like surgery. Such infections may be associated with a primary disease of the skin (e.g. eczema) and may follow trauma to the skin (e.g. insect bites).[88]

New Zealand has one of the highest rates of childhood skin infections in the western world.[89] Between 1990 and 2007 skin infection hospitalisation rates almost doubled with disproportionate increases in infection rates in Māori and Pacific children and children from areas with high socioeconomic deprivation scores.[90] An initial study suggests that there may be 14 cases treated in the community (primary care/GP) for every serious skin infection hospitalisation[91] A number of socioeconomic factors are linked to the increasing frequency of skin infections including affordability of hot water, washing machines and dryers, access to medical care, household crowding, and inadequate nutrition.[92] Other reasons for the development of skin infection include lack of awareness or knowledge about skin infections, and community attitudes which normalise such infection or stigmatise it so that people keep the condition hidden.[89]

The following section reports on hospitalisations for serious skin infections in children and young people using information from the National Minimum Dataset. It concludes with a brief overview of evidence-based reviews and guidelines which consider the most effective interventions for preventing or managing serious skin infections.

Data sources and methods

Indicator

Hospitalisations involving serious skin infections in 0–24 year olds

Data sources

Numerator: National Minimum Dataset

Denominator: Statistics NZ Estimated Resident Population (with linear extrapolation being used to calculate denominators between Census years).

Definition

Hospitalisations:

Hospitalisations of 0–24 year olds with a diagnosis of a serious skin infection in any of the first 15 diagnoses (hospitalisations per 1,000 age-specific population)

The following select conditions were identified as the primary diagnosis among the hospitalisations involving serious skin infections: impetigo, cutaneous abscess, furuncle, or carbuncle, cellulitis, acute lymphadenitis, pilonidal cyst with abscess, other infections of skin and subcutaneous tissue, infections of other anatomical sites, infected, unspecified, or other dermatitis, insect or spider bites, post traumatic or open wound infection, scabies, and varicella with other complications.

Notes on interpretation

Note 1: This section utilises hospitalisations with relevant codes (see **Appendix 6**) in ANY of the first 15 diagnoses, rather than the primary diagnosis.

Note 2: This section utilises a broader set of the diagnostic codes compared to those utilised in the sections covering ambulatory sensitive hospitalisations (ASH) or hospitalisations with a social gradient. Select codes external to the skin infection codes have been incorporated, such as insect and spider bites, infected and unspecified eczema, infected open wounds, and infections at specific anatomical sites (e.g. the genitalia), based on review by O'Sullivan and Baker of skin infections in children.[90]

Note 3: The rates presented here differ from those presented in the ambulatory sensitive hospitalisations (ASH) or hospitalisations with a social gradient sections. As these indicators utilise primary diagnoses and full assessment and sector consultation has not yet occurred regarding these sections adopting of the revised coding convention, as utilised in this section.

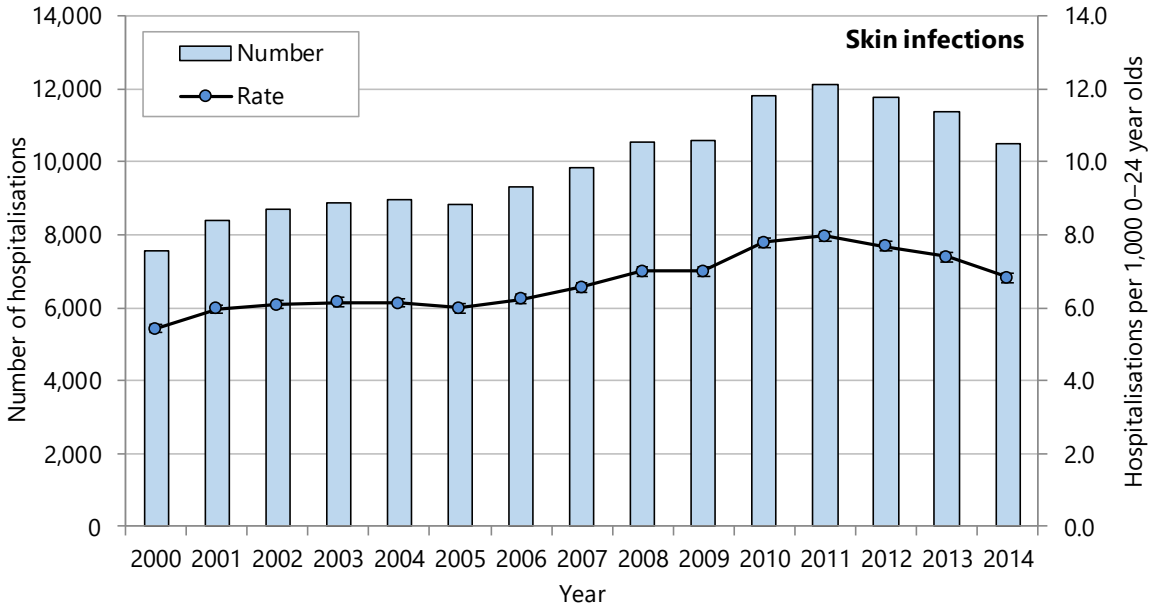
Note 4: **Appendix 3** outlines the limitations of the data utilised from the National Minimum Dataset. The reader is advised to review this appendix before interpreting any trends.

National trends and distribution

The hospitalisation rate for skin infections in 0–24 year olds was stable from 2000 to 2005, rose from 2005 to 2011 and has since been steadily falling **(Figure 137)**. A similar pattern was seen in 0–14 year olds and 15–24 year olds although in every year the rate was higher in the younger age group **(Figure 138)**.

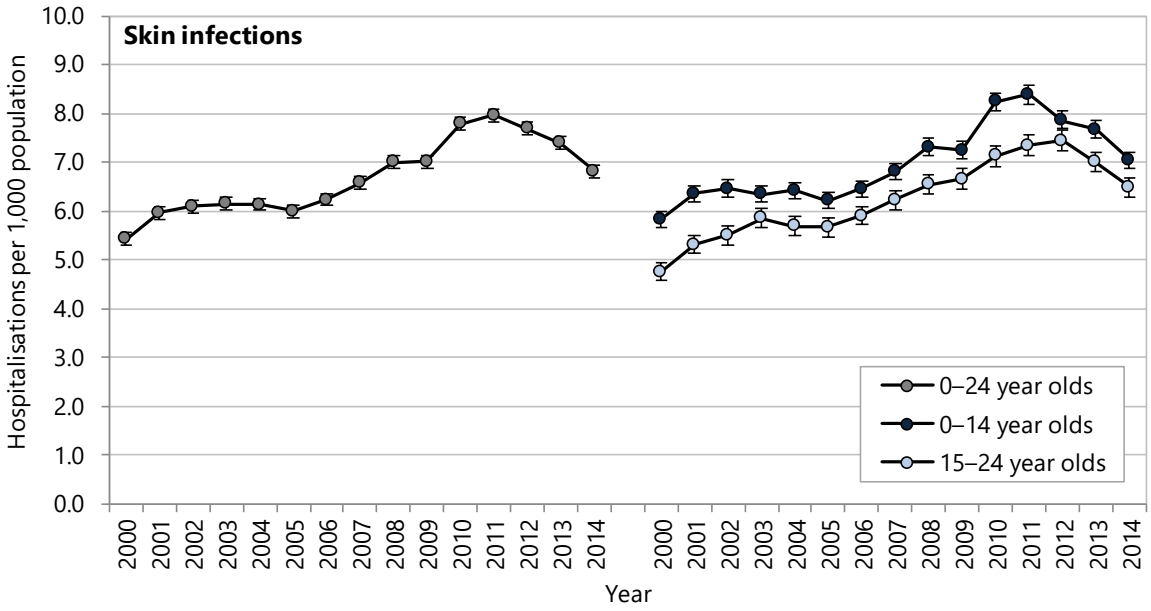
During the same period, rates were consistently highest in Pacific 0–24 year olds, followed by Māori then European then Asian/Indian. Pacific rates peaked in 2011 and Māori rates in 2010. Asian/Indian rates, although low, rose from 2000 to 2014, while European rates rose from 2000 to 2011 and then fell. Rates for MELAA were variable and slightly higher than European rates in 2009–2014 **(Figure 139)**.

Figure 137. Hospitalisations involving skin infections in 0–24 year olds, New Zealand 2000–2014



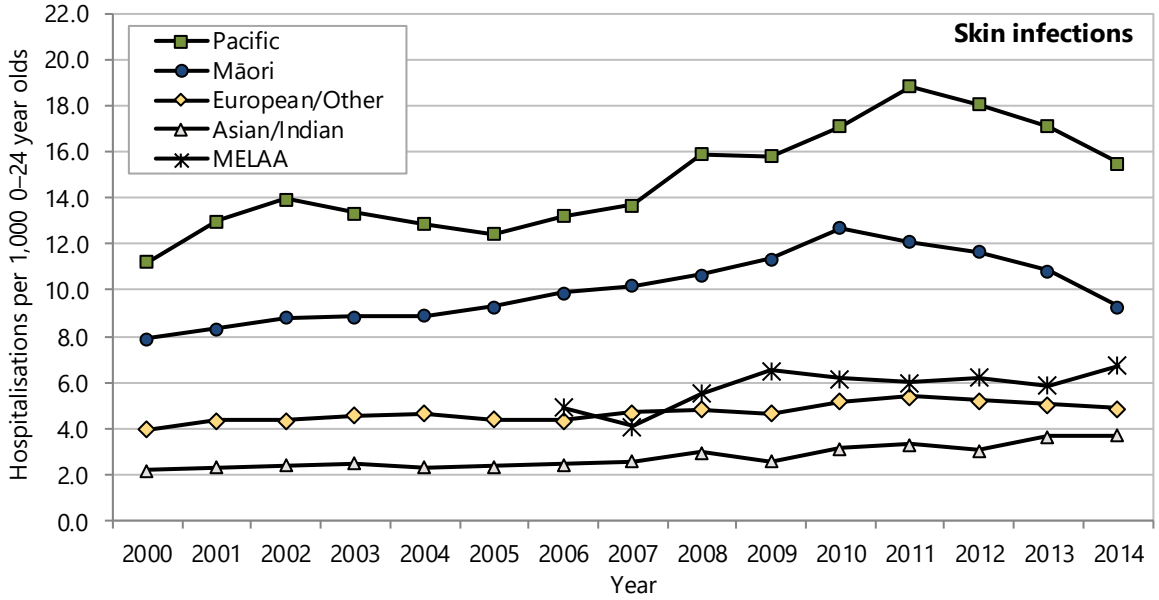
Numerator: National Minimum Dataset; Denominator: Statistics NZ Estimated Resident Population; skin infections in any of the first 15 diagnoses

Figure 138. Hospitalisations involving skin infections in 0–24 year olds, by age group, New Zealand 2000–2014



Numerator: National Minimum Dataset; Denominator: Statistics NZ Estimated Resident Population; Rate is per 1,000 age-specific population; skin infections in any of the first 15 diagnoses

Figure 139. Hospitalisations involving skin infections in 0–24 year olds, by ethnicity, New Zealand 2000–2014



Numerator: National Minimum Dataset; Denominator: Statistics NZ Estimated Resident Population; Rate is per 1,000 age-specific population; skin infections in any of the first 15 diagnoses

Distribution by cause

Between 2010 and 2014 cellulitis and cutaneous abscesses/furuncles/ carbuncles were the most frequent primary diagnoses in 0–14 year olds and 15–24 year olds hospitalised with serious skin infections **(Table 101)**. Pilonidal cyst with abscess was also a relatively common diagnosis in 15–24 year olds.

Table 101. Hospitalisations for skin infections in 0–24 year olds, by age group and primary diagnosis, New Zealand 2010–2014

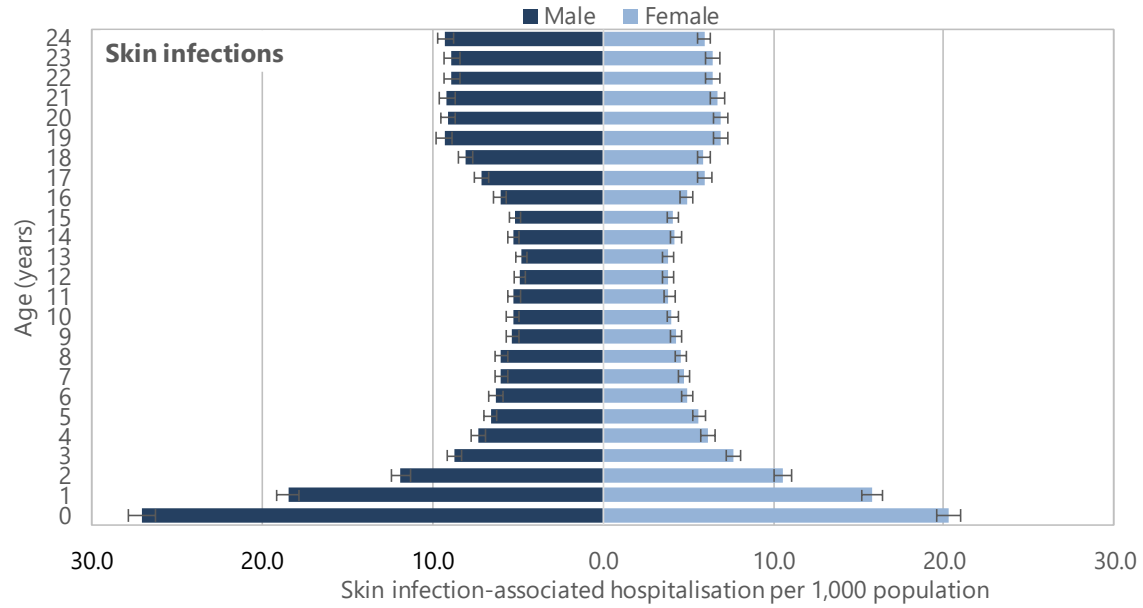
Primary skin infection diagnosis	Number: 2010–2014	Number: annual average	Rate	95% CI	Per cent
New Zealand					
0–14 year olds					
Cellulitis	6,674	1,335	1.47	1.44–1.51	18.8
Cutaneous abscess, furuncle, or carbuncle	6,392	1,278	1.41	1.38–1.45	18.0
Infected, unspecified, or other dermatitis	2,823	565	0.62	0.60–0.65	8.0
Infections of other anatomical sites	1,977	395	0.44	0.42–0.46	5.6
Acute lymphadenitis	1,151	230	0.25	0.24–0.27	3.2
Impetigo	825	165	0.18	0.17–0.20	2.3
Other infections of skin and subcutaneous tissue	623	125	0.14	0.13–0.15	1.8
Insect or spider bites	566	113	0.12	0.12–0.14	1.6
Scabies	518	104	0.11	0.10–0.12	1.5
Varicella with other complications	465	93	0.10	0.09–0.11	1.3
Post traumatic or open wound infection	144	29	0.03	0.03–0.04	0.4
Pilonidal cyst with abscess	113	23	0.02	0.02–0.03	0.3
Other diagnoses	13,209	2,642	2.92	2.87–2.97	37.2
Total	35,480	7,096	7.83	7.75–7.92	100.0
15–24 year olds					
Cutaneous abscess, furuncle, or carbuncle	4,703	941	1.51	1.46–1.55	21.3
Cellulitis	3,507	701	1.12	1.09–1.16	15.9
Pilonidal cyst with abscess	2,750	550	0.88	0.85–0.91	12.5
Infections of other anatomical sites	1,803	361	0.58	0.55–0.61	8.2
Infected, unspecified, or other dermatitis	399	80	0.13	0.12–0.14	1.8
Insect or spider bites	321	64	0.10	0.09–0.11	1.5
Other infections of skin and subcutaneous tissue	168	34	0.05	0.05–0.06	0.8
Post traumatic or open wound infection	121	24	0.04	0.03–0.05	0.5
Acute lymphadenitis	119	24	0.04	0.03–0.05	0.5
Impetigo	117	23	0.04	0.03–0.04	0.5
Scabies	71	14	0.02	0.02–0.03	0.3
Varicella with other complications	8	2	<0.01	s	<0.1
Other diagnoses	7,993	1,599	2.56	2.51–2.62	36.2
Total	22,080	4,416	7.07	6.98–7.17	100.0

Numerator: National Minimum Dataset; Denominator: Statistics NZ Estimated Resident Population; skin infections in any of the first 15 diagnoses

Distribution by demographic factors

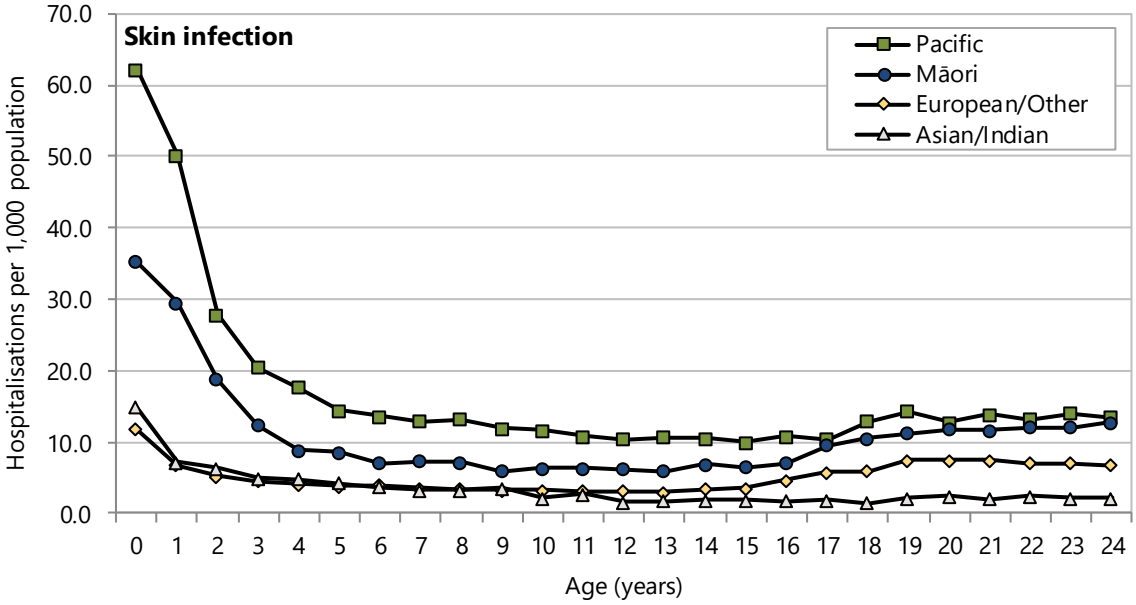
Between 2010 and 2014 skin infection hospitalisation rates for 0–24 year olds were highest for one year olds and decreased sharply with increasing age from one to four years. From age 15 years, rates rose somewhat with increasing age before levelling off from 19 years. At every age, male rates were a little higher than female rates **(Figure 140)**. Similar patterns according to age were observed for all ethnic groups. Hospitalisation rates were consistently highest in Pacific, followed by Māori then European/Other and then Asian/Indian **(Figure 141)**.

Figure 140. Hospitalisations involving skin infections in 0–24 year olds, by age and gender, New Zealand 2010–2014



Numerator: National Minimum Dataset; Denominator: Statistics NZ Estimated Resident Population; Rates are per 1,000 age-specific population; skin infections in any of the first 15 diagnoses

Figure 141. Hospitalisations involving skin infections in 0–24 year olds, by age and ethnicity, New Zealand 2010–2014



Numerator: National Minimum Dataset; Denominator: Statistics NZ Estimated Resident Population; Rates are per 1,000 age-specific population; skin infections in any of the first 15 diagnoses

Between 2010 and 2014 in 0–14 year olds there were disparities in skin infection hospitalisation rates by NZDep2013 index of deprivation score, ethnicity and gender. At each level of deprivation (other than deciles 1–2), rates were *significantly higher* than those of the level below. There were *significant* differences in rates between all ethnic groups. Rates were highest in Pacific, followed by (in decreasing order) Māori, MELAA, Asian/Indian and European. Male rates were *significantly higher* than female rates **(Table 102)**.

In 15–24 year olds there were also disparities in skin infection hospitalisation rates by NZDep2013 index of deprivation score, ethnicity and gender. At each level of deprivation (other than deciles 1–2), rates were *significantly higher* than those of the level below. There were *significant* differences in rates between most ethnic groups. Only the difference between MELAA and European was *non-significant*. Rates were highest in

Pacific, followed by (in decreasing order) Māori, European and MELAA. Male rates were *significantly higher* than female rates **(Table 102)**.

Table 102. Hospitalisations involving skin infections in 0–24 year olds, by age group and demographic factor, New Zealand 2010–2014

Variable	Number: 2010–2014	Rate per 1,000 population	Rate ratio	95% CI
Skin infections				
0–14 year olds				
NZDep2013 Index of deprivation quintile				
Deciles 1–2	3,078	3.53	1.00	
Deciles 3–4	3,549	4.40	1.24	1.19–1.31
Deciles 5–6	4,868	5.69	1.61	1.54–1.69
Deciles 7–8	7,245	7.71	2.18	2.09–2.28
Deciles 9–10	16,578	15.71	4.45	4.28–4.62
Prioritised ethnicity				
Māori	13,629	11.83	2.74	2.67–2.81
Pacific	8,806	20.24	4.68	4.55–4.81
Asian/Indian	2,235	4.69	1.09	1.04–1.14
MELAA	336	6.04	1.40	1.25–1.56
European/Other	10,418	4.32	1.00	
Gender				
Female	15,385	6.97	1.00	
Male	20,095	8.65	1.24	1.22–1.27
15–24 year olds				
NZDep2013 Index of deprivation quintile				
Deciles 1–2	2,288	4.31	1.00	
Deciles 3–4	2,709	5.19	1.20	1.14–1.27
Deciles 5–6	3,539	6.08	1.41	1.34–1.49
Deciles 7–8	5,027	7.39	1.72	1.63–1.80
Deciles 9–10	8,302	10.31	2.39	2.29–2.51
Prioritised ethnicity				
Māori	6,523	10.35	1.64	1.59–1.69
Pacific	3,326	12.52	1.99	1.91–2.06
Asian/Indian	947	2.05	0.33	0.30–0.35
MELAA	272	6.41	1.02	0.90–1.15
European/Other	10,847	6.30	1.00	
Gender				
Female	9,219	6.01	1.00	
Male	12,861	8.11	1.35	1.31–1.39

Numerator: National Minimum Dataset; Denominator: Statistics NZ Estimated Resident Population; Rates are per 1,000 age-specific population; skin infections in any of the first 15 diagnoses; Rate ratios are unadjusted; Ethnicity is level 1 prioritised; Decile is NZDep2013

Distribution by month

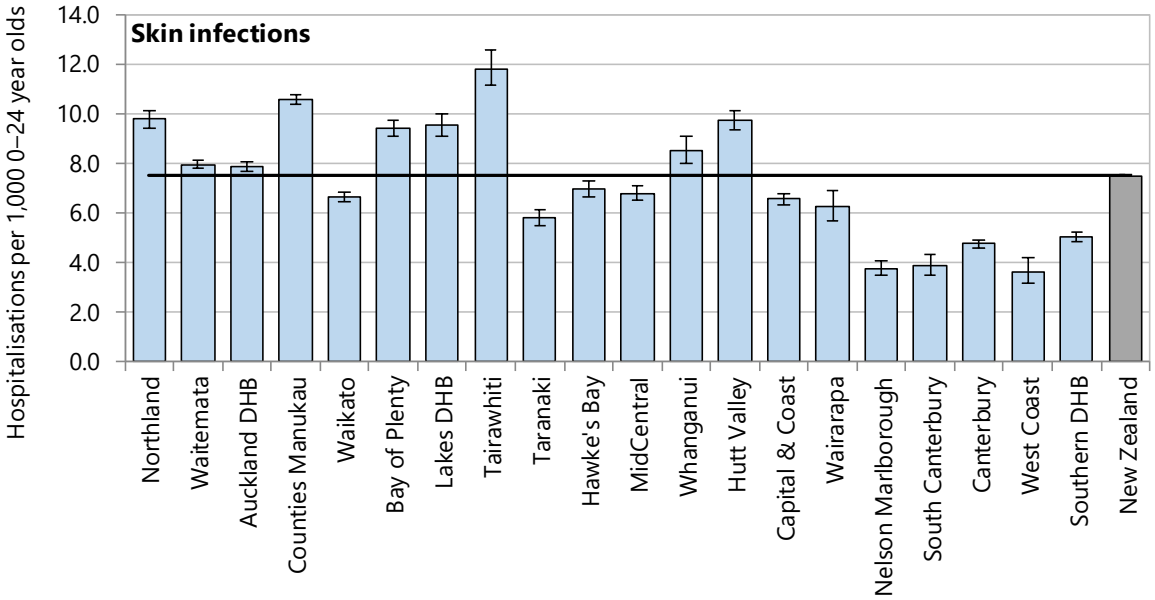
There was no great variation in hospitalisation for serious skin infections by month in 0–14 year olds or 15–24 year olds in 2010–2014 but rates tended to be somewhat higher during January–March.

Distribution by region

Between 2010 and 2014 hospitalisation rates for serious skin infections in 0–24 year olds were *significantly higher* than the national rate in the Northland, Waitemata, Auckland, Counties Manukau, Bay of Plenty, Lakes, Tairawhiti, Whanganui, and Hutt Valley DHBs, and *significantly* lower in Waikato, Taranaki, Hawke's Bay, MidCentral, Capital & Coast, Wairarapa and all of the South Island DHBs **(Figure 142, Table 103)**.

The significance for DHB hospitalisation rates for serious skin infections in 0–14 year olds was the same as for 0–24 year olds **(Table 104)** while for **15–24 year olds** rates were *significantly higher* than the national rate in the Northland, Counties Manukau, Bay of Plenty, Lakes, Tairawhiti, Whanganui and Hutt Valley DHBs, and *significantly lower* in Auckland, Waikato, Capital & Coast, and all of the South Island DHBs **(Table 105)**.

Figure 142. Hospitalisations involving skin infections in 0–24 year olds, by district health board, New Zealand 2010–2014



Numerator: National Minimum Dataset; Denominator: Statistics NZ Estimated Resident Population; skin infections in any of the first 15 diagnoses; Rates are per 1,000 0–24 year olds

Table 103. Hospitalisations involving skin infections in 0–24 year olds, by district health board, New Zealand 2010–2014

DHB	Number: 2010–2014	Number: annual average	Rate per 1,000 0–24 year olds	Rate ratio	95% CI
Any skin infections					
0–24 year olds					
Northland	2,721	544	9.79	1.30	1.25–1.35
Waitemata	7,525	1,505	7.96	1.06	1.03–1.08
Auckland	6,161	1,232	7.87	1.05	1.02–1.07
Counties Manukau	10,295	2,059	10.60	1.41	1.38–1.44
Waikato	4,493	899	6.63	0.88	0.85–0.91
Bay of Plenty	3,316	663	9.41	1.25	1.21–1.29
Lakes	1,761	352	9.56	1.27	1.21–1.33
Tairawhiti	1,068	214	11.83	1.57	1.48–1.67
Taranaki	1,096	219	5.82	0.77	0.73–0.82
Hawke's Bay	1,889	378	6.97	0.93	0.89–0.97
MidCentral	2,023	405	6.79	0.90	0.86–0.94
Whanganui	893	179	8.53	1.13	1.06–1.21
Hutt Valley	2,394	479	9.75	1.30	1.24–1.35
Capital & Coast	3,309	662	6.56	0.87	0.84–0.90
Wairarapa	413	83	6.28	0.83	0.76–0.92
Nelson Marlborough	792	158	3.78	0.50	0.47–0.54
South Canterbury	330	66	3.87	0.51	0.46–0.57
Canterbury	3,939	788	4.76	0.63	0.61–0.65
West Coast	182	36	3.65	0.49	0.42–0.56
Southern	2,611	522	5.05	0.67	0.65–0.70
New Zealand	57,560	11,512	7.52	1.00	

Numerator: National Minimum Dataset; Denominator: Statistics NZ Estimated Resident Population; skin infections in any of the first 15 diagnoses; Rates are per 1,000 0–24 year olds

Table 104. Hospitalisations for serious skin infections in 0–14 year olds, by district health board, New Zealand 2010–2014

DHB	Number: 2010–2014	Number: annual average	Rate per 1,000 0–14 year olds	Rate ratio	95% CI
Any skin infections					
0–14 year olds					
Northland	1,853	371	10.22	1.30	1.24–1.37
Waitemata	4,805	961	8.56	1.09	1.06–1.13
Auckland	3,949	790	9.57	1.22	1.18–1.26
Counties Manukau	6,749	1,350	11.37	1.45	1.41–1.49
Waikato	2,720	544	6.67	0.85	0.82–0.88
Bay of Plenty	2,143	429	9.44	1.21	1.15–1.26
Lakes	1,100	220	9.36	1.19	1.13–1.27
Tairawhiti	738	148	12.60	1.61	1.50–1.73
Taranaki	596	119	4.98	0.64	0.59–0.69
Hawke's Bay	1,240	248	7.16	0.91	0.86–0.97
MidCentral	1,098	220	6.40	0.82	0.77–0.87
Whanganui	567	113	8.66	1.11	1.02–1.20
Hutt Valley	1,574	315	10.42	1.33	1.27–1.40
Capital & Coast	1,905	381	6.96	0.89	0.85–0.93
Wairarapa	244	49	5.81	0.74	0.65–0.84
Nelson Marlborough	473	95	3.52	0.45	0.41–0.49
South Canterbury	197	39	3.72	0.48	0.41–0.55
Canterbury	2,048	410	4.33	0.55	0.53–0.58
West Coast	75	15	2.38	0.30	0.24–0.38
Southern	1,255	251	4.48	0.57	0.54–0.60
New Zealand	35,480	7,096	7.83	1.00	

Numerator: National Minimum Dataset; Denominator: Statistics NZ Estimated Resident Population; skin infections in any of the first 15 diagnoses; Rates are per 1,000 0–14 year olds; Rate ratios are unadjusted

Table 105. Hospitalisations for serious skin infections in 15–24 year olds, by district health board, New Zealand 2010–2014

DHB	Number: 2010–2014	Number: annual average	Rate per 1,000 15–24 year olds	Rate ratio	95% CI
Any skin infections					
15–24 year olds					
Northland	868	174	9.00	1.27	1.19–1.36
Waitemata	2,720	544	7.09	1.00	0.96–1.04
Auckland	2,212	442	5.97	0.84	0.81–0.88
Counties Manukau	3,546	709	9.39	1.33	1.28–1.37
Waikato	1,773	355	6.57	0.93	0.89–0.97
Bay of Plenty	1,173	235	9.35	1.32	1.25–1.40
Lakes	661	132	9.92	1.40	1.30–1.51
Tairawhiti	330	66	10.42	1.47	1.32–1.64
Taranaki	500	100	7.27	1.03	0.94–1.12
Hawke's Bay	649	130	6.65	0.94	0.87–1.02
MidCentral	925	185	7.33	1.04	0.97–1.11
Whanganui	326	65	8.31	1.17	1.05–1.31
Hutt Valley	820	164	8.67	1.23	1.14–1.31
Capital & Coast	1,404	281	6.08	0.86	0.81–0.91
Wairarapa	169	34	7.11	1.01	0.86–1.17
Nelson Marlborough	319	64	4.23	0.60	0.54–0.67
South Canterbury	133	27	4.12	0.58	0.49–0.69
Canterbury	1,891	378	5.33	0.75	0.72–0.79
West Coast	107	21	5.84	0.83	0.68–1.00
Southern	1,356	271	5.74	0.81	0.77–0.86
New Zealand	22,080	4,416	7.07	1.00	

Numerator: National Minimum Dataset; Denominator: Statistics NZ Estimated Resident Population; skin infections in any of the first 15 diagnoses; Rates are per 1,000 15–24 year olds; Rate ratios are unadjusted

Northern region distribution and trends

Comparison with New Zealand

Between 2010 and 2014 hospitalisation rates for serious skin infections in 0–24 year olds and 0–14 year olds were *significantly higher* than the national rate in all four Northern DHBs. In 15–24 year olds, rates were *significantly higher* than the national rate in Northland and Counties Manukau, *significantly lower* in Auckland DHB, and *not significantly different* in Waitemata **(Table 106)**.

Table 106. Hospitalisations involving skin infections in 0–24 year olds, by age group, Northern DHBs vs New Zealand 2010–2014

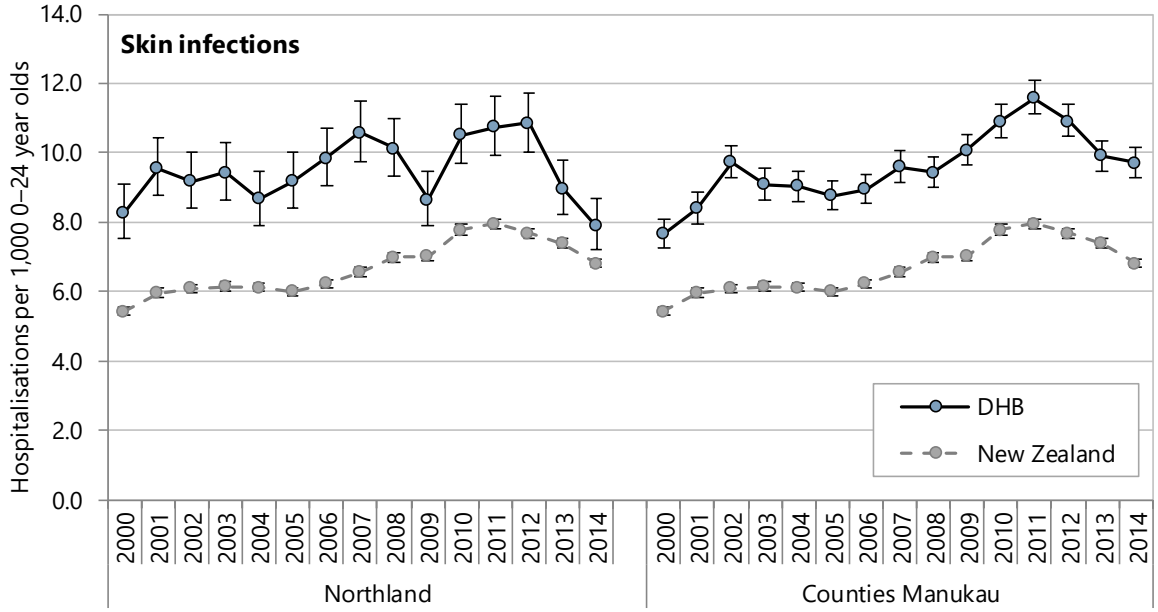
DHB	Number: 2010–2014	Number: annual average	Rate per 1,000 population	Rate ratio	95% CI
Any skin infections					
0–24 year olds					
Northland	2,721	544	9.79	1.30	1.25–1.35
Waitemata	7,525	1,505	7.96	1.06	1.03–1.08
Auckland	6,161	1,232	7.87	1.05	1.02–1.07
Counties Manukau	10,295	2,059	10.60	1.41	1.38–1.44
New Zealand	57,560	11,512	7.52	1.00	
0–14 year olds					
Northland	1,853	371	10.22	1.30	1.24–1.37
Waitemata	4,805	961	8.56	1.09	1.06–1.13
Auckland	3,949	790	9.57	1.22	1.18–1.26
Counties Manukau	6,749	1,350	11.37	1.45	1.41–1.49
New Zealand	35,480	7,096	7.83	1.00	
15–24 year olds					
Northland	868	174	9.00	1.27	1.19–1.36
Waitemata	2,720	544	7.09	1.00	0.96–1.04
Auckland	2,212	442	5.97	0.84	0.81–0.88
Counties Manukau	3,546	709	9.39	1.33	1.28–1.37
New Zealand	22,080	4,416	7.07	1.00	

Numerator: National Minimum Dataset; Denominator: Statistics NZ Estimated Resident Population; Skin infections in any of the first 15 diagnoses; Rate ratios are unadjusted

Regional trends

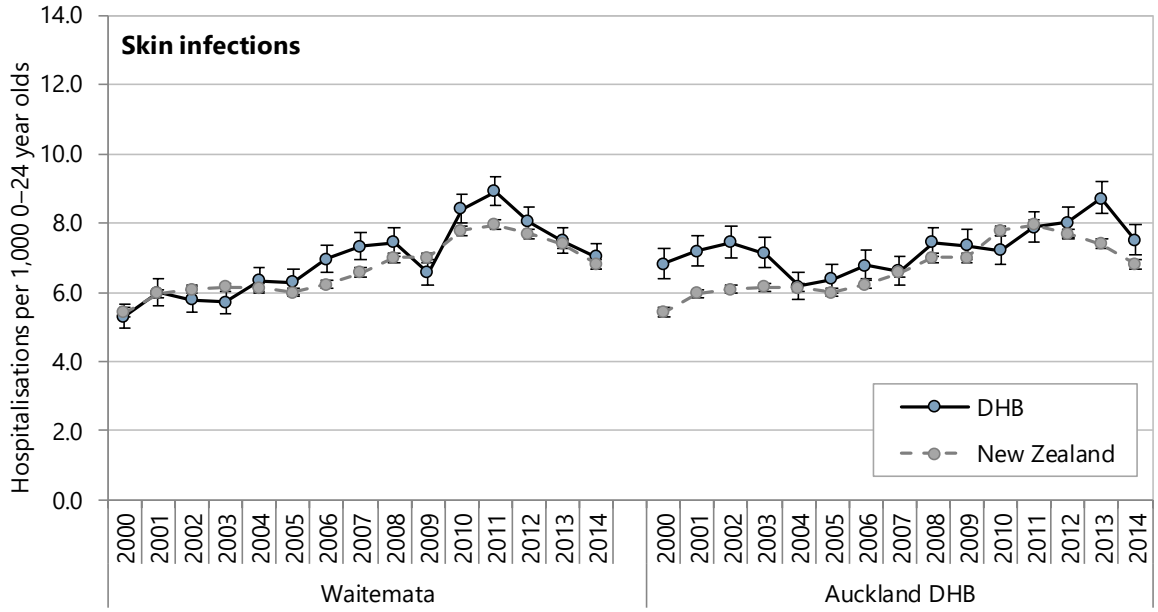
During 2000–2014, hospital admissions for serious skin infections in 0–24 year olds generally increased in all four Northern DHBs over most of the period but, like the national rate, have been falling over recent years **(Figure 143, Figure 144)**. The same general trend was apparent in all four DHBs in both the 0–14 and 15–24 years age groups, but in Auckland and Counties Manukau rates were consistently higher for 0–14 year olds, while in Waitemata rates for 0–14 year olds were generally only a little higher, and in Northland there was little difference in rates between the two age groups **(Figure 145**, **Figure 146)**.

Figure 143. Hospitalisations involving skin infections in 0–24 year olds, Northland and Counties Manukau DHBs vs New Zealand 2000–2014



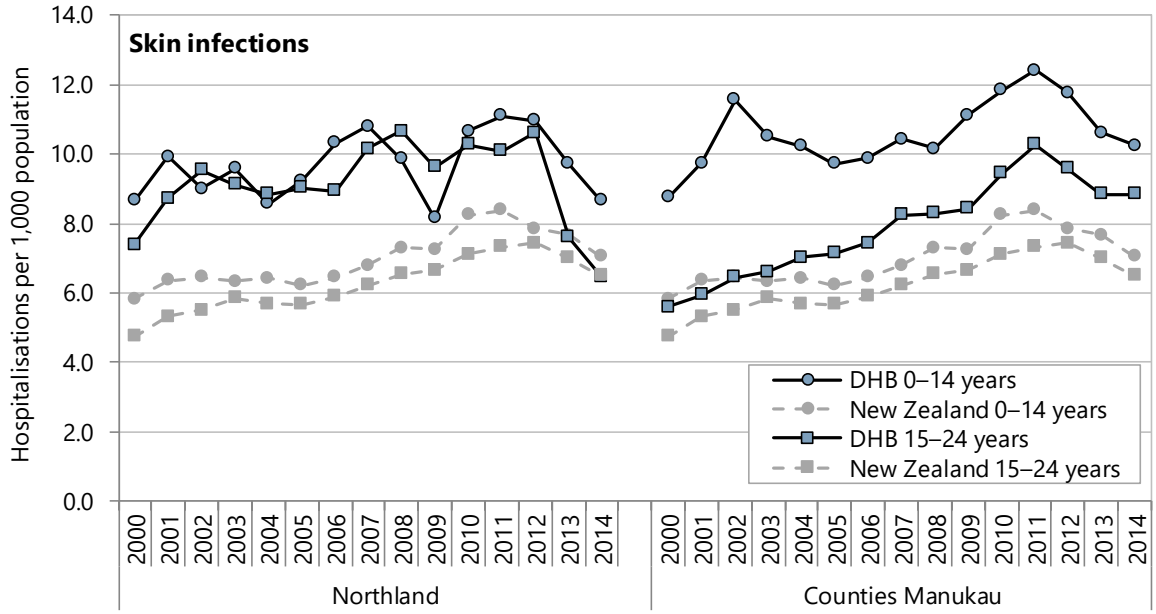
Numerator: National Minimum Dataset; Denominator: Statistics NZ Estimated Resident Population; Skin infections in any of the first 15 diagnoses

Figure 144. Hospitalisations involving skin infections in 0–24 year olds, Waitemata and Auckland DHBs vs New Zealand 2000–2014



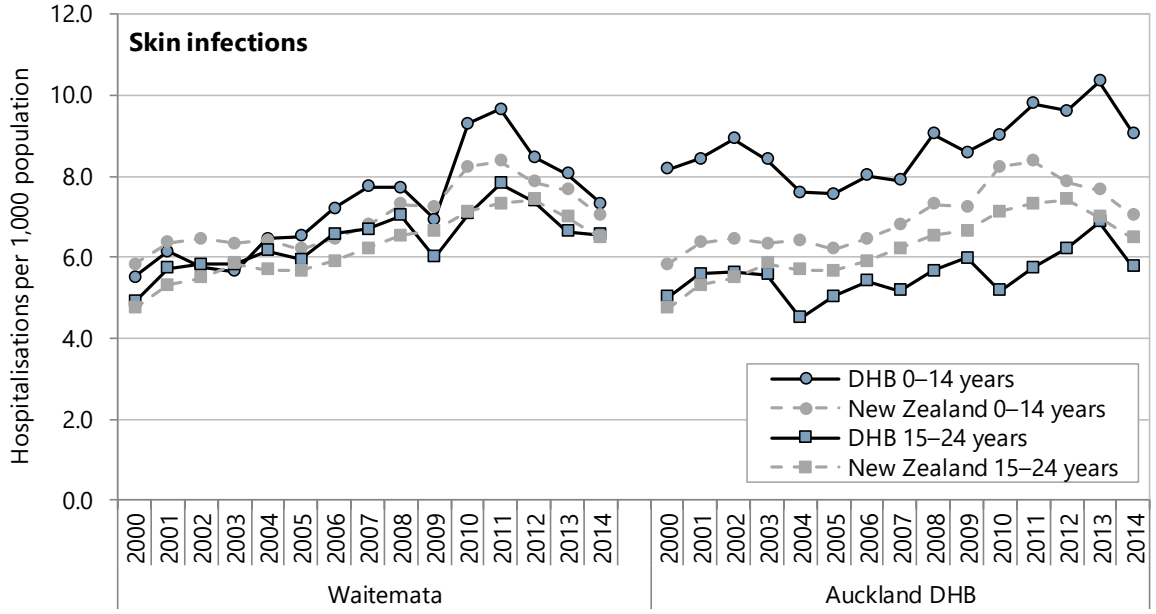
Numerator: National Minimum Dataset; Denominator: Statistics NZ Estimated Resident Population; Skin infections in any of the first 15 diagnoses

Figure 145. Hospitalisations involving skin infections in 0–24 year olds, by age group, Northland and Counties Manukau DHBs vs New Zealand 2000–2014



Numerator: National Minimum Dataset; Denominator: Statistics NZ Estimated Resident Population; Skin infections in any of the first 15 diagnoses

Figure 146. Hospitalisations involving skin infections in 0–24 year olds, by age group, Waitemata and Auckland DHBs vs New Zealand 2000–2014

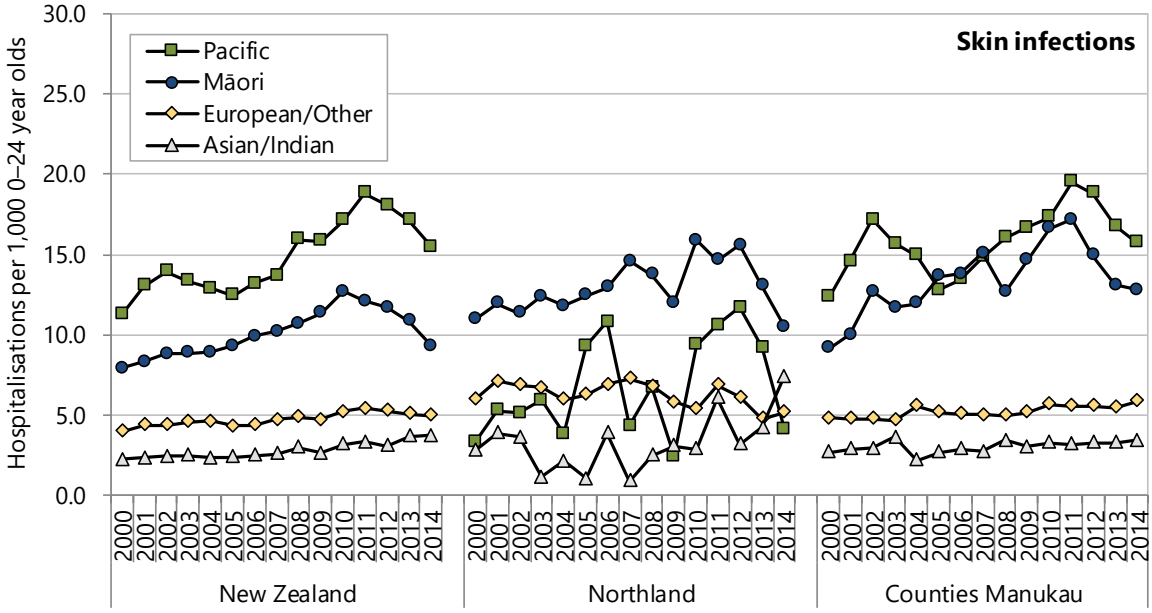


Numerator: National Minimum Dataset; Denominator: Statistics NZ Estimated Resident Population; Skin infections in any of the first 15 diagnoses

From 2000 to 2014, rates for Pacific and Māori 0–24 year olds hospitalised with skin infections in Waitemata, Auckland DHB, and Counties Manukau, and for Māori 0–24 year olds in Northland, followed the overall national trend rising for the earlier part of the period and falling more recently. Pacific rates were mostly higher than Māori rates in Waitemata, Auckland and Counties Manukau. Māori consistently had the highest rates in Northland.

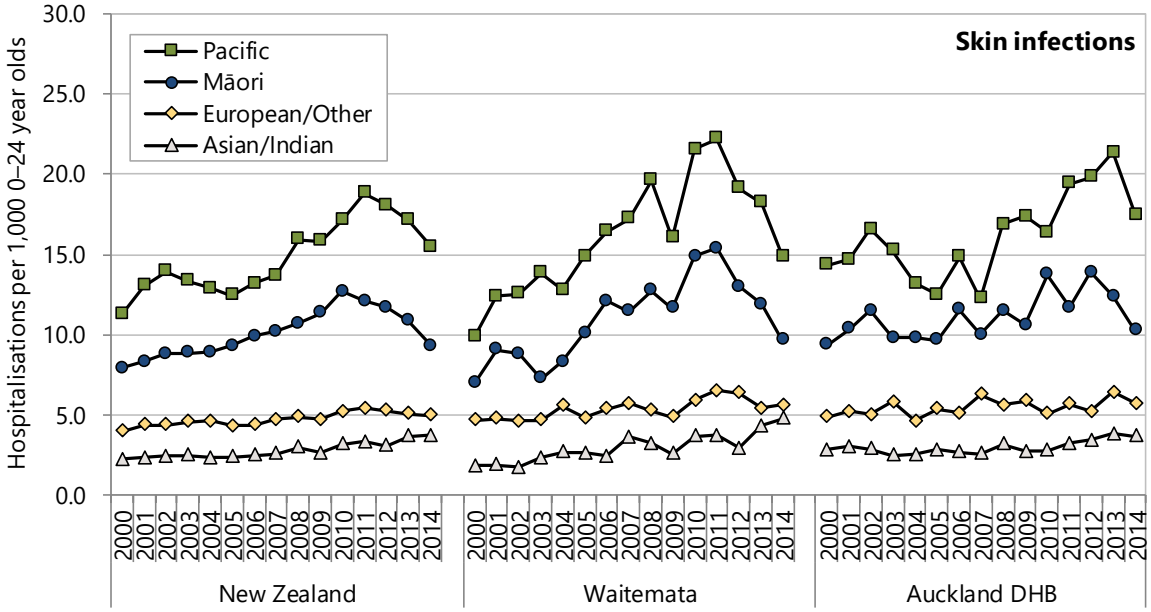
European rates remained steady in all Northern DHBs between 2000 and 2014, while Asian/Indian rates rose slightly in Waitemata, Auckland and Counties Manukau. European rates were higher than Asian/Indian but lower than Māori and Pacific rates in Waitemata, Auckland and Counties Manukau, and lower than Māori rates in Northland. In Northland, rates for Pacific and Asian/Indian 0–24 year olds were variable, which is likely to be a reflection of the small numbers in those ethnic groups there **(Figure 147**, **Figure 148)**.

Figure 147. Hospitalisations involving skin infections in 0–24 year olds, by ethnicity, Northland and Counties Manukau DHBs vs New Zealand 2000–2014



Numerator: National Minimum Dataset; Denominator: Statistics NZ Estimated Resident Population; Skin infections in any of the first 15 diagnoses

Figure 148. Hospitalisations involving skin infections in 0–24 year olds, by ethnicity, Waitemata and Auckland DHBs vs New Zealand 2000–2014



Numerator: National Minimum Dataset; Denominator: Statistics NZ Estimated Resident Population; Skin infections in any of the first 15 diagnoses

Regional distribution by cause

In all the Northern DHBs during 2010–2014, cellulitis and cutaneous abscesses, furuncles or carbuncles were the most frequent primary diagnoses in 0–24 year olds admitted to hospital with serious skin infections **(Table 107, Table 108, Table 109, Table 110)**.

Table 107. Hospitalisations for serious skin infections in 0–24 year olds, by age group and primary diagnosis, Northland 2010–2014

Primary diagnosis	Number: 2010–2014	Number: annual average	Rate per 1,000 population	95% CI	Per cent
Northland					
0–14 year olds					
Cellulitis	306	61	1.69	1.51–1.89	16.5
Cutaneous abscess, furuncle, or carbuncle	282	56	1.55	1.38–1.75	15.2
Infected, unspecified, or other dermatitis	141	28	0.78	0.66–0.92	7.6
Infections of other anatomical sites	71	14	0.39	0.31–0.49	3.8
Acute lymphadenitis	66	13	0.36	0.29–0.46	3.6
Impetigo	52	10	0.29	0.22–0.38	2.8
Other infections of skin and subcutaneous tissue	47	9	0.26	0.19–0.34	2.5
Varicella with other complications	31	6	0.17	0.12–0.24	1.7
Insect or spider bites	27	5	0.15	0.10–0.22	1.5
Scabies	27	5	0.15	0.10–0.22	1.5
Post traumatic or open wound infection	11	2	0.06	0.03–0.11	0.6
Pilonidal cyst with abscess	<5	s	s	s	s
Other diagnoses	791	158	4.36	4.07–4.67	42.7
Total	1853	371	10.22	9.76–10.7	100.0
15–24 year olds					
Cutaneous abscess, furuncle, or carbuncle	139	28	1.44	1.22–1.70	16.0
Cellulitis	120	24	1.24	1.04–1.49	13.8
Pilonidal cyst with abscess	84	17	0.87	0.70–1.08	9.7
Infections of other anatomical sites	53	11	0.55	0.42–0.72	6.1
Infected, unspecified, or other dermatitis	21	4	0.22	0.14–0.33	2.4
Insect or spider bites	21	4	0.22	0.14–0.33	2.4
Post traumatic or open wound infection	13	3	0.13	0.08–0.23	1.5
Acute lymphadenitis	10	2	0.10	0.06–0.19	1.2
Other infections of skin and subcutaneous tissue	7	1	0.07	0.04–0.15	0.8
Scabies	<5	s	s	s	s
Impetigo	<5	s	s	s	s
Varicella with other complications	<5	s	s	s	s
Other diagnoses	392	78	4.06	3.68–4.49	45.2
Total	868	174	9.00	8.42–9.61	100.0

Numerator: National Minimum Dataset; Denominator: Statistics NZ Estimated Resident Population; Skin infections in any of the first 15 diagnoses

Table 108. Hospitalisations for serious skin infections in 0–24 year olds, by age group and primary diagnosis, Waitemata 2010–2014

Primary diagnosis	Number: 2010–2014	Number: annual average	Rate per 1,000 population	95% CI	Per cent
Waitemata					
0–14 year olds					
Cellulitis	1,090	218	1.94	1.83–2.06	22.7
Cutaneous abscess, furuncle, or carbuncle	971	194	1.73	1.62–1.84	20.2
Infections of other anatomical sites	290	58	0.52	0.46–0.58	6.0
Infected, unspecified, or other dermatitis	230	46	0.41	0.36–0.47	4.8
Acute lymphadenitis	173	35	0.31	0.27–0.36	3.6
Impetigo	82	16	0.15	0.12–0.18	1.7
Other infections of skin and subcutaneous tissue	66	13	0.12	0.09–0.15	1.4
Insect or spider bites	58	12	0.10	0.08–0.13	1.2
Scabies	54	11	0.10	0.07–0.13	1.1
Varicella with other complications	44	9	0.08	0.06–0.11	0.9
Pilonidal cyst with abscess	23	5	0.04	0.03–0.06	0.5
Post traumatic or open wound infection	9	2	0.02	0.01–0.03	0.2
Other diagnoses	1,715	343	3.05	2.91–3.20	35.7
Total	4,805	961	8.56	8.32–8.80	100.0
15–24 year olds					
Cutaneous abscess, furuncle, or carbuncle	649	130	1.69	1.57–1.83	23.9
Cellulitis	401	80	1.05	0.95–1.15	14.7
Pilonidal cyst with abscess	373	75	0.97	0.88–1.08	13.7
Infections of other anatomical sites	240	48	0.63	0.55–0.71	8.8
Insect or spider bites	32	6	0.08	0.06–0.12	1.2
Infected, unspecified, or other dermatitis	31	6	0.08	0.06–0.11	1.1
Other infections of skin and subcutaneous tissue	15	3	0.04	0.02–0.06	0.6
Impetigo	14	3	0.04	0.02–0.06	0.5
Post traumatic or open wound infection	9	2	0.02	0.01–0.04	0.3
Scabies	8	2	0.02	0.01–0.04	0.3
Acute lymphadenitis	6	1	0.02	0.01–0.03	0.2
Varicella with other complications	0	..	..	..	..
Other diagnoses	942	188	2.46	2.31–2.62	34.6
Total	2,720	544	7.09	6.83–7.37	100.0

Numerator: National Minimum Dataset; Denominator: Statistics NZ Estimated Resident Population; Skin infections in any of the first 15 diagnoses; Rates are per 1,000 age-specific population

Table 109. Hospitalisations for serious skin infections in 0–24 year olds, by age group and primary diagnosis, Auckland DHB 2010–2014

Primary diagnosis	Number: 2010–2014	Number: annual average	Rate per 1,000 population	95% CI	Per cent
Auckland DHB					
0–14 year olds					
Cellulitis	860	172	2.08	1.95–2.23	21.8
Cutaneous abscess, furuncle, or carbuncle	814	163	1.97	1.84–2.11	20.6
Infections of other anatomical sites	241	48	0.58	0.51–0.66	6.1
Infected, unspecified, or other dermatitis	205	41	0.50	0.43–0.57	5.2
Acute lymphadenitis	143	29	0.35	0.29–0.41	3.6
Impetigo	98	20	0.24	0.19–0.29	2.5
Scabies	44	9	0.11	0.08–0.14	1.1
Other infections of skin and subcutaneous tissue	43	9	0.10	0.08–0.14	1.1
Varicella with other complications	42	8	0.10	0.08–0.14	1.1
Insect or spider bites	36	7	0.09	0.06–0.12	0.9
Pilonidal cyst with abscess	9	2	0.02	0.01–0.04	0.2
Post traumatic or open wound infection	5	1	0.01	0.01–0.03	0.1
Other diagnoses	1,409	282	3.42	3.24–3.60	35.7
Total	3,949	790	9.57	9.28–9.87	100.0
15–24 year olds					
Cutaneous abscess, furuncle, or carbuncle	532	106	1.44	1.32–1.56	24.1
Cellulitis	418	84	1.13	1.02–1.24	18.9
Pilonidal cyst with abscess	218	44	0.59	0.51–0.67	9.9
Infections of other anatomical sites	204	41	0.55	0.48–0.63	9.2
Infected, unspecified, or other dermatitis	29	6	0.08	0.05–0.11	1.3
Insect or spider bites	20	4	0.05	0.03–0.08	0.9
Impetigo	19	4	0.05	0.03–0.08	0.9
Acute lymphadenitis	15	3	0.04	0.02–0.07	0.7
Other infections of skin and subcutaneous tissue	12	2	0.03	0.02–0.06	0.5
Scabies	<5	s	s	s	s
Post traumatic or open wound infection	<5	s	s	s	s
Varicella with other complications	<5	s	s	s	s
Other diagnoses	736	147	1.99	1.85–2.13	33.3
Total	2,212	442	5.97	5.72–6.22	100.0

Numerator: National Minimum Dataset; Denominator: Statistics NZ Estimated Resident Population; Skin infections in any of the first 15 diagnoses

Table 110. Hospitalisations for serious skin infections in 0–24 year olds, by age group and primary diagnosis, Counties Manukau 2010–2014

Primary diagnosis	Number: 2010–2014	Number: annual average	Rate per 1,000 population	95% CI	Per cent
Counties Manukau					
0–14 year olds					
Cutaneous abscess, furuncle, or carbuncle	1,496	299	2.52	2.40–2.65	22.2
Cellulitis	1,304	261	2.20	2.08–2.32	19.3
Infections of other anatomical sites	421	84	0.71	0.64–0.78	6.2
Infected, unspecified, or other dermatitis	381	76	0.64	0.58–0.71	5.6
Acute lymphadenitis	205	41	0.35	0.30–0.40	3.0
Impetigo	122	24	0.21	0.17–0.25	1.8
Scabies	122	24	0.21	0.17–0.25	1.8
Other infections of skin and subcutaneous tissue	86	17	0.14	0.12–0.18	1.3
Varicella with other complications	83	17	0.14	0.11–0.17	1.2
Insect or spider bites	63	13	0.11	0.08–0.14	0.9
Pilonidal cyst with abscess	27	5	0.05	0.03–0.07	0.4
Post traumatic or open wound infection	20	4	0.03	0.02–0.05	0.3
Other diagnoses	2,419	484	4.07	3.92–4.24	35.8
Total	6,749	1,350	11.37	11.1–11.6	100.0
15–24 year olds					
Cutaneous abscess, furuncle, or carbuncle	1,010	202	2.67	2.51–2.84	28.5
Cellulitis	535	107	1.42	1.30–1.54	15.1
Pilonidal cyst with abscess	363	73	0.96	0.87–1.07	10.2
Infections of other anatomical sites	244	49	0.65	0.57–0.73	6.9
Infected, unspecified, or other dermatitis	82	16	0.22	0.17–0.27	2.3
Insect or spider bites	22	4	0.06	0.04–0.09	0.6
Other infections of skin and subcutaneous tissue	21	4	0.06	0.04–0.09	0.6
Scabies	17	3	0.05	0.03–0.07	0.5
Impetigo	15	3	0.04	0.02–0.07	0.4
Acute lymphadenitis	13	3	0.03	0.02–0.06	0.4
Post traumatic or open wound infection	8	2	0.02	0.01–0.04	0.2
Varicella with other complications	<5	s	s	s	s
Other diagnoses	1,214	243	3.21	3.04–3.40	34.2
Total	3,546	709	9.39	9.09–9.70	100.0

Numerator: National Minimum Dataset; Denominator: Statistics NZ Estimated Resident Population; Skin infections in any of the first 15 diagnoses; Rates are per 1,000 age-specific population

Regional distribution by season

In the Northern DHBs during 2010–2014, there were no consistent seasonal variations in hospitalisation rates for serious skin infections 0–24 year olds.

Evidence for good practice relevant to serious skin infections

Ministry of Health publications
White C, et al. 2013. **Health literacy and the prevention and management of skin infections.** Workplace Education Trust. http://www.healthliteracy.org.nz/wp-content/uploads/2013/11/Report-skin-infections.pdf This report was prepared for the Ministry of Health to investigate the role of health literacy interventions in the prevention and management of skin infections in Māori children aged under 15 years. Identification of barriers to and facilitators of health literacy as well as interventions to improve health literacy led to the development and trialling of resources for parents and caregivers. These could be used by health practitioners and teachers to discuss the prevention and management of skin infections. The booklet and poster were well received and lesson plans developed for schools also received positive feedback from teachers. Appendices include the full skin infection literature review and copies of the booklet and poster. The latter resources can also be accessed from the Workplace Education webpage (scroll down to find skin resources) http://www.healthliteracy.org.nz/research-and-projects/#3726 .
New Zealand guidelines
DermNet New Zealand Trust. 2015. DermNet NZ: **The dermatology resource**. http://www.dermnetnz.org/contents.html accessed 16 November 2015. This interactive website provides detailed information about skin conditions including boils, abscesses, impetigo and cellulitis. For each type of skin infection there are links to clinical information including photographs, reasons for occurrence, prevention and treatment methods. Within the website there is also a link to an online continuing education resource for health professionals on bacterial skin infections http://www.dermnetnz.org/doctors/bacterial-infections/
Evidence-based medicine reviews
Bowen AC, et al. 2015. **The global epidemiology of impetigo: A systematic review of the population prevalence of impetigo and pyoderma.** PLoS ONE, 10(8). A systematic review of the global childhood population prevalence of impetigo (also known as skin sores or school sores) and bacterial skin infections associated with the production of pus (collectively known as pyoderma; a term that is inclusive of impetigo) using journal articles published between 1970 and 2014. Impetigo prevalence was highest in Oceania, in both resource-poor countries and underprivileged populations within high-income countries. The authors comment that as antibiotics are a mainstay of treatment for impetigo, the high disease burden may contribute to antibiotic resistance in the absence of evidence-based treatment algorithms.
Koning S, et al. 2012. **Interventions for impetigo.** Cochrane Database of Systematic Reviews. http://onlinelibrary.wiley.com/doi/10.1002/14651858.CD003261.pub3/full Authors included 68 trials with 5578 participants, reporting on 50 different treatments, including placebo. Topical antibiotic treatment showed better cure rates than placebo (pooled risk ratio (RR) 2. 24, 95% confidence interval (CI) 1.61 to 3.13) in 6 studies with 575 participants. In 4 studies with 440 participants the two most commonly studied topical antibiotics (mupirocin and fusidic acid) were equally effective. There was good evidence that topical mupirocin and topical fusidic acid are equally, or more, effective than oral treatment. There was a lack of evidence for the benefit of using disinfectant solutions. In 2 pooled studies with 292 participants, topical antibiotics were significantly better than disinfecting treatments (RR 1.15, 95% CI 1.01 to 1.32).
Other relevant publications
O'Sullivan CE, et al. 2011. **Increasing hospitalizations for serious skin infections in New Zealand children, 1990 - 2007**. Epidemiology and Infection, 139(11), 1794-804. Descriptive epidemiology of serious skin infections in New Zealand 0–14 year olds showed an increase in incidence from 1990 to 2007 in which time rates almost doubled. Between 1990 and 2007 there were 64,568 hospitalisations of NZ children for serious skin infections with a mean stay of 3.3 days. Cost of hospitalisations in 2007 alone was estimated at NZ$15 million. Hospitalisation rates were significantly higher in summer and autumn, and there was a rough North-South gradient with higher rates in North Island DHBs compared with South Island. Urban areas had higher hospitalisation rates than rural areas for skin infections. There was worsening disparity by NZ Index of Deprivation score over time.
O'Sullivan C & Baker MG. 2012. **Skin infections in children in a New Zealand primary care setting: Exploring beneath the tip of the iceberg**. New Zealand Medical Journal, 125(1351), 70-79. https://www.nzma.org.nz/journal/read-the-journal/all-issues/2010-2019/2012/vol-125-no-1351/article-osullivan2 O'Sullivan et al undertook subsequent research to estimate the incidence of childhood skin infections in primary care through prospective observational analysis of cases seen by a cohort of general practitioners (GPs) in the Tairawhiti region. They found that the epidemiology of skin infections in primary care reflected that of hospitalised serious skin infections, except there was a relatively higher proportion of 5–9 year olds presenting to GPs whereas hospitalisations were mainly of preschool-aged children. If the observed ratio of 14 primary care cases for every one hospitalised case applied uniformly across NZ there may be 62,347 GP cases per year nationally, although further studies in other primary care populations are needed before relying on such extrapolations.
Websites
Kidshealth. 2014. Looking after your child's skin and treating skin infections. http://kidshealth.org.nz/looking-after-your-childs-skin-and-treating-skin-infections accessed 18 November 2015. Kidshealth. 2014. **Boils**. accessed 16 November 2015. This webpage provides a link to a 24 page booklet that will assist parents and caregivers to keep skin healthy and recognise a number of skin conditions including boils, cellulitis and impetigo. From this page parents can follow links to information about a number of skin conditions including patient-centred information about identification and management of boils http://kidshealth.org.nz/boils and impetigo http://kidshealth.org.nz/impetigo-school-sores and a poster about skin problems in children http://kidshealth.org.nz/skin-problems-children.

GASTROENTERITIS

Introduction

Acute gastroenteritis is the sudden onset of diarrhoea with three or more loose stools per day and may be accompanied by vomiting. It is most commonly caused by micro-organisms spread by the faecal-oral route and is only rarely due to chemical contamination of water or food.[76] Gastroenteritis caused by rotavirus is extremely common, estimated to affect almost all children, and has an illness spectrum more severe than diarrhoea from other causes. Clinical presentation of rotavirus can vary from asymptomatic infection to severe dehydrating gastroenteritis; the latter occurs predominantly between the ages of three months and two years.[58]

Certain categories of acute gastroenteritis are notifiable conditions including cases of infectious gastroenteritis where there is a suspected common source (e.g. norovirus or rotavirus outbreak); single cases in a high-risk category (e.g. early childhood education worker), single cases of chemical, bacterial or toxic food poisoning (e.g. botulism), and disease caused by toxin-producing *Escherichia coli* or other organisms of public health importance. These must all be reported to the local medical officer of health without delay.[76] The most important factors in preventing the spread of gastroenteritis are washing hands with soap in warm running water and careful drying (especially after going to the toilet or changing nappies and before preparing, serving or eating food), and keeping children away from school until at least 48 hours after the last episode of diarrhoea or vomiting and from swimming in pools until two weeks after the last episode of diarrhoea.[76,93] However because rates of rotavirus illness are similar in developed and developing countries it is likely that good hygiene and clean water supplies do not have a significant impact on primary prevention of rotaviral disease and immunisation is the primary public health measure for the reduction of rotavirus disease burden. Since July 2014 rotavirus vaccine has been funded at ages 6 weeks, 3 and 5 months as part of the National Immunisation Schedule.[58]

The following section reports on hospitalisations for gastroenteritis in children and young people using information from the National Minimum Dataset. It concludes with a brief overview of evidence-based reviews and guidelines which consider the most effective interventions for preventing or managing gastroenteritis in children and young people.

Data sources and methods

Indicator

Hospitalisations for gastroenteritis in 0–24 year olds

Data sources

Numerator: National Minimum Dataset

Denominator: Statistics NZ Estimated Resident Population (with linear extrapolation being used to calculate denominators between Census years).

Definition

Hospitalisations: Acute and arranged hospitalisations for 0–24 year olds with a primary diagnosis of gastroenteritis. Refer to **Appendix 6** for the codes included.

Notes on interpretation

Note 1: An acute admission is an unplanned hospitalisation occurring on the day of presentation, while an arranged admission (also referred to as a semi-acute hospitalisation) is a non-acute hospitalisation with an admission date less than seven days after the date the decision was made that the hospitalisation was necessary.

Note 2: **Appendix 3** outlines the limitations of the data utilised from the National Minimum Dataset. The reader is advised to review this appendix before interpreting any trends.

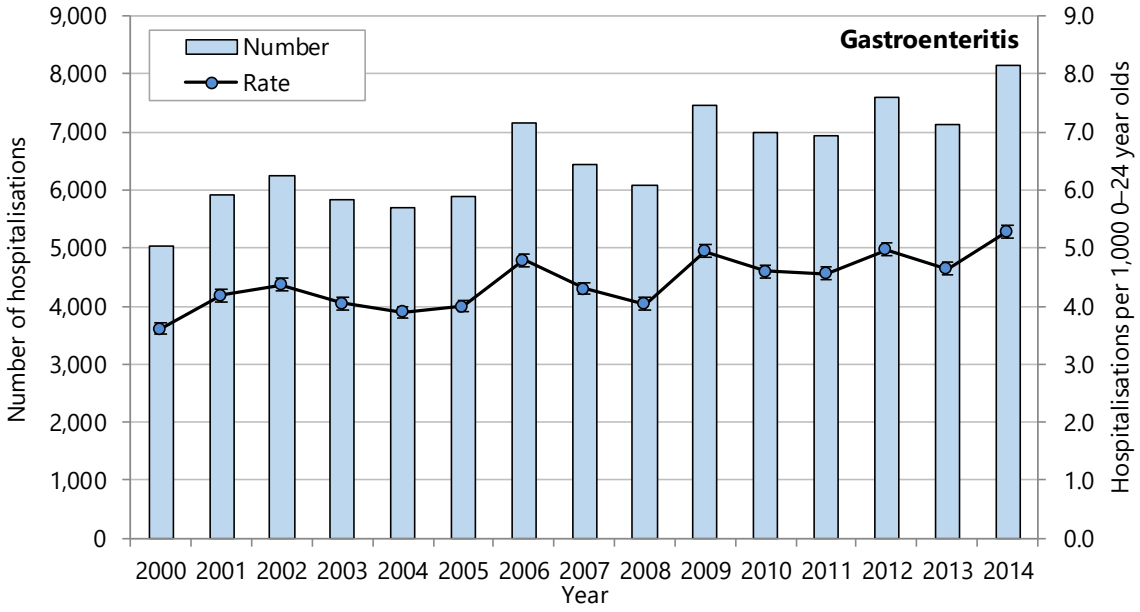
National trends and distribution

From 2000 to 2014 the gastroenteritis hospitalisation rate for 0–24 year olds rose slightly overall although there were year to year fluctuations **(Figure 149)**.

Similar patterns over time were observed for the four largest ethnic groups. Pacific rates were consistently higher than all other groups except MELAA. Māori, European/Other and Asian/Indian rates were similar over the period (with European rates generally being slightly higher), but MELAA rates were consistently higher than any other ethnic group and increased to a greater degree from 2007 onwards so that the gap between rates

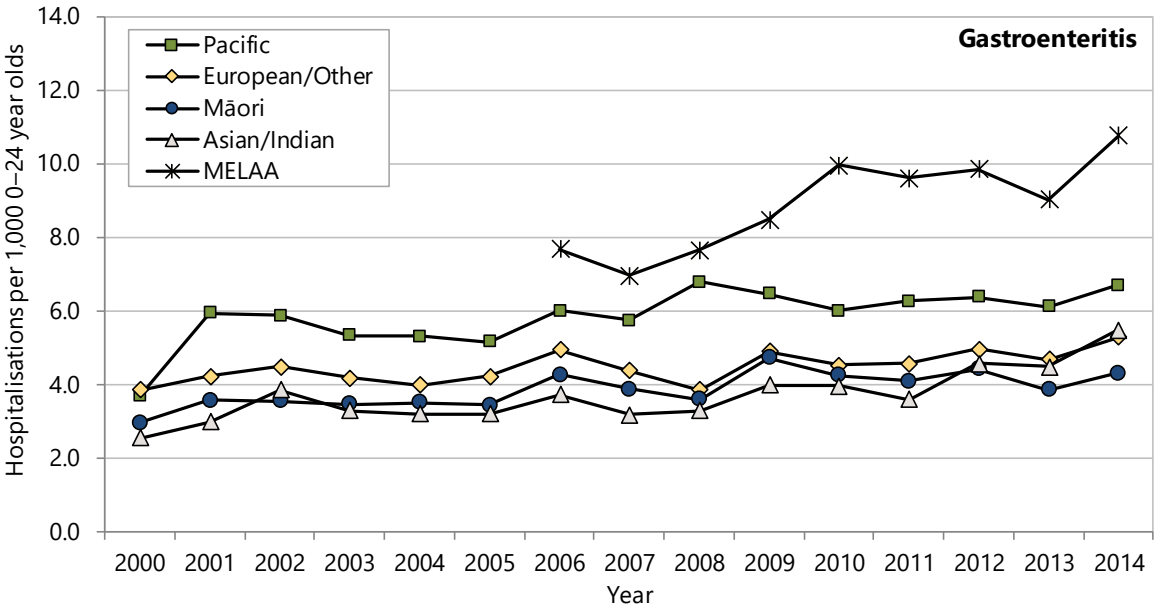
for MELAA and for other ethnic groups increased noticeably over time **(Figure 150)**. The upward trend in gastroenteritis admission rates was evident in all age groups **(Figure 151)**.

Figure 149. Hospitalisations for gastroenteritis in 0–24 year olds, New Zealand 2000–2014



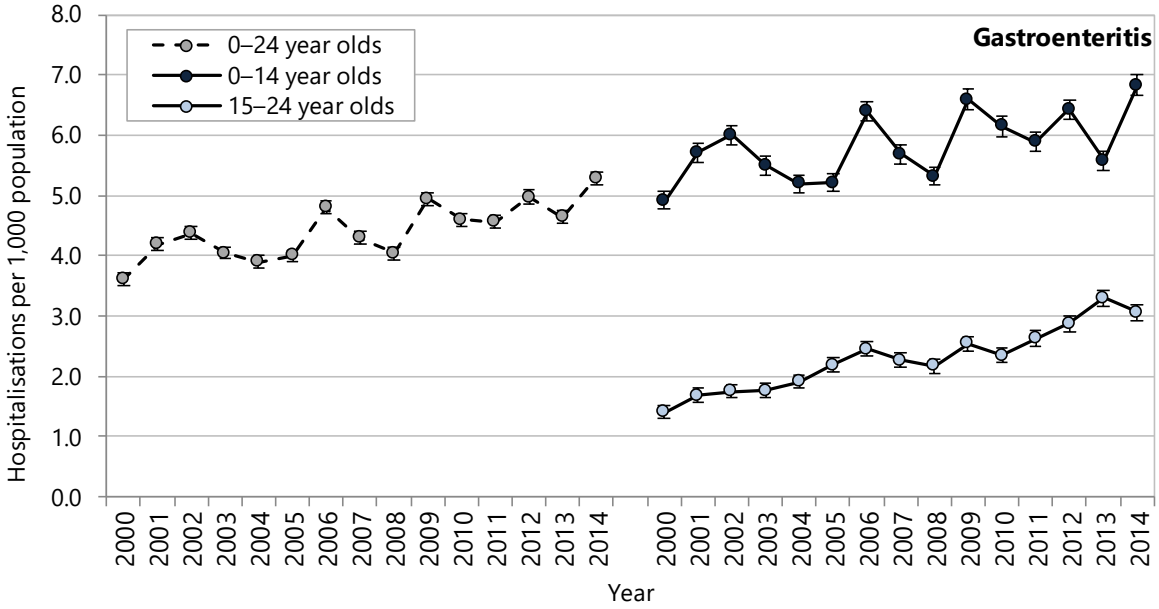
Numerator: National Minimum Dataset (acute and arranged admissions); Denominator: Statistics NZ Estimated Resident Population

Figure 150. Hospitalisations for gastroenteritis in 0–24 year olds, by ethnicity, New Zealand 2000–2014



Numerator: National Minimum Dataset (acute and arranged admissions); Denominator: Statistics NZ Estimated Resident Population

Figure 151. Hospitalisations for gastroenteritis in 0–24 year olds, by age group, New Zealand 2000–2014



Numerator: National Minimum Dataset (acute and arranged admissions); Denominator: Statistics NZ Estimated Resident Population

Distribution by cause

Between 2010 and 2014 most gastroenteritis hospitalisations were presumed infectious although the specific agent was not identified, and where identified, viral infections were most common. During this period, then the most frequent primary diagnoses among 0–24 year olds admitted to hospital with gastroenteritis were 'other gastroenteritis and colitis of infectious origin and viral enteritis' **(Table 111)**.

Table 111. Hospitalisations for gastroenteritis in 0–24 year olds, by primary diagnosis, New Zealand 2010–2014

Primary diagnosis	Number: 2010–2014	Number: annual average	Rate per 1,000 0–24 year olds	95% CI	Per cent
Gastroenteritis in 0–24 year olds					
New Zealand					
Bacterial					
Typhoid and paratyphoid fevers	116	23	0.02	0.01–0.02	0.3
Other salmonella infections	202	40	0.03	0.02–0.03	0.5
Shigellosis	42	8	0.01	0.004–0.01	0.1
Other bacterial intestinal infections	1,150	230	0.15	0.14–0.16	3.1
Other bacterial foodborne intoxications	106	21	0.01	0.01–0.02	0.3
Total bacterial	1,616	323	0.21	0.20–0.22	4.4
Parasitic					
Amoebiasis	11	2	0.00	0.001–0.003	0.0
Other protozoal intestinal diseases	138	28	0.02	0.02–0.02	0.4
Total parasitic	149	30	0.02	0.02–0.02	0.4
Viral					
Rotavirus	3,557	711	0.46	0.45–0.48	9.7
Norovirus	81	16	0.01	0.01–0.01	0.2
Other viral	8,461	1,692	1.11	1.08–1.13	23.0
Total viral	12,099	2,420	1.58	1.55–1.61	32.9
Other infectious					
Other gastroenteritis and colitis of infectious origin	16,848	3,370	2.20	2.17–2.24	45.7
Other (presumed non-infectious)					
Nausea and vomiting	5,719	1,144	0.75	0.73–0.77	15.5
Non-infective gastroenteritis and colitis, unspecified	397	79	0.05	0.05–0.06	1.1
Total	36,828	7,366	4.81	4.77–4.86	100.0

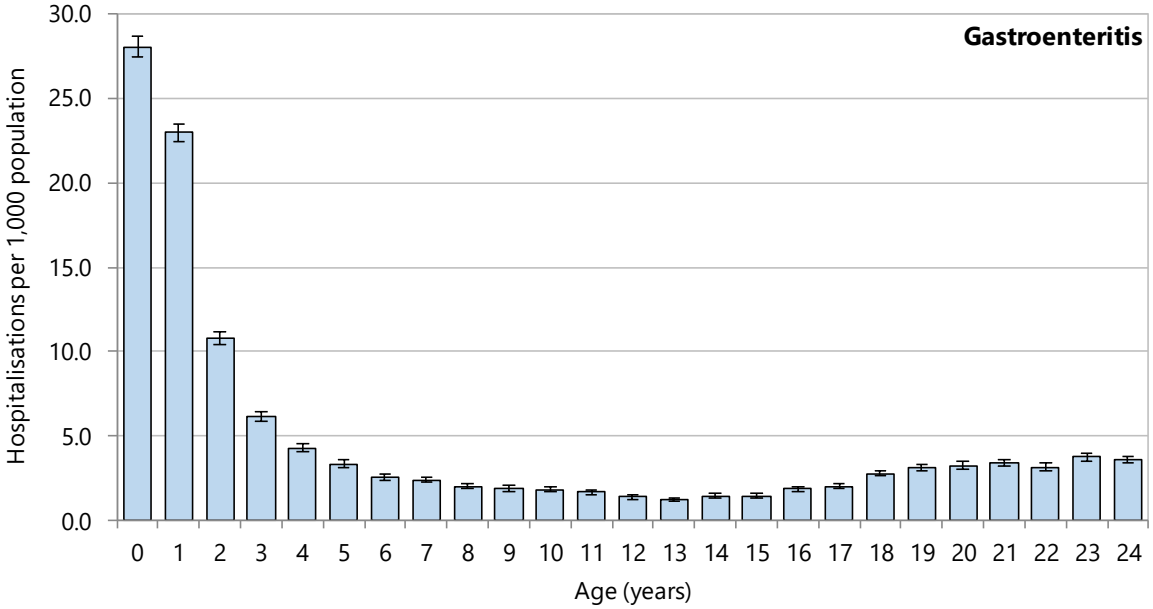
Numerator: National Minimum Dataset (acute and arranged admissions); Denominator: Statistics NZ Estimated Resident Population

Distribution by demographic factors

Between 2010 and 2014 gastroenteritis hospitalisation rates for 0–24 year olds were highest for babies under one year old and decreased steeply with increasing age from zero to five years, and then changed little with increasing age from age six years, although there was a small increase from age 15 to 21 years **(Figure 152)**.

Between 2010 and 2014 there was disparity in gastroenteritis hospitalisation rates by NZDep2013 index of deprivation score, ethnicity and age. Rates were *significantly lower* in areas with lower deprivation scores compared with areas with higher deprivation scores. There was a *significant increase* in gastroenteritis hospitalisation rates between each quintile of NZDep2013 scores compared with the quintile below. Compared with European/Other, rates were *significantly lower* for Māori and Asian/Indian and *significantly higher* for Pacific and MELAA. The rate for the 0–4 year olds was *significantly higher* than those of older age groups **(Table 112)**.

Figure 152. Hospitalisations for gastroenteritis in 0–24 year olds, by age New Zealand 2010–2014



Numerator: National Minimum Dataset (acute and arranged admissions); Denominator: Statistics NZ Estimated Resident Population

Table 112. Hospitalisations for gastroenteritis in 0–24 year olds, by demographic factor, New Zealand 2010–2014

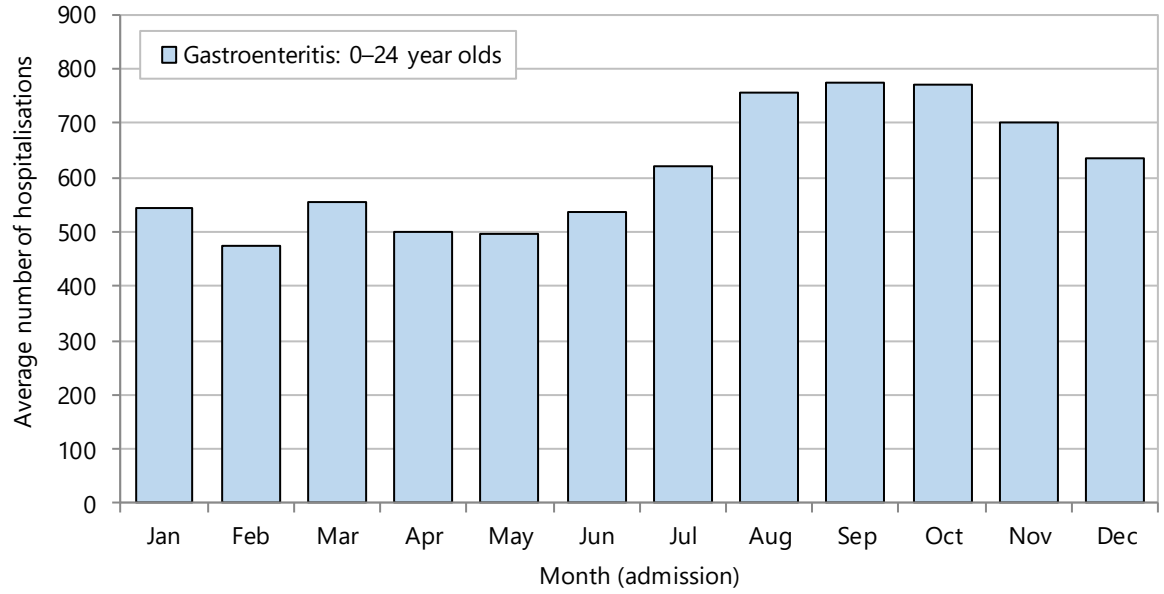
Variable	Number: 2010–2014	Rate per 1,000 0–24 year olds	Rate ratio	95% CI
Gastroenteritis in 0–24 year olds				
New Zealand				
NZ Deprivation Index quintile				
Deciles 1–2	4,807	3.43	1.00	
Deciles 3–4	5,364	4.04	1.18	1.13–1.22
Deciles 5–6	6,463	4.50	1.31	1.26–1.36
Deciles 7–8	8,379	5.17	1.51	1.46–1.56
Deciles 9–10	11,501	6.18	1.80	1.74–1.87
Prioritised ethnicity				
Māori	7,430	4.17	0.87	0.85–0.89
Pacific	4,400	6.28	1.31	1.27–1.35
Asian/Indian	4,148	4.42	0.92	0.89–0.95
MELAA	965	9.84	2.06	1.93–2.19
European/Other	19,771	4.79	1.00	
Gender				
Female	18,179	4.86	1.00	
Male	18,649	4.77	0.98	0.96–1.00
Age group (years)				
0–4	22,037	14.30	5.03	4.91–5.15
5–14	5,918	1.98	0.70	0.67–0.72
15–24	8,873	2.84	1.00	

Numerator: National Minimum Dataset (acute and arranged admissions); Denominator: Statistics NZ Estimated Resident Population; Rate ratios are unadjusted; Ethnicity is level 1 prioritised; Decile is NZDep2013

Distribution by month

There was seasonal variation in gastroenteritis hospitalisation rates. Between 2010 and 2014, rates were higher in late winter, spring and early summer **(Figure 153)**.

Figure 153. Average number of hospitalisations for gastroenteritis in 0–24 year olds, by month, New Zealand 2010–2014



Numerator: National Minimum Dataset (acute and arranged admissions); Number is annual average

Distribution by region

Between 2010 and 2014 hospitalisation rates for gastroenteritis in 0–24 year olds were *significantly higher* than the national rate in the Waitemata, Auckland, Counties Manukau, Bay of Plenty, Whanganui and Hutt Valley DHBs and *significantly lower* in the Taranaki, Hawke's Bay, MidCentral, and Capital & Coast DHBs and all the South Island DHBs except for Southern DHB. In the remaining district health boards there was *no significant difference* from the national rate **(Table 113**, **Figure 154)**.

In 2010–2014 hospitalisation rates for gastroenteritis in 0–14 year olds were *significantly higher* than the national rate in the Waitemata, Auckland, Counties Manukau, Bay of Plenty and Hutt Valley DHBs and *significantly lower* in the Northland, Lakes, Taranaki, Hawke's Bay, MidCentral, and Capital & Coast DHBs and all the South Island DHBs except for Southern DHB. In the remaining district health boards there was *no significant difference* from the national rate **(Table 114)**.

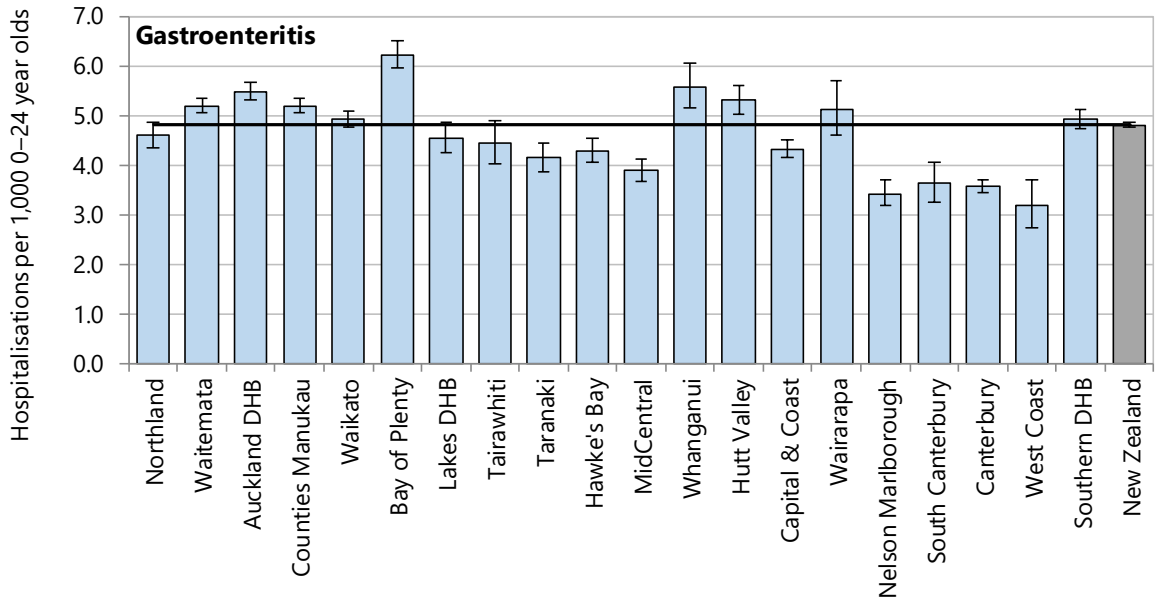
In 2010–2014 hospitalisation rates for gastroenteritis in 15–24 year olds were *significantly higher* than the national rate in the Northland, Waitemata, Bay of Plenty, Taranaki, Whanganui, Wairarapa and Southern DHBs and *significantly lower* in the Counties Manukau, Tairawhiti, Hutt Valley, Capital & Coast, Canterbury and West Coast DHBs. In the remaining district health boards there was *no significant difference* from the national rate **(Table 115)**.

Table 113. Hospitalisations for gastroenteritis in 0–24 year olds, by district health board, New Zealand 2010–2014

DHB	Number: 2010–2014	Number: annual average	Rate per 1,000 0–24 year olds	Rate ratio	95% CI
Gastroenteritis					
0–24 year olds					
Northland	1,278	256	4.60	0.96	0.90–1.01
Waitemata	4,916	983	5.20	1.08	1.05–1.11
Auckland	4,303	861	5.49	1.14	1.11–1.18
Counties Manukau	5,046	1,009	5.19	1.08	1.05–1.11
Waikato	3,343	669	4.93	1.02	0.99–1.06
Bay of Plenty	2,196	439	6.23	1.29	1.24–1.35
Lakes	838	168	4.55	0.94	0.88–1.01
Tairawhiti	402	80	4.45	0.93	0.84–1.02
Taranaki	782	156	4.15	0.86	0.80–0.93
Hawke's Bay	1,163	233	4.29	0.89	0.84–0.95
MidCentral	1,164	233	3.91	0.81	0.77–0.86
Whanganui	584	117	5.58	1.16	1.07–1.26
Hutt Valley	1,304	261	5.31	1.10	1.04–1.17
Capital & Coast	2,181	436	4.32	0.90	0.86–0.94
Wairarapa	338	68	5.14	1.07	0.96–1.19
Nelson Marlborough	720	144	3.43	0.71	0.66–0.77
South Canterbury	310	62	3.64	0.76	0.68–0.85
Canterbury	2,961	592	3.57	0.74	0.72–0.77
West Coast	159	32	3.19	0.66	0.57–0.77
Southern	2,544	509	4.93	1.02	0.98–1.06
New Zealand	36,828	7,366	4.81	1.00	

Numerator: National Minimum Dataset (acute and arranged admissions); Denominator: Statistics NZ Estimated Resident Population

Figure 154. Hospitalisations for gastroenteritis in 0–24 year olds, by district health board, New Zealand 2010–2014



Numerator: National Minimum Dataset (acute and arranged admissions); Denominator: Statistics NZ Estimated Resident Population

Table 114. Hospitalisations for gastroenteritis in 0–14 year olds, by district health board, New Zealand 2010–2014

DHB	Number: 2010–2014	Number: annual average	Rate per 1,000 0–14 year olds	Rate ratio	95% CI
Gastroenteritis					
0–14 year olds					
Northland	941	188	5.19	0.84	0.79–0.90
Waitemata	3,705	741	6.60	1.07	1.03–1.11
Auckland	3,275	655	7.94	1.29	1.24–1.33
Counties Manukau	4,064	813	6.84	1.11	1.07–1.15
Waikato	2,524	505	6.19	1.00	0.96–1.04
Bay of Plenty	1,728	346	7.61	1.23	1.18–1.29
Lakes	631	126	5.37	0.87	0.80–0.94
Tairawhiti	334	67	5.70	0.92	0.83–1.03
Taranaki	516	103	4.31	0.70	0.64–0.76
Hawke's Bay	905	181	5.22	0.85	0.79–0.90
MidCentral	813	163	4.74	0.77	0.72–0.82
Whanganui	440	88	6.72	1.09	0.99–1.20
Hutt Valley	1,119	224	7.41	1.20	1.13–1.27
Capital & Coast	1,583	317	5.78	0.94	0.89–0.99
Wairarapa	253	51	6.02	0.98	0.86–1.10
Nelson Marlborough	507	101	3.78	0.61	0.56–0.67
South Canterbury	222	44	4.20	0.68	0.60–0.78
Canterbury	2,343	469	4.95	0.80	0.77–0.84
West Coast	138	28	4.37	0.71	0.60–0.84
Southern	1,730	346	6.17	1.00	0.95–1.05
New Zealand	27,955	5,591	6.17	1.00	

Numerator: National Minimum Dataset (acute and arranged admissions); Denominator: Statistics NZ Estimated Resident Population

Table 115. Hospitalisations for gastroenteritis in 15–24 year olds, by district health board, New Zealand 2010–2014

DHB	Number: 2010–2014	Number: annual average	Rate per 1,000 15–24 year olds	Rate ratio	95% CI
Gastroenteritis					
15–24 year olds					
Northland	337	67	3.49	1.23	1.10–1.37
Waitemata	1,211	242	3.16	1.11	1.05–1.18
Auckland	1,028	206	2.77	0.98	0.91–1.04
Counties Manukau	982	196	2.60	0.91	0.86–0.98
Waikato	819	164	3.04	1.07	0.99–1.15
Bay of Plenty	468	94	3.73	1.31	1.20–1.44
Lakes	207	41	3.11	1.09	0.95–1.25
Tairawhiti	68	14	2.15	0.76	0.60–0.96
Taranaki	266	53	3.87	1.36	1.20–1.54
Hawke's Bay	258	52	2.64	0.93	0.82–1.05
MidCentral	351	70	2.78	0.98	0.88–1.09
Whanganui	144	29	3.67	1.29	1.10–1.52
Hutt Valley	185	37	1.96	0.69	0.59–0.80
Capital & Coast	598	120	2.59	0.91	0.84–0.99
Wairarapa	85	17	3.58	1.26	1.02–1.56
Nelson Marlborough	213	43	2.83	0.99	0.87–1.14
South Canterbury	88	18	2.73	0.96	0.78–1.18
Canterbury	618	124	1.74	0.61	0.56–0.66
West Coast	21	4	1.15	0.40	0.26–0.62
Southern	814	163	3.44	1.21	1.13–1.30
New Zealand	8,873	1,775	2.84	1.00	

Numerator: National Minimum Dataset (acute and arranged admissions); Denominator: Statistics NZ Estimated Resident Population

Northern region distribution and trends

In the Northern DHBs between 2010 and 2014, hospitalisations for gastroenteritis were *significantly higher* than the national rate in Waitemata, Auckland and Counties Manukau DHBs and *not significantly different* from the national rate in Northland **(Table 116)**.

Table 116. Hospitalisations for gastroenteritis in 0–24 year olds, Northern DHBs vs New Zealand 2010–2014

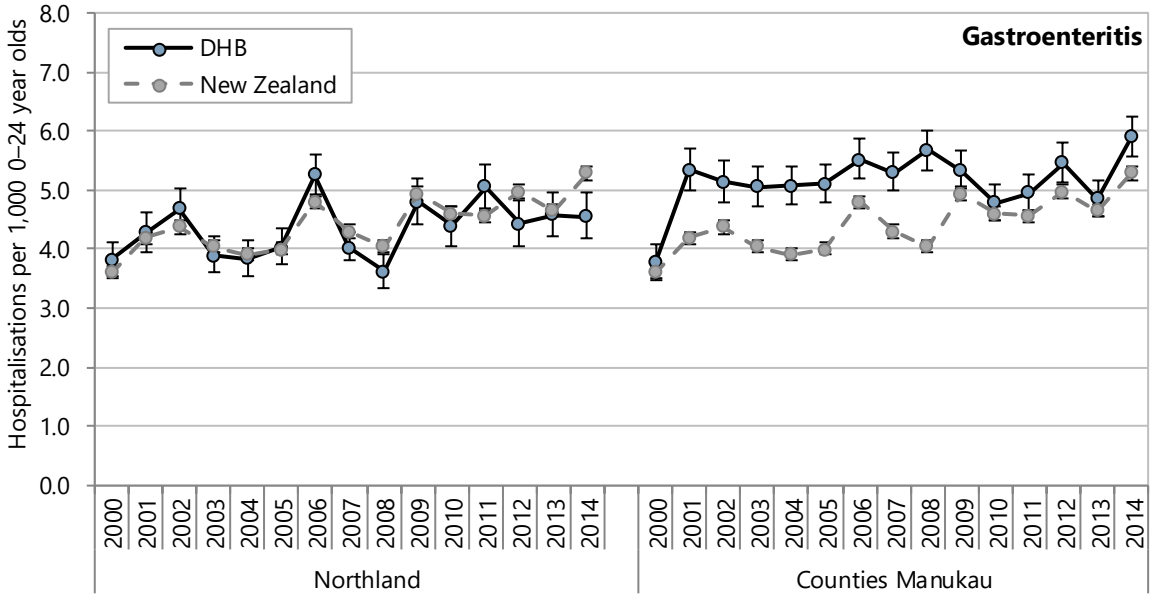
DHB	Number: 2010–2014	Number: annual average	Rate per 1,000 population	Rate ratio	95% CI
Gastroenteritis					
0–24 year olds					
Northland	1,278	256	4.60	0.96	0.90–1.01
Waitemata	4,916	983	5.20	1.08	1.05–1.11
Auckland	4,303	861	5.49	1.14	1.11–1.18
Counties Manukau	5,046	1,009	5.19	1.08	1.05–1.11
New Zealand	36,828	7,366	4.81	1.00	

Numerator: National Minimum Dataset (acute and arranged admissions); Denominator: Statistics NZ Estimated Resident Population

Regional trends

Hospitalisations for gastroenteritis in 0–24 year olds increased over the period 2000 to 2014 in all the Northern DHBs, in a similar manner to the national trend **(Figure 155, Figure 156)**. As in New Zealand as a whole, rates were higher in 0–14 year olds in all the Northern DHBs, and rates in both 0–14 year olds and 15–24 year olds rose over the period (**Figure 157, Figure 158**).

Figure 155. Hospitalisations for gastroenteritis in 0–24 year olds, Northland and Counties Manukau DHBs vs New Zealand 2000–2014

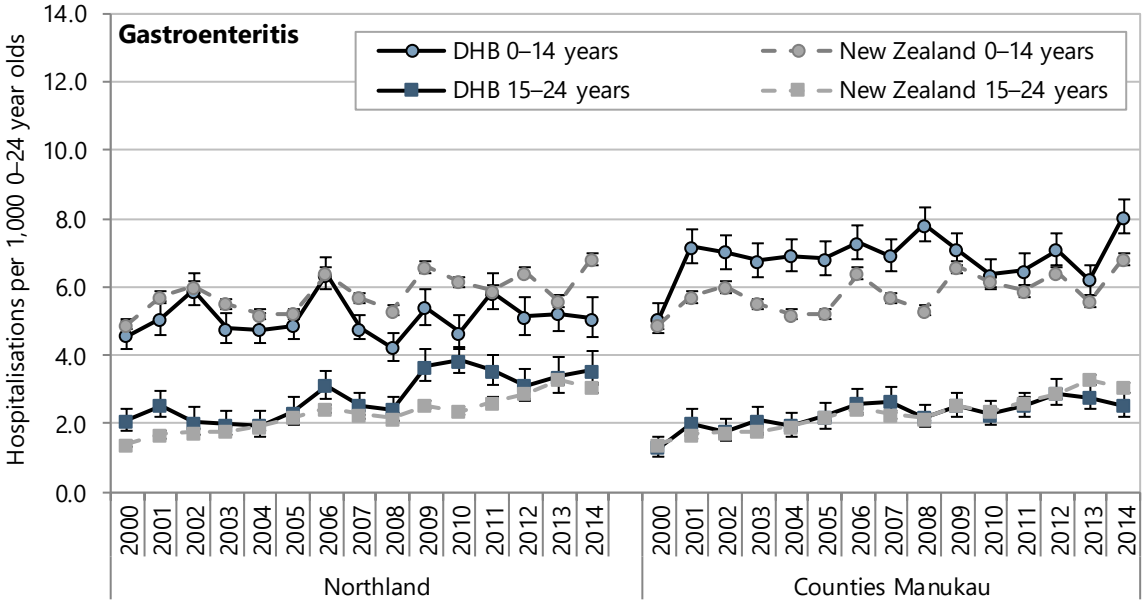


Numerator: National Minimum Dataset (acute and arranged admissions); Denominator: Statistics NZ Estimated Resident Population

Figure 156. Hospitalisations for gastroenteritis in 0–24 year olds, Waitemata and Auckland DHBs vs New Zealand 2000–2014

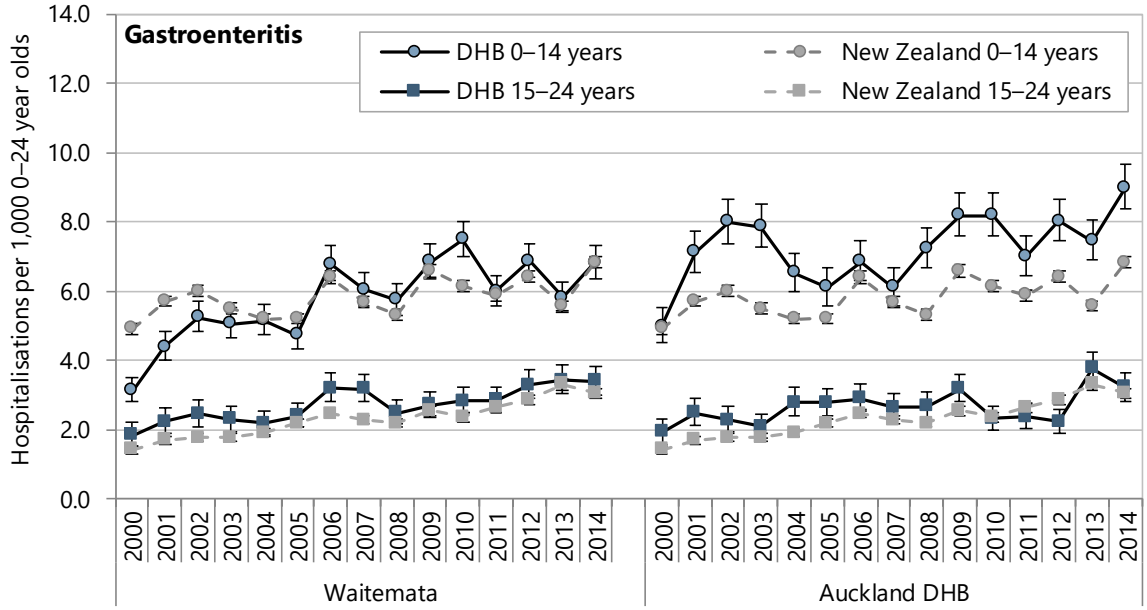
Numerator: National Minimum Dataset (acute and arranged admissions); Denominator: Statistics NZ Estimated Resident Population

Figure 157. Hospitalisations for gastroenteritis in 0–24 year olds, by age group, Northland and Counties Manukau DHBs vs New Zealand 2000–2014



Numerator: National Minimum Dataset (acute and arranged admissions); Denominator: Statistics NZ Estimated Resident Population

Figure 158. Hospitalisations for gastroenteritis in 0–24 year olds, by age group, Waitemata and Auckland DHBs vs New Zealand 2000–2014



Numerator: National Minimum Dataset (acute and arranged admissions); Denominator: Statistics NZ Estimated Resident Population

Evidence for good practice for the prevention and management of gastroenteritis

Ministry of Health publications
Ministry of Health. 2012. **Communicable Disease Control Manual 2012**. Wellington: Ministry of Health. http://www.health.govt.nz/publication/communicable-disease-control-manual-2012 This manual outlines the epidemiology and clinical features of gastroenteritis, with management advice for individual cases and for managing contacts. In early childhood services or other institutional situations it is important to ensure satisfactory facilities and practices regarding hand cleaning; nappy changing; toilet use and toilet training; preparation and handling of food; and cleaning of sleeping areas, toys and other surfaces. Complete case information must be entered into EpiSurv and the Ministry of Health Communicable Diseases Team notified if an outbreak occurs. If a food premise or commercial food source is thought to be involved then liaison with a local authority environmental health officer or with the Ministry for Primary Industries is required.
Ministry of Health. 2014. **Immunisation Handbook 2014**. Wellington: Ministry of Health. Since July 2014 rotavirus vaccine has been funded at ages 6 weeks, 3 and 5 months as part of the National Immunisation Schedule. The first dose must be given before age 15 weeks and the third dose must be given before age 8 months. The Immunisation Handbook provides information about the microbiology, clinical features and epidemiology of rotavirus infection in NZ as well as details of public health measures..
Ministry for Primary Industries publications
Ministry for Primary Industries. 2012. **Food safety at home**. Wellington: Ministry for Primary Industries. http://www.foodsmart.govt.nz/elibrary/consumer/food-safety-in-the-home.pdf A consumer-focused booklet detailing ways to avoid foodborne illness. Covers general measures and also specific advice regarding outdoor cooking (barbecue) and packed lunches. The Ministry for Primary Industries also has detailed information about food regulation and legislation safety and food handling advice for households on interactive websites http://www.foodsafety.govt.nz/ and http://www.foodsmart.govt.nz/
New Zealand guidelines
Ministry of Health. 2015. **Guidelines for Drinking Water Quality Management for New Zealand 2015**. Wellington: Ministry of Health. http://www.health.govt.nz/system/files/documents/publications/guidelines-drinking-water-quality-management-for-new-zealand-2015-oct15.pdf The guidelines provide information about tools the Ministry of Health uses to promote provision of drinking water that is safe to drink and protects the public from pathogenic micro-organisms and toxic chemicals. There have been a number of waterborne gastroenteritis outbreaks in New Zealand including several involving school children. Contaminated drinking water also contributes to the endemic and sporadic enteric disease burden. The Guidelines bring together legislative and regulatory requirements, guidance and good management principles for community drinking-water supplies and technical data to assist drinking-water providers, especially in small communities, to comply with the standards.
International Guidelines
National Institute for Health and Care Excellence. 2015. **Diarrhoea and vomiting in children overview.** http://pathways.nice.org.uk/pathways/diarrhoea-and-vomiting-in-children# accessed 12 November 2015. This overview brings together information about the 'red flag' symptoms and signs of clinical dehydration and shock as well as key steps in the diagnosis and management of gastroenteritis and advise for parents and carers. It is presented as an interactive webpage and also available as a downloaded pdf file. There is a link to a detailed flow chart with guidance on fluid and nutritional management in children with diarrhoea and vomiting. http://pathways.nice.org.uk/pathways/diarrhoea-and-vomiting-in-children#path=view%3A/pathways/diarrhoea-and-vomiting-in-children/fluid-and-nutritional-management-in-children-with-diarrhoea-and-vomiting.xml&content=view-index
Evidence-Based Medicine Reviews
Fedorowicz Z, et al. 2011. **Antiemetics for reducing vomiting related to acute gastroenteritis in children and adolescents.** Cochrane Database of Systematic Reviews doi:10.1002/14651858.CD005506.pub5 http://onlinelibrary.wiley.com/doi/10.1002/14651858.CD005506.pub5/abstract accessed 12 November 2015 This is a systematic review of seven trials involving 1,020 children and adolescent aged five months to 12 years who presented with vomiting and had a confirmed clinical diagnosis of gastroenteritis. All seven trials were randomized, double blind, and placebo-controlled. Six of the trials were conducted in emergency departments of children's hospitals and one enrolled children from six paediatric practices. Although all seven studies were classified as either 'unclear' or 'high' risk of bias, the authors consider that the body of evidence is sufficient to allow certain conclusions to be drawn about the effectiveness of the interventions used in the treatment of vomiting related to acute gastroenteritis in children and adolescents. Ondansetron given as a single dose (0.1 mg/kg orally, or intravenously) to children with mild to moderate dehydration in the emergency department appears to decrease the number of children who have persistent vomiting as a barrier to oral rehydration therapy (ORT) and decreases the number of children requiring intravenous

rehydration and hospital admission. It may not reduce the chance of a revisit or admission after departure from the emergency department. Oral ondansetron may be useful alongside ORT in the outpatient or home-care setting.

Soares-Weiser K, et al. 2012. **Vaccines for preventing rotavirus diarrhoea: vaccines in use.** Cochrane Database of Systematic Reviews doi:10.1002/14651858.CD008521.pub3 http://onlinelibrary.wiley.com/doi/10.1002/14651858.CD008521.pub3/abstract accessed 12 November 2015

A systematic review of 41 randomised controlled trials (RCTs) in children comparing rotavirus vaccines approved for use with placebo, no intervention, or another vaccine. Twenty-nine trials (101,671 participants) assessed RV1, and 12 trials (84,592 participants) evaluated RV5 which is the vaccine funded in NZ. In countries with low-mortality rates, RV5 probably prevents 87% of severe rotavirus diarrhoea cases in children aged up to one year (RR 0.13, 95% CI 0.04 to 0.45; 2344 participants, three trials; moderate-quality evidence), and may prevent 72% of severe all-cause diarrhoea cases (RR 0.28, 95% CI 0.16 to 0.48; 1029 participants, one trial; low-quality evidence). Three trials reported on severe rotavirus diarrhoea cases in children aged up to two years and found that RV5 probably prevents 82% (RR 0.18, 95% CI 0.07 to 0.50; 3190 participants, three trials; moderate-quality evidence), and may prevent 96% of severe all-cause diarrhoea cases (RR 0.04, 95% CI 0.00 to 0.70; 1029 participants, one trial; low-quality evidence). The trials were not powered to detect death as an end point. Serious adverse events were reported in 1884 out of 78,226 children (2.4%) vaccinated with RV5 with 34 cases of intussusception reported in 81,459 children after RV5 vaccination. No significant difference was found between children receiving RV1 or RV5 and placebo in the number of serious adverse events, and intussusception in particular.

Pammi M & Haque Khalid N. 2011. **Oral immunoglobulin for the prevention of rotavirus infection in low birth weight infants.** Cochrane Database of Systematic Reviews doi:10.1002/14651858.CD003740.pub2 http://onlinelibrary.wiley.com/doi/10.1002/14651858.CD003740.pub2/abstract accessed 12 November 2015

Rotavirus infection can occur and spread in a neonatal unit and oral administration of anti-rotaviral immunoglobulin preparations is a possible way to prevent rotaviral infections especially in low birth weight babies. A search of the literature found only one published study addressing the effectiveness and safety of oral immunoglobulin preparations for the prevention of rotavirus infection in hospitalized low birthweight infants (birthweight < 2500 g), and found no significant difference in the rates of rotavirus infection after oral gammaglobulin versus placebo in hospitalized low birthweight babies [RR 1.27 (95% CI 0.65 to 2.37). In the subset of infants in the study who became infected with rotavirus there was no significant difference in the duration of rotavirus excretion between the group who had gammaglobulin (mean 2 days, range 1 to 4 days) and the group who had placebo (mean 3 days, range 1 to 6 days). Therefore current evidence does not support the use of oral immunoglobulin preparations to prevent rotavirus infection in low birthweight infants and more research is needed.

Websites

Kidshealth. 2015. **Viral gastroenteritis**. http://kidshealth.org.nz/viral-gastroenteritis-gastro accessed 4 November 2015.

Kidshealth provides accurate and reliable information about children's health for NZ parents, caregivers, family and whānau. Key points in relation to gastroenteritis include the importance of maintaining fluid intake by offering small amounts of fluid often, and taking children to the doctor if they become dehydrated or if aged less than six months. The page provides specific information about care at home and preventing spread of illness. There are links to the Ministry of Health information about rotavirus vaccination which is free for babies aged up to 15 weeks https://www.healthed.govt.nz/resource/immunise-against-rotavirus-protect-your-child and also to Ministry of Health leaflets about specific bacterial causes of gastroenteritis: https://www.healthed.govt.nz/resource/campylobacter https://www.healthed.govt.nz/resource/giardia and https://www.healthed.govt.nz/resource/cryptosporidium

Ministry of Health. 2015. **Rotavirus**. http://www.health.govt.nz/your-health/conditions-and-treatments/diseases-and-illnesses/rotavirus accessed 4 November 2015.

This webpage provides consumer information about the symptoms, treatment and prevention of rotavirus and includes a link to the Ministry of Health information about rotavirus vaccination https://www.healthed.govt.nz/resource/immunise-against-rotavirus-protect-your-child

Ministry of Health. 2012. **Drinking-water DVD series.** http://www.health.govt.nz/publication/drinking-water-dvd-series accessed 12 November 2015.

A series of five DVDs owned by the Ministry of Health and licensed for reuse under a Creative Commons Licence which are intended for users of small drinking-water supplies (and also suitable for Pacific Island countries) to support drinking-water quality improvement.

UNINTENTIONAL INJURIES

Introduction

Injury is a leading cause of death in New Zealand among children and young people and unintentional injury is the largest contributor.[94] There are two common causes of unintentional injury deaths in this age group. The rate of suffocation is relatively high among infants under 12 months of age and the rate for road traffic injury is high among those aged 15–24 years. Drowning rates are the next most common cause of death for all age groups. The Statistics NZ data for 2000 to 2013 indicate that the rate of traffic crash deaths has fallen over the last decade, and the rate for injury, as Crash Analysis System (CAS) records of injury, has been falling since 2007.[95] Further analysis shows that while the fatality rates for 0–14 year olds have remained relatively low, high rates continue to be seen among those aged 15–24 years. Since 2009 there has been a decrease in the rate of sudden unexpected death in infancy (SUDI) to which the rate of suffocation contributes.[18]

There are effective interventions for both these causes of injury death and data are showing a reduction in the rates for both. Other causes of injury death also have effective interventions and what is needed is consistent and ongoing implementation. Evidence of this is seen in New Zealand with proper implementation of regulations and strategies for road safety being effective in reducing the road toll:[96] for example, speed limits, the Graduated Drivers Licence, child restraint use, alcohol limits, median strips, and the changes that have been made in the construction of cars.

Injury death is recognised internationally as a leading cause of death for those aged under 25 years, but it is not the only serious outcome as a result of injury.[97,98] Increasingly attention is being paid to the well-recognised long term impact of the physical, cognitive and behavioural problems that can arise with serious injury, for example, traumatic head injury.[99] Traumatic head injury, is often associated with road traffic crashes and it has implications for the individual and their whānau as well as for health and other services. Injury such as burns and near drowning can also result in high personal and resource costs.

Internationally concern is expressed regarding the lack of sustained, strategically-planned action to reduce injury at the country level, and the lack of focus on unintentional injury globally, particularly when injury has been implicated as the leading cause of inequalities for children in the EU.[100] Prevention is important because injury can have long term effects for individuals, whānau, and health and community services. Children and young people have been injured needlessly because effective interventions have not been implemented.

The following sections review the main causes of injury for 0–24 year olds using data from the National Minimum Dataset and the National Mortality Collection. The section concludes with a brief overview of local policy documents and evidence-based reviews which consider the prevention of injuries at the population level.

Data sources and methods

Indicators

Deaths of 0–24 year olds from unintentional injury
Hospitalisations of 0–24 year olds for unintentional injury

Data sources

Numerators:
Deaths: National Mortality Collection
Hospitalisations: National Minimum Dataset
Denominator: Statistics NZ Estimated Resident Population (with linear extrapolation being used to calculate denominators between Census years)

Definition

Death of 0–24 year olds where the main underlying cause of death was an unintentional injury
Hospitalisation of 0–24 year olds with a primary diagnosis of injury (excluding cases involving intentional injury, complications of drugs/medical/surgical care and late sequelae of injury or where there was an Emergency Medicine Specialty code on discharge). Refer to **Appendix 6** for the codes included.

Notes on interpretation

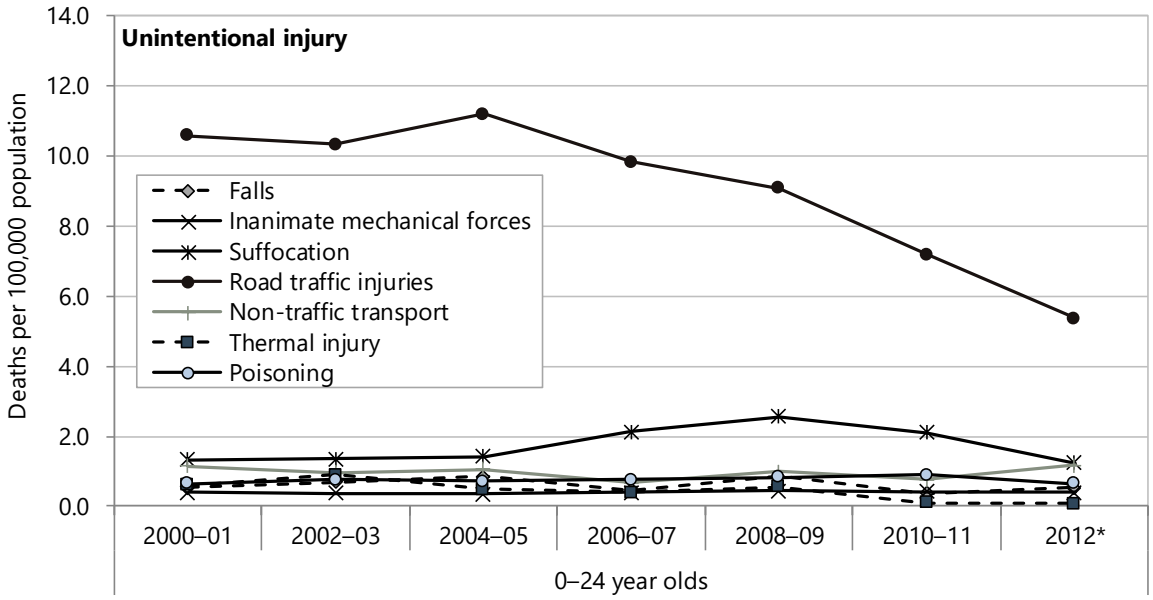
Appendix 3 describes the National Minimum Dataset and outlines the limitations of the data utilised from this collection. Please read this appendix before interpreting any trends.

National trends and distribution

Unintentional injury deaths fell consistently from 2008 to 2012. **Figure 159** shows the main causes of injury death for 0–24 year olds which indicates the reduction is predominantly as a result of a fall in the rate of road traffic injury which began in 2006–07. The suffocation rate (most evident in under 1 year olds) rose from 2004–

05 to 2008–09 before falling again. (Suffocation occurred most commonly in bed and these events are included in Sudden Unexpected Death in Infancy (SUDI) (see **page 63**).

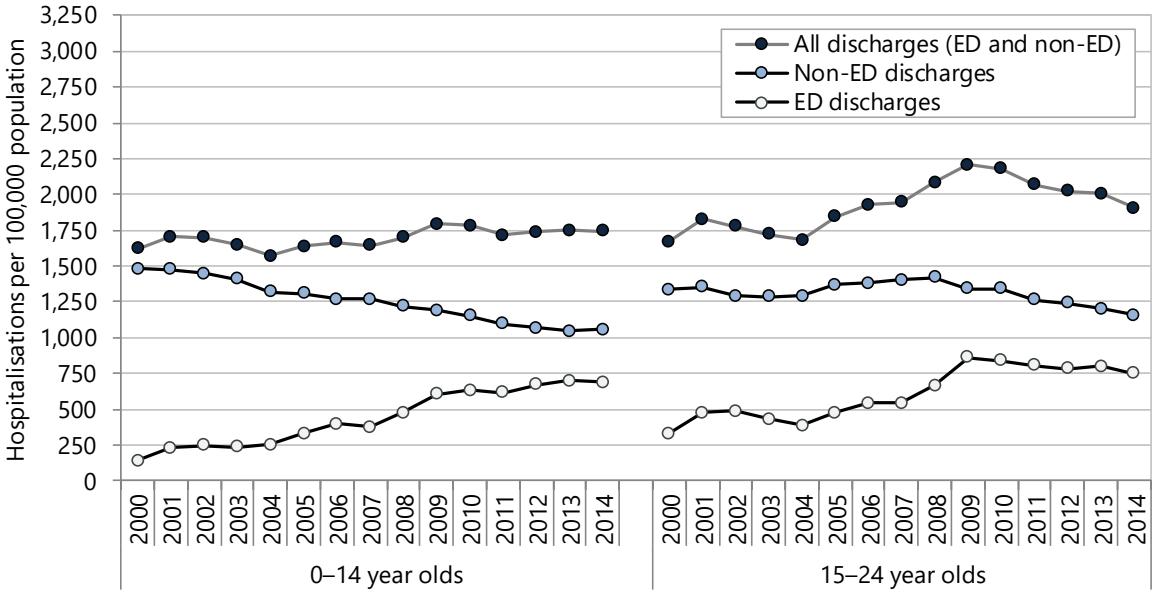
Figure 159. Deaths due to injuries in 0–24 year olds, by age group, year of discharge, and injury type, New Zealand, 2000–2012



Numerator: National Mortality Collection; Denominator: Statistics NZ Estimated Resident Population

From 2000 to 2014 the hospitalisation rate (excluding emergency department or ED discharges) for unintentional injury among 0–14 year olds fell steadily. For 15–24 year olds the rate remained stable in 2000–2008 and then fell **(Figure 160)**. The ED only discharges rose over time for 0–14 year olds, but from 2009, the rate of ED only discharges fell for 15–24 year olds.

Figure 160. Hospitalisations from injuries in 0–24 year olds, by age group, year of discharge, and discharge type



Numerator: National Minimum Dataset (acute and arranged admissions); Denominator: Statistics NZ Estimated Resident Population

Distribution by cause

From 2008 to 2012 there were 373 deaths of 0–14 year olds and 773 deaths of 15–24 year olds from unintentional injury; a total of 1,146 deaths. Among those aged 0–14 years, 40.2% were from suffocation (predominantly aged under 1 year), 22.0% from road traffic injuries (RTI), 12.3% from drowning and 10.7%

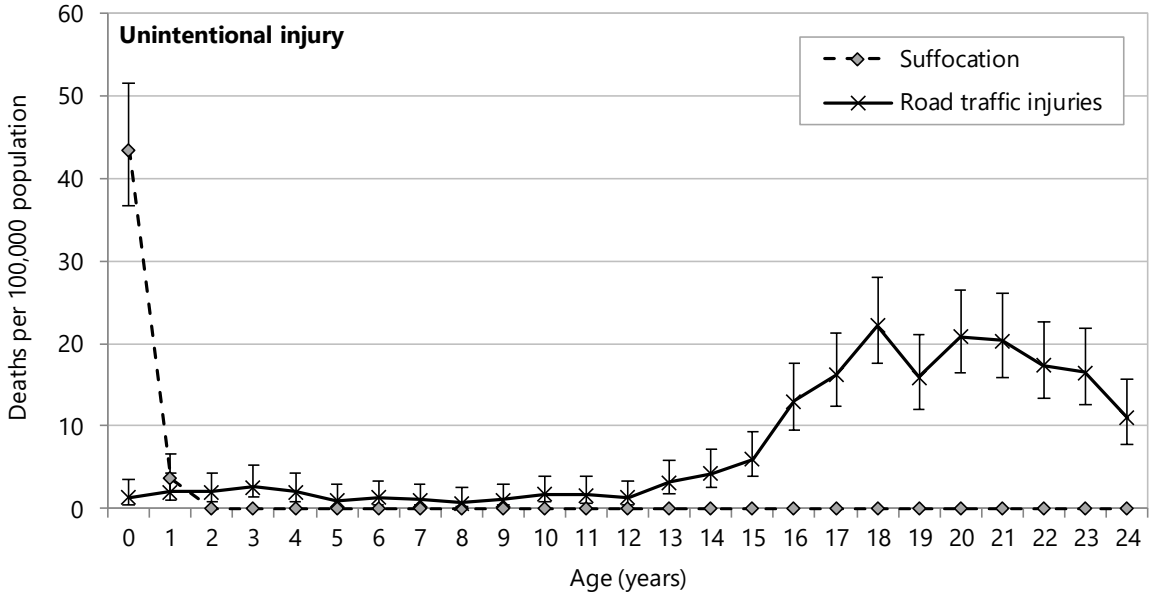
from non-traffic transport events. Among 15–24 year olds 63.8% were from RTI with 6.9% from poisoning and 6.5% from drowning **(Table 117**, **Figure 161)**.

Table 117. Deaths due to unintentional injuries in 0–24 year olds, by age group and cause of injury, New Zealand, 2008–2012

Deaths by cause of unintentional injury	Number: 2008–2012	Number: annual average	Rate per 100,000 population	95% CI	Per cent
New Zealand					
0–14 year olds					
Suffocation	150	30	3.33	2.84–3.91	40.2
Road traffic crashes	82	16	1.82	1.47–2.26	22.0
Drowning or submersion	46	9	1.02	0.77–1.36	12.3
Non-traffic transport accidents	40	8	0.89	0.65–1.21	10.7
Inanimate mechanical forces	14	3	0.31	0.19–0.52	3.8
Thermal	11	2	0.24	0.14–0.44	2.9
Poisoning	9	2	0.20	0.11–0.38	2.4
Falls	7	1	0.16	0.08–0.32	1.9
Animate mechanical forces	<5	s	s	s	s
Other or unspecified land transport	<5	s	s	s	s
Other transport	<5	s	s	s	s
Other causes	8	2	0.18	0.09–0.35	2.1
Undetermined intent	0	s	s	s	s
Total	373	75	8.29	7.49–9.17	100.0
15–24 year olds					
Road traffic crashes	493	99	15.96	14.6–17.4	63.8
Poisoning	53	11	1.72	1.31–2.24	6.9
Drowning or submersion	50	10	1.62	1.23–2.13	6.5
Falls	38	8	1.23	0.90–1.69	4.9
Non-traffic transport accidents	31	6	1.00	0.71–1.42	4.0
Other transport	23	5	0.74	0.50–1.12	3.0
Inanimate mechanical forces	18	4	0.58	0.37–0.92	2.3
Suffocation	10	2	0.32	0.18–0.60	1.3
Thermal	10	2	0.32	0.18–0.60	1.3
Animate mechanical forces	<5	s	s	s	s
Other or unspecified land transport	<5	s	s	s	s
Other causes	42	8	1.36	1.01–1.84	5.4
Undetermined intent	0	..	..	..	..
Total	773	155	25.03	23.32–26.86	100.0

Numerator: National Mortality Collection; Denominator: Statistics NZ Estimated Resident Population

Figure 161. Deaths from selected unintentional injuries in 0–24 year olds, by age and injury type, New Zealand 2008–2012



Numerator: National Mortality Collection; Denominator: Statistics NZ Estimated Resident Population

Between 2010 and 2014, 45.1% of unintentional injury hospitalisations for 0–14 year olds were from falls and 23.5% were from inanimate mechanical forces **(Table 118)**. For the 15–24 year olds, inanimate mechanical forces and falls comprised 26.6% and 25.6% respectively of the hospitalisations for injury **(Table 119)**. More detailed discussion of hospitalisation data for specific types of injury follows later in this section.

Table 118. Hospitalisations from unintentional injuries in 0–14 year olds, by external cause of injury, New Zealand 2010–2014

Hospitalisations by main external cause of unintentional injury	Number: 2010–2014	Number: annual average	Rate per 100,000 population	95% CI	Per cent
New Zealand					
0–14 year olds					
Falls	22,130	4,426	488.60	482.22–495.07	45.1
Inanimate mechanical forces	11,560	2,312	255.23	250.63–259.92	23.5
Animate mechanical forces	2,949	590	65.11	62.80–67.50	6.0
Non-traffic transport accidents	2,393	479	52.83	50.76–54.99	4.9
Road traffic crashes	2,111	422	46.61	44.66–48.64	4.3
Other or unspecified land transport	711	142	15.70	14.59–16.89	1.4
Other transport	63	13	1.39	1.09–1.78	0.1
Thermal	1,965	393	43.38	41.51–45.35	4.0
Poisoning	1,792	358	39.57	37.78–41.44	3.6
Suffocation	441	88	9.74	8.87–10.69	0.9
Drowning or submersion	172	34	3.80	3.27–4.41	0.4
Other causes	2,563	513	56.59	54.44–58.82	5.2
Undetermined intent	253	51	5.59	4.94–6.32	0.5
Total	49,103	9,821	1,084.13	1,074.64–1,093.71	100.0

Numerator: National Minimum Dataset (acute and arranged admissions); Denominator: Statistics NZ Estimated Resident Population

Table 119. Hospitalisations from unintentional injuries in 15–24 year olds, by external cause of injury, New Zealand 2010–2014

Hospitalisations by main external cause of unintentional injury	Number: 2010–2014	Number: annual average	Rate per 100,000 population	95% CI	Per cent
New Zealand					
15–24 year olds					
Inanimate mechanical forces	10,299	2,060	330.00	323.70–336.43	26.6
Falls	9,913	1,983	317.63	311.45–323.94	25.6
Road traffic crash	5,801	1,160	185.88	181.16–190.72	15.0
Animate mechanical forces	3,360	672	107.66	104.08–111.36	8.7
Non-traffic transport incidents	2,710	542	86.83	83.63–90.16	7.0
Other or unspecified land transport	736	147	23.58	21.94–25.35	1.9
Other transport	164	33	5.25	4.51–6.12	0.4
Thermal	759	152	24.32	22.65–26.11	2.0
Poisoning	504	101	16.15	14.80–17.62	1.3
Suffocation	56	11	1.79	1.38–2.33	0.1
Drowning or submersion	35	7	1.12	0.81–1.56	0.1
Other causes	3,705	741	118.72	114.96–122.60	9.6
Undetermined intent	677	135	21.69	20.12–23.39	1.7
Total	38,719	7,744	1,240.64	1,228.42–1,252.98	100.0

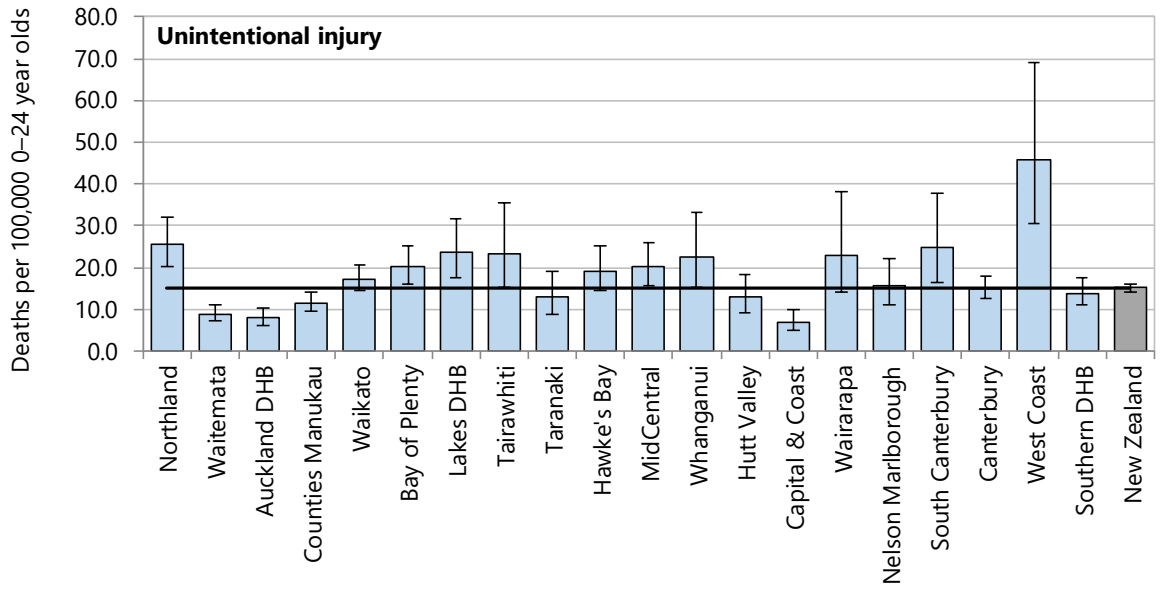
Numerator: National Minimum Dataset (acute and arranged admissions); Denominator: Statistics NZ Estimated Resident Population

Distribution by region

From 2008 to 2012 deaths due to unintentional injury were *significantly higher* than the overall national rate in Northland, Bay of Plenty, Lakes, MidCentral, South Canterbury and West Coast while rates in Waitemata, Auckland, Counties Manukau, and Capital & Coast DHBs were *significantly lower* than the national rate. In the remaining DHBs there was *no significant difference* from the national rate **(Figure 162)**.

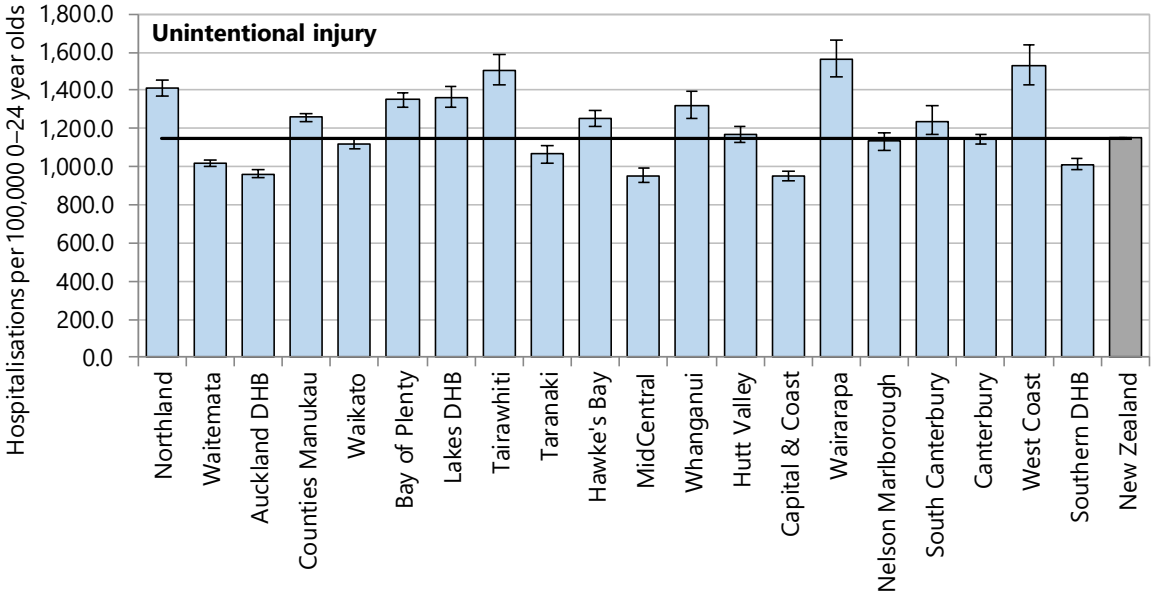
From 2010 to 2014 injury hospitalisation rates in Northland, Counties Manukau, Bay of Plenty, Lakes, Tairawhiti, Hawke's Bay, Whanganui, Wairarapa, South Canterbury, and West Coast were *significantly higher* than the national rate. Rates for Waitemata, Auckland, Taranaki, MidCentral, Capital & Coast, and Southern DHBs were *significantly lower* than the overall national rate. In the remaining DHBs there was *no significant difference* from the national rate **(Figure 163)**.

Figure 162. Deaths due to unintentional injuries in 0–24 year olds, by district health board, New Zealand 2008–2012



Numerator: National Mortality Collection; Denominator: Statistics NZ Estimated Resident Population

Figure 163. Hospitalisations for unintentional injuries in 0–24 year olds, by district health board, New Zealand 2010–2014

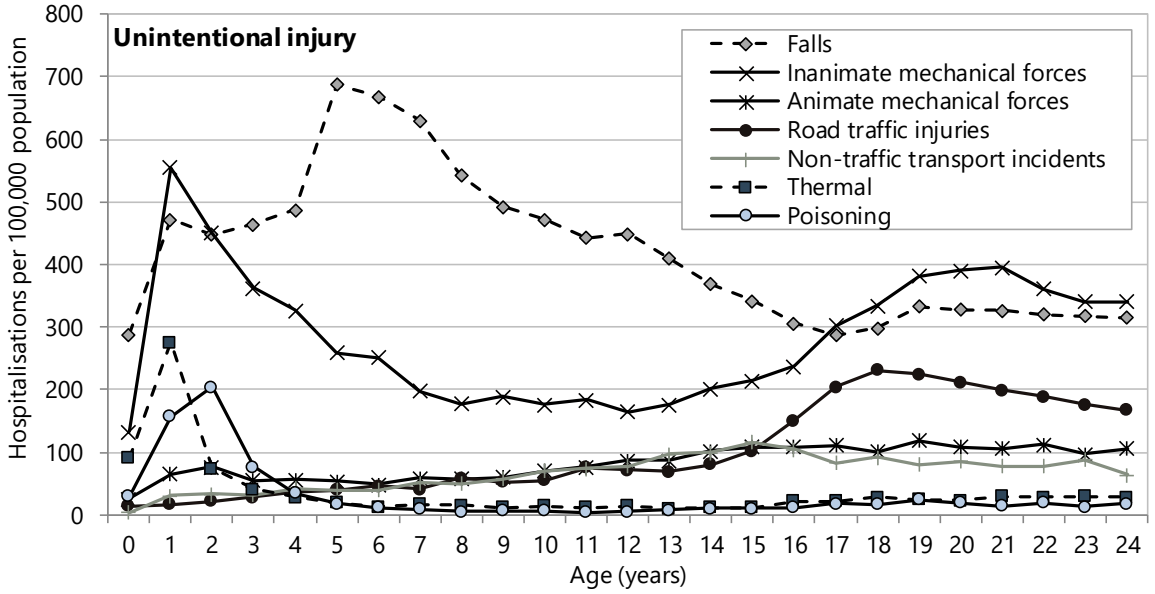


Numerator: National Minimum Dataset (acute and arranged admissions; excludes ED cases); Denominator: Statistics NZ Estimated Resident Population

Distribution by demographic factors

Certain causes of unintentional injury have noticeable age distributions. Injury hospitalisation rates for falls, inanimate mechanical forces (which includes struck against or by, caught between, contact with sharp items, machinery), thermal, and poisoning peak around ages 1 to 2 years. Inanimate mechanical forces, road traffic crashes, and falls are the most common causes of injury among those older than 15 years. Both non-traffic land transport and animate mechanical forces injury hospitalisation rates gradually increase with increasing age from about 4 years **(Figure 164)**.

Figure 164. Hospitalisations from selected unintentional injuries in 0–24 year olds, by age and injury type, New Zealand 2010–2014



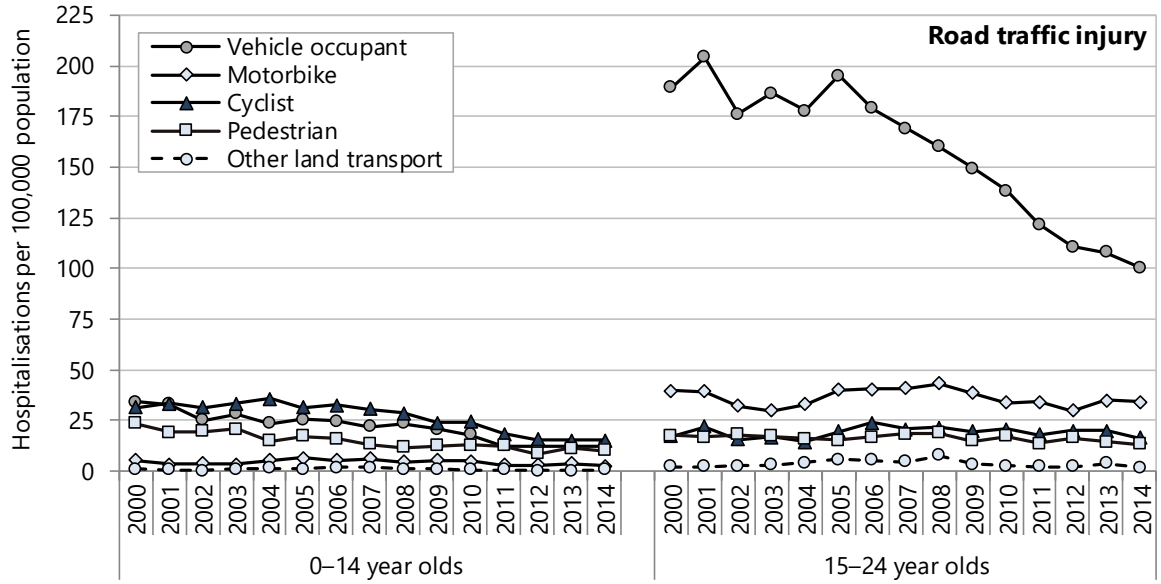
Numerator: National Minimum Dataset (acute and arranged admissions; excludes ED cases); Denominator: Statistics NZ Estimated Resident Population

Road traffic injury

Death rates from road traffic injuries rates fell steeply from 10.59 deaths per 100,000 0–24 year olds in 2000–01 to 5.36 in 2012 and most of this fall has occurred since 2004 **(Figure 159)**. Between 2008 and 2012 there were 82 deaths of 0–14 year olds and 493 deaths of 15–24 year olds as a result of road traffic injury (RTI). In both 0–14 and 15–24 age groups the deceased was most commonly a vehicle occupant or a pedestrian. For 15–24 year olds motorbike injury deaths were equal to pedestrian deaths **(Table 117).**

From 2000 to 2014 hospitalisation rates for RTI fell and this was mainly attributable to a steep fall in hospitalisation rates of 15–24 year olds as a vehicle occupant in a road traffic crash, although over the whole time period hospitalisation rates were consistently highest for this type of RTI in this age group. Hospitalisation rates for pedestrian injury also fell for 15–24 year olds, whereas rates for motorbike and pedestrian injury were more variable. For 0–14 year olds there was a slight steady fall in all types of RTI hospitalisations as a vehicle occupant, cyclist, pedestrian or on a motorbike. In this age group hospitalisation rates for cyclist RTI were consistently higher than for other types of RTI **(Figure 165)**.

Figure 165. Hospitalisations from road traffic injuries in 0–24 year olds, by age group, year of discharge, and RTI type, New Zealand 2000–2014



Numerator: National Minimum Dataset (acute and arranged admissions; excludes ED cases); Denominator: Statistics NZ Estimated Resident Population

Distribution by cause

There were 2,111 hospitalisations of 0–14 year olds and 5,801 hospitalisations of 15–24 year olds for RTI between 2010 and 2014. The most common types of RTI hospitalisation for 0–14 year olds were as cyclists, vehicle occupants and pedestrian. The most common types of RTI for 15–24 year olds were as vehicle occupant, motorbike, and cyclist **(Table 120)**.

Table 120. Hospitalisations from road traffic injuries in 0–24 year olds, by age group, New Zealand 2010–2014

Cause of injury: road traffic crashes	Number: 2010–2014	Number: annual average	Rate per 100,000 population	95% CI	Per cent
New Zealand					
0–14 year olds					
Vehicle occupant	619	124	13.67	12.63–14.79	29.3
Motorbike	160	32	3.53	3.03–4.12	7.6
Cyclist	805	161	17.77	16.59–19.04	38.1
Pedestrian	504	101	11.13	10.20–12.14	23.9
Other land transport	23	5	0.51	0.34–0.76	1.1
Total	2,111	422	46.61	44.66–48.64	100.0
15–24 year olds					
Vehicle occupant	3,615	723	115.83	112.12–119.67	62.3
Motorbike	1,044	209	33.45	31.48–35.54	18.0
Cyclist	597	119	19.13	17.66–20.73	10.3
Pedestrian	469	94	15.03	13.73–16.45	8.1
Other land transport	76	15	2.44	1.95–3.05	1.3
Total	5,801	1,160	185.88	181.16–190.72	100.0

Numerator: National Minimum Dataset (acute and arranged admissions; excludes ED cases); Denominator: Statistics NZ Estimated Resident Population

Distribution by demographic factors

The patterns of RTI hospitalisation varied by age group **(Figure 166)**. Hospitalisation rates as a result of vehicle occupant injury were highest at ages 15–19 (115.2 per 100,000 age-specific population) and 20–24 years (116.5) where rates for 0–4 years was 10.7. Across the age groups, motorbike injury rates were highest at age 20–24 years (39.4); cyclist injuries were highest at age 10–14 years although within age groups, cycling injuries were also the highest RTI for 5–9 years. Pedestrian was the highest cause of RTI for 0–4 year olds **(Table 121)**.

Table 121. Hospitalisations from road traffic crash injuries in 0–24 year olds, by 5-year age group, New Zealand 2010–2014

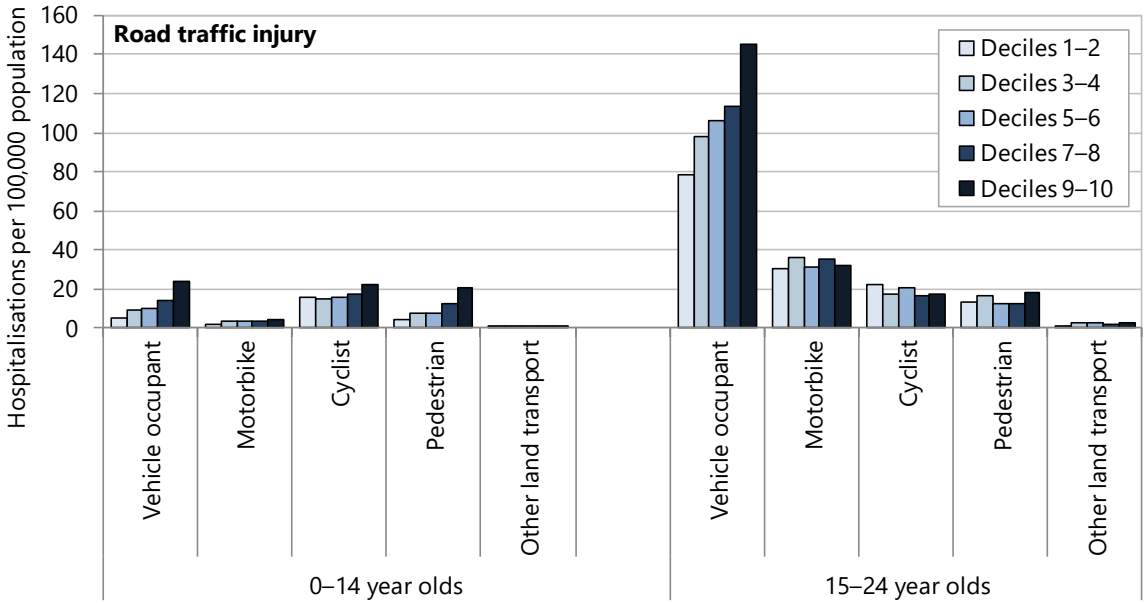
Cause of injury: road traffic crashes	Number: 2010–2014	Number: annual average	Rate per 100,000 population	95% CI	Per cent
New Zealand					
0–4 year olds					
Vehicle occupant	165	33	10.71	9.19–12.47	46.5
Motorbike	7	1	0.45	0.22–0.94	2.0
Cyclist	53	11	3.44	2.63–4.50	14.9
Pedestrian	126	25	8.18	6.87–9.73	35.5
Other land transport	<5	s	s	s	s
Total	355	71	23.03	20.76–25.56	100.0
5–9 year olds					
Vehicle occupant	204	41	13.65	11.90–15.66	28.9
Motorbike	36	7	2.41	1.74–3.33	5.1
Cyclist	273	55	18.27	16.22–20.57	38.7
Pedestrian	190	38	12.71	11.03–14.65	27.0
Other land transport	<5	s	s	s	s
Total	705	141	47.17	43.82–50.79	100.0
10–14 year olds					
Vehicle occupant	250	50	16.74	14.79–18.95	23.8
Motorbike	117	23	7.83	6.54–9.39	11.1
Cyclist	479	96	32.07	29.32–35.07	45.6
Pedestrian	188	38	12.59	10.91–14.52	17.9
Other land transport	17	3	1.14	0.71–1.82	1.6
Total	1,051	210	70.37	66.24–74.75	100.0
15–19 year olds					
Vehicle occupant	1,801	360	115.21	110.01–120.65	63.1
Motorbike	430	86	27.51	25.03–30.23	15.1
Cyclist	349	70	22.33	20.10–24.79	12.2
Pedestrian	242	48	15.48	13.65–17.56	8.5
Other land transport	34	7	2.17	1.56–3.04	1.2
Total	2,856	571	182.70	176.12–189.52	100.0
20–24 year olds					
Vehicle occupant	1,814	363	116.46	111.22–121.94	61.6
Motorbike	614	123	39.42	36.42–42.66	20.8
Cyclist	248	50	15.92	14.06–18.03	8.4
Pedestrian	227	45	14.57	12.80–16.60	7.7
Other land transport	42	8	2.70	1.99–3.64	1.4
Total	2,945	589	189.07	182.37–196.01	100.0

Numerator: National Minimum Dataset (acute and arranged admissions; excludes ED cases); Denominator: Statistics NZ Estimated Resident Population

Between 2010 and 2014 disparities in RTI hospitalisation rates by NZDep2013 score, ethnicity and gender varied according to the type of RTI. The strongest social gradients were seen in vehicle occupant injuries in 0–14 and 15–24 year olds where hospitalisation rates were *significantly higher* for areas with higher deprivation index scores (NZDep2013 deciles 3–10) compared with low deprivation score areas (deciles 1–2) **(Table 122)**. Although numbers were small, motorbike injury hospitalisation rates were *significantly higher* for 0–14 year olds in areas with the highest deprivation scores (deciles 9–10) compared with lower scoring areas (deciles 1–8) but there was *no significant difference* by NZDep2013 scores for motorbike injury in 15–24 year olds **(Table 123)**. Cycle injury hospitalisation rates for 0–14 year olds were in *significantly higher* in NZDep2013 deciles 9–10 compared with deciles 1–2, but in 0–24 year olds the gradient reversed with *significantly lower* rates in NZDep2013 deciles 7–10 compared with deciles 1–2 **(Table 124)**. Hospitalisation rates for 0–14 year old pedestrian injury were *significantly higher* for NZDep2013 deciles 3–10 compared to those in decile 1–2

whereas for 15–24 year olds the rate was *significantly higher* only in areas with the highest NZDep2013 scores (deciles 9–10) **(Table 125)**.

Figure 166. Hospitalisations from road traffic injuries in 0–24 year olds, by NZ Deprivation quintile, New Zealand 2010–2014



Numerator: National Minimum Dataset (acute and arranged admissions; excludes ED cases); Denominator: Statistics NZ Estimated Resident Population; Decile is NZDep2013

Compared with European/Other, vehicle occupant RTI hospitalisation rates were *significantly higher* for Māori aged 0–14 years and 15–24 years and *significantly lower* for Pacific and Asian/Indian aged 15–24 years. Motorbike rates were *significantly lower* for Māori, Pacific and Asian/Indian aged 15–24 years. Cyclist rates were *significantly lower* for Asian/Indian aged 0–14 years and for Māori, Pacific and Asian/Indian aged 15–24 years; and pedestrian rates were *significantly higher* for Māori aged 0–24 years and Pacific and MELAA aged 0–14 years **(Table 122, Table 123**, **Table 124**, **Table 125)**.

Hospitalisation rates were *significantly higher* for males than females in the 0–14 and 15–24 year age groups for all types of road traffic injury except for injury as a vehicle occupant where there was *no significant difference* by gender in 0–14 year olds. The disparity by gender was most marked for motorbike injuries **(Table 122**, **Table 123**, **Table 124**, and **Table 125)**.

Table 122. Hospitalisations for vehicle occupant-related road traffic injuries in 0–24 year olds, by age group and demographic factor, New Zealand 2010–2014

Variable	Number: 2010–2014	Rate per 100,000 population	Rate ratio	95% CI
Road traffic injuries: vehicle occupant				
0–14 year olds				
NZ Deprivation Index quintile				
Deciles 1–2	49	5.62	1.00	
Deciles 3–4	73	9.04	1.61	1.12–2.31
Deciles 5–6	88	10.29	1.83	1.29–2.59
Deciles 7–8	137	14.58	2.59	1.87–3.59
Deciles 9–10	256	24.26	4.32	3.18–5.86
Prioritised ethnicity				
Māori	272	23.60	2.42	2.03–2.88
Pacific	51	11.72	1.20	0.89–1.63
Asian/Indian	54	11.34	1.16	0.86–1.56
MELAA	<5	s	s	s
European/Other	235	9.75	1.00	
Gender				
Female	311	14.09	1.00	
Male	308	13.27	0.94	0.80–1.10
15–24 year olds				
NZ Deprivation Index quintile				
Deciles 1–2	416	78.31	1.00	
Deciles 3–4	514	98.44	1.26	1.10–1.43
Deciles 5–6	618	106.19	1.36	1.20–1.54
Deciles 7–8	771	113.33	1.45	1.28–1.63
Deciles 9–10	1,172	145.60	1.86	1.66–2.08
Prioritised ethnicity				
Māori	1,021	161.96	1.40	1.30–1.51
Pacific	266	100.15	0.87	0.76–0.99
Asian/Indian	274	59.32	0.51	0.45–0.58
MELAA	41	96.63	0.84	0.62–1.14
European/Other	1,984	115.32	1.00	
Gender				
Female	1,508	98.29	1.00	
Male	2,107	132.79	1.35	1.26–1.44

Numerator: National Minimum Dataset (acute and arranged admissions; excludes ED cases); Denominator: Statistics NZ Estimated Resident Population; Rate ratios are unadjusted; Ethnicity is level 1 prioritised; Decile is NZDep2013

Table 123. Hospitalisations for motorbike-related road traffic injuries in 0–24 year olds, by age group and demographic factor, New Zealand 2010–2014

Variable	Number: 2010–2014	Rate per 100,000 population	Rate ratio	95% CI
Road traffic injuries: motorbike				
0–14 year olds				
NZ Deprivation Index quintile				
Deciles 1–2	19	2.18	1.00	
Deciles 3–4	29	3.59	1.65	0.92–2.94
Deciles 5–6	31	3.62	1.66	0.94–2.94
Deciles 7–8	35	3.72	1.71	0.98–2.99
Deciles 9–10	46	4.36	2.00	1.17–3.41
Prioritised ethnicity				
Māori	50	4.34	1.00	0.71–1.39
Pacific	<5	s	s	s
Asian/Indian	<5	s	s	s
MELAA	0	..	..	..
European/Other	105	4.36	1.00	
Gender				
Female	21	0.95	1.00	
Male	139	5.99	6.29	3.98–9.96
15–24 year olds				
NZ Deprivation Index quintile				
Deciles 1–2	162	30.49	1.00	
Deciles 3–4	189	36.20	1.19	0.96–1.46
Deciles 5–6	184	31.62	1.04	0.84–1.28
Deciles 7–8	238	34.98	1.15	0.94–1.40
Deciles 9–10	256	31.80	1.04	0.86–1.27
Prioritised ethnicity				
Māori	215	34.10	0.79	0.68–0.92
Pacific	33	12.42	0.29	0.20–0.41
Asian/Indian	33	7.14	0.17	0.12–0.23
MELAA	12	28.28	0.66	0.37–1.16
European/Other	742	43.13	1.00	
Gender				
Female	133	8.67	1.00	
Male	911	57.41	6.62	5.52–7.94

Numerator: National Minimum Dataset (acute and arranged admissions; excludes ED cases); Denominator: Statistics NZ Estimated Resident Population; Rate ratios are unadjusted; Ethnicity is level 1 prioritised; Decile is NZDep2013

Table 124. Hospitalisations for cyclist-related road traffic injuries in 0–24 year olds, by age group and demographic factor, New Zealand 2010–2014

Variable	Number: 2010–2014	Rate per 100,000 population	Rate ratio	95% CI
Road traffic injuries: cyclist				
0–14 year olds				
NZ Deprivation Index quintile				
Deciles 1–2	139	15.95	1.00	
Deciles 3–4	121	14.99	0.94	0.74–1.20
Deciles 5–6	138	16.13	1.01	0.80–1.28
Deciles 7–8	166	17.66	1.11	0.88–1.39
Deciles 9–10	236	22.37	1.40	1.14–1.73
Prioritised ethnicity				
Māori	222	19.27	1.05	0.90–1.24
Pacific	69	15.86	0.87	0.67–1.12
Asian/Indian	61	12.80	0.70	0.54–0.91
MELAA	10	17.97	0.98	0.52–1.84
European/Other	441	18.30	1.00	
Gender				
Female	217	9.83	1.00	
Male	588	25.33	2.58	2.20–3.01
15–24 year olds				
NZ Deprivation Index quintile				
Deciles 1–2	120	22.59	1.00	
Deciles 3–4	92	17.62	0.78	0.59–1.02
Deciles 5–6	119	20.45	0.91	0.70–1.17
Deciles 7–8	114	16.76	0.74	0.57–0.96
Deciles 9–10	138	17.14	0.76	0.59–0.97
Prioritised ethnicity				
Māori	96	15.23	0.59	0.47–0.74
Pacific	19	7.15	0.28	0.18–0.44
Asian/Indian	26	5.63	0.22	0.15–0.32
MELAA	8	18.86	0.73	0.36–1.47
European/Other	443	25.75	1.00	
Gender				
Female	124	8.08	1.00	
Male	473	29.81	3.69	3.03–4.49

Numerator: National Minimum Dataset (acute and arranged admissions; excludes ED cases); Denominator: Statistics NZ Estimated Resident Population; Rate ratios are unadjusted; Ethnicity is level 1 prioritised; Decile is NZDep2013

Table 125. Hospitalisations for pedestrian-related road traffic crash injuries in 0–24 year olds, by age group and demographic factor, New Zealand 2010–2014

Variable	Number: 2010–2014	Rate per 100,000 population	Rate ratio	95% CI
Road traffic injuries: pedestrian				
0–14 year olds				
NZ Deprivation Index quintile				
Deciles 1–2	40	4.59	1.00	
Deciles 3–4	62	7.68	1.67	1.12–2.49
Deciles 5–6	67	7.83	1.71	1.15–2.52
Deciles 7–8	115	12.24	2.67	1.86–3.82
Deciles 9–10	217	20.57	4.48	3.20–6.28
Prioritised ethnicity				
Māori	187	16.23	2.31	1.88–2.85
Pacific	102	23.44	3.34	2.61–4.27
Asian/Indian	33	6.93	0.99	0.68–1.43
MELAA	10	17.97	2.56	1.35–4.85
European/Other	169	7.01	1.00	
Gender				
Female	164	7.43	1.00	
Male	340	14.64	1.97	1.64–2.37
15–24 year olds				
NZ Deprivation Index quintile				
Deciles 1–2	70	13.18	1.00	
Deciles 3–4	87	16.66	1.26	0.92–1.73
Deciles 5–6	73	12.54	0.95	0.69–1.32
Deciles 7–8	84	12.35	0.94	0.68–1.29
Deciles 9–10	147	18.26	1.39	1.04–1.84
Prioritised ethnicity				
Māori	132	20.94	1.55	1.25–1.91
Pacific	47	17.70	1.31	0.96–1.79
Asian/Indian	49	10.61	0.78	0.58–1.07
MELAA	6	14.14	1.04	0.46–2.35
European/Other	233	13.54	1.00	
Gender				
Female	173	11.28	1.00	
Male	296	18.65	1.65	1.37–2.00

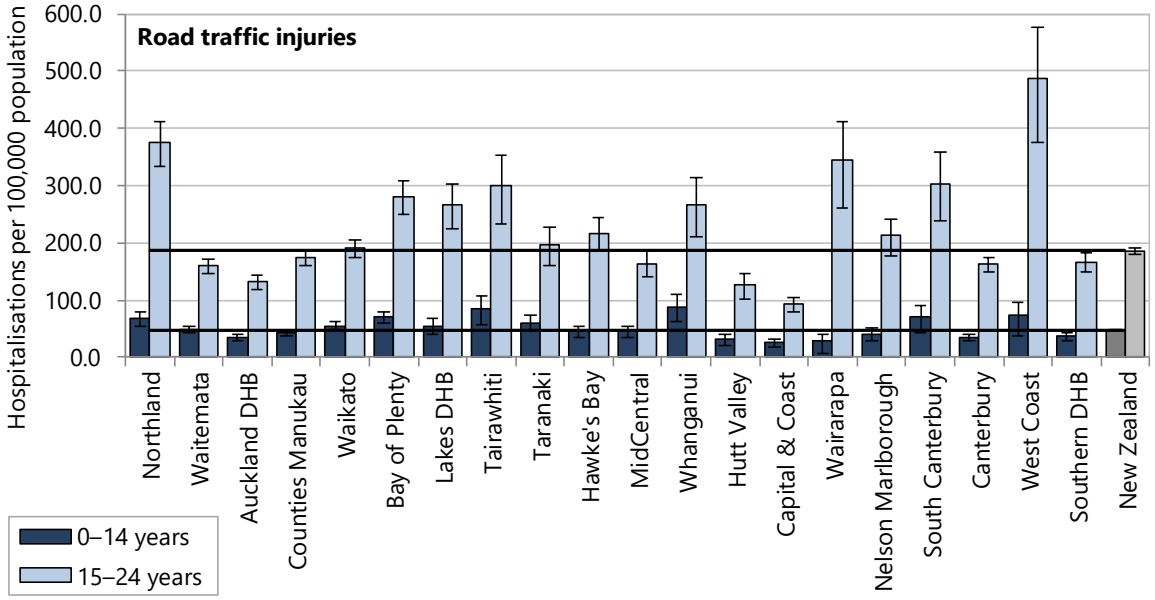
Numerator: National Minimum Dataset (acute and arranged admissions; excludes ED cases); Denominator: Statistics NZ Estimated Resident Population; Rate ratios are unadjusted; Ethnicity is level 1 prioritised; Decile is NZDep2013

Distribution by region

For 0–14 year olds, the RTI hospitalisation rates were *significantly higher* than the national rate in the Northland, Waikato, Bay of Plenty, Tairawhiti, Taranaki, Whanganui, South Canterbury and West Coast DHBs and *significantly lower* in the Auckland, Hutt Valley, Capital & Coast, Canterbury and Southern DHBs. In remaining district health boards there was *no significant difference* from the national rate.

For 15–24 year olds the RTI hospitalisation rates were *significantly higher* than the national rate in the Northland, Bay of Plenty, Lakes, Tairawhiti, Hawke's Bay, Whanganui, Wairarapa, South Canterbury and West Coast DHBs and *significantly lower* in the Waitemata, Auckland, Hutt Valley, Capital & Coast, Canterbury and Southern DHBs. In remaining district health boards there was *no significant difference* from the national rate **(Figure 167)**.

Figure 167. Hospitalisations for injuries from road traffic crash, by age group and district health board, New Zealand 2010–2014



Numerator: National Minimum Dataset (acute and arranged admissions; excludes ED cases); Denominator: Statistics NZ Estimated Resident Population

Falls

There are few injury deaths resulting from falls among those aged 0–24 years. Between 2008 and 2012 there were 7 deaths of 0–14 year olds and 38 deaths of 15–24 year olds **(Table 117)**. Falls were the most common reason for unintentional injury hospitalisation among 0–24 year olds and between 2010 and 2014 there were 22,130 hospitalisations of 0–14 year olds for injury from falls, more than twice the 9,913 hospitalisations for 15–24 year olds **(Table 118, Table 119).**

Distribution by cause

The most common types of fall resulting in hospitalisation for 0–14 year olds were falls involving playground equipment and falls on the same level. For 15–24 year olds the most common type was fall on same level due to collision with, or pushing by, another person **(Table 126)**. Falls from playground equipment occurred most commonly in schools.

Table 126. Hospitalisations from fall-related injuries in 0–24 year olds, by age group and cause of injury, New Zealand 2010–2014

Cause of injury: falls	Number: 2010–2014	Number: annual average	Rate per 100,000 population	95% CI	Per cent
New Zealand					
0–14 year olds					
Fall involving playground equipment	7,023	1,405	155.06	151.48–158.73	31.7
Fall on same level from slipping, tripping and stumbling	2,432	486	53.70	51.60–55.87	11.0
Fall involving ice-skates, skis, rollerskates or skateboards	2,110	422	46.59	44.64–48.62	9.5
Other fall on same level	1,581	316	34.91	33.23–36.67	7.1
Fall from, out of or through building or structure	1,244	249	27.47	25.98–29.04	5.6
Other fall on same level due to collision with, or pushing by, another person	1,243	249	27.44	25.96–29.01	5.6
Other fall from one level to another	1,303	261	28.77	27.25–30.37	5.9
Fall from tree	918	184	20.27	19.00–21.62	4.1
Fall involving chair	1,035	207	22.85	21.50–24.29	4.7
Fall involving bed	875	175	19.32	18.08–20.64	4.0
Fall on and from stairs and steps	621	124	13.71	12.67–14.83	2.8
Fall while being carried or supported by other persons	402	80	8.88	8.05–9.79	1.8
Fall involving other furniture	294	59	6.49	5.79–7.28	1.3
Fall from cliff	119	24	2.63	2.20–3.14	0.5
Diving or jumping into water causing injury*	104	21	2.30	1.90–2.78	0.5
Fall on and from ladder	96	19	2.12	1.74–2.59	0.4
Other specified falls	33	7	0.73	0.52–1.02	0.1
Unspecified fall	697	139	15.39	14.29–16.57	3.1
Total	22,130	4,426	488.60	482.22–495.07	100.0
15–24 year olds					
Other fall on same level due to collision with, or pushing by, another person	2,021	404	64.76	62.00–67.64	20.4
Fall on same level from slipping, tripping and stumbling	1,627	325	52.13	49.66–54.73	16.4
Fall involving ice-skates, skis, rollerskates or skateboards	1,574	315	50.43	48.00–52.99	15.9
Other fall on same level	1,107	221	35.47	33.44–37.62	11.2
Fall from, out of or through building or structure	826	165	26.47	24.72–28.33	8.3
Fall on and from stairs and steps	669	134	21.44	19.87–23.12	6.7
Other fall from one level to another	586	117	18.78	17.32–20.36	5.9
Fall from cliff	243	49	7.79	6.87–8.83	2.5
Fall involving playground equipment	227	45	7.27	6.39–8.28	2.3
Diving or jumping into water causing injury*	165	33	5.29	4.54–6.16	1.7
Fall on and from ladder	109	22	3.49	2.90–4.21	1.1
Fall from tree	108	22	3.46	2.87–4.18	1.1
Fall involving chair	63	13	2.02	1.58–2.58	0.6
Fall while being carried or supported by other persons	49	10	1.57	1.19–2.08	0.5
Fall involving bed	36	7	1.15	0.83–1.60	0.4
Fall involving other furniture	24	5	0.77	0.52–1.14	0.2
Other specified falls	56	11	1.79	1.38–2.33	0.6
Unspecified fall	423	85	13.55	12.32–14.91	4.3
Total	9,913	1,983	317.63	311.45–323.94	100.0

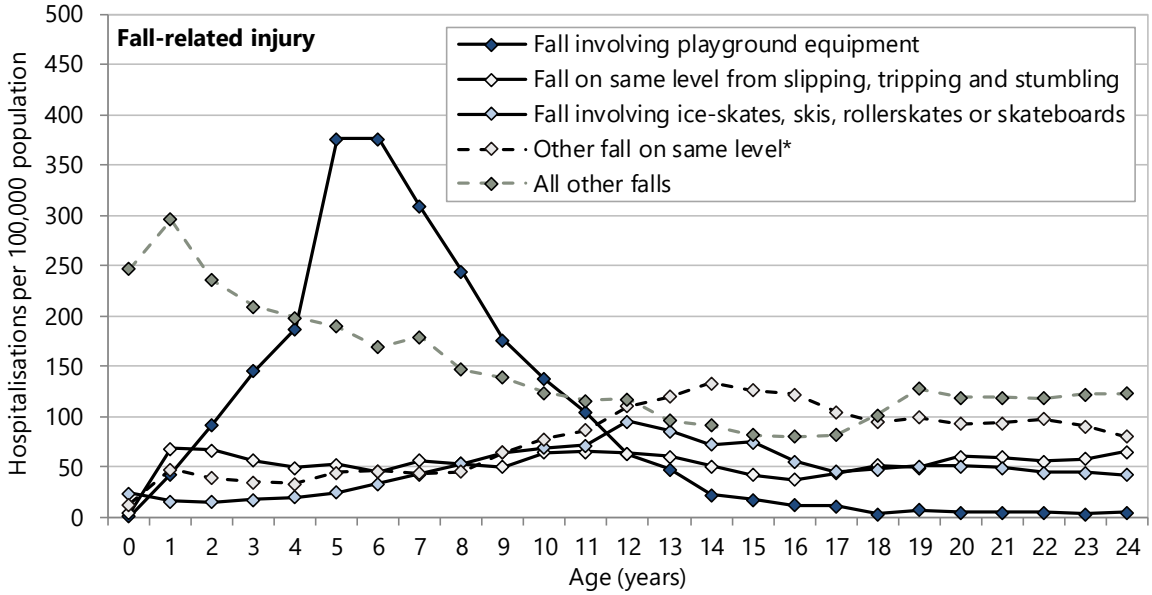
Numerator: National Minimum Dataset (acute and arranged admissions; excludes ED cases); Denominator: Statistics NZ Estimated Resident Population; * Diving or jumping into water causing injury other than drowning or submersion

Distribution by demographic factors

Patterns of fall-related hospitalisation rates by age show a very high rate of falls involving playground equipment peaking at age 5–6 years and then falling steeply with increasing age. Rates for falls on same level

due to collision with or pushing by another person began to rise from age nine years and remained at relatively high levels through the teenage years. Rates for falls involving skates, skis or skateboards rose until age 13 and then fell with increasing age. Other types of fall had highest rates at age one year and then tended to fall with increasing age until rising again from age 18–19 years **(Figure 168)**.

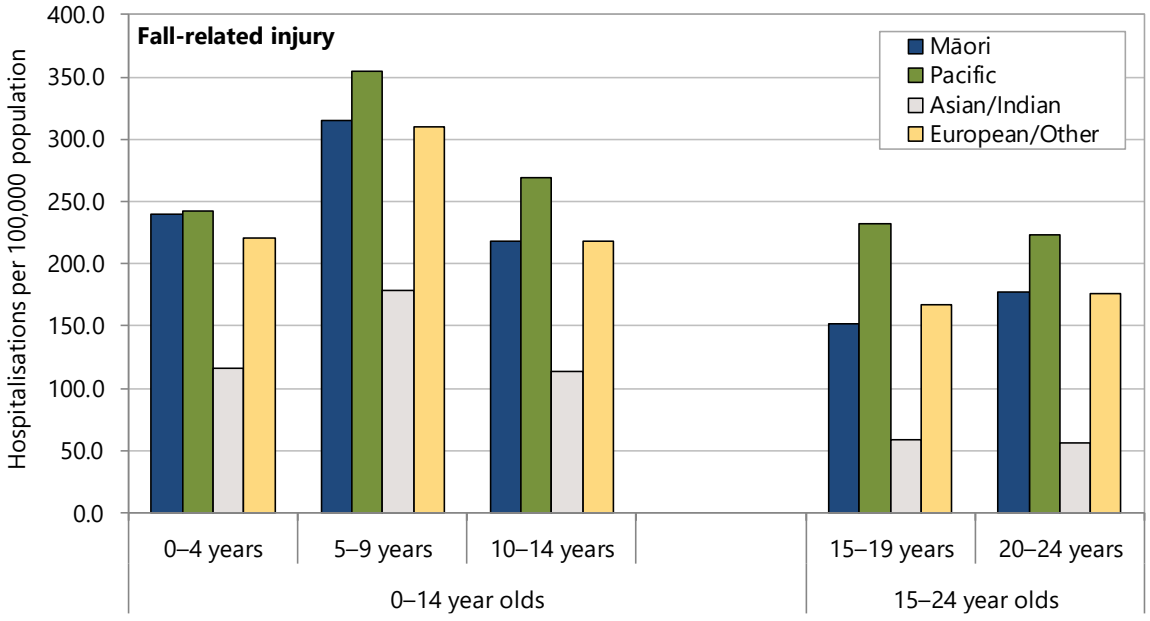
Figure 168. Hospitalisations from fall-related injuries in 0–24 year olds, by age and fall type, New Zealand 2010–2014



Numerator: National Minimum Dataset (acute and arranged admissions; excludes ED cases); Denominator: Statistics NZ Estimated Resident Population; Rates per 100,000 age-specific population; * Other fall on same level relates to other fall on same level due to collision with, or pushing by, another person

Fall-related injury hospitalisation rates were highest at age 5–9 years for all ethnic groups, with rates for Pacific generally higher and rates for Asian/Indian consistently lower than rates for European/Other and Māori **(Figure 169)**. This peak in rates in 5–9 year olds is mainly due to falls involving playground equipment.

Figure 169. Hospitalisations from fall-related injuries in 0–24 year olds, by age and ethnicity, New Zealand 2010–2014



Numerator: National Minimum Dataset (acute and arranged admissions; excludes ED cases); Denominator: Statistics NZ Estimated Resident Population; Ethnicity is level 1 prioritised.

Between 2010 and 2014 in 0–14 year olds there was some disparity in hospitalisation rates for fall injury involving playground equipment by NZDep2013 index of deprivation score and ethnicity. Rates were *significantly higher* in areas with the highest deprivation scores (NZDep2013 deciles 9–10) compared with areas with lower deprivation scores (deciles 1–8). Rates were *significantly lower* for Asian/Indian than rates for European/Other, Māori, Pacific and MELAA. There was *no significant difference* between male and female rates **(Table 127)**.

In the same time period for 15–24 year olds there was similar disparity by NZDep2013 score for falls on the same level due to collision with or pushing by another person with *significantly higher* injury hospitalisation rates in areas with the highest deprivation scores (NZDep2013 deciles 9–10) compared with areas with lower deprivation scores (deciles 1–8). Compared with European/Other, rates for this form of injury were *significantly higher* for Māori and Pacific and *significantly lower* for Asian/Indian and *no significant difference* for MELAA **(Table 127)**.

Table 127. Hospitalisations for fall-related injuries in 0–24 year olds, by age group and demographic factor, New Zealand 2010–2014

Variable	Number: 2010–2014	Rate per 100,000 population	Rate ratio	95% CI
New Zealand				
Falls among 0–14 year olds involving playground equipment				
NZ Deprivation Index quintile				
Deciles 1–2	1,217	139.65	1.00	
Deciles 3–4	1,114	138.01	0.99	0.91–1.07
Deciles 5–6	1,149	134.34	0.96	0.89–1.04
Deciles 7–8	1,344	143.00	1.02	0.95–1.11
Deciles 9–10	2,135	202.36	1.45	1.35–1.55
Prioritised ethnicity				
Māori	1,917	166.36	1.06	1.00–1.12
Pacific	740	170.04	1.08	1.00–1.17
Asian/Indian	452	94.88	0.60	0.55–0.66
MELAA	82	147.33	0.93	0.75–1.16
European/Other	3,797	157.59	1.00	
Gender				
Female	3,359	152.17	1.00	
Male	3,664	157.81	1.04	0.99–1.09
Injuries among 15–24 year olds from other fall on same level*				
NZ Deprivation Index quintile				
Deciles 1–2	289	54.40	1.00	
Deciles 3–4	319	61.10	1.12	0.96–1.32
Deciles 5–6	347	59.62	1.10	0.94–1.28
Deciles 7–8	378	55.56	1.02	0.88–1.19
Deciles 9–10	673	83.61	1.54	1.34–1.76
Prioritised ethnicity				
Māori	483	76.62	1.45	1.29–1.61
Pacific	534	201.05	3.79	3.41–4.22
Asian/Indian	58	12.56	0.24	0.18–0.31
MELAA	16	37.71	0.71	0.43–1.17
European/Other	912	53.01	1.00	
Gender				
Female	158	10.30	1.00	
Male	1,863	117.41	11.40	9.69–13.41

Numerator: National Minimum Dataset (acute and arranged admissions; excludes ED cases); Denominator: Statistics NZ Estimated Resident Population; Rate ratios are unadjusted; Ethnicity is level 1 prioritised; Decile is NZDep2013

Inanimate mechanical force

Between 2008 and 2012 injury from inanimate mechanical force resulted in 14 deaths of 0–14 year olds and 18 deaths of 15–24 year olds **(Table 117)**. Injury from exposure to inanimate forces was a major cause of hospitalisation. Over the five years 2010–2014 there were 11,560 hospitalisations of 0–14 year olds and 10,299 of 15–24 year olds for this type of injury **(Table 118, Table 119).**

Distribution by cause

The main causes were similar for both 0–14 year olds and 15–24 year olds: caught between, foreign body penetrating, struck against or by some object and events involving cutting and piercing **(Table 128)**.

Table 128. Hospitalisations for injuries from exposure to an inanimate mechanical force in 0–24 year olds, by age group and cause of injury, New Zealand 2010–2014

Cause of injury: exposure to an inanimate mechanical force	Number: 2010–2014	Number: annual average	Rate per 100,000 population	95% CI	Per cent
New Zealand					
0–14 year olds					
Caught, crushed, jammed or pinched in or between objects	3,955	791	87.32	84.64–90.08	34.2
Foreign body entering into or through eye, natural orifice or skin	2,611	522	57.65	55.48–59.90	22.6
Striking against or struck by sports equipment or other objects*	2,567	513	56.68	54.53–58.91	22.2
Contact with sharp glass, knife, sword or dagger	1,287	257	28.42	26.90–30.01	11.1
Contact with other powered, other and unspecified machinery†	350	70	7.73	6.96–8.58	3.0
Contact with nonpowered hand tool	296	59	6.54	5.83–7.32	2.6
Discharge of firework, handgun or other and unspecified firearms	64	13	1.41	1.11–1.80	0.6
Explosion and rupture of gas cylinder or other materials	19	4	0.42	0.27–0.66	0.2
Exposure to other and unspecified inanimate mechanical forces‡	411	82	9.07	8.24–10.00	3.6
Total	11,560	2,312	255.23	250.63–259.92	100.0
15–24 year olds					
Caught, crushed, jammed or pinched in or between objects	706	141	22.62	21.01–24.35	6.9
Foreign body entering into or through eye, natural orifice or skin	750	150	24.03	22.37–25.81	7.3
Striking against or struck by sports equipment or other objects*	2,713	543	86.93	83.72–90.26	26.3
Contact with sharp glass, knife, sword or dagger	3,608	722	115.61	111.90–119.44	35.0
Contact with other powered, other and unspecified machinery†	1,516	303	48.58	46.19–51.08	14.7
Contact with nonpowered hand tool	334	67	10.70	9.61–11.91	3.2
Discharge of firework, handgun or other and unspecified firearms	148	30	4.74	4.04–5.57	1.4
Explosion and rupture of gas cylinder or other materials	66	13	2.11	1.66–2.69	0.6
Exposure to other and unspecified inanimate mechanical forces‡	458	92	14.68	13.39–16.08	4.4
Total	10,299	2,060	330.00	323.70–336.43	100.0

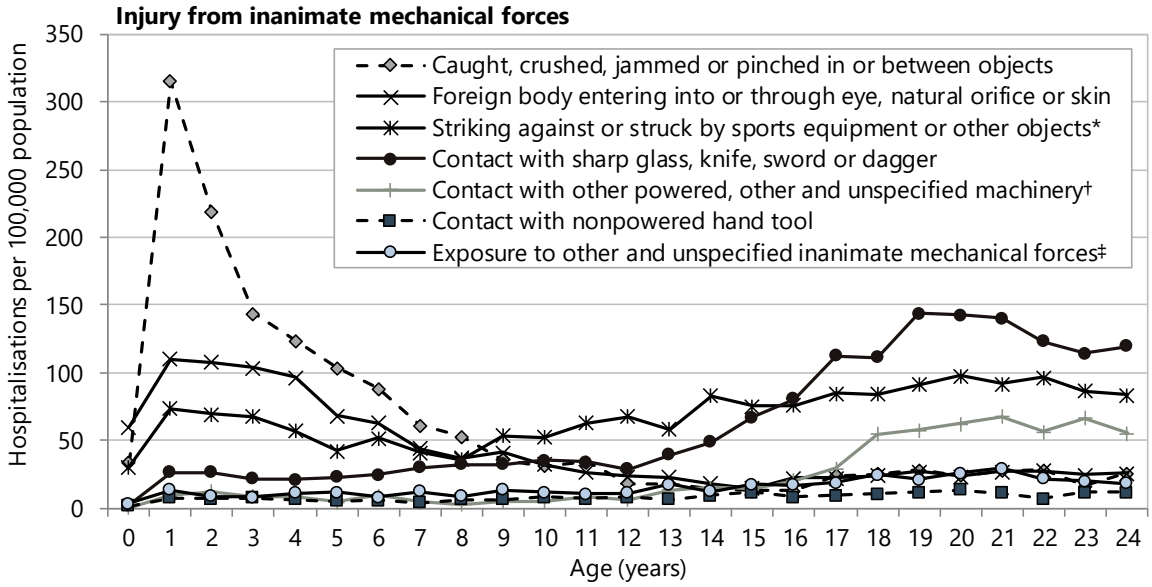
Numerator: National Minimum Dataset (acute and arranged admissions; excludes ED cases); Denominator: Statistics NZ Estimated Resident Population; * Striking against or struck by sports equipment or other objects or thrown, projected or falling object; † includes contact with powered lawnmower, agricultural machinery, other and unspecified machinery, other powered hand tools and household machinery, and lifting and transmission devices, not elsewhere classified; ‡ includes contact with hypodermic needle, exposure to high-pressure jet, and to other and unspecified inanimate mechanical forces

Distribution by demographic factors

Children around one year of age had a high rate of hospitalisation for caught, jammed, pinched in or between objects. Rates for foreign bodies entering fell from about 4 years of age while rates for sports-related struck by injury rose from age 8 years. Injury from sharp objects increased from age 12 years and peaked around 19–20 years **(Figure 170)**.

For injury caused by being caught, crushed, jammed, or pinched in or between objects there was a significant difference associated with NZDep2013 score: hospitalisation rates for 0–14 year olds in areas with higher deprivation scores (NZDep2013 deciles 9–10 were *significantly higher* than rates in deciles 1–2. Among 15–24 year olds hospitalisation rates after contact with sharp glass, knife, sword or dagger were *significantly higher* in NZDep2013 deciles than in areas with the lowest deprivation scores (deciles 1–2). Compared with European/Other hospitalisation rates for 'caught between' injuries were *significantly higher* for Māori, Pacific and MELAA 0–14 year olds. Hospitalisation rates for injury from sharp objects were *significantly higher* for Māori and Pacific 15–24 year olds and *significantly lower* for Asian/Indian compared with European/Other and MELAA. Males in both age groups, 0–14 years and 15–24 years, were *significantly more likely* than females to be hospitalised from inanimate mechanical forces **(Table 129)**.

Figure 170. Hospitalisations for injuries from inanimate mechanical forces in 0–24 year olds, by age and force type, New Zealand 2010–2014



Numerator: National Minimum Dataset (acute and arranged admissions; excludes ED cases) * Striking against or struck by sports equipment or other objects or thrown, projected or falling object; † includes contact with powered lawnmower, agricultural machinery, other and unspecified machinery, other powered hand tools and household machinery, and lifting and transmission devices, not elsewhere classified; ‡ includes discharge of firework, handgun or other and unspecified firearms, explosion and rupture of gas cylinder or other materials, contact with hypodermic needle, exposure to high-pressure jet, and to other and unspecified inanimate mechanical forces

Table 129. Hospitalisations for injuries from exposure to an inanimate mechanical force in 0–24 year olds, by age group and demographic factor, New Zealand 2010–2014

Variable	Number: 2010–2014	Rate per 100,000 population	Rate ratio	95% CI
New Zealand				
Injuries among 0–14 year olds from being caught, crushed, jammed, or pinched in or between objects				
NZ Deprivation Index quintile				
Deciles 1–2	491	56.34	1.00	
Deciles 3–4	468	57.98	1.03	0.91–1.17
Deciles 5–6	565	66.06	1.17	1.04–1.32
Deciles 7–8	768	81.71	1.45	1.30–1.62
Deciles 9–10	1,645	155.91	2.77	2.50–3.06
Prioritised ethnicity				
Māori	1,116	96.85	1.51	1.40–1.63
Pacific	902	207.27	3.24	2.98–3.52
Asian/Indian	323	67.80	1.06	0.94–1.19
MELAA	63	113.19	1.77	1.38–2.28
European/Other	1,542	64.00	1.00	
Gender				
Female	1,787	80.95	1.00	
Male	2,168	93.38	1.15	1.08–1.23
Injuries among 15–24 year olds from contact with sharp glass, knife, sword or dagger				
NZ Deprivation Index quintile				
Deciles 1–2	348	65.51	1.00	
Deciles 3–4	451	86.38	1.32	1.15–1.52
Deciles 5–6	531	91.24	1.39	1.22–1.59
Deciles 7–8	856	125.82	1.92	1.70–2.18
Deciles 9–10	1,390	172.68	2.64	2.34–2.96
Prioritised ethnicity				
Māori	1,237	196.22	2.01	1.87–2.17
Pacific	492	185.24	1.90	1.72–2.10
Asian/Indian	136	29.44	0.30	0.25–0.36
MELAA	40	94.28	0.97	0.71–1.32
European/Other	1,676	97.42	1.00	
Gender				
Female	759	49.47	1.00	
Male	2,849	179.55	3.63	3.35–3.93

Numerator: National Minimum Dataset (acute and arranged admissions; excludes ED cases); Denominator: Statistics NZ Estimated Resident Population; Rate ratios are unadjusted; Ethnicity is level 1 prioritised; Decile is NZDep2013

Animate mechanical force

Between 2008 and 2012 there were fewer than five deaths of 0–14 year olds and of 15–24 year olds as a result of animate mechanical force **(Table 117)**. Between 2010 and 2014, there were 2,949 hospitalisations of 0–14 year olds and 3,360 of 15–24 year olds for injuries resulting from animate mechanical forces **(Table 118, Table 119)**.

Distribution by cause

Causes varied by age from these injuries, however, 49.4% of these hospitalisations for 0–14 year olds and 77.1% for 15–24 year olds were from being struck, hit, twisted, by a person or crowd (or stampede). Being bitten or struck by a dog accounted for 29.6% of animate force hospitalisations in 0–14 year olds and 8.6% in 15–24 year olds **(Table 130.** Hospitalisations for injuries from exposure to an animate mechanical force in 0–24 year olds, by age group and cause of injury, New Zealand 2010–2014**)**.

Table 130. Hospitalisations for injuries from exposure to an animate mechanical force in 0–24 year olds, by age group and cause of injury, New Zealand 2010–2014

Cause of injury: exposure to an animate mechanical force	Number: 2010–2014	Number: annual average	Rate per 100,000 population	95% CI	Per cent
New Zealand					
0–14 year olds					
Struck etc by another person or by crowd or human stampede*	1,456	291	32.15	30.54–33.84	49.4
Bitten or struck by dog*	874	175	19.30	18.06–20.62	29.6
Contact with plant or bitten or stung†	434	87	9.58	8.72–10.53	14.7
Contact with, bitten or struck by marine animal, rat or other mammals	174	35	3.84	3.31–4.46	5.9
Exposure to other and unspecified animate mechanical forces‡	11	2	0.24	0.14–0.43	0.4
Total	2,949	590	65.11	62.80–67.50	100.0
15–24 year olds					
Struck etc by another person or by crowd or human stampede*	2,592	518	83.05	79.92–86.31	77.1
Bitten or struck by dog	289	58	9.26	8.25–10.39	8.6
Contact with plant or bitten or stung†	185	37	5.93	5.13–6.85	5.5
Contact with, bitten or struck by marine animal, rat or other mammals	280	56	8.97	7.98–10.09	8.3
Exposure to other and unspecified animate mechanical forces‡	14	3	0.45	0.27–0.75	0.4
Total	3,360	672	107.66	104.08–111.36	100.0

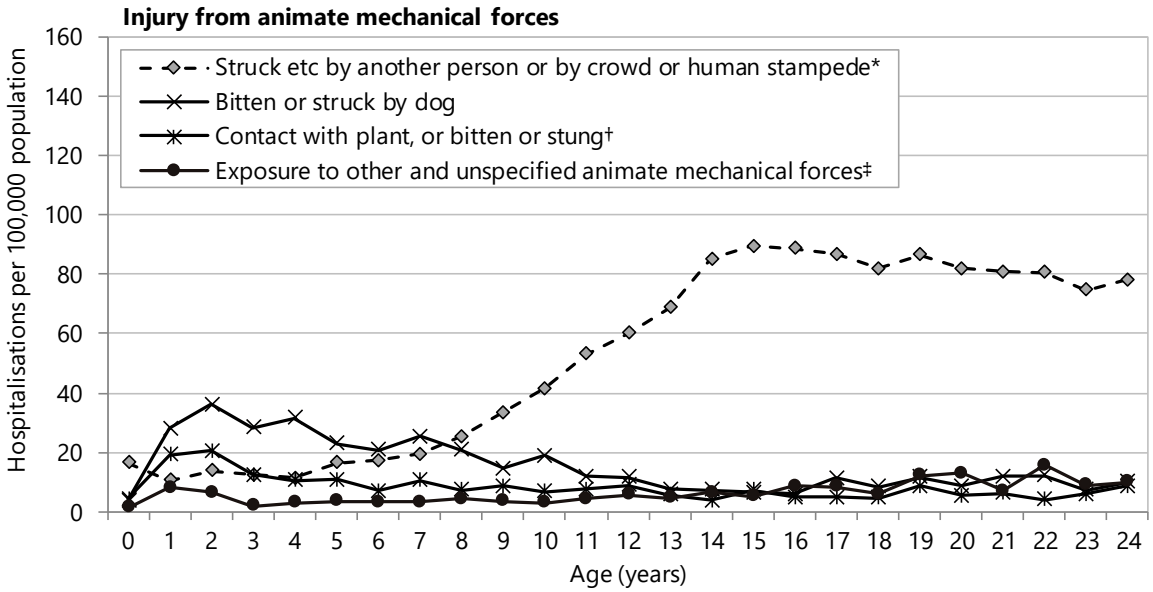
Numerator: National Minimum Dataset (acute and arranged admissions; excludes ED cases); Denominator: Statistics NZ Estimated Resident Population; * Hit, struck, kicked, twisted, bitten, scratched, striking against or bumped into by another person or crushed, pushed or stepped on by crowd or human stampede; † Contact with plant thorns and spines and sharp leaves or bitten or stung by nonvenomous insect and other nonvenomous arthropods; ‡ Exposure to other and unspecified animate mechanical forces also includes being bitten or struck by other animals

Distribution by demographic factors

Patterns of animate force injury requiring hospitalisation varied by age. Hospitalisation rates after being hit, struck, kicked, twisted, bitten, scratched, striking against or bumped into by another person or crushed, pushed or stepped on by crowd or human stampede rose with increasing age from age 8 years to a plateau from around 14–24 years. Dog-related injury hospitalisations were highest at age 2 years and then fell with increasing age until a plateau from around age 13. Plant- and insect-related injuries were also most common in 2–3 year olds and then tended to decline with increasing age **(Figure 171)**.

For all ages, those living in areas with the highest deprivation scores (NZDep2013 deciles 9–10) had a *significantly higher* chance of being struck by another person or a crowd compared with deciles 1–6. Compared with European/Other, hospitalisation rates for this type of injury were *significantly higher* for Pacific 0–24 year olds and Māori 15–24 year olds. Males had a *significantly higher* rate than females of being struck by and this was most marked in the 15–24 year age group **(Table 131**, **Table 132)**.

Figure 171. Hospitalisations for injuries from animate mechanical forces in 0–24 year olds, by age and force type, New Zealand 2010–2014



Numerator: National Minimum Dataset (acute and arranged admissions; excludes ED cases); Denominator: Statistics NZ Estimated Resident Population; * Hit, struck, kicked, twisted, bitten, scratched, striking against or bumped into by another person or crushed, pushed or stepped on by crowd or human stampede; † Contact with plant thorns and spines and sharp leaves or bitten or stung by nonvenomous insect and other nonvenomous arthropods; ‡ Exposure to other and unspecified animate mechanical forces also includes being bitten or struck by other animals

Table 131. Hospitalisations for injuries from exposure to an animate mechanical force in 0–14 year olds, by age group and demographic factor, New Zealand 2010–2014

Variable	Number: 2010–2014	Rate per 100,000 population	Rate ratio	95% CI
Injuries from animate mechanical forces: struck etc by another person or by crowd or human stampede*				
0–14 year olds				
NZ Deprivation Index quintile				
Deciles 1–2	252	28.92	1.00	
Deciles 3–4	237	29.36	1.02	0.85–1.21
Deciles 5–6	223	26.07	0.90	0.75–1.08
Deciles 7–8	295	31.39	1.09	0.92–1.28
Deciles 9–10	444	42.08	1.46	1.25–1.70
Prioritised ethnicity				
Māori	384	33.32	1.00	0.89–1.13
Pacific	189	43.43	1.30	1.11–1.53
Asian/Indian	56	11.76	0.35	0.27–0.46
MELAA	19	34.14	1.03	0.65–1.62
European/Other	802	33.29	1.00	
Gender				
Female	381	17.26	1.00	
Male	1,075	46.30	2.68	2.39–3.02

Numerator: National Minimum Dataset (acute and arranged admissions; excludes ED cases); Denominator: Statistics NZ Estimated Resident Population; * Hit, struck, kicked, twisted, bitten, scratched, striking against or bumped into by another person or crushed, pushed or stepped on by crowd or human stampede; Rate ratios are unadjusted; Ethnicity is level 1 prioritised; Decile is NZDep2013

Table 132. Hospitalisations for injuries from exposure to an animate mechanical force in 15–24 year olds, by age group and demographic factor, New Zealand 2010–2014

Variable	Number: 2010–2014	Rate per 100,000 population	Rate ratio	95% CI
Injuries from animate mechanical forces: struck etc by another person or by crowd or human stampede*				
15–24 year olds				
NZ Deprivation Index quintile				
Deciles 1–2	384	72.28	1.00	
Deciles 3–4	337	64.54	0.89	0.77–1.03
Deciles 5–6	424	72.85	1.01	0.88–1.16
Deciles 7–8	563	82.75	1.14	1.01–1.30
Deciles 9–10	858	106.59	1.47	1.31–1.66
Prioritised ethnicity				
Māori	681	108.02	1.49	1.36–1.63
Pacific	505	190.14	2.62	2.36–2.90
Asian/Indian	96	20.78	0.29	0.23–0.35
MELAA	38	89.56	1.23	0.89–1.70
European/Other	1,249	72.60	1.00	
Gender				
Female	325	21.18	1.00	
Male	2,267	142.87	6.74	6.00–7.58

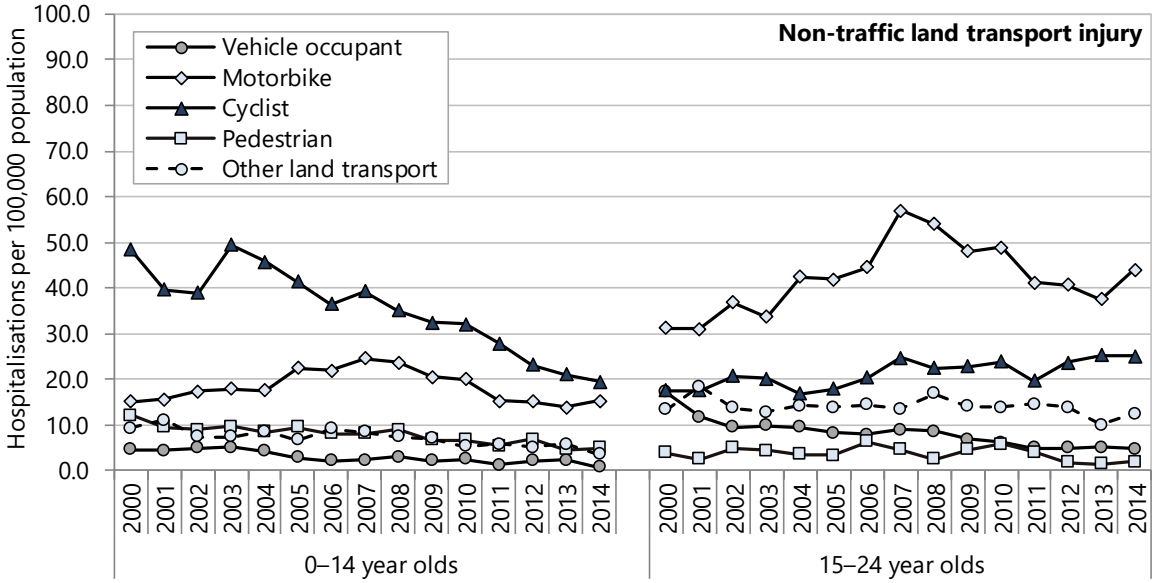
Numerator: National Minimum Dataset (acute and arranged admissions; excludes ED cases); Denominator: Statistics NZ Estimated Resident Population; * Hit, struck, kicked, twisted, bitten, scratched, striking against or bumped into by another person or crushed, pushed or stepped on by crowd or human stampede; Rate ratios are unadjusted; Ethnicity is level 1 prioritised; Decile is NZDep2013

Non-traffic transport injury

Between 2008 and 2012 there were 40 deaths as a result of injuries from non-traffic transport (i.e. events occurring off road) among children aged 0–14 years and 31 deaths among 15–24 year olds. The deceased was most commonly a pedestrian among 0–14 year olds (24 deaths) and a vehicle occupant among 15–24 year olds (12 deaths) **(Table 117)**.

The hospitalisation rate for non-traffic injuries fell from 2004 to 2014 for the 0–14 year olds and this was mainly driven by a fall in cyclist hospitalisations. Among 15–24 year olds the hospitalisation rate rose from 2004 to 2007 and then declined overall; this pattern was influenced mainly by changes in motorbike-related injury hospitalisations. A similar rise and fall in motorbike-related injury hospitalisation over time was seen in 0–14 year olds although with lower rates overall and a flatter peak **(Figure 172)**.

Figure 172. Hospitalisations from non-traffic land transport injuries in 0–24 year olds, by age group, year of discharge, and type, New Zealand 2000–2014



Numerator: National Minimum Dataset (acute and arranged admissions; excludes ED cases); Denominator: Statistics NZ Estimated Resident Population

Distribution by cause

Between 2010 and 2014 injuries arising from non-traffic transport resulted in 2,393 hospitalisations among 0–14 year olds and 2,710 hospitalisations among those aged 15–24 years. Hospitalisations for non-traffic transport injury among 0–14 year olds were more commonly for cycling (46.6%) followed by motorbike (29.9%) and for 15–24 year olds most common was motorbike injuries (48.9%) and cycling (27.0%) **(Table 133)**.

Table 133. Hospitalisations from unintentional non-traffic crash injuries in 0–24 year olds, by age group, New Zealand 2010–2014

Cause of injury: non-traffic land transport	Number: 2010–2014	Number: annual average	Rate per 100,000 population	95% CI	Per cent
New Zealand					
0–14 year olds					
Vehicle occupant	78	16	1.72	1.38–2.15	3.3
Motorbike	716	143	15.81	14.69–17.01	29.9
Cyclist	1,116	223	24.64	23.24–26.13	46.6
Pedestrian	256	51	5.65	5.00–6.39	10.7
Other land transport	227	45	5.01	4.40–5.71	9.5
Total	2,393	479	52.83	50.76–54.99	100.0
15–24 year olds					
Vehicle occupant	160	32	5.13	4.39–5.99	5.9
Motorbike	1,324	265	42.42	40.20–44.77	48.9
Cyclist	733	147	23.49	21.85–25.25	27.0
Pedestrian	92	18	2.95	2.40–3.61	3.4
Other land transport	401	80	12.85	11.65–14.17	14.8
Total	2,710	542	86.83	83.63–90.16	100.0

Numerator: National Minimum Dataset (acute and arranged admissions; excludes ED cases); Denominator: Statistics NZ Estimated Resident Population

Distribution by demographic factors

Between 2010 and 2014 hospitalisation rates of 0–24 year olds for vehicle occupant non-traffic injuries were *significantly higher* in areas with the highest NZDep2013 scores (NZDep2013 deciles 9–10) compared with deciles 1–2. Asian/Indian ethnic groups had *significantly lower* rates than European/Other, and 0–4 and 5–14 year olds had *significantly lower* rates than 15–24 year olds **(Table 134)**.

There was no clear social gradient in hospitalisation rates for non-traffic motorbike or cycle injuries with the highest rates in areas with NZDep2013 decile 3-4 scores (*significantly higher* than deciles 1–2) and the lowest rates in areas with the highest deprivation index scores (*significantly lower* than deciles 1–2) **(Table 135)**. For both these type of injury Māori, Pacific and Asian/Indian had *significantly lower* rates than European/Other. Compared with 15–24 year olds non-traffic motorbike hospitalisation rates were *significantly lower* for 0–4 and 5–14 year olds, whereas for non-traffic cycle injury hospitalisation rates were *significantly lower* for 0–4 year olds and *significantly higher* for 5–14 year olds **(Table 135**).

Hospitalisation rates for pedestrian injuries were *significantly higher* in areas with higher deprivation index scores (NZDep2013 deciles 7–10) compared with deciles 1–2. Māori rates were *significantly higher* than European/Other, and rates for for 0–4 and 5–14 year olds were *significantly higher* than for 15–24 year olds (**Table 136**).

Male hospitalisation rates were *significantly higher* than female for all specific types of non-traffic injury and this difference was particularly marked for motorbike injury **(Table 135**, **Table 136).**

Table 134. Hospitalisations for vehicle occupant-related non-traffic land transport injuries in 0–24 year olds, by demographic factor, New Zealand 2010–2014

Variable	Number: 2010–2014	Rate per 100,000 population	Rate ratio	95% CI
Non-traffic land transport injuries: vehicle occupant				
0–24 year olds				
NZ Deprivation Index quintile				
Deciles 1–2	34	2.42	1.00	
Deciles 3–4	38	2.86	1.18	0.74–1.87
Deciles 5–6	42	2.92	1.21	0.77–1.89
Deciles 7–8	47	2.90	1.20	0.77–1.86
Deciles 9–10	70	3.76	1.55	1.03–2.34
Prioritised ethnicity				
Māori	62	3.48	0.98	0.73–1.31
Pacific	20	2.85	0.80	0.50–1.28
Asian/Indian	5	0.53	0.15	0.06–0.37
MELAA	<5	s	s	s
European/Other	147	3.56	1.00	
Gender				
Female	75	2.00	1.00	
Male	163	4.17	2.08	1.58–2.73
Age group (years)				
0–4	33	2.14	0.42	0.29–0.61
5–14	45	1.51	0.29	0.21–0.41
15–24	160	5.13	1.00	

Numerator: National Minimum Dataset, Denominator: Statistics NZ Estimated Resident Population; Rate ratios are unadjusted; Ethnicity is level 1 prioritised; Decile is NZDep2013

Table 135. Hospitalisations for motorbike-related and cyclist-related non-traffic land transport injuries in 0–24 year olds, by demographic factor, New Zealand 2010–2014

Variable	Number: 2010–2014	Rate per 100,000 population	Rate ratio	95% CI
0–24 year olds				
Non-traffic land transport injuries: motorbike				
NZ Deprivation Index quintile				
Deciles 1–2	352	25.09	1.00	
Deciles 3–4	443	33.33	1.33	1.15–1.53
Deciles 5–6	450	31.31	1.25	1.09–1.43
Deciles 7–8	409	25.24	1.01	0.87–1.16
Deciles 9–10	368	19.78	0.79	0.68–0.91
Prioritised ethnicity				
Māori	272	15.26	0.37	0.32–0.42
Pacific	18	2.57	0.06	0.04–0.10
Asian/Indian	11	1.17	0.03	0.02–0.05
MELAA	<5	s	s	s
European/Other	1,717	41.58	1.00	
Gender				
Female	182	4.86	1.00	
Male	1,858	47.54	9.77	8.39–11.38
Age group (years)				
0–4	24	1.56	0.04	0.02–0.05
5–14	692	23.16	0.55	0.50–0.60
15–24	1,324	42.42	1.00	
Non-traffic land transport injuries: cyclist				
NZ Deprivation Index quintile				
Deciles 1–2	310	22.10	1.00	
Deciles 3–4	356	26.78	1.21	1.04–1.41
Deciles 5–6	345	24.00	1.09	0.93–1.27
Deciles 7–8	363	22.40	1.01	0.87–1.18
Deciles 9–10	440	23.66	1.07	0.93–1.24
Prioritised ethnicity				
Māori	405	22.72	0.74	0.66–0.83
Pacific	97	13.84	0.45	0.37–0.56
Asian/Indian	42	4.48	0.15	0.11–0.20
MELAA	24	24.47	0.80	0.53–1.20
European/Other	1,263	30.58	1.00	
Gender				
Female	342	9.14	1.00	
Male	1,507	38.56	4.22	3.75–4.74
Age group (years)				
0–4	209	13.56	0.58	0.50–0.67
5–14	907	30.35	1.29	1.17–1.42
15–24	733	23.49	1.00	

Numerator: National Minimum Dataset, Denominator: Statistics NZ Estimated Resident Population; Rate ratios are unadjusted; Ethnicity is level 1 prioritised; Decile is NZDep2013

Table 136. Hospitalisations for pedestrian-related non-traffic land transport injuries in 0–24 year olds, by demographic factor, New Zealand 2010–2014

Variable	Number: 2010–2014	Rate per 100,000 population	Rate ratio	95% CI
Non-traffic land transport injuries: pedestrian				
0–24 year olds				
NZ Deprivation Index quintile				
Deciles 1–2	38	2.71	1.00	
Deciles 3–4	46	3.46	1.28	0.83–1.96
Deciles 5–6	46	3.20	1.18	0.77–1.82
Deciles 7–8	78	4.81	1.78	1.21–2.62
Deciles 9–10	132	7.10	2.62	1.83–3.76
Prioritised ethnicity				
Māori	126	7.07	1.90	1.50–2.40
Pacific	37	5.28	1.42	0.99–2.03
Asian/Indian	27	2.88	0.77	0.51–1.16
MELAA	<5	s	s	s
European/Other	154	3.73	1.00	
Gender				
Female	133	3.55	1.00	
Male	215	5.50	1.55	1.25–1.92
Age group (years)				
0–4	137	8.89	3.02	2.32–3.93
5–14	119	3.98	1.35	1.03–1.77
15–24	92	2.95	1.00	

Numerator: National Minimum Dataset, Denominator: Statistics NZ Estimated Resident Population; Rate ratios are unadjusted; Ethnicity is level 1 prioritised; Decile is NZDep2013

Thermal injury

Between 2008 and 2012 there were 11 deaths of 0–14 year olds and 10 deaths of 15–24 year olds as a result of thermal injury **(Table 117)**. Between 2010 and 2014 thermal injury resulted in 1,965 hospitalisations for 0–14 year olds and 759 hospitalisations of 15–24 year olds **(Table 118**, **Table 119)**.

Distribution by cause

Over half the hospitalisations of 0–14 year olds (57.4%) were the result of contact with hot drinks, food, fats and other hot fluids. For 15–24 year olds the most common causes of thermal injury were exposure to smoke, flame and fire, and contact with hot drinks, foods; combined these two causes comprised 56.8% of all hospitalisations for the older age group **(Table 137)**.

Table 137. Hospitalisations for thermal injuries in 0–24 year olds, by age group and cause of injury, New Zealand 2010–2014

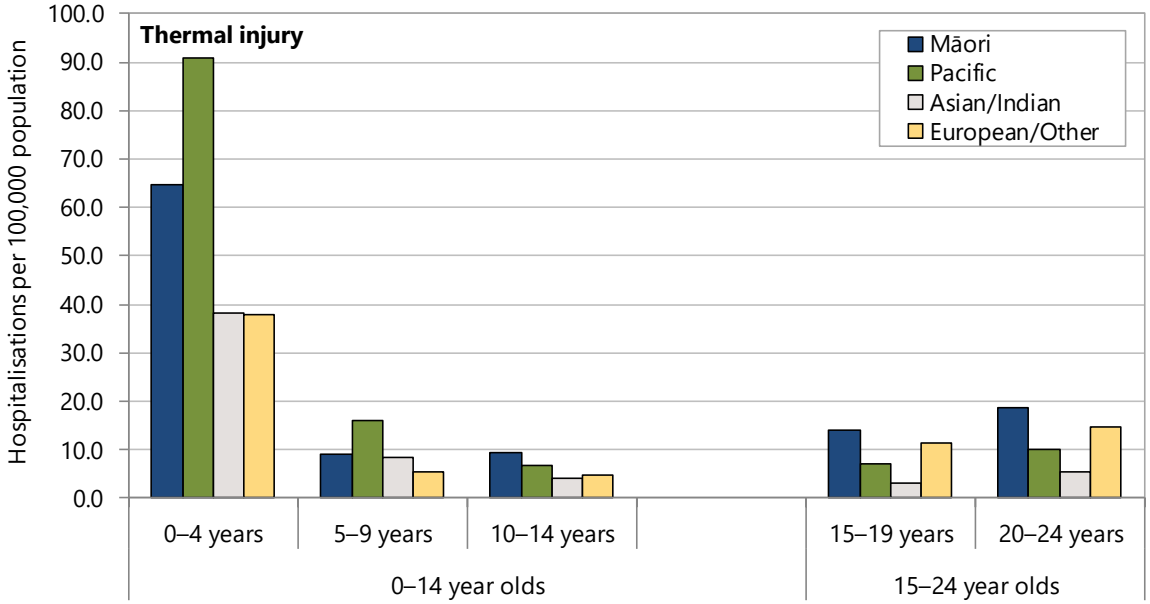
Cause of injury: thermal injury	Number: 2010–2014	Number: annual average	Rate per 100,000 population	95% CI	Per cent
New Zealand					
0–14 year olds					
Contact with hot drinks, food, fats, cooking oils, other hot fluids	1,128	226	24.90	23.49–26.40	57.4
Contact with hot household appliances, hot heating appliances, radiators and pipes	260	52	5.74	5.08–6.48	13.2
Contact with hot tap-water	204	41	4.50	3.93–5.17	10.4
Exposure to smoke, fire and flames	182	36	4.02	3.48–4.65	9.3
Contact with hot substances, other hot metals, other and unspecified heat	61	12	1.35	1.05–1.73	3.1
Exposure to ignition of highly flammable material	44	9	0.97	0.72–1.30	2.2
Contact with hot engines, machinery and tools	28	6	0.62	0.43–0.89	1.4
Exposure to electric current	28	6	0.62	0.43–0.89	1.4
Exposure to ignition or melting clothing or nightwear	26	5	0.57	0.39–0.84	1.3
Other thermal injury	<5	s	s	s	s
Total	1,965	393	43.38	41.51–45.35	100.0
15–24 year olds					
Exposure to smoke, fire and flames	222	44	7.11	6.24–8.11	29.2
Contact with hot drinks, food, fats, cooking oils, other hot fluids	209	42	6.70	5.85–7.67	27.5
Exposure to ignition of highly flammable material	125	25	4.01	3.36–4.77	16.5
Contact with hot substances, other hot metals, other and unspecified heat	53	11	1.70	1.30–2.22	7.0
Exposure to electric current	50	10	1.60	1.22–2.11	6.6
Contact with hot household appliances, hot heating appliances, radiators and pipes	32	6	1.03	0.73–1.45	4.2
Contact with hot engines, machinery and tools	22	4	0.70	0.47–1.07	2.9
Contact with hot tap-water	19	4	0.61	0.39–0.95	2.5
Exposure to ignition or melting clothing or nightwear	18	4	0.58	0.36–0.91	2.4
Other thermal injury	9	2	0.29	0.15–0.55	1.2
Total	759	152	24.32	22.65–26.11	100.0

Numerator: National Minimum Dataset (acute and arranged admissions; excludes ED cases); Denominator: Statistics NZ Estimated Resident Population

Distribution by demographic factors

For 0–14 year olds there is a differential for thermal injury hospitalisation with rates for areas with NZDep2013 decile 3–10 scores being *significantly higher* than those in deciles 1–2. Among 15–24 year olds rates were *significantly higher* for NZDep2013 deciles 7–10. Compared with European/Other thermal injury hospitalisation rates were *significantly higher* for Māori 0–24 year olds, Pacific, Asian/Indian and MELAA 0–14 year olds, and *significantly lower* for Pacific and Asian/Indian 15–24 year olds. Males had a *significantly higher* rate than females **(Table 138**, **Table 139)**. Children aged under 5 years had much higher rates of hospitalisation than any other age group **(Figure 173)**.

Figure 173. Hospitalisations for thermal injuries in 0–24 year olds, by age group and ethnicity, New Zealand 2010–2014



Numerator: National Minimum Dataset (acute and arranged admissions; excludes ED cases); Denominator: Statistics NZ Estimated Resident Population; Ethnicity is level 1 prioritised

Table 138. Hospitalisations for thermal injuries in 0–14 year olds, by demographic factor, New Zealand 2010–2014

Variable	Number: 2010–2014	Rate per 100,000 population	Rate ratio	95% CI
Thermal injuries				
0–14 year olds				
NZ Deprivation Index quintile				
Deciles 1–2	175	20.08	1.00	
Deciles 3–4	210	26.02	1.30	1.06–1.58
Deciles 5–6	266	31.10	1.55	1.28–1.87
Deciles 7–8	439	46.71	2.33	1.95–2.77
Deciles 9–10	861	81.61	4.06	3.45–4.78
Prioritised ethnicity				
Māori	670	58.14	1.92	1.73–2.13
Pacific	340	78.13	2.58	2.26–2.93
Asian/Indian	172	36.11	1.19	1.01–1.41
MELAA	45	80.85	2.66	1.97–3.60
European/Other	731	30.34	1.00	
Gender				
Female	799	36.20	1.00	
Male	1,166	50.22	1.39	1.27–1.52

Numerator: National Minimum Dataset (acute and arranged admissions; excludes ED cases); Denominator: Statistics NZ Estimated Resident Population; Rate ratios are unadjusted; Ethnicity is level 1 prioritised; Decile is NZDep2013

Table 139. Hospitalisations for thermal injuries in 15–24 year olds, by demographic factor, New Zealand 2010–2014

Variable	Number: 2010–2014	Rate per 100,000 population	Rate ratio	95% CI
Thermal injuries				
15–24 year olds				
NZ Deprivation Index quintile				
Deciles 1–2	92	17.32	1.00	
Deciles 3–4	105	20.11	1.16	0.88–1.54
Deciles 5–6	128	21.99	1.27	0.97–1.66
Deciles 7–8	179	26.31	1.52	1.18–1.95
Deciles 9–10	240	29.82	1.72	1.35–2.19
Prioritised ethnicity				
Māori	205	32.52	1.23	1.04–1.45
Pacific	45	16.94	0.64	0.47–0.87
Asian/Indian	41	8.88	0.34	0.24–0.46
MELAA	<5	s	s	s
European/Other	454	26.39	1.00	
Gender				
Female	208	13.56	1.00	
Male	551	34.73	2.56	2.18–3.00

Numerator: National Minimum Dataset (acute and arranged admissions; excludes ED cases); Denominator: Statistics NZ Estimated Resident Population; Rate ratios are unadjusted; Ethnicity is level 1 prioritised; Decile is NZDep2013

Poisoning

Between 2008 and 2012 there were nine deaths of 0–14 year olds and 53 deaths of 15–24 year olds as a result of unintentional poisoning **(Table 117)**. Between 2010 and 2014 there were 1,792 hospitalisations of 0–14 year olds and 504 of 15–24 year olds for poisoning **(Table 118, Table 119).**

Distribution by cause

The most common causes of poisoning for both 0–14 year olds and 15–24 year olds were the two groupings: firstly, antiepileptic, sedative-hypnotic, anti-parkinsonism and psychotropic drugs, not elsewhere classified, and secondly, non-opioid analgesics, antipyretics and anti-rheumatics **(Table 140).**

Table 140. Hospitalisations for poisoning in 0–24 year olds, by age group and type of poisoning, New Zealand 2010–2014

Cause of injury: poisoning	Number: 2010–2014	Number: annual average	Rate per 100,000 population	95% CI	Per cent
New Zealand					
0–14 year olds					
Antiepileptic, sedative-hypnotic, antiparkinsonism and psychotropic drugs, NEC	340	68	7.51	6.75–8.35	19.0
Non-opioid analgesics, antipyretics and antirheumatics	333	67	7.35	6.60–8.19	18.6
Narcotics and psychodysleptics (hallucinogens), NEC	162	32	3.58	3.07–4.17	9.0
Other and unspecified drugs, medicaments and biological substances	422	84	9.32	8.47–10.25	23.5
Other drugs acting on the autonomic nervous system	80	16	1.77	1.42–2.20	4.5
Organic solvents and halogenated hydrocarbons and their vapours	71	14	1.57	1.24–1.98	4.0
Pesticides	40	8	0.88	0.65–1.20	2.2
Alcohol	34	7	0.75	0.54–1.05	1.9
Other gases and vapours	20	4	0.44	0.29–0.68	1.1
Other and unspecified chemicals and noxious substances	290	58	6.40	5.71–7.18	16.2
Total	1,792	358	39.57	37.78–41.44	100.0
15–24 year olds					
Antiepileptic, sedative-hypnotic, antiparkinsonism and psychotropic drugs, NEC	120	24	3.85	3.22–4.60	23.8
Non-opioid analgesics, antipyretics and antirheumatics	117	23	3.75	3.13–4.49	23.2
Narcotics and psychodysleptics (hallucinogens), NEC	52	10	1.67	1.27–2.18	10.3
Other and unspecified drugs, medicaments and biological substances	44	9	1.41	1.05–1.89	8.7
Other drugs acting on the autonomic nervous system	<5	s	s	s	s
Alcohol	39	8	1.25	0.91–1.71	7.7
Other gases and vapours	19	4	0.61	0.39–0.95	3.8
Pesticides	6	1	0.19	0.09–0.42	1.2
Organic solvents and halogenated hydrocarbons and their vapours	<5	s	s	s	s
Other and unspecified chemicals and noxious substances	102	20	3.27	2.69–3.97	20.2
Total	504	101	16.15	14.80–17.62	100.0

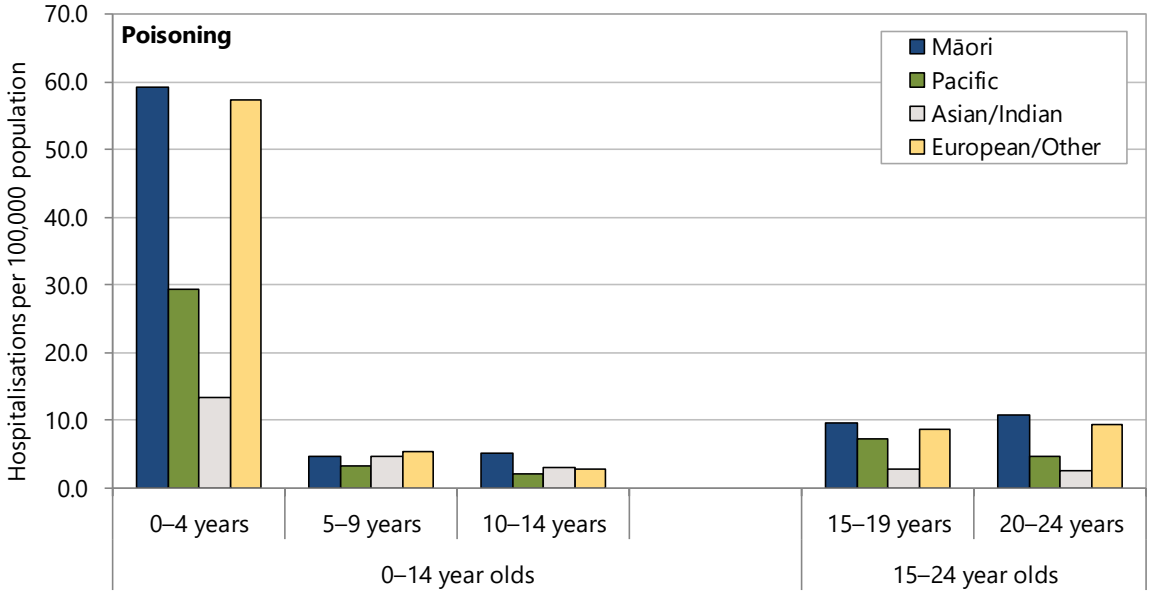
Numerator: National Minimum Dataset (acute and arranged admissions; excludes ED cases); Denominator: Statistics NZ Estimated Resident Population

Distribution by demographic factors

The 0–14 year olds living in areas with higher deprivation index scores (NZDep2013 deciles 5–10) had *significantly higher* rates for poisoning than those living in low deprivation areas (deciles 1–2). Rates for Māori were *significantly higher*, and for Pacific and Asian/Indian *significantly lower*, than European/Other for those aged 0–14 years. There was *no significant* difference between males and females aged 0–14 years **(Table 141)**.

Among 15–24 year olds, those in NZDep2013 deciles 7–10 had *significantly higher* rates, and Pacific and Asian/Indian had *significantly lower* rates than European/Other. There was *no significant* difference between males and females among 15–24 year olds **(Table 142)**. Rates for hospitalisations for unintentional poisoning were highest for Māori and European/Other aged 0–4 year olds **(Figure 174)**.

Figure 174. Hospitalisations for poisoning in 0–24 year olds, by age and ethnicity, New Zealand 2010–2014



Numerator: National Minimum Dataset (acute and arranged admissions; excludes ED cases); Denominator: Statistics NZ Estimated Resident Population; Rate ratios are unadjusted; Ethnicity is level 1 prioritised

Table 141. Hospitalisations for poisoning in 0–14 year olds, by demographic factor, New Zealand 2010–2014

Variable	Number: 2010–2014	Rate per 100,000 population	Rate ratio	95% CI
Poisoning				
0–14 year olds				
NZ Deprivation Index quintile				
Deciles 1–2	227	26.05	1.00	
Deciles 3–4	249	30.85	1.18	0.99–1.42
Deciles 5–6	329	38.47	1.48	1.25–1.75
Deciles 7–8	454	48.30	1.85	1.58–2.17
Deciles 9–10	527	49.95	1.92	1.64–2.24
Prioritised ethnicity				
Māori	559	48.51	1.13	1.02–1.26
Pacific	104	23.90	0.56	0.46–0.68
Asian/Indian	70	14.69	0.34	0.27–0.44
MELAA	25	44.92	1.05	0.71–1.56
European/Other	1,032	42.83	1.00	
Gender				
Female	831	37.65	1.00	
Male	961	41.39	1.10	1.00–1.21

Numerator: National Minimum Dataset (acute and arranged admissions; excludes ED cases); Denominator: Statistics NZ Estimated Resident Population; Rate ratios are unadjusted; Ethnicity is level 1 prioritised; Decile is NZDep2013

Table 142. Hospitalisations for poisoning in 15–24 year olds, by demographic factor, New Zealand 2010–2014

Variable	Number: 2010–2014	Rate per 100,000 population	Rate ratio	95% CI
Poisoning				
15–24 year olds				
NZ Deprivation Index quintile				
Deciles 1–2	63	11.86	1.00	
Deciles 3–4	70	13.41	1.13	0.80–1.59
Deciles 5–6	81	13.92	1.17	0.84–1.63
Deciles 7–8	147	21.61	1.82	1.36–2.45
Deciles 9–10	137	17.02	1.44	1.06–1.93
Prioritised ethnicity				
Māori	127	20.15	1.12	0.91–1.38
Pacific	32	12.05	0.67	0.47–0.97
Asian/Indian	25	5.41	0.30	0.20–0.45
MELAA	8	18.86	1.05	0.52–2.12
European/Other	309	17.96	1.00	
Gender				
Female	244	15.90	1.00	
Male	260	16.39	1.03	0.87–1.23

Numerator: National Minimum Dataset (acute and arranged admissions; excludes ED cases); Denominator: Statistics NZ Estimated Resident Population; Rate ratios are unadjusted; Ethnicity is level 1 prioritised; Decile is NZDep2013

Northern region distribution and trends

Comparison with New Zealand

From 2008 to 2012 death rates due to unintentional injury for 0–24 year olds were *significantly higher* in Northland than the overall national rate and *significantly lower* in Waitemata, Auckland, and Counties Manukau DHBs **(Table 143)**. The same pattern was evident among 15–24 year olds and also for 0–14 year olds except in Counties Manukau where rates for 0–14 year olds were *not significantly different* to the national rate.

Table 143. Deaths due to unintentional injuries, by age group, Northern DHBs vs New Zealand 2008–2012

DHB	Number: 2008–2012	Number: annual average	Rate per 100,000 population	Rate ratio	95% CI
Unintentional injury deaths					
0–24 year olds					
Northland	70	14	25.49	1.69	1.33–2.15
Waitemata	83	17	8.93	0.59	0.47–0.74
Auckland	62	12	8.02	0.53	0.41–0.69
Counties Manukau	111	22	11.60	0.77	0.63–0.93
New Zealand	1,146	229	15.10	1.00	
0–14 year olds					
Northland	32	6	17.80	2.15	1.50–3.08
Waitemata	26	5	4.70	0.57	0.38–0.84
Auckland	14	3	3.44	0.42	0.24–0.71
Counties Manukau	45	9	7.65	0.92	0.68–1.26
New Zealand	373	75	8.29	1.00	
15–24 year olds					
Northland	38	8	40.05	1.60	1.16–2.22
Waitemata	57	11	15.14	0.61	0.46–0.79
Auckland	48	10	13.08	0.52	0.39–0.70
Counties Manukau	66	13	17.90	0.72	0.56–0.92
New Zealand	773	155	25.03	1.00	

Numerator: National Mortality Collection; Denominator: Statistics NZ Estimated Resident Population

From 2010 to 2014 injury hospitalisation rates for 0–24 year olds were *significantly higher* in Northland and Counties Manukau than the overall national rate, and *significantly lower* in Waitemata and Auckland DHBs. **(Table 144)**.

Table 144. Hospitalisations for unintentional injuries, by age group, Northern DHBs vs New Zealand 2010–2014

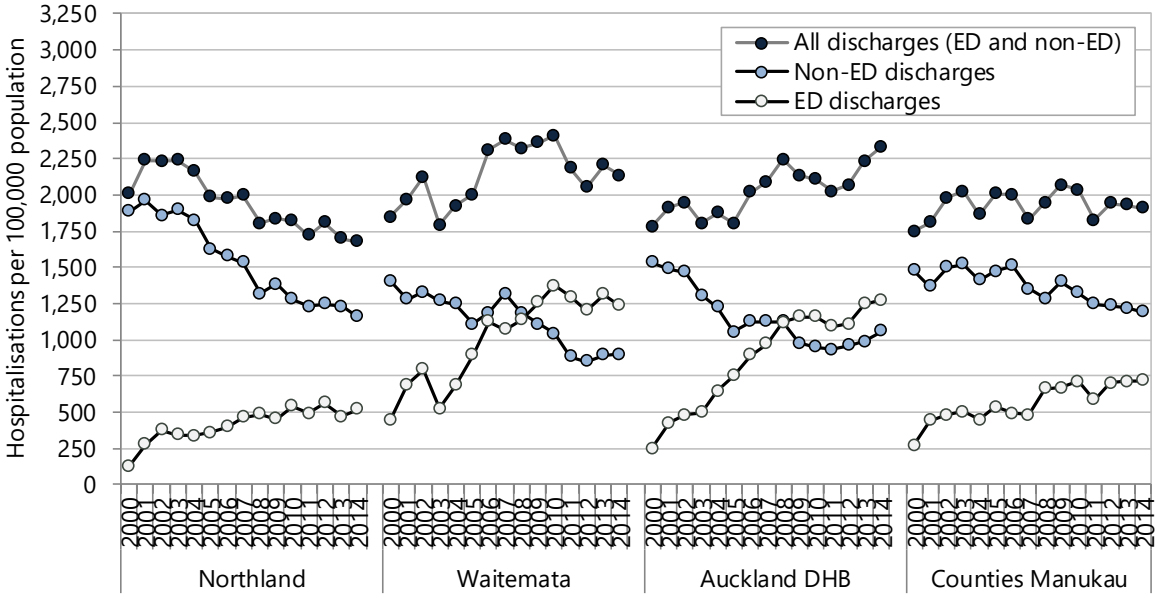
DHB	Number: 2010–2014	Number: annual average	Rate per 100,000 population	Rate ratio	95% CI
Unintentional injury hospitalisations					
0–24 year olds					
Northland	3,926	785	1,412.99	1.23	1.19–1.27
Waitemata	9,612	1,922	1,017.14	0.89	0.87–0.90
Auckland	7,541	1,508	962.80	0.84	0.82–0.86
Counties Manukau	12,228	2,446	1,258.80	1.10	1.08–1.12
New Zealand	87,822	17,564	1,147.98	1.00	
0–14 year olds					
Northland	2,228	446	1,228.32	1.13	1.09–1.18
Waitemata	5,125	1,025	912.56	0.84	0.82–0.87
Auckland	4,033	807	977.68	0.90	0.87–0.93
Counties Manukau	7,377	1,475	1,242.49	1.15	1.12–1.17
New Zealand	49,103	9,821	1,084.13	1.00	
15–24 year olds					
Northland	1,698	340	1,760.24	1.42	1.35–1.49
Waitemata	4,487	897	1,170.32	0.94	0.91–0.97
Auckland	3,508	702	946.24	0.76	0.74–0.79
Counties Manukau	4,851	970	1,284.45	1.04	1.01–1.07
New Zealand	38,719	7,744	1,240.64	1.00	

Numerator: National Minimum Dataset (acute and arranged admissions; excludes ED cases); Denominator: Statistics NZ Estimated Resident Population; Rates are per 100,000 age specific population

Northern region trends

From 2000 to 2014 the hospitalisation rate (excluding emergency department (ED) discharges) for unintentional injury among 0–14 year olds declined in all Northern DHBs. **(Figure 175)**. The decline was most notable for Northland.

Figure 175. Hospitalisations from injuries in 0–14 year olds, by year of discharge and discharge type, Northern DHBs 2000–2014



Numerator: National Minimum Dataset (acute and arranged admissions); Denominator: Statistics NZ Estimated Resident Population; See **Appendix 3** for definitions for hospitalisation and discharge

Injury hospitalisation rates for falls for 0–14 year olds declined from 2000 to 2014 in the four Northern DHBs, while hospitalisations for inanimate mechanical forces remained relatively stable. The hospitalisation rate for 15–24 year olds varied by injury type during this period **(Figure 176)**.

In the four Northern DHBs hospitalisation rates for road traffic injury (RTI) declined over the period 2000 to 2014 and this was mainly attributable to a fall in rates for 15–24 year olds vehicle occupants in road traffic crashes. Between 2000 and 2014, rates fell steeply for vehicle occupant hospitalisations for both 0–14 and 15–24 year olds in Northland **(Figure 176)**.

Distribution by cause

In the Northern DHBs between 2008 and 2012, the leading causes of death were suffocation among 0–14 year olds and RTIs among 15–24 year olds. The less commonly occurring causes were found in both age groups, although not consistently so: RTIs, inanimate mechanical forces, drowning, non-traffic transport incidents, poisoning and thermal **(Table 145, Table 146)**.

Table 145. Unintentional injury deaths in 0–24 year olds, by age group and cause, Northland and Counties Manukau DHBs 2008–2012

Deaths by cause of unintentional injury	Number: 2008–2012	Number: annual average	Rate per 100,000 population	95% CI	Per cent
Northland					
0–14 year olds					
Suffocation	15	3	8.34	5.06–13.77	46.9
Non-traffic transport incidents	4	1	2.23	0.87–5.72	12.5
Road traffic	4	1	2.23	0.87–5.72	12.5
Drowning or submersion	4	1	2.23	0.87–5.72	12.5
Other causes	5	1	2.78	1.19–6.51	15.6
Total	32	6	13.35	8.97–19.87	100.0
15–24 year olds					
Road traffic	28	6	29.51	20.42–42.64	73.7
Other causes	10	2	10.54	5.72–19.40	26.3
Total	38	8	8.43	4.27–16.64	100.0
Counties Manukau					
0–14 year olds					
Suffocation	16	3	2.72	1.67–4.42	35.6
Road traffic	8	2	1.36	0.69–2.68	17.8
Non-traffic transport incidents	7	1	1.19	0.58–2.46	15.6
Drowning or submersion	7	1	1.19	0.58–2.46	15.6
Other causes	7	1	1.19	0.58–2.46	15.6
Total	45	9	5.10	3.57–7.28	100.0
15–24 year olds					
Road traffic	50	10	13.56	10.28–17.87	75.8
Other causes	16	3	4.34	2.67–7.05	24.2
Total	66	13	4.34	2.67–7.05	100.0

Numerator: National Mortality Collection; Denominator: Statistics NZ Estimated Resident Population; Rates are per 100,000 age-specific population

Table 146. Deaths due to unintentional injuries in 0–24 year olds, by age group and cause of injury, Waitemata and Auckland DHBs 2008–2012

	Number: 2008–2012	Number: annual average	Rate per 100,000 population	95% CI	Per cent
Waitemata					
0–14 year olds					
Suffocation	9	2	1.63	0.86–3.09	34.6
Drowning or submersion	7	1	1.26	0.61–2.61	26.9
Non-traffic transport incidents	5	1	0.90	0.39–2.11	19.2
Other causes	5	1	0.90	0.39–2.11	19.2
Total	26	5	3.43	2.20–5.36	100.0
15–24 year olds					
Road traffic	37	7	9.83	7.13–13.55	64.9
Poisoning	5	1	1.33	0.57–3.11	8.8
Drowning or submersion	4	1	1.06	0.41–2.73	7.0
Thermal	3	1	0.80	0.27–2.34	5.3
Other causes	8	2	2.13	1.08–4.19	14.0
Total	57	11	4.78	3.03–7.56	100.0
Auckland DHB					
0–14 year olds					
Suffocation	11	2	2.71	1.51–4.85	78.6
Road traffic	3	1	0.74	0.25–2.17	21.4
Total	14	3	2.71	1.51–4.85	100.0
15–24 year olds					
Road traffic	25	5	6.81	4.62–10.06	52.1
Inanimate mechanical forces	8	2	2.18	1.10–4.30	16.7
Drowning or submersion	6	1	1.64	0.75–3.57	12.5
Poisoning	4	1	1.09	0.42–2.80	8.3
Other causes	5	1	1.36	0.58–3.19	10.4
Total	48	10	6.00	3.96–9.08	100.0

Numerator: National Mortality Collection; Denominator: Statistics NZ Estimated Resident Population; Rates are per 100,000 age-specific population

Between 2010 and 2014, falls was the leading cause of hospitalisations among 0–14 year olds in all four Northern DHBs, contributing between 43.3% and 47.0% of the injury hospitalisations. The next most common causes of injury were inanimate mechanical forces and animate mechanical forces. Two frequent causes of injury hospitalisations for 15–24 year olds during this time period were inanimate mechanical forces, falls and RTIs **(Table 147**, **Table 148**, **Table 149**, **Table 150)**.

Table 147. Hospitalisations from unintentional injuries in 0–24 year olds, by age group and cause of injury, Northland 2010–2014

Hospitalisations by main external cause of unintentional injury	Number: 2010–2014	Number: annual average	Rate per 100,000 population	95% CI	Per cent
Northland					
0–14 year olds					
Falls	1,022	204	563.44	530.02–598.95	45.9
Inanimate mechanical forces	386	77	212.81	192.63–235.09	17.3
Non-traffic transport incidents	149	30	82.15	69.98–96.43	6.7
Vehicle occupant	*5*	*1*	*2.76*	*1.18–6.45*	*0.2*
Motorbike	*49*	*10*	*27.01*	*20.44–35.71*	*2.2*
Cyclist	*63*	*13*	*34.73*	*27.15–44.43*	*2.8*
Pedestrian	*16*	*3*	*8.82*	*5.43–14.33*	*0.7*
Other or unspecified	*16*	*3*	*8.82*	*5.43–14.33*	*0.7*
Animate mechanical forces	147	29	81.04	68.96–95.24	6.6
Road traffic crash	122	24	67.26	56.34–80.30	5.5
Vehicle occupant	*51*	*10*	*28.12*	*21.39–36.96*	*2.3*
Motorbike	*16*	*3*	*8.82*	*5.43–14.33*	*0.7*
Cyclist	*31*	*6*	*17.09*	*12.04–24.26*	*1.4*
Pedestrian	*20*	*4*	*11.03*	*7.14–17.03*	*0.9*
Other or unspecified	*<5*	*s*	*s*	*s*	*s*
Other or unspecified land transport	72	14	39.69	31.52–49.98	3.2
Other transport	<5	s	s	s	s
Poisoning	97	19	53.48	43.84–65.23	4.4
Thermal	78	16	43.00	34.46–53.66	3.5
Drowning or submersion	16	3	8.82	5.43–14.33	0.7
Suffocation	13	3	7.17	4.19–12.26	0.6
Other causes	111	22	61.20	50.82–73.68	5.0
Undetermined intent	11	2	6.06	3.39–10.86	0.5
Total	2,228	446	1,228.32	1,178.65–1,280.06	100.0
15–24 year olds					
Inanimate mechanical forces	388	78	402.22	364.21–444.19	22.9
Road traffic crash	362	72	375.27	338.61–415.88	21.3
Vehicle occupant	265	53	274.71	243.60–309.78	15.6
Motorbike	*52*	*10*	*53.91*	*41.11–70.68*	*3.1*
Cyclist	*18*	*4*	*18.66*	*11.80–29.50*	*1.1*
Pedestrian	*20*	*4*	*20.73*	*13.42–32.02*	*1.2*
Other or unspecified	*7*	*1*	*7.26*	*3.52–14.98*	*0.4*
Falls	*357*	*71*	*370.09*	*333.69–410.43*	*21.0*
Non-traffic transport incidents	163	33	168.97	144.96–196.95	9.6
Vehicle occupant	13	3	13.48	7.88–23.06	0.8
Motorbike	*82*	*16*	*85.01*	*68.50–105.49*	*4.8*
Cyclist	*22*	*4*	*22.81*	*15.06–34.53*	*1.3*
Pedestrian	*6*	*1*	*6.22*	*2.85–13.57*	*0.4*
Other or unspecified	*40*	*8*	*41.47*	*30.45–56.46*	*2.4*
Other or unspecified land transport	67	13	69.46	54.70–88.19	3.9
Other transport	7	1	7.26	3.52–14.98	0.4
Animate mechanical forces	155	31	160.68	137.31–188.02	9.1
Thermal	37	7	38.36	27.83–52.86	2.2
Poisoning	22	4	22.81	15.06–34.53	1.3
Drowning or submersion	5	1	5.18	2.21–12.13	0.3
Suffocation	<5	s	s	s	s
Other causes	107	21	110.92	91.81–134.01	6.3
Undetermined intent	24	5	24.88	16.72–37.02	1.4
Total	1,698	340	1,760.24	1,679.15–1,845.16	100.0

Numerator: National Minimum Dataset (acute and arranged admissions; excludes ED cases); Denominator: Statistics NZ Estimated Resident Population

Table 148. Hospitalisations from unintentional injuries in 0–24 year olds, by age group and cause of injury, Waitemata 2010–2014

Hospitalisations by main external cause of unintentional injury	Number: 2010–2014	Number: annual average	Rate per 100,000 population	95% CI	Per cent
Waitemata					
0–14 year olds					
Falls	2,264	453	403.13	386.89–420.04	44.2
Inanimate mechanical forces	1,369	274	243.76	231.20–257.01	26.7
Animate mechanical forces	316	63	56.27	50.40–62.82	6.2
Road traffic crash	277	55	49.32	43.85–55.48	5.4
Vehicle occupant	*71*	*14*	*12.64*	*10.02–15.94*	*1.4*
Motorbike	*7*	*1*	*1.25*	*0.60–2.57*	*0.1*
Cyclist	*127*	*25*	*22.61*	*19.01–26.90*	*2.5*
Pedestrian	*67*	*13*	*11.93*	*9.40–15.15*	*1.3*
Other or unspecified	*5*	*1*	*0.89*	*0.38–2.08*	*0.1*
Non-traffic transport incidents	197	39	35.08	30.51–40.33	3.8
Vehicle occupant	*7*	*1*	*1.25*	*0.60–2.57*	*0.1*
Motorbike	*33*	*7*	*5.88*	*4.18–8.25*	*0.6*
Cyclist	*107*	*21*	*19.05*	*15.77–23.02*	*2.1*
Pedestrian	*26*	*5*	*4.63*	*3.16–6.78*	*0.5*
Other or unspecified	*24*	*5*	*4.27*	*2.87–6.36*	*0.5*
Other or unspecified land transport	71	14	12.64	10.02–15.94	1.4
Other transport	9	2	1.60	0.84–3.05	0.2
Thermal	164	33	29.20	25.06–34.03	3.2
Poisoning	117	23	20.83	17.38–24.96	2.3
Suffocation	53	11	9.44	7.22–12.34	1.0
Drowning or submersion	23	5	4.10	2.73–6.15	0.4
Other causes	251	50	44.69	39.50–50.57	4.9
Undetermined intent	14	3	2.49	1.48–4.18	0.3
Total	5,125	1,025	912.56	888.02–937.77	100.0
15–24 year olds					
Falls	1,264	253	329.68	312.03–348.33	28.2
Inanimate mechanical forces	1,240	248	323.42	305.94–341.90	27.6
Road traffic crash	613	123	159.89	147.73–173.04	13.7
Vehicle occupant	*350*	*70*	*91.29*	*82.22–101.36*	*7.8*
Motorbike	*126*	*25*	*32.86*	*27.61–39.12*	*2.8*
Cyclist	*70*	*14*	*18.26*	*14.45–23.06*	*1.6*
Pedestrian	*63*	*13*	*16.43*	*12.84–21.02*	*1.4*
Other or unspecified	*<5*	*s*	*s*	*s*	*s*
Animate mechanical forces	367	73	95.72	86.42–106.02	8.2
Non-traffic transport incidents	218	44	56.86	49.80–64.92	4.9
Vehicle occupant	*22*	*4*	*5.74*	*3.79–8.69*	*0.5*
Motorbike	*96*	*19*	*25.04*	*20.51–30.57*	*2.1*
Cyclist	*60*	*12*	*15.65*	*12.16–20.14*	*1.3*
Pedestrian	*11*	*2*	*2.87*	*1.60–5.14*	*0.2*
Other or unspecified	*29*	*6*	*7.56*	*5.27–10.86*	*0.6*
Other or unspecified land transport	71	14	18.52	14.68–23.36	1.6
Other transport	24	5	6.26	4.21–9.31	0.5
Thermal	62	12	16.17	12.62–20.73	1.4
Poisoning	61	12	15.91	12.39–20.43	1.4
Suffocation	7	1	1.83	0.88–3.77	0.2
Drowning or submersion	<5	s	s	s	s
Other causes	448	90	116.85	106.52–128.17	10.0
Undetermined intent	110	22	28.69	23.81–34.58	2.5
Total	4,487	897	1,170.32	1,136.76–1,204.85	100.0

Numerator: National Minimum Dataset (acute and arranged admissions; excludes ED cases); Denominator: Statistics NZ Estimated Resident Population

Table 149. Hospitalisations from unintentional injuries in 0–24 year olds, by age group and cause of injury, Auckland DHB 2010–2014

Hospitalisations by main external cause of unintentional injury	Number: 2010–2014	Number: annual average	Rate per 100,000 population	95% CI	Per cent
Auckland DHB					
0–14 year olds					
Falls	1,896	379	459.63	439.44–480.74	47.0
Inanimate mechanical forces	1,226	245	297.21	281.05–314.29	30.4
Animate mechanical forces	227	45	55.03	48.32–62.67	5.6
Thermal	150	30	36.36	30.99–42.67	3.7
Road traffic crash	144	29	34.91	29.65–41.09	3.6
Vehicle occupant	*21*	*4*	*5.09*	*3.33–7.78*	*0.5*
Motorbike	*<5*	*s*	*s*	*s*	*s*
Cyclist	*61*	*12*	*14.79*	*11.51–18.99*	*1.5*
Pedestrian	*59*	*12*	*14.30*	*11.09–18.45*	*1.5*
Other or unspecified	*0*	..	..	..	..
Non-traffic transport incidents	91	18	22.06	17.97–27.08	2.3
Vehicle occupant	*5*	*1*	*1.21*	*0.52–2.84*	*0.1*
Motorbike	*10*	*2*	*2.42*	*1.32–4.46*	*0.2*
Cyclist	*53*	*11*	*12.85*	*9.82–16.80*	*1.3*
Pedestrian	*17*	*3*	*4.12*	*2.57–6.60*	*0.4*
Other or unspecified	*6*	*1*	*1.45*	*0.67–3.17*	*0.1*
Other or unspecified land transport	38	8	9.21	6.71–12.64	0.9
Other transport	7	1	1.70	0.82–3.50	0.2
Poisoning	46	9	11.15	8.36–14.87	1.1
Suffocation	45	9	10.91	8.15–14.60	1.1
Drowning or submersion	5	1	1.21	0.52–2.84	0.1
Other causes	152	30	36.85	31.44–43.19	3.8
Undetermined intent	6	1	1.45	0.67–3.17	0.1
Total	4,033	807	977.68	948.11–1,008.17	100.0
15–24 year olds					
Falls	1,159	232	312.63	295.16–331.12	33.0
Inanimate mechanical forces	939	188	253.29	237.61–269.99	26.8
Road traffic crash	486	97	131.09	119.95–143.27	13.9
Vehicle occupant	*248*	*50*	*66.90*	*59.07–75.75*	*7.1*
Motorbike	*94*	*19*	*25.36*	*20.72–31.02*	*2.7*
Cyclist	*80*	*16*	*21.58*	*17.34–26.85*	*2.3*
Pedestrian	*61*	*12*	*16.45*	*12.81–21.13*	*1.7*
Other or unspecified	*3*	*1*	*0.81*	*0.28–2.38*	*0.1*
Animate mechanical forces	336	67	90.63	81.45–100.85	9.6
Non-traffic transport incidents	94	19	25.36	20.72–31.02	2.7
Vehicle occupant	*9*	*2*	*2.43*	*1.28–4.61*	*0.3*
Motorbike	*24*	*5*	*6.47*	*4.35–9.63*	*0.7*
Cyclist	*41*	*8*	*11.06*	*8.15–15.00*	*1.2*
Pedestrian	*6*	*1*	*1.62*	*0.74–3.53*	*0.2*
Other or unspecified	*14*	*3*	*3.78*	*2.25–6.34*	*0.4*
Other or unspecified land transport	24	5	6.47	4.35–9.63	0.7
Other transport	17	3	4.59	2.86–7.34	0.5
Thermal	53	11	14.30	10.93–18.70	1.5
Poisoning	38	8	10.25	7.47–14.07	1.1
Suffocation	5	1	1.35	0.58–3.16	0.1
Drowning or submersion	<5	s	s	s	s
Other causes	334	67	90.09	80.94–100.28	9.5
Undetermined intent	19	4	5.13	3.28–8.01	0.5
Total	3,508	702	946.24	915.58–977.92	100.0

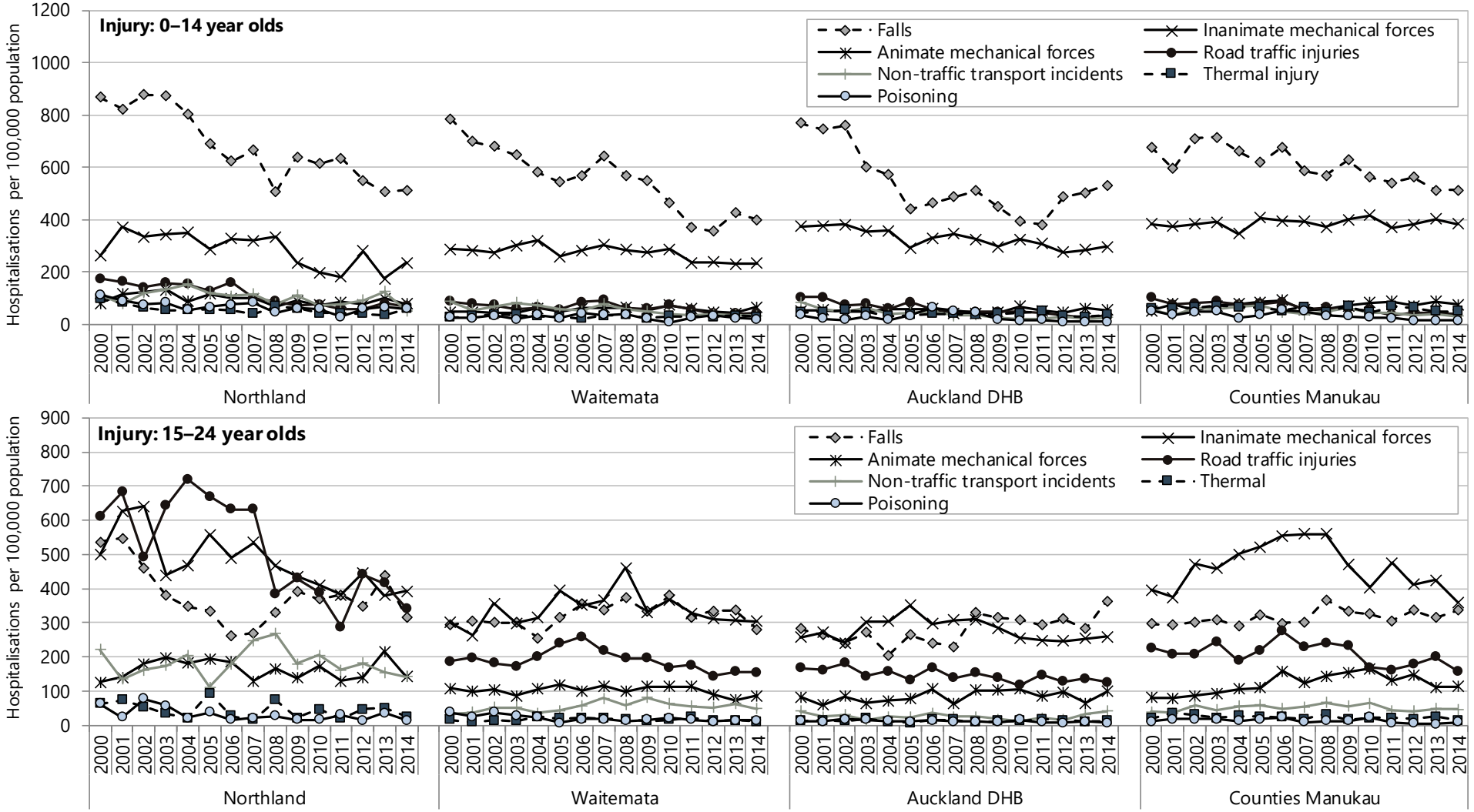
Numerator: National Minimum Dataset (acute and arranged admissions; excludes ED cases); Denominator: Statistics NZ Estimated Resident Population

Table 150. Hospitalisations from unintentional injuries in 0–24 year olds, by age group and cause of injury, Counties Manukau 2010–2014

Hospitalisations by main external cause of unintentional injury	Number: 2010–2014	Number: annual average	Rate per 100,000 population	95% CI	Per cent
Counties Manukau					
0–14 year olds					
Falls	3,191	638	537.45	519.17–556.37	43.3
Inanimate mechanical forces	2,316	463	390.08	374.54–406.26	31.4
Animate mechanical forces	473	95	79.67	72.81–87.17	6.4
Thermal	323	65	54.40	48.79–60.67	4.4
Road traffic crash	247	49	41.60	36.73–47.12	3.3
Vehicle occupant	*56*	*11*	*9.43*	*7.26–12.25*	*0.8*
Motorbike	*14*	*3*	*2.36*	*1.40–3.96*	*0.2*
Cyclist	*96*	*19*	*16.17*	*13.24–19.74*	*1.3*
Pedestrian	*79*	*16*	*13.31*	*10.68–16.58*	*1.1*
Other or unspecified	*<5*	*s*	*s*	*s*	*s*
Non-traffic transport incidents	226	45	38.06	33.42–43.36	3.1
Vehicle occupant	*12*	*2*	*2.02*	*1.16–3.53*	*0.2*
Motorbike	*35*	*7*	*5.89*	*4.24–8.20*	*0.5*
Cyclist	*129*	*26*	*21.73*	*18.29–25.81*	*1.7*
Pedestrian	*35*	*7*	*5.89*	*4.24–8.20*	*0.5*
Other or unspecified	*15*	*3*	*2.53*	*1.53–4.17*	*0.2*
Other or unspecified land transport	57	11	9.60	7.41–12.44	0.8
Other transport	6	1	1.01	0.46–2.20	0.1
Poisoning	102	20	17.18	14.15–20.85	1.4
Suffocation	64	13	10.78	8.44–13.76	0.9
Drowning or submersion	18	4	3.03	1.92–4.79	0.2
Other causes	327	65	55.08	49.42–61.38	4.4
Undetermined intent	27	5	4.55	3.13–6.62	0.4
Total	7,377	1,475	1,242.49	1,214.62–1,270.98	100.0
15–24 year olds					
Inanimate mechanical forces	1,566	313	414.65	394.65–435.65	32.3
Falls	1,225	245	324.36	306.72–343.00	25.3
Road traffic crash	657	131	173.96	161.17–187.77	13.5
Vehicle occupant	*437*	*87*	*115.71*	*105.36–127.07*	*9.0*
Motorbike	*106*	*21*	*28.07*	*23.21–33.94*	*2.2*
Cyclist	*45*	*9*	*11.92*	*8.91–15.94*	*0.9*
Pedestrian	*60*	*12*	*15.89*	*12.34–20.45*	*1.2*
Other or unspecified	*9*	*2*	*2.38*	*1.25–4.53*	*0.2*
Animate mechanical forces	506	101	133.98	122.81–146.16	10.4
Non-traffic transport incidents	187	37	49.51	42.91–57.14	3.9
Vehicle occupant	*19*	*4*	*5.03*	*3.22–7.86*	*0.4*
Motorbike	*74*	*15*	*19.59*	*15.61–24.59*	*1.5*
Cyclist	*54*	*11*	*14.30*	*10.96–18.65*	*1.1*
Pedestrian	*11*	*2*	*2.91*	*1.63–5.22*	*0.2*
Other or unspecified	*29*	*6*	*7.68*	*5.35–11.03*	*0.6*
Other or unspecified land transport	65	13	17.21	13.50–21.93	1.3
Other transport	10	2	2.65	1.44–4.87	0.2
Thermal	79	16	20.92	16.79–26.07	1.6
Poisoning	39	8	10.33	7.55–14.12	0.8
Suffocation	8	2	2.12	1.07–4.18	0.2
Drowning or submersion	<5	s	s	s	s
Other causes	459	92	121.53	110.92–133.16	9.5
Undetermined intent	49	10	12.97	9.81–17.15	1.0
Total	4,851	970	1,284.45	1,249.03–1,320.86	100.0

Numerator: National Minimum Dataset (acute and arranged admissions; excludes ED cases); Denominator: Statistics NZ Estimated Resident Population

Figure 176. Hospitalisations from injuries in 0–24 year olds, by age group, year of discharge, and injury type, Northern DHBs 2000–2014



Numerator: National Minimum Dataset (acute and arranged admissions; excludes ED cases); Denominator: Statistics NZ Estimated Resident Population

Evidence for good practice for the prevention of injury

New Zealand policy documents
Ministry of Transport. **Safer Journeys: New Zealand's Road Safety Strategy 2010–2020** http://www.transport.govt.nz/saferjourneys/Documents/SaferJourneyStrategy.pdf Increasing the safety of young drivers is a major priority in the Road Safety Strategy 2010–2020. The aim is to reduce road fatality rates for young people from 21 per 100,000 to a rate similar to Australia (13 per 100,000). Proposed strategies include multiple policy and practice initiatives across four key areas: safe roads and roadsides, safe speeds, safe vehicles and safe road use. The strategy reflects a programme designed to address some of the risk factors that research has identified but also to actively engage the community in acting positively to increase road safety.
New Zealand Water Safety Sector Strategy 2020 http://www.watersafety.org.nz/our-sector/water-safety-sector-strategy-2020/ The New Zealand Water Safety Sector has collectively developed and published in 2015, the Water Safety Sector Strategy 2020. In the face of New Zealand having the 8th highest drowning rate in the OECD, the Strategy provides describes the problem and identifies a set of outcomes and goals. Its goals are to reduce preventable drowning deaths by 35%, reduce drowning hospitalisations by 42%, halve the male drowning rate and reduce pre-school drowning to zero by 2020. These are to be reached by the sector working collectively so that all New Zealanders enjoy the water safely.
Ministry of Business Industry and Enterprise **Working Safer: a blueprint for health and safety at work** http://www.mbie.govt.nz/info-services/employment-skills/workplace-health-and-safety-reform/document-and-image-library/safety-first-blueprint.pdf The Working Safer Blueprint spells out the intention to reduce the unacceptably high rates of fatalities and serious injuries in the workplace by at least 25% by 2020. It quotes the principle included in the report of the Royal Commission on the Pike River Tragedy that "health and safety in New Zealand can be improved only by the combined efforts of government, employers and workers." The blueprint does not specify young people within the document, however, it is relevant to young people who are in the workforce.
International guidelines
NICE – National Institute for Health and Care Excellence http://www.nice.org.uk/ Unintentional injuries among under – 15s overview http://pathways.nice.org.uk/pathways/unintentional-injuries-among-under-15s http://www.nice.org.uk/guidance/ph30, http://www.nice.org.uk/guidance/ph31 The Pathway provides guidelines for preventing unintentional injury to children. The first of a series of three guidelines provides recommendations for national and local strategy, policy and development and setting specific paths for health services, local authorities, highway authorities, police, fire and rescue services, schools and for private and public outdoor play. Topics include off road cycling, home visiting, water safety, and road safety. The second and third of the set of Guidances (PH30, PH31) provide more specific recommendations for preventing unintentional injuries in the home and on the road. Head injuries quality standard (QS74) and Head injuries assessment and early management (CG176) https://www.nice.org.uk/guidance/conditions-and-diseases/injuries–accidents-and-wounds/head-injuries In addition to the injury prevention guidance, NICE is developing a set of pathways for injuries, accidents and wounds. These include head injuries, trauma, wound management and general injury, accidents and wounds. The head injury quality standard and assessment and early management guidelines have been completed while guidance or advice for others is to be published in February 2016. While being based in the UK system and not specifically for children, guidance is based on research evidence and therefore has relevance to the New Zealand setting.
Systematic reviews: Home safety
Kendrick D, Mulvaney C, Ye, L et al **Parenting interventions for the prevention of unintentional injuries in childhood** Cochrane Database of Systematic Reviews. (2013) (6). Kendrick et al examined 22 studies (including 16 RCTs) among which were 15 home visiting programmes and 2 paedediatric practice-based interventions. The families in 19 of the studies were from families in socioeconomically disadvantaged populations and were considered to be at risk of adverse child outcomes. The authors' meta-analysis (10 studies, 5074 participants) indicated that intervention families had a statistically significant lower risk of injury than control families. The authors concluded that "parenting programmes are effective in reducing unintentional injury in children and can improve home safety, particularly in families who may be considered 'at risk,' such as some teenage or single mothers. It would be worthwhile for health and social care providers to make parenting programmes available to families".

Kendrick D, Young B, Masonjones AJ et al **Home safety education and provision of safety equipment for injury prevention.** Cochrane Database of Systematic Reviews. (2014)(10)

This systematic review involved examining 98 studies (2,605,044 people) of which 54 were included in the meta-analysis (812,705 people), and of these 35 were RCTs. The criteria were for home safety education with or without the provision of safety equipment for those aged ≤19 years and which reported injury, safety practices or possession of safety equipment. The main conclusion was that home safety interventions that provide face-to-face, one-to-one education and provision of safety equipment may reduce injury rates, particularly if they are provided at home. The review notes conflicting findings on the provision of equipment. There was no evidence, however, that home safety education was less effective in those participants at greater risk of injury. Further research is required however to confirm these findings.

Systematic reviews: Road safety

Ehiri JE, Ejere ODH, Magnussen L et al. Interventions for promoting booster seat use in four to eight year olds travelling in motor vehicles. Cochrane Database of Systematic Reviews (2012)(11)

It has been recommended that booster seats be used for children aged from around 4 to 8 years to reduce the potential for injury in the event of a crash. Various interventions have been implemented to increase the use of these booster seats. This review examines the effectiveness of the interventions to increase acquisition and use of the booster seats in the target audience. Five studies (3,070 participants) were examined and all showed a positive effect. The effective interventions included incentives combined with education, distribution of free booster seats with education and education only. The study in which the intervention was enforcement of the law demonstrated no marked beneficial effect, although before and after studies that did not meet the inclusion criteria for the meta-analysis did show some beneficial effect of legislation.

Kardamanidis K, Martiniuk A, Ivers RQ, Stevenson MR, Thistlethwaite K. **Motorcycle rider training for the prevention of road traffic crashes.** Cochrane Database of Systematic Reviews 2010, Issue 10. Art. No.: CD005240. DOI: 10.1002/14651858.CD005240.pub2

This review considered evaluations of the effectiveness of motorcycle rider courses in reducing the number of traffic offences, crashes, injuries and death. There was a variety of content and delivery within the 23 research studies included in the review. The evidence was unclear as to whether training reduces any of these outcomes, and what kind of training is most effective. The authors concluded they could not recommend a particular type of rider training. They did note that some form of rider training was necessary for learning basic motorcycle handling techniques and to ride a motorcycle safely and that further research was required.

Thompson DC, Rivara F, Thompson R. **Helmets for preventing head and facial injuries in bicyclists.** Cochrane Database of Systematic Reviews (2009) (4)

The main conclusion from this review of cycle helmets was that helmets provide between 63 to 88% reduction in the risk of head, brain and severe brain injury. This is for all ages of riders. This conclusion was based on the results of five case control studies that met the inclusion criteria and were considered well conducted. Helmets are considered to provide protection for events involving motor vehicle crashes (69%) as well as other causes (68%).

Systematic review: water safety

Leavy JE, Crawford G, Leaversuch F, et al. A review of drowning prevention interventions for children and young people in high, low and middle income countries. Journal Community Health DOI 10.1007/s10900-015-0105-2 October 2015.

The authors of this review identified 15 studies from five different countries that met PRISMA criteria. The studies examined were varied, with more than seven designs utilised and the age of the participants, duration, strategies and evaluation measures and outcomes varied between interventions. All used aspects of the International Life Saving Federation (ILSF) drowning prevention chain-control measures (education and information, denial of access, supervision and acquisition of survival skills): 40% of the studies depended on education and information. Only three studies used a multi-themed approach while supervision was a key theme in two studies. While the review identifies considerable limitations in all the studies, for example because of their over reliance on self-report and focus on short term effects, the authors provide a useful analysis for intervention studies.

Systematic reviews: Sport and recreational injury

Rossler R, Donath L, Verhagen E et al. **Exercise-based injury prevention in child and adolescent sport: a systematic review and meta-analysis.** Sports Med. 2014;44(12):1733-48. doi: 10.1007/s40279-014-0234-2.

Conclusions drawn following examination of 21 trials conducted on 27,561 athletes with an age range of 10 .7 to 17.8 years were that there was good evidence that there were beneficial effects of exercise based injury prevention programmes for organised youth sports. Programmes focusing on specific injuries and injuries in general showed significant reductions and girls benefited more than boys. Multimodal programmes that included jumping/plyometric exercises were recommended. However, there is little data for effects of such programmes for children <14 years and for individual sports.

Brussoni MJ, Olsen LL, Pike I, Sleet DA. **Risky play and children's safety: balancing priorities for optimal child development** Int. J. Environ. Res. Public Health 2012; 9(9): 3134-3148.

This review examines the role of injury prevention and its relationship between child development, play and concepts of risk taking. This is a useful review to inform discussion around the debate of whether children are over-protected. The authors suggest a modification to the safety paradigm to aim to create an environment for children that is "as safe as necessary" rather than "as safe as possible". They discuss the options for increasing opportunities for play, the importance of play and the effects of parents curtailing children's activities and the potential reactive response may be problematic for the interventions that have made a major difference to injury death and hospitalisations for children, such as child car restraints

Data links – New Zealand

Statistics New Zealand. Injury Information Portal http://search.stats.govt.nz/browse_for_stats/health/injuries.aspx

This website provides links to various websites that provide data on New Zealand injury.

Injury Prevention Research Unit. **New Zealand Injury Query System** http://ipru3.otago.ac.nz/niqs/

Visitors to this website can select from year range, age range, cause of injury, intent, gender, region (district health board, territorial local authority, all New Zealand) to create tables of for injury, either fatal or non-fatal. The data come from public hospital discharge data and the New Zealand Coronial Service. A customised enquiries service is also available.

New Zealand Child and Youth Mortality Review Committee**. 10th Data Report 2009-2013.** http://www.hqsc.govt.nz/assets/CYMRC/Publications/tenth-data-report-2009-2013.pdf (2014)

The Health Quality and Safety Commission publish an annual report from the NZ Child Mortality Review Group in which the data on deaths to those aged between 0 to 24 years are presented in 5-year age groups. It uses the underlying cause of death classification from the Ministry of Health's Mortality Collection.

International reports

World Health Organization. **Injuries and Violence: The Facts**. 2014 http://apps.who.int/iris/bitstream/10665/149798/1/9789241508018_eng.pdf?ua=1&ua=1

This publication outlines the magnitude of death from injury in the global context, noting that more than 5 million people die each year as a result of injuries. Of these 24% are road traffic injuries and the report notes that road traffic injuries are the leading cause of death among 15–29 year olds worldwide. Evidence-based measures to reduce main causes of injury death are listed which are relevant to the New Zealand context.

Peden M, Oyegbite K, Ozanne-Smith J et al (eds). **World report on child injury prevention** World Health Organization and Unicef 2008 http://www.unicef.org/eapro/World_report.pdf

The World report notes that for each area of child injury, there are proven ways to reduce the likelihood and severity of injury. Much of the problem is a lack of awareness of the problem and the lack of political will to make a difference. While this report was published in 2008 and includes much directed towards middle income countries, in its examination of each area of injury, it contains interventions that are current, known to be effective and many are relevant to New Zealand. Each chapter provides key messages, makes recommendations for reducing childhood injury and offers fact sheets intended for various audiences.

European Public Health Alliance (EPHA) and TACTICS. EPHA Briefing: Mandated responsibility for intentional and Unintentional Child Injury Prevention in Europe focusing on road safety, water safety, home safety and intentional injury. http://epha.org/IMG/pdf/EPHA_Briefing_-_TACTICS-child_safety-Final.pdf (2014)

The underlying rationale for the development of this brief is the United Nations Convention on the rights of the Child. This document provides a strategy for the member states of the EU to reach a set of objectives to improve the well-being of children. Included are the development of a framework for an evidence based review, the promotion of multisectoral action, and to identify the role of the health sector in developing and coordinating policies and delivering services to meet the health needs of children and young people. Safety for children and young people is one of the seven priority areas for the EU.

REPRODUCTIVE HEALTH

IN DEPTH TOPIC: YOUNG PEOPLE'S SEXUAL AND REPRODUCTIVE HEALTH

By Dr Judith Adams

Introduction

Having sex for the first time is a major milestone in life that almost everyone reaches. In New Zealand, around 37% of secondary school students have had sex by the age of 16 years and around 46% by the age of 17 or more.[101] Becoming sexually active brings both risks and rewards. Policy makers are generally most concerned with the risks, particularly the risks of early unintended pregnancy and sexually transmitted infections and the associated costs to society. Good sexual health, however, is more than not contracting a sexually transmitted infection and not being involved in an unintended pregnancy. It has both individual and public health dimensions, as indicated by the following broad definition of sexual health, developed in the US:

> *'Sexual health is a state of well-being in relation to sexuality across the life span that involves physical, emotional, mental, social, and spiritual dimensions. Sexual health is an intrinsic element of human health and is based on a positive, equitable, and respectful approach to sexuality, relationships, and reproduction, that is free of coercion, fear, discrimination, stigma, shame, and violence. It includes: the ability to understand the benefits, risks, and responsibilities of sexual behaviour; the prevention and care of disease and other adverse outcomes; and the possibility of fulfilling sexual relationships. Sexual health is impacted by socioeconomic and cultural contexts–including policies, practices, and services–that support healthy outcomes for individuals, families, and their communities.'*[102]

Supporting young people to attain sexual health as defined above is clearly not something the health system can accomplish on its own, nevertheless there is an important role for the health system in helping young people to avoid unwanted pregnancy, providing care to young pregnant women, and preventing and treating sexually transmitted infections.

This in-depth topic considers ways of improving the sexual and reproductive health of New Zealand adolescents and young adults. It focuses on the prevention of unintended teenage pregnancy but also touches on the prevention of sexually transmitted infections. It does not deal with maternity services for pregnant teenagers or services for teenage parents because a previous in-depth topic in this series of reports (2012) was entitled *Services and Interventions for Women Experiencing Multiple Adversities in Pregnancy* and this included a substantial section on services for teenage parents.[103]

It begins by summarising what is known about the sexual behaviour of young people in New Zealand. It then reviews sexuality education, sexual and reproductive health services for young people, and contraceptive options for young people (with a particular focus on long-acting reversible methods). It concludes with some recommendations for improving the sexual and reproductive health of New Zealand young people and preventing unintended teenage pregnancies.

This choice of areas for review was influenced by the 2013 report of the Health Committee (one of the select committees of the New Zealand Parliament) Inquiry into improving child health outcomes and preventing child abuse with a focus from preconception until three years of age.[104] One of the major recommendations which came out of the inquiry was as follows:

> *'We recommend to the Government that it develop a co-ordinated cross-sectoral action plan with the objective of giving New Zealand world-leading, best-practice evidence-based sexuality and reproductive health education, contraception, sterilisation, termination, and sexual health services, distributed to cover the whole country. The plan should be developed within 12 to 18 months of this report being published, and be matched with appropriate, sustainable resourcing. The plan should also be monitored by trends in teenage pregnancy, sexually transmitted diseases, unplanned pregnancy, and terminations.'*

It should be borne in mind that in developed countries teenage pregnancy (except in the youngest teenagers) is not so much a medical problem as a social problem.[105] Many of the adverse medical outcomes attributed to teenage pregnancy, such as prematurity and low birth weight, are probably mostly due to the poor socio-economic circumstances and associated risk-taking behaviours that predispose young women to early pregnancy.[106,107] It should not be assumed that if women in the most deprived communities would only delay

their first birth by five years or ten years, then that alone would inevitably improve outcomes for them and their children.

The sexual health and behaviour of New Zealand's young people

The only recently published surveys of the sexual health and behaviour of New Zealand young people are the Youth 2000 series of surveys of secondary school students, conducted in 2001[108], 2007[109] and 2012,[110] and the 2009 Tertiary Student Health Survey.[111]

Information from the Youth 2000 Survey Series

The 2012 survey found that, out of all 8,500 participating students, 24% reported that they had ever had sex and 19% that they were currently sexually active (these categories did not include sexual abuse).[110] There were no significant differences between males and females. As could be expected, the proportions of students reporting having ever had sex and being currently sexually active increased with increasing age. Of students aged 17 years or older, 46% reported that they had ever had sex and 36% were currently sexually active.

Most students (93% of males and 92% of females) were attracted only to the opposite sex, while 4% of students were attracted to the same-sex or to both sexes and 4% were either not sure of their sexual attractions or were attracted to neither sex.[110]

Of the students who were sexually active, 58% reported always using contraception to prevent pregnancy. Forty-four percent had talked to their partner about preventing sexually transmitted infections and 46% reported always using a condom to protect against sexually transmitted infections. Seventeen percent of the students who were currently sexually active reported that they did not or only sometimes used condoms or other contraception. This proportion was greater among younger students and students living in high deprivation areas.[112]

Comparing results from the 2000, 2007 and 2012 surveys shows that the percentage of students who always use contraception to prevent pregnancy and the percentage who always use condoms to prevent sexually transmitted infections have not changed over time.[110] The percentage of students who reported ever having had sex was lower in 2012 (24%) than in 2001 (31%) and 2007 (36%) but this may have been because the 2012 survey question about having ever had sex explicitly told students not to count abuse or unwanted sexual experiences, whereas in 2007 and 2001 this was not stated.[101,110]

Information from the 2009 Tertiary Student Health Survey

This survey involved 2,922 students aged 17 to 24 years from all eight New Zealand universities (50.6% of the 5,770 invited to participate).[111] Sixty-nine percent of both men and women reported having had sexual intercourse, and the median age at first sex was 16 for women and 17 for men. The median number of sexual partners ever was three for both men and women. The median number of partners in the last year was one although about 25% of students had three or more. Most students (66%) reported that the person they last had sex with was someone they were in a 'steady relationship' or were 'living together, engaged, or married' but 3% of women and 11% of men reported having 'just met' the person they last had sex with. Fifty-eight percent of men and 51% of women reported using a condom the last time they had sex. Those with a higher number of sexual partners in the last 12 months were less likely to report having used a condom at last sex (51% of those with one partner vs. 42% of those with nine or more partners).

Overall, 32% of respondents reported that they had been drinking alcohol the last time they had sex. Adverse sexual experiences (unsafe sex, regretted sex, experiencing unwanted sexual advances) as a result of a respondent's own or others' drinking were common.[113]

Of the women survey participants, 112 (5.8% of those who had ever had sex) reported having had an unintended pregnancy and 74% of these had resulted in a termination.

Around 95% of students reported sexual attraction to the opposite sex mainly. Men were more likely than women to report being exclusively heterosexual (90.8% vs. 83.2%). About 2% of both men and women reported attraction to both sexes equally and about and 3% of men and 1% of women reported same sex attraction only or mainly.

Information from official and health services statistics

Some indirect information about the sexual health and behaviour of New Zealand's young people can be gained by looking at official statistics and data collected by health services. Information on rates of sexually transmitted infections in young people is analysed by The Institute of Environmental Science and Research (ESR) which

collects surveillance information on STIs from diagnostic laboratories and from sexual health and family planning clinics.[114] The ESR has stated that laboratory information is the best indicator of disease incidence for chlamydia and gonorrhoea in most DHBs and that surveillance of genital herpes and genital warts is solely clinic based.[114] The Abortion Supervisory Committee collects and analyses data on abortions performed in New Zealand.[115]

Teenage births in New Zealand

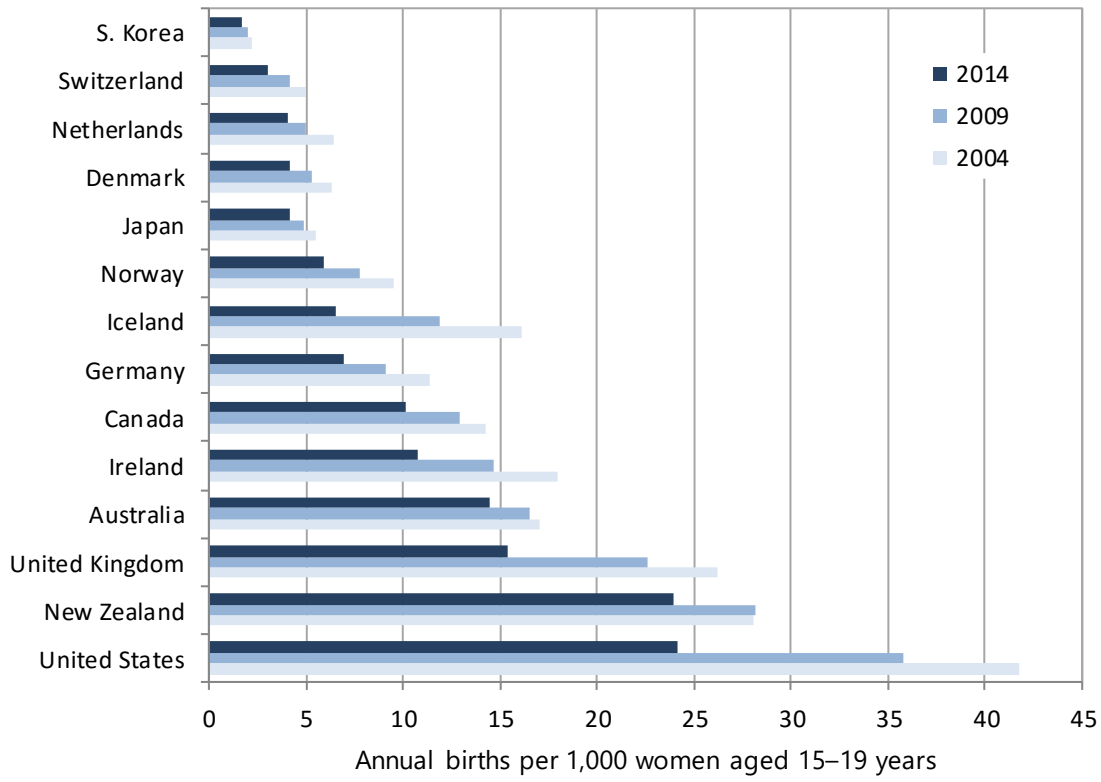
Information on trends in teenage births in New Zealand can be found in the 'Births' section beginning on **page 352** of this report. The New Zealand teenage birth rate in 2014 was 23.9 per 1,000 women aged 15–19 years.[116] New Zealand's teenage birth rate is declining and births to teenage mothers are increasingly concentrated in teenagers aged 18 and 19 years.[117] In 2013, almost three quarters (71.6%) of all teenage births were to 18 and 19 year olds (up from 66.6% in 2006).[117] Few teenagers have more than one birth as teenagers. Of the women who had a baby aged 15 years in 2008, only 2% had a second or subsequent birth before their 20th birthday.[117]

Māori have a higher rate of teenage births than the national rate (53.2 vs. 22.0 per 1,000 in 2013) but the Māori rate is declining at a similar rate to the national rate.[117] Teenage birth rates are significantly higher than the national average in Northland and Gisborne, and significantly lower in metropolitan Auckland, Wellington and Canterbury, as well as in the rest of the South Island.[117] Nationally there is a very strong correlation between the level of socioeconomic deprivation (NZDep score) and teenage birth rates and, in the regions with high teenage birth rates, a relatively large proportion of the teenage population live in high deprivation areas.[118] Māori teenage birth rates are higher than European rates at all levels of deprivation, indicating that socioeconomic deprivation is not the sole reason for higher teenage birth rates among Māori, and that other factors, such as a cultural preference for early motherhood, may play a part.[118,119]

International comparisons in teenage birth rates

As can be seen from **Figure 177**, New Zealand has a teenage birth rate that is high compared to other OECD countries, with the exception of the United States. Teenage birth rates have declined in all the countries shown in **Figure 177**, but not to the same degree.

Figure 177. Teenage birth rates in selected OECD countries 2005 to 2015



The World Bank. Adolescent fertility rate (births per 1,000 women ages 15-19). 2015 [cited November, 2015]; Available from: http://data.worldbank.org/indicator/SP.ADO.TFRT

Sexually transmitted infections in New Zealand young people

Chlamydia is the most commonly reported STI in New Zealand.[114] This infection is often asymptomatic (in around 25% of male cases and 70% of female cases) but can have serious consequences if untreated, including pelvic inflammatory disease, ectopic pregnancy and both female and male infertility.[114] In 2013, the ESR reported that 68% (19,327) of positive chlamydia cases were young people aged 15–24 years.[114] National disease rates were 3,080 per 100,000 for 15–19 year olds and 2,981 per 100,000 for 20–24 year olds. There were marked geographic variations in young people's chlamydia rates. Lakes and Tairawhiti DHBs had rates around twice the national rate. Rates for young females, but not young males, declined from 2009 to 2013 (by 27% in females aged 15–19 years and by 17% in females aged 20–24). Testing rates were 205 per 1,000 for 15−19 year olds and 298 per 1,000 for 20–24 year olds. Young women were around five times more likely to have tests than young men but the men's tests were more likely to be positive.

Gonorrhoea is also most commonly reported in young people. In 2013, 59% of positive cases were aged 15–24 years. National rates were 358 per 100,000 for 15–19 year olds and 277 per 100,000 for 20–24 year olds. From 2009 to 2013, there was a 43% increase in the rate of gonorrhoea in females in the 15–19 years age group (from 312 to 445 cases per 100,000) and a small increase in the rate for 15–19 year old males. Rates for young people in Tairawhiti, Lakes and Hawke's Bay DHBs were much higher than the national rate.[114]

The number of cases of genital warts in young people has been decreasing since 2009, which is likely to be related to the introduction of HPV vaccination onto the routine immunisation schedule for girls aged 12 years from late 2008, together with a catch-up programme targeting girls born on or after 1 January 1990.[58,114,120]

Abortions in young New Zealand women

In the year ended December 2014, 44% of all abortions were performed in women aged less than 25 years.[121] In 2014 1,758 women aged 15–19 years and 4,024 women aged 20–24 years had an abortion. These figures correspond to abortion rates of 11.5 per 1,000 for women aged 15–19 years and 25.2 per 1,000 for women aged 20–24 years.[121] Information on previous abortions and contraceptive use by age has not been reported for those who had abortions in 2014[121] but, in 2013, 12% of the 15–19 year olds and 32% of the 20–24 year olds who had an abortion had previously had one or more abortions.[122] In 2013, Fifty-nine percent of the 15–19 year olds and 55% of the 20–24 year olds who had an abortion had not used contraception.[122]

Since 2007, there has been a steady decline in abortion rates for young women. The fall has been especially dramatic for 15–19 year olds (from 27 per 1,000 in 2007 to 11.5 per 1,000 in 2014).[121] The Abortion Supervisory Committee attributed this to the licencing and funding of a long acting subcutaneous implant in August 2010.[122]

Sexuality education

Young people learn about relationships and sexuality in many ways: from parents and other family members, peers, their first sexual partner, teachers, health professionals, movies, television, radio, popular music, advertising, books, magazines and other print media, the internet, social media, video games and pornography.[123] This section discusses only formal sexuality education, in other words, planned health promotion interventions intended to equip young people with the knowledge and skills that will make them more likely to attain physical, emotional, mental and social wellbeing in relation to their sexuality. It takes the standpoint that all young people have a fundamental right to the information and services necessary to maintain their sexual health. It has a focus on preventing sexually transmitted infections and unintended pregnancies, not because rates of unintended pregnancy or STIs are the only or the best indicators of a population's sexual health but because these indicators are relatively easy to quantify and commonly used as outcome measures in research studies, for assessing trends in sexual health, and for international comparisons.

Sexuality education in schools

Schools are in a special position to influence the wellbeing of adolescents since almost everyone attends school. The World Health Organization has recognised this and, in 1995, it launched the Global School Health Initiative to help improve the health of students, staff, parents and community members and increase the number of Health-Promoting Schools. Its publication *Family Life, Reproductive Health, and Population Education: Key elements of a Health-Promoting School*[124], states that: 'When schools do not address family life, reproductive health, and population issues, they miss an opportunity to positively affect students' education, quality of life and relationships, and ultimately the economy and productivity of nations'. It sets out a series of well-referenced arguments that make a case for family life, reproductive health, and population education and can be used to convince families, community members, and religious leaders that schools are able to address these issues in an appropriate and effective way that does not lead to promiscuity. It notes that adolescents who engage in one type

of risky behaviour, such as unprotected sex, are more likely to engage in other risky behaviours such as tobacco and drug use or violence, and so addressing one risky behaviour may have a positive influence on other risky behaviours.

Sexuality education in New Zealand schools

Sexuality education is one of seven key learning areas in the health and physical education section of *The New Zealand Curriculum* (the Ministry of Education's statement of official policy relating to teaching and learning in New Zealand schools).[125] Health education is the only part of a school's curriculum regarding which boards of trustees are legally required to consult with their school's community on how the school will implement the curriculum.[126] Under section 25AA of the Education Act 1989 (updated in 2001), the parent of a student enrolled at any State school may get their child excluded from tuition in specified parts of the health curriculum related to sexuality education.[127] All students study health and physical education from Years 1 to 10, but not all senior students choose to study health as one of their NCEA subjects.

The Ministry of Education has recently (in 2015) released new guidelines on sexuality education.[126] These suggest that in the junior primary years discussions about identity, personal health, body parts, and families are woven into learning throughout the year, but that in later years specific time is devoted to learning about sexuality. They state that the Education Review Office has found that schools with effective sexuality education programmes spend at least 12–15 hours per year on sexuality education, with significantly more time allocated for programmes for senior secondary students (in years 11 to 13)[128], and they recommend that all senior students engage in sexuality education, not just those studying health to achieve NCEA qualifications.

The new guidelines promote holistic and comprehensive sexuality education that not only equips students with the knowledge and skills to take care of their sexual and reproductive health, but also gives them opportunities to learn about, consider and discuss issues relating to relationships, gender, sexual identities, sexual orientation, sexual behaviour, consent and coercion, rights and responsibilities, societal attitudes and messages, sexual harassment, and pornography.[126] The guidelines stress the importance of a school-wide culture where diversity is valued and students feel supported, visible and safe, regardless of their sexual and gender identity.

The research literature on sexuality education for young people

Introduction

From a global perspective the AIDS pandemic has been the main impetus for improving sexuality education. In Western developed countries, however, prevention of teenage pregnancy is the main aim of sexuality education. There is a very substantial research literature devoted to the evaluation of educational interventions to improve adolescent sexual and reproductive health.

Programme content categorises sexuality education programmes as belonging to one of three broad types:[129]

- **Abstinence-only** programmes promote abstinence as the only way to avoid adverse sexual health outcomes. Some stress abstinence until marriage. They generally include messages about the psychological and health benefits of abstinence and the dangers of sexual activity.[130] They do not include information on safer sex strategies or contraception. If they mention condoms and contraception it is only to highlight their failure rates.[131]
- **Abstinence-plus** programmes have abstinence as their main message but also provide information on safer sex practices and contraception.
- **Comprehensive** programmes are similar to abstinence-plus programmes but have a focus on safer sex practices and contraception, with the benefits of delaying sex being included in the information provided. Some also provide information on, or access to, contraceptive and sexual health services. Some are part of comprehensive youth development programmes.[130]

Some background to research on sexuality education interventions

Evaluations of sexuality education programmes have used a variety of outcome measures to assess programmes' effectiveness: pregnancy rates, STI rates, self-reported behavioural outcomes (condom use, delayed sex or abstinence, number of sexual partners) and proxy measures (such as changes in sexual health knowledge, attitudes and intentions, and self-efficacy).[129] A study using pregnancy, birth or STI rates as outcome measures needs to be large and have long term follow-up to be likely to measure statistically significant results, and will therefore be expensive to carry out. This is probably the main reason why there have been relatively few studies that have used these outcome measures and most studies have relied on participants self-reporting outcomes.

The review *Emerging Answers 2007*[132] explains this point in more detail (page 94): '*At least two important methodological problems stand in the way of using pregnancy and STI rates as outcome measures. First,*

regardless of how they are measured, pregnancy and STI rates are a very insensitive measure of programme impact. If a programme reduces the annual teen pregnancy rate by 20%, from 100 pregnancies per 1,000 to 80 per 1,000, the programme would be very successful. However, that decrease represents a difference of only 20 pregnancies per 1,000 (or two percentage points), so a very large sample size (more than 6,000) would be required to have a strong chance of finding that change to be statistically significant. The same problem applies to an even greater extent to birth rates, and it applies to STI rates whenever those rates are low in a population.'

Most studies of sexual health interventions for young people have been conducted in the US and a majority of the US studies targeted African Americans.[133] A number of influential reviews have included only studies of prevention programmes that were conducted in the US.[130-132]

It is worth remembering that health care in the US is characterised by a mix of public and private funding and that individual states have considerable autonomy. Teen pregnancy programmes tend to be commercial products (developed and researched with the help of funding from various sources including government, academic, charitable and faith-based organisations) that can be purchased by schools or healthcare providers.[134] The US Department of Health and Human Services, through the Office of Adolescent Health's Teen Pregnancy Program funds only evidence-based programs, that have been shown, in at least one program evaluation, to have a positive impact on preventing teen pregnancies, sexually transmitted infections, or sexual risk behaviours[135], therefore there is an incentive for programme developers to undertake robust evaluations of their programmes' efficacy (using RCTs or quasi-experimental methods) and publish the results of these evaluations in peer-reviewed academic journals.

It has been argued that evidence-based interventions tend to have a narrow focus on preventing pregnancy and STIs and that they do not take account of the broad context of adolescents' lives or the psychosocial and structural factors that shape the ways adolescents conduct their sexual lives.[136] Schalet et al.[136] state that there is extensive social and behavioural research documenting the influence of gender inequity, ideologies and stereotypes; sexual orientation; school and peer culture; poverty (both at the individual and neighbourhood level); racism and socio-political issues on adolescent sexual health and behaviour. They point out that, in the most disadvantaged communities, young women may feel that their life prospects are made no worse by an early pregnancy and young men may view sexual activity as a pathway to social status rather than an obstacle to socio-economic achievement. They suggest that sexuality education needs to recognise students' diverse life courses and family formations and create opportunities for them to discuss sexual agency and risk in the context of their broader life aspirations and the multiple factors that constrain those aspirations.

Kirby's 2007 review

In his comprehensive 2007 review for the US National Campaign to Prevent Teen and Unplanned Pregnancy, entitled *Emerging Answers 2007: Research Finding on Programs to Reduce Teen Pregnancy and Sexually Transmitted Diseases*[132], Kirby described the programmes and approaches that have reduced teen sexual risk-taking and teen pregnancy or STIs in the US. He provided a list of programmes with strong evidence of impact and described the characteristics of effective sex and STI/HIV education programmes that contributed to their success. The review considered only primary prevention of teen pregnancy (not prevention of repeat pregnancies in teen mothers), and it did not consider the efficacy of the various contraceptive measures, nor same-sex aspects of STI and HIV prevention. Studies were eligible for inclusion in the review if they had been conducted in the US between 1990 and 2007; were focussed on teens aged 12 to 18 years; examined impacts on sexual behaviour, use of condoms or other contraceptives, combined measures of sexual risk, and pregnancy, birth or STI rates; had a reasonably strong experimental or quasi-experimental research design and a sample size of at least 100 teens; measured behaviour for a sufficient length of time; and used appropriate statistical analysis.

Of the 115 studies were included in the review, 56 measured the impact of curriculum-based sex and STI/HIV education programmes and 59 measured the effect of other types of programmes (such as clinic programmes, school-based health services, welfare reforms, and early childhood or youth development programmes). Seventy had an experimental design (they were RCTs) while 45 had a good quasi-experimental design (they compared a study group with a comparison group believed to be similar to the study group although participants were not randomly assigned to one or the other group). Eighty-three of the 115 studies measured outcomes for one year or more, 40 measured outcomes for two years or more, and 26 measured outcomes for three years or more. A large majority of the studies were underpowered and so, while they found intervention effects, these were often not statistically significant. Kirby stated that this produced a conservative bias which was probably quite large (in other words, programmes may be more effective than study results indicated).

The aim of educational interventions is to change the behaviour that leads to unintended pregnancy and STIs. Kirby stated that interventions to prevent pregnancy need to encourage both abstaining from sex (including delaying first sex, returning to abstinence, and avoiding unwanted, unintended and unprotected sex) and effective use of contraception, while interventions for reducing STIs need to encourage abstaining from sex, limiting the number of sexual partners (especially concurrent partners), increasing the time between sexual partners, reducing the frequency of sex, using condoms, getting tested and treated for STIs, and vaccination against Hepatitis B and HPV. He noted that most US teen pregnancy prevention programmes address all the relevant behaviours (abstinence and use of contraception) but most STI prevention programmes do not as they tend to address only abstinence and condom use. He stated that some STI programmes place some (lesser) emphasis on STI testing and treatment but very few emphasise the importance of having few sexual partners and almost none mention avoiding concurrent partners (and having sex with people who have them), increasing the time between partners and the value of long-term committed and caring relationships.

In addition to addressing the behaviours that lead to unintended pregnancy and STIs, interventions may address the risk factors for risky sexual behaviour. Kirby stated that research has identified more than 500 factors that either increase or decrease the chances that teens will engage in risky sexual behaviour and that some are easier to modify than others. He stated that the factors most strongly related to sexual behaviour are teens' own sexual beliefs, values and attitudes, and that the risk and protective factors most easily changed by teen pregnancy/STI prevention programmes are the sexual ones: sexual knowledge and values, perception of peer norms, motivation and self-efficacy. He suggested that identifying groups of teens at high risk because of factors such as community and/or family disorganisation and disadvantage is useful (even though these risk factors may not be changeable in the short term) because high-risk teens can be targeted with more intensive and effective interventions.

Curriculum-based educational programmes

Kirby's review reported on studies of 56 curriculum-based programmes. Eight focussed on reducing teen pregnancy, 24 on preventing STIs/HIV, and 24 on both. Eight were abstinence programmes and the remaining 48 were comprehensive programmes which encouraged both abstinence and contraceptive use.

A substantial proportion of programmes significantly reduced one or more types of risky sexual behaviour and they did not increase sexual behaviour among young people, as has been feared. Most of the studies that measured pregnancy, birth rates or STI rates did not find statistically significant effects. As explained earlier, this may reflect the difficulties and expense of conducting studies that are adequately powered to detect statistically significant results. Twelve studies measured programme impact on self-reported pregnancy rates: nine found no significant results while two found a significant decrease, and one a significant increase. Four studies measured impact on birth rates: one found a significant decrease and three found no significant impact. Ten studies measured effects on STI rates: seven found no significant results; one found a significant increase in self-reported STIs, which may have been because the programme encouraged young people to be tested and treated; and two found significant decreases in STI rates based on laboratory tests.

The review examined abstinence and comprehensive programmes separately, although the author noted that programmes fell on a continuum and were not easy to categorise. The main findings were as follows.

- A number of abstinence programmes, including abstinence-until-marriage programmes, have been rigorously evaluated and found not to have any effect on delaying initiation of sex, age at first sex, return to abstinence, contraceptive or condom use or number of sexual partners. Abstinence programmes do not seem to have any negative effects and they do not appear to hasten or increase sexual activity or reduce condom or contraceptive use.
- In contrast, comprehensive programmes have shown strong evidence of positive effects on behaviour and no significant negative effects. Two-thirds of comprehensive programmes delayed initiation of sex, reduced frequency of sex, reduced number of sexual partners, increased condom use, increased contraceptive use, or reduced risky sexual behaviour. None hastened sexual initiation or increased the frequency of sex. Almost all had a positive impact on one or more factors affecting behaviour. They improved factors such as knowledge about the risks and consequences of pregnancy and STIs; attitudes and values related to having sex and using condoms or contraception; perceptions of peer norms about sex and contraception; confidence in ability to refuse unwanted sex, insist on condom or contraceptive use, or actually use condoms or contraception; intentions to avoid sex or use contraception; and communication with parents and other adults about sexual matters.
- Among the weaknesses of the research studies were: few described programmes adequately; none dealt with students engaging in same-sex behaviour; some had implementation problems; an unknown

number had measurement problems; and many were inadequately powered and did not adjust for multiple tests of significance or clustering. There may have been publication bias because studies with positive results are more likely to be published.

The characteristics of effective education programmes

Kirby identified 17 characteristics of effective sex and STI/HIV education programmes. He stated that most of the programmes with these 17 characteristics were effective; most effective programmes had most of the 17 characteristics; and programmes with these characteristics were more effective than those without. The 17 characteristics fell into three categories: those related to the process of developing the curriculum; those related to the overall design and teaching strategies of the curriculum itself; and those related to the process of implementing the curriculum. They are presented in **Table 151**. Kirby suggested that the first 13 characteristics can be used to select programmes likely to be effective, to adapt selected programmes to make them more effective, or to develop new programme curricula from scratch, and that the final four characteristics can be used as a guide for implementing effective curricula.

Table 151. The characteristics of effective curriculum-based programmes

The process of developing the curriculum
1. Involved multiple people with expertise in theory, research, and STI/HIV education to develop the curriculum 2. Assessed relevant needs and assets of the target group 3. Used a logic model approach that specified the health goals, the types of behaviour affecting those goals, the risk and protective factors affecting those types of behaviour, and activities to change those risk and protective factors 4. Designed activities consistent with community values and available resources (e.g. staff time, staff skills, facility space and supplies) 5. Pilot-tested the programme
The contents of the curriculum itself*
Curriculum goals and objectives 6. Focussed on clear health goals–the prevention of STI/HIV, pregnancy or both 7. Focussed narrowly on specific types of behaviour leading to those health goals (e.g. abstaining from sex or using condoms or other contraceptives), gave clear messages about these types of behaviour, and discussed situations that might lead to unwanted and/or unprotected sex and how to avoid them 8. Addressed sexual psychosocial risk and protective factors that affect sexual behaviour (e.g. knowledge, perceived risks, values, attitudes, perceived norms, and self-efficacy) and changed them Activities and teaching methods 9. Created a safe social environment for young people to participate 10. Included multiple activities to change each of the targeted risk and protective factors 11. Employed instructionally sound teaching methods that actively involved participants, that helped them personalise the information, and that were designed to change the targeted risk and protective factors 12. Employed activities, instructional methods, and behavioural messages that were appropriate to the teens' culture, developmental age and sexual experience 13. Covered topics in a logical sequence
The process of implementing the curriculum
14. Secured at least minimal support from appropriate authorities, such as departments of health, school districts, or community organisations 15. Selected educators with desired characteristics (whenever possible), trained them, and provided monitoring supervision and support 16. If needed, implemented activities to recruit and retain teens and overcome barriers to their involvement (e.g. publicised the programme, offered food or obtained consent) 17. Implemented virtually all activities with reasonable fidelity

Kirby D. 2007. Emerging answers 2007[132] https://thenationalcampaign.org/sites/default/files/resource-primary-download/EA2007_full_0.pdf . * This section is based on a review of the curricula for 19 effective programmes, five of which were from outside the US.

Gender and power issues as part of sexuality education

To be able to protect their own sexual health, young women need to be empowered to see themselves as equal partners in their relationships, and as individuals capable of being active participants in society. In their 2014 review of sexuality education in the global context, Haberland and Rogow[137] stated that relatively few comprehensive sexuality education (CSE) programmes have historically emphasised gender and rights but that there is increasing evidence that an empowerment approach to CSE is particularly effective.

Comprehensive sex education that takes an empowerment approach uses curricula encompassing feminist theory – either explicitly or implicitly – which help students to understand how gender inequality is socially constructed and to reflect on and critique prevailing social norms (such as social expectations for boys to 'score'

and the 'double standard').[137] The aim is that, as students develop more egalitarian attitudes and relationships, they will adopt different behaviour and, among other positive outcomes, have better sexual health outcomes.[137]

Haberland and Rogow reviewed sexual risk reduction programmes that had been evaluated using pregnancy and STI rates and they stated that programmes that addressed issues of gender and power were more likely to show significant positive effects on health outcomes than those that did not.[138] Examples of successful gender-and-empowerment orientated programmes included HORIZONS, an HIV prevention intervention for young African-American women which reduced rates of chlamydial infection[139], and Stepping Stones, an HIV prevention programme which was associated with a 33% reduction in the incidence of Herpes simplex type 2 in a cluster-RCT conducted in South Africa.[140] The Stepping Stones trial found that the intervention also significantly reduced the proportions of men reporting intimate partner violence, transactional sex and problem drinking at 12 months.

The publication *It's All One Curriculum: Guidelines and Activities for a Unified Approach to Sexuality, Gender, HIV, and Human Rights Education*[141] provides valuable information on sexuality education that emphasises gender equality and human rights, and critical-thinking teaching methods. It was developed by a working group comprised of three international NGOs (Population Council, IPPF, and International Women's Health Coalition); one regional NGO (IPPF/Western Hemisphere Region); and three country-based NGOs (Girls Power Initiative/Nigeria, CREA/India, and Mexfam/Mexico).

The 2012 systematic reviews by Chin et al.

Chin et al. conducted systematic reviews for the US Guide to Community Preventive Services on two strategies for group-based behavioural interventions for adolescents to prevent or reduce the risk of adolescent pregnancy, HIV and STIs; one on comprehensive risk reduction interventions and one on abstinence education.[130,131] (In the US until 2010, states could receive federal funding to implement only abstinence programmes that followed federal A-H guidelines. These guidelines stated that abstinence from sexual activity outside marriage is the expected standard for all school age children and that a mutually faithful monogamous relationship in context of marriage is the expected standard of human sexual activity.[142])

The reviews assessed the effectiveness of the two strategies by determining how much they reduced sexual risk behaviours, pregnancy, HIV and other STIs, and increased protective sexual behaviours. To be eligible for inclusion in the review studies had to be published in English during 1988–2007 and evaluate an intervention delivered in US schools, community settings or both. Interventions for teen parents or HIV-infected adolescents were excluded.

For each strategy the reviewers conducted meta-analyses on seven key outcomes: current sexual activity; number of sex partners; frequency of unprotected sexual activity; use of protection (condoms and/or hormonal contraception); pregnancy; and STIs.

<u>The effectiveness of comprehensive risk-reduction interventions</u>

Chin et al.'s review of comprehensive risk reduction interventions included 66 studies, 62 of which provided data for the analyses. Twelve were considered to have good quality of execution and 50 to have fair quality. Sixty-one percent were RCTs and the rest were controlled before-and-after studies. Interventions were almost evenly split between school and community settings and between targeted and untargeted approaches. Percentages of recipients by school level were 35% middle school (10−14 years) and 65% high school (15−19 years). Intervention contact hours ranged from one to fifty-four, with a mean of 14.5 hours. Most interventions (80%) were delivered by an adult only, but 20% were delivered by an adult together with a peer. Most outcomes were self-reported although STIs were sometimes confirmed by laboratory testing.

All of the outcomes measured in the comprehensive risk reduction interventions showed effectiveness **(Table 152)**. All the effects estimates, except for pregnancy rates, were statistically significant. (The risk ratio can be interpreted as the ratio of the risk of an outcome in the intervention group to the risk of the same outcome in the control group. A risk ratio of 0.75 indicates that those in the intervention group had 75% of the risk of those in the control group.[143])

<u>The economic efficiency of comprehensive risk-reduction interventions</u>

Chin et al.'s review identified ten comprehensive risk-reduction studies that included economic information. In six of the eight economic evaluations of individual interventions studies, costs per participant per year (in 2008 US dollars) ranged from $66[144] to $10,024[145] per person per year. The review authors stated that the wide variation was due to variability in programme content, number of participants and programme duration. The lowest cost was for a school-based programme involving curriculum-based education[144] while the most expensive programme was a multi-faceted youth development intervention that included family life, sex and

health education; career support; academic support; artistic expression; recreation; and physical and mental health referrals.[145] Six studies reported on economic benefits from intervention: six estimated healthcare costs averted and four estimated productivity costs.

Table 152. Effectiveness of comprehensive risk-reduction interventions, as indicated by meta-analysis results

Outcomes[1]	Number of studies	Number of study arms	Odds ratio (95% CI)	Estimated Risk Ratio
Sexual activity	38	54	0.84 (0.75–0.95)	0.88
Frequency of sexual activity	13	14	0.81 (0.72–0.90)	–[2]
Number of sex partners	23	27	0.83 (0.74–0.93)	0.86
Unprotected sexual activity	22	28	0.70 (0.60–0.82)	0.75
Protection[3]	38	50	1.39 (1.19–1.62)	1.13
Condoms[3]	33	44	1.45 (1.20–1.74)	1.12
Oral contraceptives[3]	9	10	1.29 (0.89–1.85)	1.22
Dual use[3]	4	4	1.21 (0.70–2.12)	1.17
Pregnancy	9	11	0.88 (0.60–1.30)	0.89
STI	6	8	0.65 (0.47–0.90)	0.69
HIV	0	0	–	–

Chin et al. 2012[131] Notes: [1]All self-reported, except for STI which were either laboratory-confirmed or self-reported; [2]Couldn't be calculated; [3]Odds ratios > 1 for these outcomes indicate beneficial effects (i.e. that the intervention increased the outcome, as desired)

The review authors stated that, overall, most of the comprehensive risk-reduction studies that made a comprehensive assessment of the benefits of preventing pregnancy, STIs and HIV, and secondary benefits (such as educational attainment) found a positive economic value from investments in such interventions. They noted that there are other dimensions of positive behaviours affected by interventions (particularly youth development interventions) that are harder to quantify and value in monetary terms (such as reduced crime, better academic attainment and improved parenting skills).

The effectiveness of abstinence education

The review of abstinence education by Chin et al. included 23 studies, 21 of which were considered suitable for meta-analysis. Two of these had good quality of execution and nineteen had fair quality. Fewer than half were RCTs. Most outcomes were self-reported but STIs were sometimes confirmed by laboratory testing. Almost all participants were aged 10–14 years (only one study evaluated the intervention in older adolescents) and most were virgins at baseline. The interventions were mostly curriculum-based educational interventions focussed on preventing STIs/HIV and pregnancy which took place in school settings and were delivered by a trained adult.

The meta-analysis results indicated favourable effects on the primary outcomes of sexual activity and frequency of sexual activity but only the reduction in sexual activity was statistically significant. There were no effects found for the secondary effects of number of sex partners, unprotected sexual activity, and use of protection during sexual activity. The odds ratios for these outcomes were all close to one and not significant. There were marked differences between the RCTs and the non-RCTs. For sexual activity – the only outcome with a substantial number of data points from both types of studies – there was a significant difference in effect estimates: The RCTs had a non-significant odds ratio of 0.94, while the non-RCTs had a significant odds ratio of odds ratio 0.66. The RCTs had longer follow-up times (up to 6.5 years with a mean of 3.2 years) compared to the non-RCTs (a maximum follow-up of one year and a mean of 0.6 years). There was possible publication bias as the studies with small sample sizes (which would be more likely to produce significant results by chance) tended to have greater intervention effects than the larger studies. Overall, the findings from the review of abstinence education interventions were inconclusive.

The economic efficiency of abstinence education

The review authors noted that one expert had stated that, up until 2005, more than $1.5 billion had been spent on abstinence education interventions in the US. They stated that the only available estimate for the cost of individual programmes is the reported cost of curricula which ranged from $31 to $646 for 21 curricula[146] (with an average of $220, presumably per teacher copy of the curriculum ± materials such as videos and student resources, although this was not explicitly stated) and that the published information about abstinence programmes was insufficient for estimating either the economic benefit or cost-effectiveness of these programmes.

Potential harms of interventions

There is a concern that comprehensive risk-reduction interventions may encourage earlier initiation of sexual activity and greater sexual frequency of sexual activity. The findings of this review, however, indicated that comprehensive risk reduction interventions reduce both sexual activity and frequency of sexual activity in adolescents receiving such interventions. A similar concern is that abstinence education interventions make it more likely that teens will fail to use contraception if they do have sex. Most of the abstinence education studies that measured use of protection during sexual activity did not demonstrate any differences between intervention and comparison groups. Effects of abstinence interventions on consistent condom use could not be assessed as none of the abstinence education studies reported on this outcome.

Public health impact

Chin et al. stated that comprehensive risk-reduction interventions would be expected to not only to reduce sexual activity but also to increase behaviours that reduce the risks associated with sexual activity whereas abstinence education would be expected to only reduce sexual activity. They also stated that comprehensive risk reduction interventions would be expected to have a greater public health impact than abstinence education interventions even if both interventions had similar effects on sexual activity since, unlike abstinence education interventions, comprehensive risk-reduction interventions offer benefits both to adolescents who abstain from sexual activity and to those who are sexually active, and to both older and younger adolescents.

The Community Preventive Services Task Force recommendations

Based on the findings of the two systematic reviews, the US Community Preventive Services Task Force recommended group-based comprehensive risk-reduction delivered to adolescents to promote behaviours that prevent or reduce the risk of pregnancy, HIV, and other STIs.[147]

Parent interventions

Several recent systematic reviews have examined studies of interventions with parents and/or families which aimed to improve parent-child communication about sex, improve adolescent sexual health, or both.[148-152] **Table 153** provides a brief summary of these reviews. In general, interventions with parents did improve parents' communication with adolescents about sexual matters, but there is limited evidence that they were effective in changing adolescents' sexual behaviour. There is considerable variation between parent programmes and in the outcome measures used by evaluation studies so it is difficult to determine which kinds of parent interventions are most effective in improving parent-child communication.

Sexual and reproductive health services for young people

In addition to having a good understanding of sexual and reproductive health issues, young people need access to sexual and reproductive health services. These services include the provision of counselling and advice on sexuality, sexual abuse, contraception, abortion and sexually transmitted infections; prescription of contraceptives of various kinds; pregnancy testing; referrals for abortions; and testing and treatment for sexually transmitted infections. Such services can be provided by GPs, youth health services (including school-based clinics, youth one-stop shops, and student health services at tertiary education institutions), family planning clinics and sexual health clinics. This section looks at issues related to sexual and reproductive health services for young people (other than prenatal and obstetric care for expectant mothers). In particular, it considers what is known about what makes services effective in improving adolescent health outcomes (such as rates of STIs and unintended pregnancy); what adolescents themselves have said about what they value in services; the provision of emergency contraception; and the use of long-acting reversible contraceptives by adolescents.

Table 153. Findings from recent systematic reviews of parent interventions to improve parent-child communication about sex, improve adolescent sexual health, or both

Author (date)	Number of studies included	Results for communication	Results for sexual behaviour
Gavin (2015).[148,153]	16 (all from US)	12 of 16 studies showed an increase in parent-child communication about sexual and reproductive health	4 of 7 studies reported reduced sexual risk behaviour 1 of 2 studies found a marginal impact on teen pregnancy
Santa Maria (2015)[149]	28 (all from US, by intention). Not all focused only on parent-child communication	Increased parent-child communication (meta-analysis of 11 controlled trials); increased parental comfort with communication (meta-analysis of 9 trials)	Insufficient evidence
Wight (2013)[150]	44 (25 RCTs), most from US (1 each from Mexico, S. Africa, Trinidad and Tobago, and Nicaragua). Parent intervention was often a component of a broader sexual health intervention	31 of 37 had a positive influence on parent-child interaction, one had a negative influence	11 of 21 had a positive influence on adolescent sexual behaviours; two had a negative influence
Akers (2011)[151]	12 (all from US, by intention)	Parents (almost invariably mothers) reported improvements in multiple communication domains. Effect sizes couldn't be calculated and studies' results couldn't be compared because the studies all used different measures to assess communication	Not assessed
Downing 2011[152]	17 (all from US) No relevant studies from other countries identified	Parent-based intervention had some positive effects on parent child communication but family-based interventions did not.	Inconsistent effects

Sexual and reproductive health services in New Zealand

In New Zealand, there are a number of providers of sexual and reproductive health services. Many offer free services to young people. Sexual health clinics are normally free for New Zealand residents. [154] They provide testing and treatment for STIs but do not usually provide contraception (other than condoms and the emergency contraceptive pill). Attending a family planning clinic is free to New Zealand residents aged under 22 years.[155] Family planning clinics provide a wide range of sexual and reproductive health services including contraception, STI testing and treatment, cervical smears, abortion counselling and referrals, and help with sexual dysfunction and gynaecological problems.[155] Many DHBs fund free sexual health services (including contraception) for young people who are enrolled with Primary Health Organisations (age limits vary and there may be a limit on the number of free visits per year). These services are often delivered in general practices, particularly in smaller towns. Youth One Stop Shops provide a range of free social and health services, including sexual and reproductive health services.[156]

Most New Zealand high schools provide health services.[157] Most commonly these are provided by visiting health professionals, but some schools have on-site health professionals.[157] Because the government has specifically allocated funding for health services in low-decile schools, it is high decile schools and private and integrated schools that tend to have no health services beyond first aid provision.[157] (The Ministry of Education assigns each school a decile rating: the lower a school's decile, the higher the proportion of students that are from low socio-economic backgrounds.) There is wide variation between schools in the level of sexual health services provided by health professionals working in or visiting schools and this is generally related to boundaries set by principals and boards of trustees.[158]

Barriers to service access

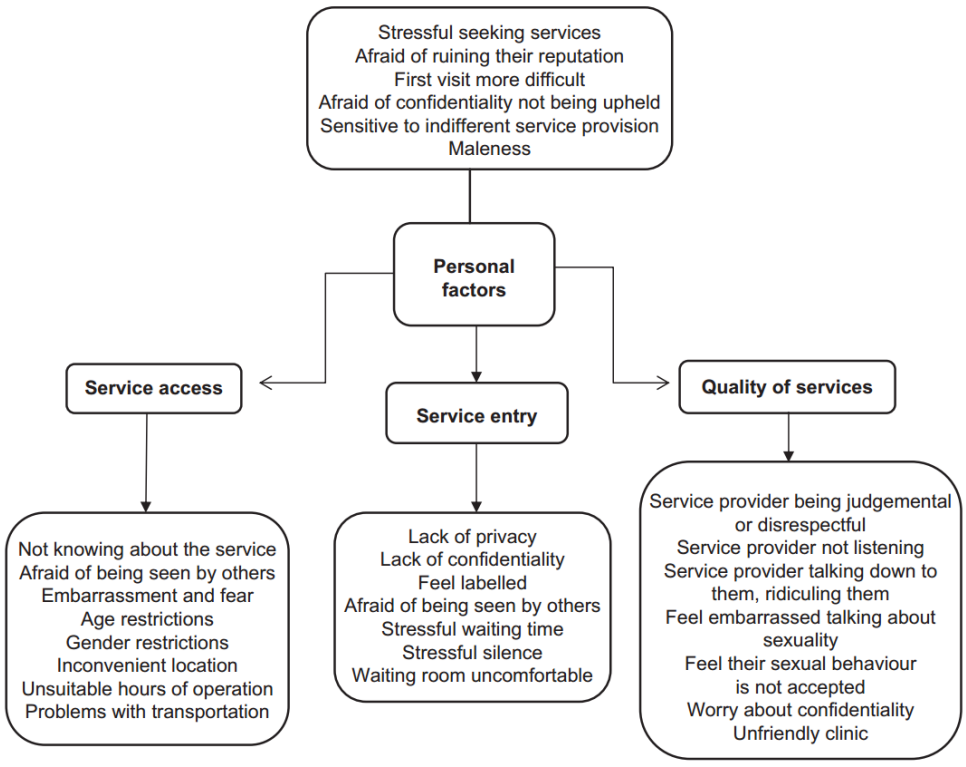
There are a number of barriers that can prevent a young person accessing services to meet their sexual and reproductive health needs or deter them from returning to a service. These barriers can exist at various levels: at the policy level (e.g. some counties have laws prohibiting the provision of contraception to under-age or

unmarried adolescents); the operational level (e.g. services having inconvenient operating hours, being too far away or too expensive); and the personal level (e.g. not recognising the signs of a health problem; not knowing what services are available; being too scared or embarrassed to phone or visit a service).[159]

A recent review by Bender and Fulbright (2013) presented a content analysis of quantitative and qualitative studies (published between 2000 and 2010) dealing with barriers to access and utilisation of sexual and reproductive services, as perceived by 10 to 25 year olds.[160] It included 17 studies conducted in the Western world (12 from the UK, three from Canada and two from the US) and it aimed to answer the question: How do young people perceive the barriers to sexual and reproductive health services?

The review authors classified the barriers identified in the studies into four categories: service access (factors which might make it difficult for young people to go to services); service entry (factors related to a young person's experience from the time they entered the clinic until they received attention from a health practitioner); quality of services; and personal factors. They regarded personal factors as factors which had personal relevance to young people on a cognitive, affective or relational level, and which were related to their own integrity. They considered this to be a central category, and they presented the following classification of barriers (**Figure 178**)

Figure 178. A classification of youth perceptions of barriers to sexual and reproductive health services



Bender SS, Fulbright YK. 2013.[160]

They reported that, although the 17 articles in their review identified different types of barriers to sexual and reproductive health clinics, they did not give any indication of the degree to which the barriers hindered young people accessing sexual and reproductive health clinics. Collectively, the articles reviewed indicated that it was the personal perceptions of young people (i.e. the personal factors) that were the most important. Privacy and confidentiality were extremely important: young people did not want anyone to find out they had visited a clinic.

Carroll et al.[161] investigated both barriers and facilitators to young people's use of school-based and school-linked sexual health services in a systematic review of studies that had explored the views and experiences of young people (aged 11 to 18 years). In total the review included 19 studies, 12 from the US and seven from the UK, none of which were included in Bender and Fulbright's review.

The authors undertook a thematic analysis of the studies and they reported that the principal themes that emerged were (in no particular order):

- awareness and need (students need to know of the existence of services and the reasons they might need to visit one)
- confidentiality and disclosure (students don't want anyone to find out they have visited a service, or to disclose their name, age and the reason for their visit to the receptionist if they can be overheard by others in the waiting room)
- staff attitudes (students value staff who make them feel comfortable and relaxed, and are friendly, supportive, helpful, welcoming, non-judgmental and caring)
- staff gender (students like to be able to choose the gender of the health practitioner they see); location (convenience is valued)
- visibility of service (students don't want to be seen entering a sexual health service, so discrete signage and integrating sexual health services with other health services is helpful)
- convenient opening hours (e.g. lunchtimes and after school)
- a pleasant physical environment; cost of services (free is preferred)
- availability of information, advice and contraception

Baxter et al. [162] reviewed 59 papers reporting on UK studies examining views of service providers and young people concerning delivery of contraceptive services. Important themes they identified were:

- perceptions of particular services (e.g. family planning is for older couples; clinics are for girls)
- accessibility of services (young people generally prefer convenient locations although some will travel to more distant clinics to reduce the chance of meeting someone they know)
- opening hours (Saturdays and after school preferred)
- appointment systems (young people like to drop in, but they also don't like to wait long)
- embarrassment, anonymity and confidentiality (young people don't want to be seen at a clinic or called out by name; the use of numbers instead of names was suggested; the possibility of being recognised is a greater problem in smaller centres)
- pleasant clinic environment
- respectful and non-judgemental staff who are easy to talk to
- links between services (e.g. between school-based and other services)
- staff training.

What makes a service youth-friendly?

It is important that health service providers make services relevant and attractive to adolescents. The World Health Organization has stated that adolescent-friendly health services need to be accessible, equitable, acceptable appropriate, comprehensive, effective and efficient.[163]

A recent systematic review by Brittain et al.[164] aimed to describe key characteristics of youth-friendly family-planning interventions and summarise the evidence regarding the effect of youth-friendly family planning services on reproductive health outcomes.

Thirteen studies discussed key characteristics of youth-friendly family-planning services: one from the perspectives of both providers and young people, nine from the perspectives of young people only, and four from the perspectives of providers only. The youth friendly characteristics identified were: (ordered according to the number of studies identifying the characteristic)

- Confidentiality: What is discussed between patient and provider will not be shared with anyone else without the patient's explicit consent (13 studies)
- Accessibility: Convenient location; low cost or free; access to transport; outreach; opening hours; short waiting times; both by appointment and 'drop in' visits available ; pleasant atmosphere at entrance; offering a range of contraceptive options (11 studies)

- Provider interaction: Sufficient time is allowed to build a rapport between provider and patient; providers engaging in one-to-one vs. group education; providers being respectful and non-judgmental (11 studies)
- Integration: Providing family planning services in setting such as youth clubs, or in settings also providing other health services such as mental health services or comprehensive health services (7 studies: 4 of young peoples' and 3 of providers' perspectives)
- Specialised staff training: Staff have received training on communicating with young people about reproductive health (5 studies; 4 of young peoples' and 1 of providers' perspectives
- Accommodating young people's preferred provider characteristics: for example being a particular gender, or type of practitioner, such as a doctor, nurse or social worker (4 studies of young people's views)
- Involvement of parents and/or families (4 studies: 2 of young peoples' and 2 of providers' views)
- Peer involvement: the use of peer health providers, peer educators, or peer support groups within the clinic (3 studies: 2 of young peoples' and 1 of providers' views)
- Cultural competence: providers and clinics have the behaviours, attitudes and policies to enable effective service provision in cross-cultural situations (1 provider study)

Do youth-friendly services produce better outcomes?

Brittain et al. [164] also identified six studies that examined the effects of youth-friendly family planning services on reproductive health outcomes. Study sample sizes ranged from 163 to 1,590 and the age of study participants from 12 to 24 years. There were two prospective cohort studies and one each of the following study types: pre-post with one study group, analysis of repeated population surveys, cross-sectional, and non-randomised trial.

Three studies examined impacts on long term outcomes (i.e. teen or unintended pregnancy rates and abortion rates). Two of these found that youth-friendly family planning service components were associated with statistically significant reductions in teen pregnancies while the third[165], an evaluation of a new contraceptive clinic for teens in Nottingham, UK for the years 1986 to 1992, found a statistically significant increase in pregnancy, birth and abortion rates.

Three studies examined impacts on medium-term outcomes and all found positive outcomes related to contraceptive use including increased odds of consistent use of birth control from first to last visit, increased odds of use of effective birth control, increased clinic utilisation (following an intervention at a Teen Clinic), and greater use of chosen contraceptive method at six and 12 month follow-up.

All three studies that examined short term impacts found significant effects, including increased positive ratings for aspects of the clinic experience, satisfaction with opening hours, and increased patient knowledge.

Overall, the review by Brittain et al.[164] found that there was limited evidence that youth-friendly family planning service improve reproductive health outcomes for young people because the body of evidence lacked rigorous study designs and had high risk for bias. The authors were unable to draw definitive conclusions because each study examined different youth-friendly services interventions, and each intervention employed different strategies to increase young people's access to services (e.g. hours to suit teenager's schedules or drop-in appointments) or improve quality of care (e.g. specialised staff training). They did, however, note the following characteristics of interventions that were associated with reduced teen pregnancy rates and improved use of contraceptives: clinic-based services with peer providers, follow-up phone calls, and outreach efforts, and services that emphasised in-depth counselling, education tailored to an adolescent's level of development, and provision of social support and reassurance. They also noted that another intervention that offered free services, tailored hours, peer group reproductive health discussion, and outreach in local schools was associated with increased use of services.

Emergency contraception

It is common for young people to have sex without using contraception.[101] When young women seeking abortion are asked why they did not use contraception, common reasons given are that they were not planning to have sex, they were 'in the moment', and they had been drinking.[166-168] Emergency contraception is the use of drugs (the 'morning after pill') or devices (the copper IUD) to prevent pregnancy after intercourse where no contraceptive method has been used or there has been a mishap in contraceptive use (such as a condom breaking or forgetting to take oral contraceptive pills).[169,170]

The emergency contraceptive pill

The most widely used emergency contraceptive pill (ECP) is 1.5 mg levonorgestrel (LNG), taken either as a single dose or in two 0.75 mg does roughly 12 hours apart.[169] (In New Zealand women are offered Postinor-1, a single-dose formulation which contains 1.5mg of levonorgestrel. [171]) There has never been a placebo-controlled trial of the efficacy of the ECP, but efficacy has been estimated by comparing the number of observed vs. expected pregnancies in women given the ECP. Two influential World Health Organization studies have indicated that LNG-ECP is highly effective. In the first study[172], 11 out of 976 (1.1%) women became pregnant, when 76 (7.8%) would have been expected to, indicating an efficacy of 86%. In the second [173], 44 out of 2712 (1.6%) women became pregnant when 216 (8%) would have been expected to, indicating an efficacy of 80%. (Efficacy is not the same as the percentage of women who do not get pregnant. The latter statistic is considerably greater than the efficacy because not all women would be expected to get pregnant following a single episode of sex, even if they used no contraception. In the two studies cited above the percentage of women who did not get pregnant was > 98%.)

The efficacy of LNG-ECP is reduced in women who have sex during the fertile window of their menstrual cycle (from five days before to one day after ovulation), and was found to be 60–68% in two other studies.[174]

A 2012 Cochrane review[175] found that the one and two dose LNG regimens were of similar effectiveness, and that women who took LNG within 72 hours of intercourse were significantly less likely to get pregnant than those who took it after 72 hours. Side effects from LNG-ECP are generally tolerable, and include nausea, vomiting, heavier than normal menstrual bleeding, fatigue, diarrhoea, dizziness and breast tenderness.[176] Recently, there have been concerns that LNG-ECP is less effective in heavier women (those weighing more than 70 kg).[174] This has led to recommendations that heavier women should be offered a copper intra-uterine device instead of the ECP.[174,177]

Emergency contraceptive pills can be purchased over-the-counter from pharmacies in many countries[169] including New Zealand (at a cost of $30 to $50[178]). In New Zealand, at family planning clinics[179] and often at GPs (through funding from DHBs), the consultation and prescription is free for young people but there is normally a $5 charge to fill the prescription at the pharmacy.[178] Some DHBs, including Nelson Marlborough[180] and Waikato[181] fund pharmacies to provide free emergency contraceptive pills, with or without a prescription.

Is advance provision of emergency contraceptive pills of benefit?

Emergency contraceptive pills are most effective if they are taken as soon as possible after unprotected sex.[182] Providing women with a supply of emergency contraception to use as needed allows women rapid access to the medication when they need it. A Cochrane review [183] summarised the evidence evaluating advance provision of emergency contraceptive pills, published up until November 2009. None of the 11 individual RCTs included in the review found significant effects on pregnancy rates, including the two studies that were adequately powered to detect such a difference. Results from pooled analyses also showed no significant differences between pregnancy rates in the advance provision and control groups. There was no evidence that advance provision had a negative impact on sexual and reproductive health behaviours and outcomes.

Copper IUDs for emergency contraception

The copper IUD is the most effective method of emergency contraception and the only emergency contraceptive method to provide on-going protection against pregnancy.[175,184] Cleland et al. reviewed 42 studies published in English or Chinese (up until August 2011) with a defined population of women who presented for emergency contraception and were provided with an IUD, and in which the number of pregnancies was ascertained and loss to follow-up was clearly defined. Almost all reported on copper IUDs. Most studies (31 or 74%) followed the standard protocol of inserting the IUD within five days of unprotected intercourse. The pregnancy rate (after one outlier study was excluded) was 0.09%, indicating that the copper IUD is by far the most reliable emergency contraceptive option.

There have been a number of recent studies exploring the awareness of and interest in IUDs among women seeking emergency contraception. These have identifies barriers to IUD use including cost, waiting time (patients cannot always get an IUD on the day they present for emergency contraception), low levels of awareness and understanding of IUDs among patients, and lack of provision by providers.[185-188] Two US studies of adolescents and young women presenting to family planning clinics reported that, when counselled about IUDs for emergency contraception, 13%–15% of them would choose an IUD, and that more would do so if IUDs could be provided on the same day and at no cost.[185,187]

Long-acting reversible contraception

The effectiveness of condoms and oral contraceptive pills in preventing pregnancy depend on correct and consistent use. Typical failure rates for the contraceptives commonly used by teens, such as condoms and the

oral contraceptive pill, are much higher than failure rates for perfect use.[189] In contrast, the effectiveness of long acting reversible contraceptive (LARC) methods, which include copper intra-uterine devices, progestogen-only injectable contraceptives, progestogen-only intrauterine devices, and progestogen-only subdermal implants, does not depend on daily compliance.[189]

Expert opinion is that LARC methods are generally under-utilised.[189] The American College of Obstetricians and Gynecologists has stated that, because LARCs have top-tier effectiveness, high rates of satisfaction and continuation, and no need for daily adherence, LARC methods should be first-line recommendations for all women and adolescents.[190] The UK's National Institute for Health and Care Excellence has stated that all currently available LARC methods are more cost effective than the combined oral contraceptive pill even at one year of use.[191]

There is evidence, including evidence from a New Zealand study[192] which explored attitudes to contraception, and particularly LARC, among young women seeking abortion, that, when they are provided with accurate information, and cost barriers are removed, young women view LARC methods favourably.[193]

The contraceptive CHOICE Project was a prospective cohort study of 10,000 women in the St. Louis region of the US who were aged 14–45 years, wished to avoid pregnancy for at least one year and were initiating a new form of reversible contraception.[193] Women recruited into the study were provided with contraceptive counselling and offered the contraceptive method of their choice at no cost for three years. Of the first 2,500 women enrolled, 63% were aged < 26 years. Of the 2,500 women, 67% chose long acting methods: 56% chose an intrauterine method (47% a levonorgestrel IUD and 9% a copper IUD) and 11% a subdermal implant. Although the study found statistically significant associations between demographic and behavioural factors and acceptance of LARCs, these associations were small and considered unlikely to be clinically meaningful. The study authors suggested that this indicated that LARC methods are acceptable to and wanted by a wide range of women seeking contraception.

Progestogen-only injectable contraceptives

Progestogen-only injectable contraceptives are slow release preparations. Depot medroxyprogesterone acetate (DMPA, trade name Depo-Provera®), which is given every 12 weeks, is the only progestogen-only injectable available in New Zealand.[194] It is very effective at preventing pregnancy. The estimated percentage of women experiencing an unintended pregnancy during the first year of use is 0.2%, while the percentage for typical use in the US has been estimated to be 6%.[195] The main factor in less than perfect use is failure to get repeat injections on time.

It is common for women to have irregular or prolonged bleeding in their first three to six months on DMPA. Amenorrhoea is common with longer DMPA use.[189,196] There have been concerns about the effects of DMPA on bone mineral density (BMD), especially in young women who have not yet attained their peak bone mass. Cross-sectional studies have indicated that BMD in DMPA users is usually lower than that of non-users, but within one standard deviation.[197] Longitudinal studies have found that there is a greater decrease in BMD over time in DMPA users than non-users, but women gain BMD when they stop using DMPA. [197] A recent Cochrane review identified two studies providing moderate quality evidence of increased fracture risk for longer current use of DMPA users, plus two lower quality studies, one of which found and increased fracture risk while the other did not [198] The review did not provide any data specifically on adolescents. The authors stated that adolescents are unlikely to have fractures related to skeletal fragility as these are rare in pre-menopausal women.

Progestogen-only subdermal implants

Contraceptive implants are inserted beneath the skin on the inside of the upper arm and slowly release progestogens into the circulation. There are two brands available in New Zealand: Jadelle®, which is fully subsidised and lasts for up to five years (2 rods, each containing 75mg levonorgestrel) and Implanon NXT® which costs around $270 and lasts for up to three years (1 radio-opaque rod containing 68 mg etonorgestrel).[178,199,200]

Implants are very effective at preventing pregnancy. Their forgettable nature is appealing to women.[201] A 2007 Cochrane review reported on research comparing different implants in RCTs.[202] Follow-up data from these studies indicated that there were three pregnancies in 2307 women years with Jadelle® and none in 2068 women years with Implanon®, equating to pregnancy rates of 0.13 and 0 per 100 women years respectively. The most common side effect of implants is changes in bleeding patterns, including infrequent, frequent and/or prolonged bleeding, as well as amenorrhoea.[203] Bleeding disturbances, especially frequent and/or prolonged bleeding, are the most common reasons women discontinue implants prematurely.[201,203] A Scottish study which followed up 324 women who had chosen Implanon® in a community family planning clinic found that, of the

68 women who discontinued Implanon® within one year, 62 (91%) did so because of unwanted side effects, the most common being frequent and/or unpredictable bleeding (n=42, 62%).[204]

There are drugs which can be used to manage troublesome bleeding patterns[205,206] but these may not be acceptable to all women. One Dutch study found that most women with troublesome bleeding refused to accept additional medications and asked for the removal of the implant.[203]

Intrauterine devices

There are two types of intrauterine device (IUD) available in New Zealand: the copper IUD, which contains copper, and the levonorgestrel intrauterine system (LNG-IUS, brand names Mirena® and Jaydess®), which is a hormone-releasing IUD that slowly releases progestogen into the uterine cavity. Jaydess® (known as Skyla® in the US) is a newer LNG-IUS, which is slightly smaller than Mirena®, lasts for three years, and is promoted as being especially suitable for young women who have not had children. There are also small-sized frameless copper IUDs which may be especially suitable for nulliparous women with a small uterine cavity, but these are not available in New Zealand.[207] Only the copper IUD is fully subsidised: young people need to pay around $300 for Mirena® or Jaydess®, unless they meet Pharmac's strict criteria for heavy menstrual bleeding.[208] (Family Planning charges $340 for Mirena® and $275 for Jaydess®.[178]) Intrauterine devices are very effective at preventing pregnancy. Failure rates during the first year of have been estimated to be 0.6% to 0.8% for copper IUDs and 0.2% for Mirena.[195]

Copper IUDs may cause increased menstrual flow and painful menstruation whereas the LNG-IUS typically produces irregular bleeding or spotting in the first months of use followed by oligomenorrhoea or amenorrhoea after longer use.[209] Unacceptable vaginal bleeding or pain is the most common reason for women requesting IUD removal.[209] Barriers to increased use of IUDs by adolescents include lack of awareness, cost, and health provider reluctance to recommend IUDs to women who have not had children and who may have multiple partners (because of outdated worries about STI-induced pelvic inflammatory disease and subsequent infertility).[210,211] The American College of Obstetricians and Gynecologists has stated that, although few studies have focussed exclusively on adolescents, current evidence suggests that the relative risk of pelvic inflammatory disease is increased only in the first 20 days after IUD insertion and then returns to baseline, while the absolute risk remains small, and that prompt treatment of chlamydia identified at the time of IUD insertion will make developing pelvic inflammatory disease unlikely.[211]

Another concern is that insertion of an IUD is more difficult and/or painful in a woman who has not had children because the cervix is more tightly closed. Bayer et al.[212] reported on a retrospective cohort study which compared the insertion and post-insertion experiences of 220 nulliparous and 87 parous teenagers (30 of who received their IUD post abortion). The mean age of study subjects was 18 years, range 15 to 19 years). The vast majority of study subjects (296 out of 307, 96%) had a successful IUD insertion on the first attempt; all of the 11 unsuccessful insertions were in nulliparous teens. Seven of the 11 had successful insertions on the second attempt and there were four failed insertions. Most of the study subjects having interval IUD insertion (i.e. not post abortion) received only ibuprofen or paracetamol and topical lidocaine gel or spray to the cervix for relief of insertion pain (269/277, 97%). (The 2015 Cochrane review on interventions for IUD insertion found that Lidocaine 2% gel, misoprostol, and most NSAIDs did not help reduce pain but that some lidocaine formulations, tramadol, and naproxen had some effect on reducing IUD insertion-related pain in specific groups.[213])

A prospective study of 109 nulliparous women, aged 18–30 years, who had an IUD placed at a student health clinic at Cornell University (88 LNG-IUS users and 21 Copper T 380A IUD users) and were followed up at one, six, 12 and 18 months after insertion reported high overall satisfaction.[214] At follow-up survey (after mean use of 13.4 months) 83% of women were 'happy' or 'very happy' with their IUD, with no differences in satisfaction between users of the two types of IUD. A majority of women (75%) reported that the insertion went 'very well' even though 78% rated insertion pain as moderate to severe. At 12 months, the continuation rate was 89%. Reasons for discontinuation were expulsion (3%), side effects (6%), lack of anticipated benefit (1%) and pregnancy (1%). Compared to users of the LNG-IUS, users of the Copper T 380A were more likely to have heavy menses (74% vs 2%, $p<0.0001$) or moderate to severe cramping (68% vs 20%, $p=0.0002$). During the study period, there were no uterine perforations and no diagnoses of pelvic inflammatory disease. The rate of failed insertions was 6.2%.

Conclusions

In New Zealand, the median age at which women have their first baby is around 28 years[215] yet the median age at which young people first have sex is around 17 years.[110] It is therefore clear that, in our society, most people

wish to have sex long before they wish to be a parent and that they need to be able to control their fertility through contraception and, as a last resort, through abortion (if that is what they want). Having several sexual partners over time is the norm[111,216] and having sex with people who have had previous partners put a person at risk of contracting a sexually transmitted infection. There is a clear link between alcohol abuse and promiscuity and unprotected sex. [113,217]

All over the developed world, governments are concerned about teenage pregnancy rates. There is considerable variation in teenage birth rates between developed countries and New Zealand's rate is high by OECD standards.[116]Teenage birth rates are falling in New Zealand and in other developed countries.[116]This suggests that broader global trends, such as greater educational opportunities for young women along with improved contraceptive technology (and access to it), are responsible for the decline rather than any particular national public policies.[218]

Young people need comprehensive sexuality education at school to equip them with the skills and understandings to take care of their sexual health. Research indicates that the effective sexuality education addresses the risk and protective factors that are most easily changed by teen pregnancy/STI prevention programmes: sexual knowledge and values, perception of peer norms, motivation and self-efficacy. There is no evidence that providing young people with comprehensive sexuality education hastens their sexual debut or increases their sexual activity.

In addition to having a good understanding of sexual and reproductive health issues, young people need access to sexual and reproductive health services. It is important to minimise barriers that deter young people from accessing services. The greatest barriers are probably embarrassment and fear that confidentiality will not be maintained. Young people generally don't want it known that they have visited a sexual health service. Other barriers include inconvenient service locations or opening hours, transportation difficulties, and cost.

Research has identified a number of characteristics that make services youth-friendly: confidentiality, accessibility, respectful and non-judgmental staff, integration of sexual and reproductive services with other health services, specialised staff training, accommodating young people's preferred provider characteristics (such as wishing to see a provider of a particular gender), involvement of parents of families (where this is desired), peer involvement (for example having young staff or peer support groups), and cultural competence.

Highly effective contraceptive methods are available but awareness and utilisation of these methods, particularly long-acting reversible methods, is not as high as it could be. Since it is common for young people to have unprotected sex, it is important that all young people have access to emergency contraception. Some DHBs fund pharmacies to provide the emergency contraceptive pill free without a prescription. Although there is no high quality evidence that providing people with an advance supply of the emergency contraceptive pill reduces unintended pregnancies, common sense would suggest that this approach could be of benefit, particularly to teenagers in remote and rural areas. The copper IUD is the most effective form of emergency contraception, and it is especially recommended for heavier women among whom the emergency contraceptive pill is less effective.

Long active reversible contraceptives (LARCs), including implants, the copper IUD and the levonorgestrel intrauterine system (Mirena® and Jaydess®) have very low failure rates and do not require daily compliance, characteristics that make them ideal for women determined to avoid pregnancy. There is a lack of awareness among health professionals and young people that intrauterine devices are suitable for women who have not had children and who may have multiple partners. Given the choice of having either a copper IUD or a levonorgestrel intrauterine system, a majority of women would likely choose a levonorgestrel intrauterine system because it reduces or eliminates menstrual bleeding whereas the copper IUD tends to increase it. In New Zealand this choice is denied to women who cannot afford to pay the high cost of levonorgestrel intrauterine system, since Pharmac funds only the copper IUD.

Providing young people with comprehensive sexuality education and free access to sexual health services will not be enough to eliminate sexually transmitted infections and unintended pregnancies in young people. Alcohol abuse is a major factor leading to unprotected and risky sexual behaviours so changing New Zealand's drinking culture is an important public health goal. When disadvantaged young women are empowered to see a future for themselves that includes completing their education and having a career that will allow them greater economic independence and greater ability to provide for any children they may eventually have, then they will be less likely to see early motherhood as their only path into adulthood, and less likely to be ambivalent about the possibility of pregnancy when they have sex.

BIRTHS

Introduction

New Zealand's teenage fertility rates are relatively high by OECD standards. In 2011, New Zealand's adolescent fertility rate was 22.1 per 1,000 women aged 15–19 years.[14] In comparison, rates (per 1,000) were 35.0 in the US, 23.6 in the UK, 14.6 in Australia, 12.5 in Canada and 5.2 in the Netherlands.[14] Teenage fertility rates are declining in New Zealand and in other developed countries.[117] In New Zealand, the decline in fertility has been greatest for younger teenagers so that births to teenage mothers are increasingly occurring to older teenagers. Almost three-quarters (71.6%) of all teenage births in 2013 were to 18 and 19 year olds (up from 66.6% in 2006).[117] Teenage fertility rates are considerably higher in areas of high socio-economic deprivation.[118]

Māori have long had higher teenage birth rates than non-Māori, but their rates are declining at a similar rate to those of non-Māori. The Māori teenage birth rate in 2013 was 53.1 births per 1,000, down from 72.2 per 1,000 in 2000.[117] Māori teenage birth rates are higher than European at all levels of socio-economic deprivation (NZDep2013).[118]

Research, both internationally and in New Zealand, suggests that the main factors responsible for declining teenage fertility rates are a decline in sexual activity among teenagers and increasing use of contraception.[117] The abortion rate for women aged 15 to 19 years in New Zealand has declined, from a high of 26.7 per 1,000 in 2007 to 11.5 per 1,000 in 2013.[219] Data from the Christchurch Health and Development Study, which followed children born in 1997 from birth to age 25 years, suggested that teenage motherhood was associated with poorer mental health, education and economic outcomes at ages 21–25 years although the association with adverse mental health outcomes was no longer significant after controlling for confounding factors.[220] For many young parents, having a baby can be a turning point in their lives which increases their motivation to take responsibility for their future and raise their educational and employment aspirations. Coordinated social services which support teen parents into education, training and employment are critical to improving outcomes for teenage parents and their children.[118]

The following section reports on teenage birth rates using information from the Birth Registration Dataset. Policy documents and evidence-based reviews relevant to the support of teenage parents and their children are summarised at the end of this section.

Data sources and methods

Indicator: *Teenage birth rates*

Data sources

Numerator: Birth registration dataset (live births)
Denominator: Statistics NZ Estimated Resident Population (with linear extrapolation being used to calculate denominators between Census years).

Definition: Teenager is defined as a woman aged 10–19 years
Teenage birth rate: The number of live births per 1,000 women aged 15–19 years
Age-specific fertility rates: The number of live births per 1,000 women for a particular age group in a given year

Notes on interpretation

Unless specified otherwise, the denominator is out of women aged 15–19 years
In the analysis of total teenage pregnancy rates, miscarriage rates were estimated at 10% of induced abortions and 20% of live births using miscarriage methodology based on Dickson, N., et. al.[221]
The teenage birth rates presented here may vary slightly from previous years, as the Ministry of Health no longer provides stillbirth data in the Birth Registration Dataset due to concerns about data quality. Thus the current analysis is restricted to teenage live births (as compared to total teenage birth rates (including stillbirths) which were presented in previous years).
An overview of the strengths and limitations of the Birth Registration Dataset is provided in the Appendices.

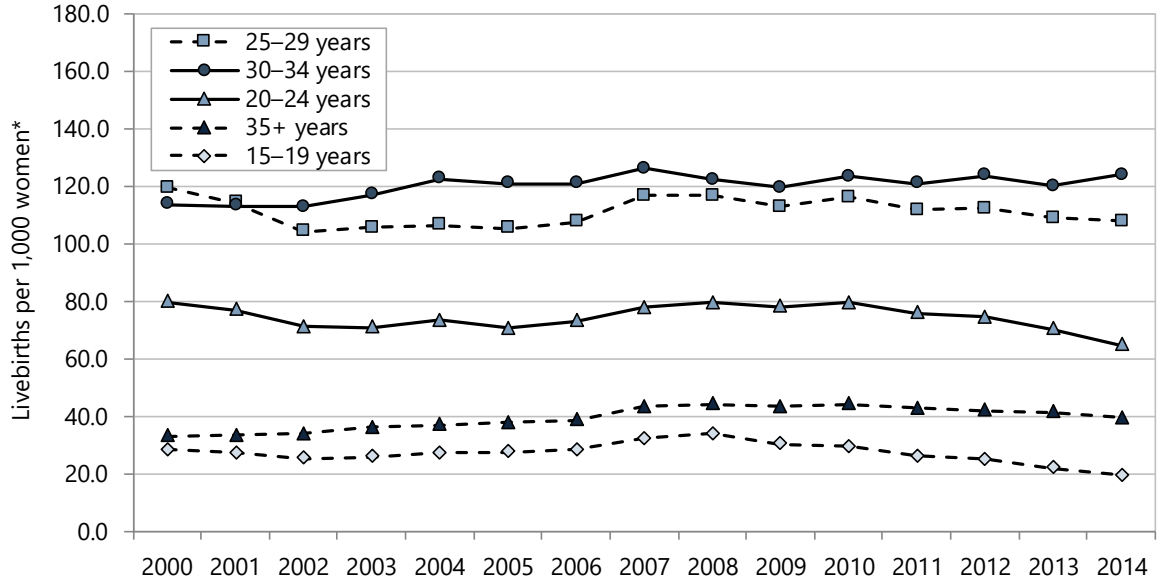
National trends and distribution

In 2000 the live birth rate varied by age from 28.1 per 1,000 15–19 year old women to 119.5 per 1,000 25–29 year olds. Rates were consistently lowest in 15–19 year olds and from 2002 were highest in 30–34 year olds. From 2000 to 2014 there was an overall fall in birth rates for women aged 15–19 years, and also for 20–24 and 25–29 year olds, with more stable rates in other age groups. **(Figure 179)**.

Among women aged under 20 years the total birth rate fell from 70.7 per 1,000 in 2000 to 36.4 per 1,000 in 2014. Birth rates were consistently higher by each increasing year of age **(Figure 180)**. Pregnancy outcomes for women aged 15–19 years showed an overall fall in pregnancy, live birth, termination and miscarriage rates from 2008 to 2014 **(Figure 181)**.

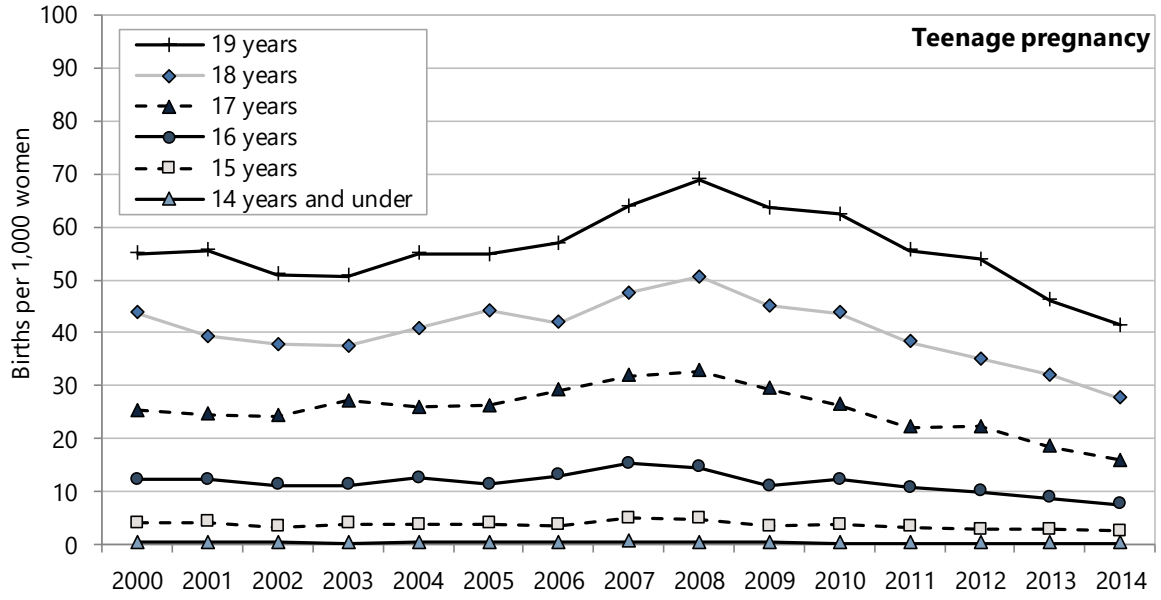
From 2000 to 2014 birth rates for 15–19 year old women declined overall in each ethnic group. Birth rates were consistently highest for Māori, followed by Pacific and European and consistently lowest for Asian/Indian **(Figure 182).**

Figure 179. Livebirths, by age group of women, New Zealand, 2000–2014



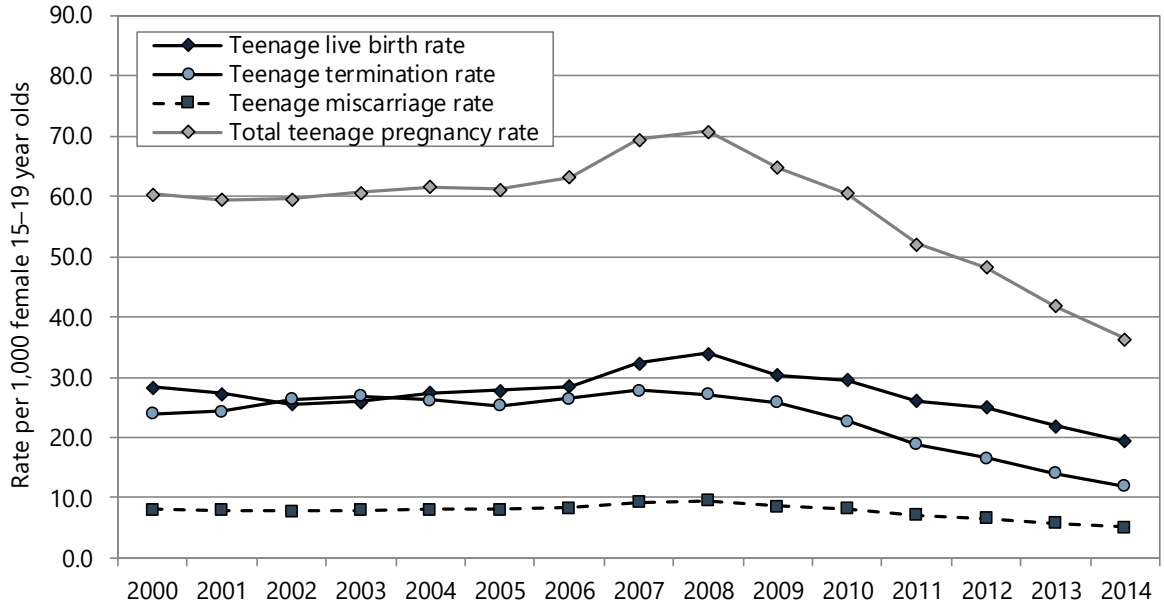
Numerator: Birth registration dataset; Denominator: Statistics NZ Estimated Resident Population; * Number of live births per 1,000 females of childbearing aged between 15–44 years

Figure 180. Teenage birth rate, by age group, New Zealand, 2000–2014



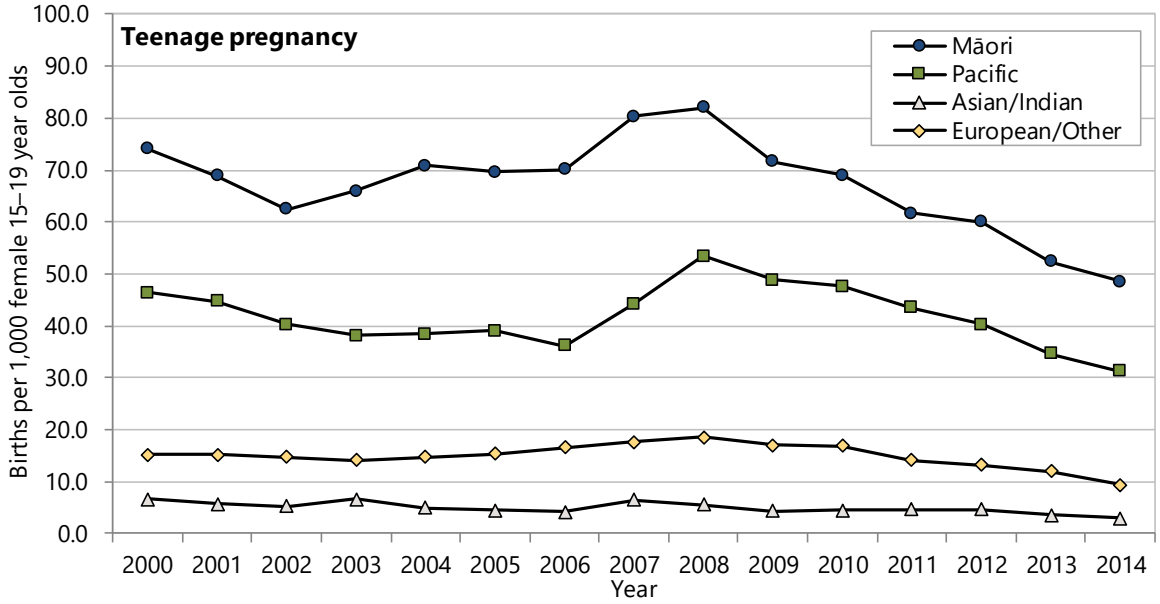
Numerator: Birth registration dataset (births registered to women aged under 20 years); Denominator: Statistics NZ Estimated Resident Population, female age range 10–19 years

Figure 181. Teenage pregnancy, by pregnancy outcome, New Zealand 2000–2014



Numerators: Birth registration dataset (live births); Abortion Supervisory Committee via Statistics New Zealand: Numerator age range 11–19; Denominator: Statistics NZ Estimated Resident Population (15–19 year old females); Miscarriages were estimated at 10% of terminations (induced abortions) and 20% of live births. Miscarriage methodology based on Dickson, N., et. al. (2000) Pregnancies among New Zealand teenagers: trends, current status and international comparisons. NZMJ (April 12) 155–159

Figure 182. Teenage birth rates by ethnicity, New Zealand 2000–2014



Numerator: Birth registration dataset (births registered to women aged under 20 years); Denominator: Statistics NZ Estimated Resident Population (15–19 year old females)

Distribution by demographic factors

Between 2010 and 2014 there was a strong social gradient in teenage live birth rates with a *significant increase* in rates between each quintile of NZDep2013 scores compared with the quintile below. Compared with European/Other, teenage birth rates were *significantly higher* for Māori and Pacific and *significantly lower* for Asian/Indian while MELAA rates were *not significantly different* **(Table 154)**.

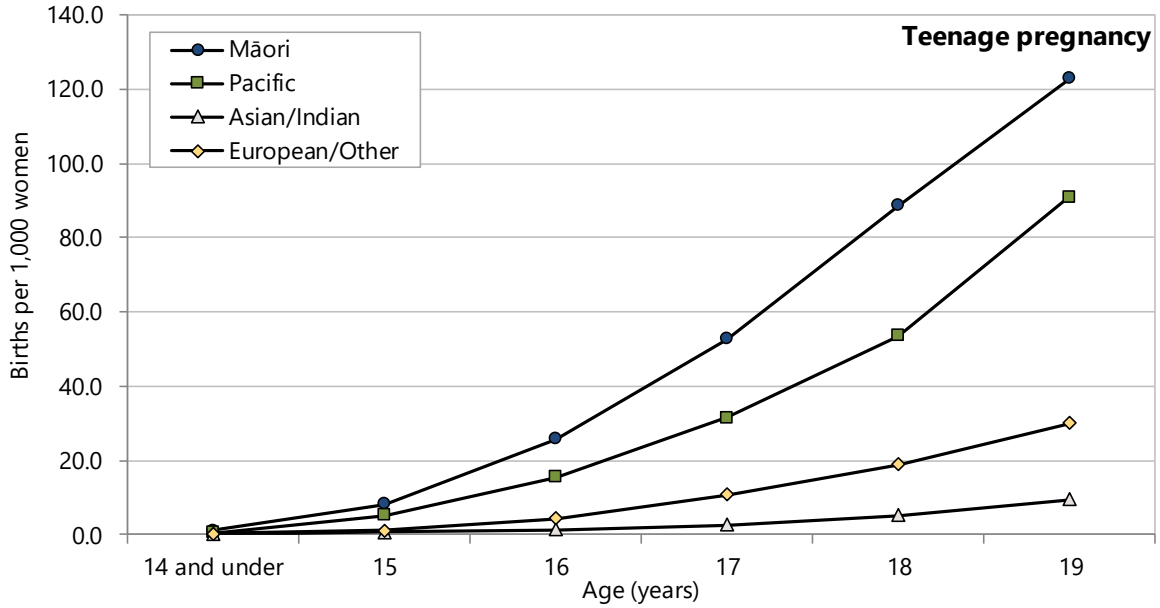
Table 154. Birth rates among 10–19 year olds, by demographic factor, New Zealand 2010–2014

Variable	Number: 2010–2014	Rate per 1,000 female 15–19 year olds	Rate ratio	95% CI
Teenage births				
New Zealand				
NZDep2013 Index of deprivation quintile				
Deciles 1–2	961	6.68	1.00	
Deciles 3–4	1,581	12.07	1.81	1.67–1.96
Deciles 5–6	2,495	17.75	2.66	2.47–2.86
Deciles 7–8	4,466	28.59	4.28	3.99–4.59
Deciles 9–10	9,085	47.51	7.11	6.66–7.60
Prioritised ethnicity				
Māori	9,813	58.31	4.45	4.31–4.59
Pacific	2,741	39.33	3.00	2.87–3.14
Asian/Indian	371	4.00	0.30	0.27–0.34
MELAA	117	12.87	0.98	0.82–1.18
European/Other	5,549	13.11	1.00	

Numerator: Birth registration dataset (births registered to women aged under 20 years); Denominator: Statistics NZ Estimated Resident Population (15–19 year old females); Rates are per 1,000 15–19 year old females, Ethnicity is level 1 prioritised; Decile is NZDep2013

The live birth rate was consistently highest for Māori, followed by Pacific, European and Asian/Indian at each year of age from 15–19 years **(Figure 183)**.

Figure 183. Teenage live birth rate, by age and ethnicity, New Zealand 2010–2014



Numerator: Birth registration dataset (births registered to women aged under 20 years); Denominator: Statistics NZ Estimated Resident Population; Rate is per 1,000 age-specific female population; Ethnicity is level 1 prioritised

Distribution by region

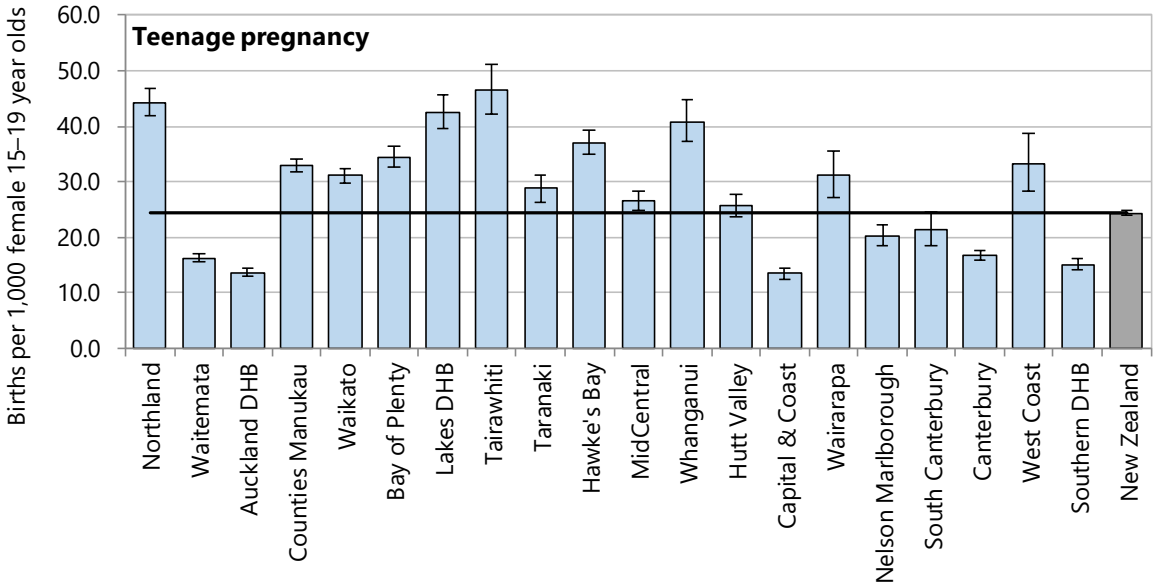
Teenage birth rates were *not significantly different* from the New Zealand rate in Hutt Valley and South Canterbury DHBs and were *significantly lower* in Waitemata, Auckland, Capital & Coast, Nelson Marlborough, Canterbury and Southern DHBs between 2010 and 2014. In the remaining 12 district health boards the teenage birth rates were *significantly higher* than the New Zealand rate. **(Table 155**, **Figure 184)**.

Table 155. Teenage birth rates, by district health board, New Zealand 2010–2014

DHB	Number: 2010–2014	Number: annual average	Rate per 1,000 female 15–19 year olds	Rate ratio	95% CI
Teenage births					
Northland	1,179	236	44.32	1.82	1.71–1.92
Waitemata	1,547	309	16.27	0.67	0.63–0.70
Auckland	1,050	210	13.69	0.56	0.53–0.60
Counties Manukau	3,156	631	32.89	1.35	1.30–1.40
Waikato	2,070	414	31.13	1.28	1.22–1.33
Bay of Plenty	1,161	232	34.49	1.41	1.33–1.50
Lakes	748	150	42.48	1.74	1.62–1.87
Tairawhiti	394	79	46.51	1.91	1.73–2.10
Taranaki	514	103	28.80	1.18	1.08–1.29
Hawke's Bay	979	196	37.05	1.52	1.43–1.62
MidCentral	836	167	26.46	1.08	1.01–1.16
Whanganui	428	86	40.87	1.67	1.52–1.84
Hutt Valley	615	123	25.63	1.05	0.97–1.14
Capital & Coast	706	141	13.50	0.55	0.51–0.60
Wairarapa	203	41	31.16	1.28	1.11–1.46
Nelson Marlborough	416	83	20.31	0.83	0.76–0.92
South Canterbury	183	37	21.31	0.87	0.76–1.01
Canterbury	1,374	275	16.86	0.69	0.65–0.73
West Coast	157	31	33.20	1.36	1.17–1.59
Southern	872	174	15.08	0.62	0.58–0.66
New Zealand	18,620	3,724	24.40	1.00	

Numerator: Birth registration dataset (births registered to women aged under 20 years); Denominator: Statistics NZ Estimated Resident Population (15–19 year old females)

Figure 184. Teenage birth rates, by district health board, New Zealand 2010–2014



Numerator: Birth registration dataset (births registered to women aged under 20 years); Denominator: Statistics NZ Estimated Resident Population (15–19 year old females)

Northern region distribution and trends

Comparison with New Zealand

Between 2010 and 2014, teenage birth rates were *significantly higher* than the national rate in Northland and Counties Manukau DHBs, while rates were *significantly lower* in Waitemata and Auckland DHBs **(Table 156)**.

Table 156. Distribution of teenage births, Northern DHBs vs New Zealand 2010–2014

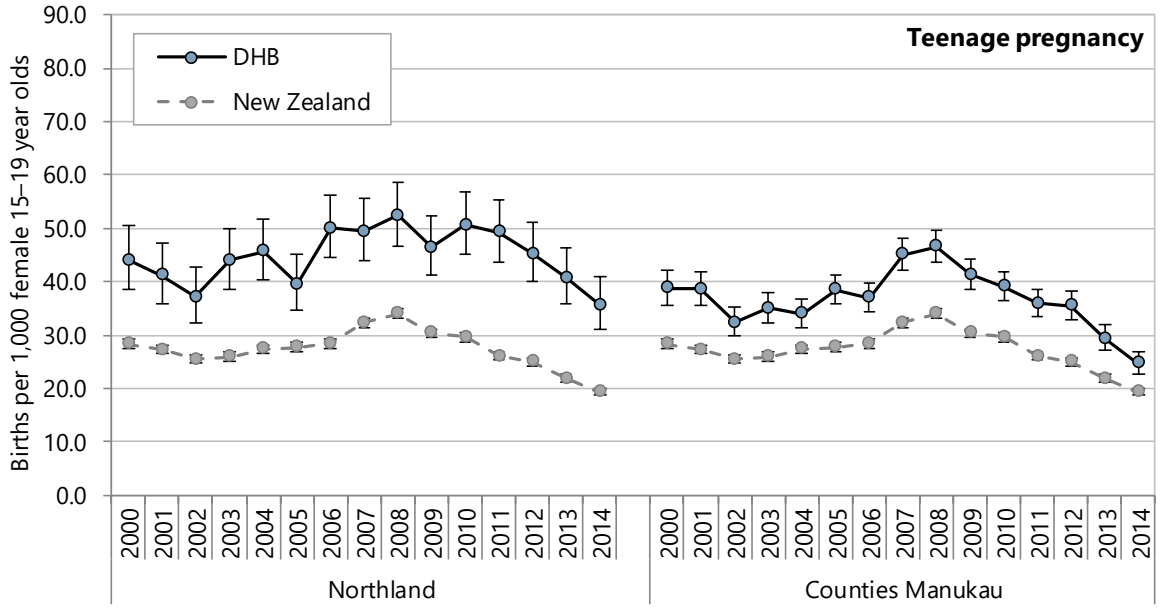
DHB	Number: 2010–2014	Number: annual average	Rate per 1,000 female 15–19 year olds	Rate ratio	95% CI
Teenage births					
Northland	1,179	236	44.32	1.82	1.71–1.92
Waitemata	1,547	309	16.27	0.67	0.63–0.70
Auckland	1,050	210	13.69	0.56	0.53–0.60
Counties Manukau	3,156	631	32.89	1.35	1.30–1.40
New Zealand	18,620	3,724	24.40	1.00	

Numerator: Birth registration dataset; Denominator: Statistics NZ Estimated Resident Population (15–19 year old females)

Regional trends

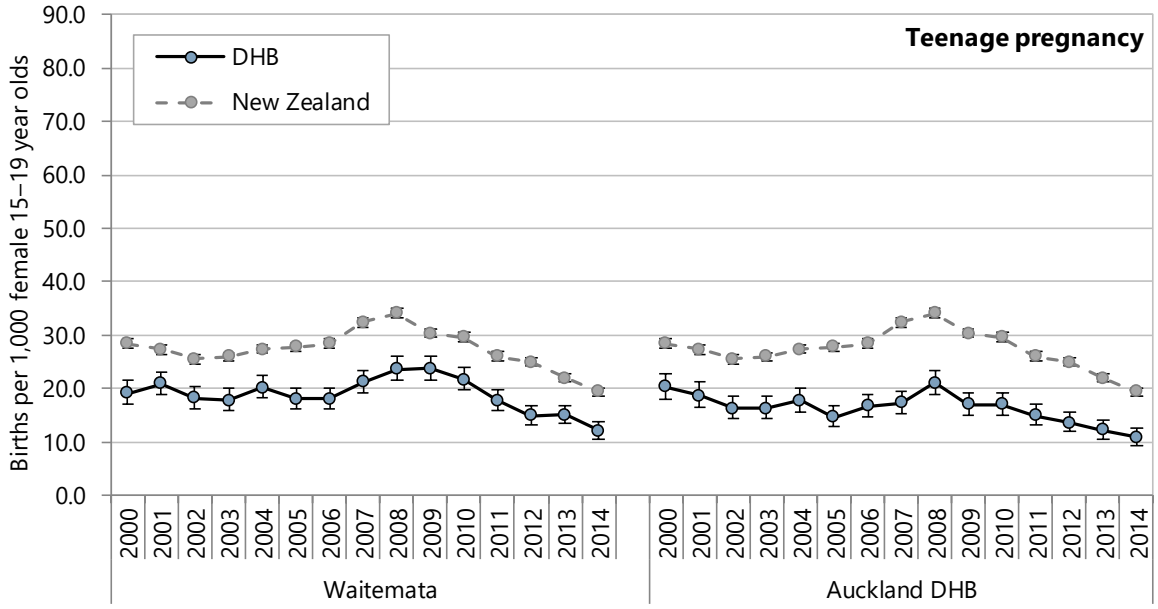
In all the Northern DHBs, teenage birth rates increased during the mid-2000s, reached their highest level in 2008, and declined steadily thereafter **(Figure 185**, **Figure 186)**.

Figure 185. Teenage birth rate, Northland and Counties Manukau DHBs vs New Zealand 2000–2014



Numerator: registration dataset; Denominator: Statistics NZ Estimated Resident Population (15–19 year old females)

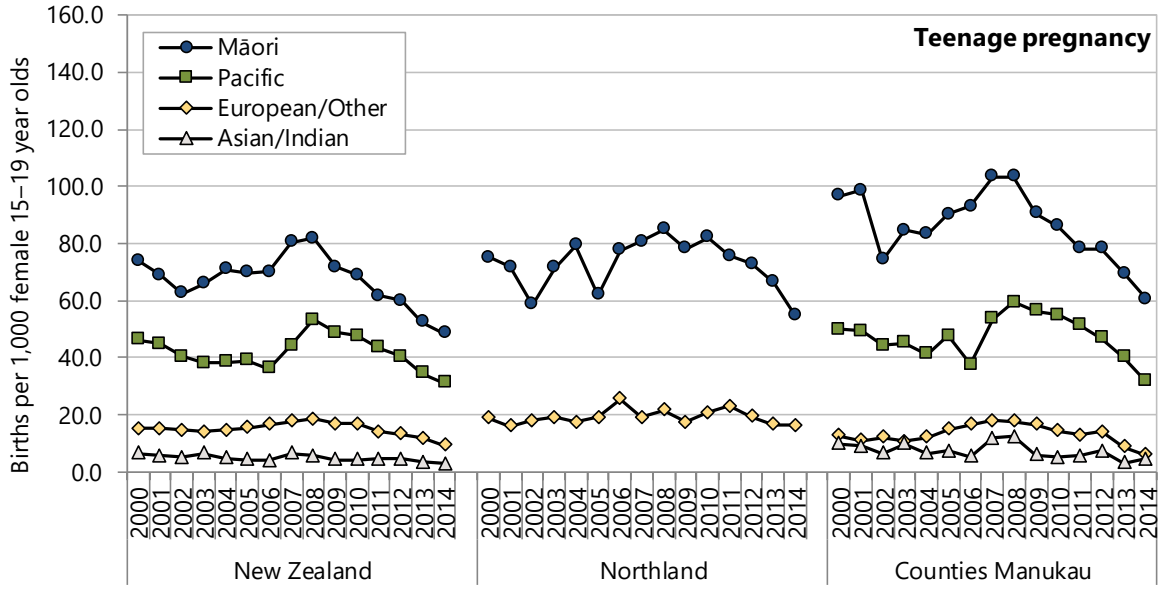
Figure 186. Teenage birth rate, Waitemata and Auckland DHBs vs New Zealand 2000–2014



Numerator: registration dataset; Denominator: Statistics NZ Estimated Resident Population (15–19 year old females)

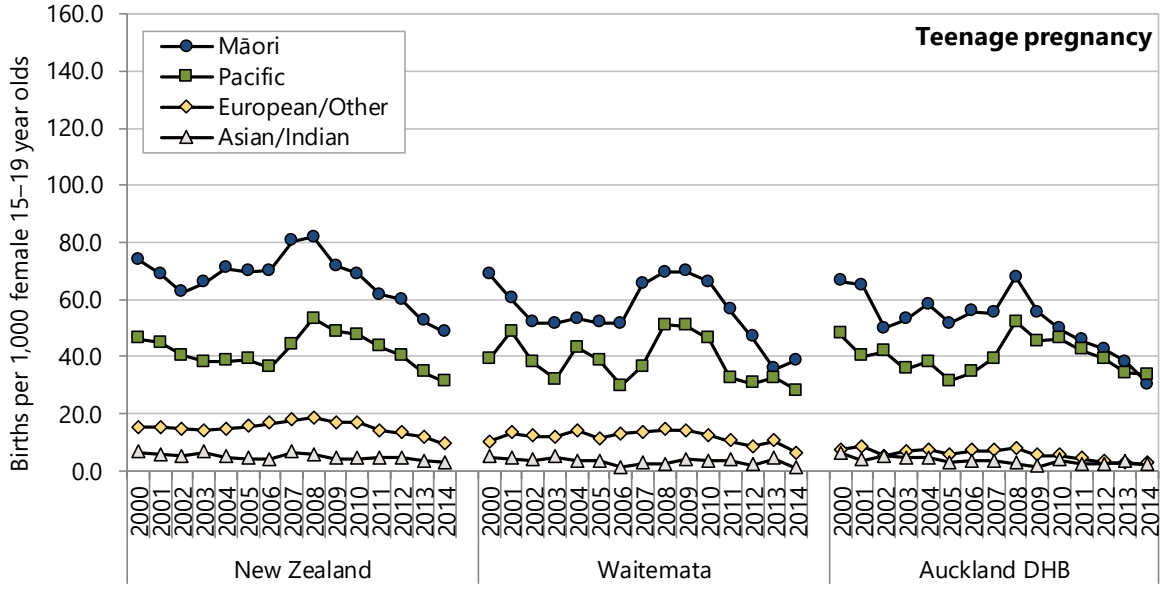
Declines in teenage birth rates were more marked for Māori and Pacific ethnic groups than for European/Other and Asian/Indian in the Northern DHBs. In the Waitemata, Auckland and Counties Manukau DHBs rates were consistently highest for Māori, followed by Pacific with the lowest rates for European/Other and Asian/Indian, while in Northland, teenage birth rates were higher for Māori than for European women **(Figure 187**, **Figure 188)**.

Figure 187. Teenage birth rate, by ethnicity, Northland and Counties Manukau DHBs vs New Zealand 2000–2014



Numerator: registration dataset; Denominator: Statistics NZ Estimated Resident Population (15–19 year old females); Ethnicity is level 1 prioritised

Figure 188. Teenage birth rate, by ethnicity, Waitemata and Auckland DHBs vs New Zealand 2000–2014



Numerator: registration dataset; Denominator: Statistics NZ Estimated Resident Population (15–19 year old females); Ethnicity is level 1 prioritised

Evidence for good practice for the support of teenage parents

Government policy and other documents
Ministry of Education. 2015. **Teen Parent Units.** http://www.education.govt.nz/school/property/state-schools/school-facilities/teen-parent-units/ This webpage provides information for schools that are considering establishing a teen parent unit (TPU) at their school. It explains the criteria that the Ministry of Education applies when deciding whether to allow a school to establish a teen parent unit. Additional information on becoming the host school for a Teen Parent Unit can be found on this page: http://www.education.govt.nz/school/running-a-school/managing-the-network-of-schools/changing-your-school-structure/becoming-the-host-school-for-a-teen-parent-unit/. A list of all the teen parent schools in New Zealand can be found on the following page, which also contains links to the Memorandum of Understanding between the Ministry and schools with a TPU, the Wellbeing Framework (which sets out the key outcomes and indicators of student success) and the Operational Guidelines (which outline the operational policy behind teen parent units). http://alternativeeducation.tki.org.nz/Teen-Parent-Units .
Social Policy Evaluation and Research Unit (SuPERU). 2014. **Effective Parenting Programmes: A review of the effectiveness of parenting programmes for parents of vulnerable children**. Wellington: Families Commission. http://www.socialserviceworkforce.org/system/files/resource/files/Effective-Parenting-Programmes-Report.pdf This review is not focussed on children of teen parents, but on vulnerable children at risk of maltreatment. It may be of interest, however, since teen parents and their children can belong to families grappling with a multitude of issues such as drug and alcohol use, family violence and maternal depression. The review considered international research on parenting programmes that had been evaluated using randomised controlled trials or other rigorous research designs with comparison groups. It also reviewed the evidence for the effectiveness of New Zealand programmes. It found that, internationally, few programmes have been shown to actually reduce child maltreatment, but many have been shown to produce positive changes in parenting, and in children's health and behaviour, and it could be argued that thereby they have reduced the risk of child maltreatment. It notes that there has been more research to support the effectiveness of parenting programmes to address children's behaviour problems than on programmes for parents of younger children (e.g. programmes to promote parent child attachment), and that younger, first-time parents are more likely to benefit from parenting programmes. Home-visiting and parenting education and support programmes have been shown to have small to moderate positive effects on children's health and development, and on parents' behaviours, attitudes and beliefs. New Zealand programmes are mostly based on overseas programmes and have not been rigorously evaluated so the review authors stated that it was difficult to make definitive judgements about their effectiveness. In their conclusions, the review authors stated that programme funders and providers need to determine the needs of their community and to match these with appropriate programmes, and that, while investing in evidence-based programmes is important, it must be recognised that such programmes are far from perfect and investment to innovate and improve on existing programmes is still needed.
Ministry of Social Development. 2013. **Services for Teen Parents and Their Children Practice Guidelines**. http://www.familyservices.govt.nz/working-with-us/funding-and-contracting/practice-guidelines/teen-parents-and-their-children-pg.html#July2013PracticeGuidelines3 These July 2013 Guidelines apply to apply to providers contracted to the Ministry of Social Development to deliver Services for Teen Parents and their Children, with contracts starting/renewing in July 2013 or later. The services are of three types: Teen Parent Intensive Case Workers, Support for Teen Fathers, and Volunteer Neighbourhood Support. The Guidelines set out the minimum standards for the delivery of these services for programmes funded by the Ministry of Social Development through Family and Community Services. They cover the target group the programme is designed to support, the services being contracted, and the outcomes to be achieved by the programme. They also provide good practice information and set out reporting requirements. The following webpage lists the locations of Teen Parent Intensive Case Workers. http://www.familyservices.govt.nz/working-with-us/programmes-services/early-intervention/teen-parent-initiatives.html. The locations of the Volunteer Neighbourhood Support and Parenting Support for Teen Fathers initiatives are listed here :http://www.familyservices.govt.nz/working-with-us/programmes-services/early-intervention/teen-parent-initiatives.html#VolunteerNeighbourhoodSupport3.
Ministry of Social Development. 2010. **Supporting Teen Fathers: a resource for service providers**. Wellington: Ministry of Social Development. http://www.msd.govt.nz/about-msd-and-our-work/publications-resources/planning-strategy/teen-fathers/index.html This publication was developed to support the delivery of services for teen fathers. It is organised in three parts: Part One discusses what is known about teen fathers in New Zealand, Part Two covers things to consider when working with teen fathers, and Part Three contains profiles of five providers currently delivering services to teen fathers in New Zealand. All of the parts include discussion of insights gained from the New Zealand and international research literature and lists of resources for each section. There is also a very comprehensive list of references at the end. The following webpage, entitled **What works best when supporting teen fathers,** provides an overview of the information contained in the above resource. http://www.familyservices.govt.nz/working-with-us/programmes-services/early-intervention/teen-fathers/what-works-best.html
International guidelines
National Collaborating Centre for Women's and Children's Health. 2010. **Pregnancy and complex social factors. A model for service provision for pregnant women with complex social factors**. London (UK): National Institute for Health and Clinical Excellence (NICE). https://www.nice.org.uk/guidance/cg110 These guidelines are based on a comprehensive review of the available evidence, and are complementary to the NICE guidance *Antenatal care: routine care for the healthy pregnant woman* https://www.nice.org.uk/guidance/cg62. Chapter 6 deals with service provision for young women under the age of 20. It outlines ways healthcare providers can encourage young women to use antenatal services (e.g. offering age-appropriate services, help with other social problems, transport to and from appointments, care in the community, and providing opportunities for the father to be involved). There are recommendations for service organisations including working in partnership with other agencies, providing antenatal care in a variety of settings (e.g. GP surgeries, children's

centres and schools, offering antenatal education in peer groups at the same time and location as clinic appointments and providing a direct-line telephone number for a named midwife who provides the majority of antenatal care). There is also guidance on training for healthcare staff and providing suitable information to pregnant young women. The full guideline and its appendices, which contain the evidence tables for the included studies and details of the excluded studies, can be downloaded from:

https://www.nice.org.uk/guidance/cg110/evidence .

Evidence-Based Medicine reviews

Hodgkinson S, Beers L, Southammakosane C, et al. 2014. **Addressing the mental health needs of pregnant and parenting adolescents**. Pediatrics, 133(1), 114-22. http://pediatrics.aappublications.org/content/133/1/114.long

This report from the American Academy of Pediatrics provides an overview of the mental health challenges associated with teen parenthood, barriers that can often prevent teen mothers from seeking mental health services, and interventions for this population that can be incorporated into primary care services. It points out that practitioners providing primary care to teen parents' children are often the first person teen parents may share their emotional and behavioural concerns with and therefore these practitioners are in a unique position to facilitate and encourage teen parents' engagement with mental health treatment. It suggests that it may be easiest to engage teen mothers with mental health services when these are delivered in a primary care setting via a multidisciplinary team. It notes that the association of teen parenthood with increased risk of mental health problems is likely to be at least partly because teen mothers are disproportionately likely to be poor, Latina or African-American, live in low-income communities, be born to parents with low educational and employment attainment, have a history of child abuse, reside in chaotic home environments characterized by poor interpersonal relationships, and have limited social support networks.

Lachance CR, Burrus BB, Scott AR. 2012. **Building an evidence base to inform interventions for pregnant and parenting adolescents: a call for rigorous evaluation**. Am J Public Health, 102(10), 1826-32. http://ajph.aphapublications.org/doi/abs/10.2105/AJPH.2012.300871?url_ver=Z39.88-2003&rfr_id=ori%3Arid%3Acrossref.org&rfr_dat=cr_pub%3Dpubmed

The authors of this review, two of whom worked with the Office of Adolescent Pregnancy Programs, in the Office of Population Affairs, US Department of Health and Human Services, reviewed the published literature to assess the evidence base for interventions for pregnant and parenting adolescents. They found that there was a dearth of rigorously evaluated programmes. They suggested that the lack of rigorous evaluations may be due to inadequate emphasis on and insufficient funding for evaluation, as well as to challenges encountered by programme evaluators working with this population. The authors identified 14 studies that met their quality criteria and had been conducted in the US: eight RCTs and six quasi-experimental studies (five of these were retrospective cohort studies). The studies mostly enrolled African Americans living in urban centres and aged 15–17 years, but four of the RCTs involved more racially and ethnically diverse populations. Interventions most commonly involved home visiting and case management, often in combination, together with other approaches such as support groups, parenting education and clinical care. The studies used various outcome measures. Repeat pregnancy was the only outcome that was assessed by a majority of the studies: six found significant positive effects, and three reported equivocal effects. Three studies measured variables related to educational progress: two reported conflicting results for attainment measures, and one found positive effects for attendance and dropout, but only during pregnancy and not in the postpartum year. All the remaining outcomes were examined by only one or two studies each and so the authors were unable to analyse programme effects across studies. The authors did not identify any evaluations of programmes serving adolescent fathers, and they stated that this population is clearly in need of intervention. They also stated that most of the studies had methodological shortcomings: many had small sample sizes and high or differential attrition, few had good descriptions of the services received by comparison groups, none reported standardised effects sizes and only some reported odds ratios or an effect as a percentage reduction. In their conclusions, the authors suggest that it is necessary to remember that although evaluation may seem costly in the short term, in the long term the benefits to society from the wellbeing of these adolescents and their children would far outweigh the short term costs.

Pinzon JL, Jones VF, Blythe MJ, et al. 2012. **Care of adolescent parents and their children**. Pediatrics, 130(6), e1743-e56. http://pediatrics.aappublications.org/content/130/6/e1743.full

This updated clinical report from the American Academy of Pediatrics reviews statistics on adolescent parenting in the US, and discusses the medical and psychosocial risks associated with adolescent pregnancy (for both the mother and the baby), the risk of repeat adolescent pregnancy, factors associated with better outcomes for adolescent mothers, fathers of infants born to adolescent mothers, neurodevelopmental considerations, and models of intervention for adolescent parents. It concludes with brief guidance for the paediatrician (who, in the US health system, may be a provider of primary care).

Buston K, Parkes A, Thomson H, et al. 2012. **Parenting interventions for male young offenders: a review of the evidence on what works**. J Adolesc, 35(3), 731-42. http://www.sciencedirect.com/science/article/pii/S0140197111001308

This paper reviews the evidence on the effectiveness of parenting interventions for young male offenders. It notes that there is a high rate of teenage fatherhood among incarcerated young male offenders (one in four in the UK). The authors identified 12 relevant evaluations: ten from the UK of programmes for incarcerated young offenders, and two from the US, of programmes for young parolees. None used experimental methods or included a comparison group. The evaluations suggested that participants liked the courses and found them useful, and that interventions may improve knowledge of, and attitudes to, parenting. The review authors suggested that future interventions should incorporate elements from promising programmes for young fathers in the community and older incarcerated fathers. They stated that future evaluations should collect data on longer-term behavioural parent and child outcomes and should use comparison groups and, ideally, randomization.

Chrisler A, Moore K A. 2012. **What works for disadvantaged and adolescent parent programs: Lessons from experimental evaluations of social programs and interventions**. Washington, DC: Child Trends, http://www.childtrends.org/wp-content/uploads/2013/04/Child_Trends-2012_08_20_WW_ParentPrograms.pdf

This fact sheet briefly reviews 20 evidence-based parenting programmes that aim to enhance parents' development and/or educate disadvantaged and teenage parents on effective parenting methods. All programmes were evaluated through random-assignment studies. Of the 11 programmes that measured child outcomes, eight programmes found at least one positive impact on a child

outcome area. In addition, of the 19 programmes that measured parent outcomes, ten programmes found at least one positive impact on a parent outcome. There is a table which shows which programmes have been found not to work, which programmes have been found to work, and which programmes have had mixed effects, for various child and parent outcomes. The links in the table do not work, therefore to find details of the programmes it is necessary to search for the programmes by name in the alphabetical list on this page: http://www.childtrends.org/what-works/list-of-programs/ where there are links to a page for each programme on which there is a brief description of the programme and its evaluation, as well as links for further information and references.

Ruedinger E, Cox JE. 2012. **Adolescent childbearing: Consequences and interventions**. Curr Opin Pediatr, 24(4), 446-52.

This concise review reports on recent literature exploring the consequences of teenage childbearing and interventions to ameliorate these consequences. It provides an entry point into the literature on this topic. It notes that many of the negative consequences of adolescent childbearing, both for the adolescents and their children, are due to associated social and economic factors rather than to young maternal age alone. It suggests that increasing educational attainment, preventing repeat pregnancy and improving mother-child interactions can improve outcomes for mothers and their children. It states that home, community, school and clinic-based programmes are all viable models of service delivery to this population. It also states that programmes that are culturally sensitive and developmentally appropriate have demonstrated success. Further research on parenting interventions, with larger sample sizes and addressing multiple outcomes, is needed to permit comparisons between programmes. The role of the father and co-parenting is another avenue for future research.

Bronte-Tinkew J, Burkhauser M, Metz A J R. 2012. **Elements of promising practices in fatherhood programs: Evidence-based research findings on interventions for fathers**. Fathering, 10(1), 6–30. http://www.mensstudies.info/OJS/index.php/FATHERING/article/view/341/pdf_157

This article reviews key evaluation findings from fatherhood programmes that have been rigorously evaluated (via a study using a random assignment design) in order to answer questions about "what works" in fatherhood programmes. The authors identified 12 rigorously evaluated fatherhood programmes. They identified 15 promising practices that were common to these programmes and which reflected different aspects of teaching and the particular context of interventions. They stated that, as yet there is no evidence to suggest which combination of these practices contributed to the overall success of these interventions, nor was there evidence that each intervention had to incorporate all of these practices in order to be successful. They stated that the 15 promising practices offer a starting point for designing and implementing fatherhood programmes that are grounded in in a reliable evidence base.

Barlow J, Smailagic N, Bennett C, et al. 2011. **Individual and group based parenting programmes for improving psychosocial outcomes for teenage parents and their children**. Cochrane Database of Systematic Reviews, 2011(3). http://onlinelibrary.wiley.com/doi/10.1002/14651858.CD002964.pub2/abstract

This review evaluated the effectiveness of programmes for teenage parents in improving psychosocial outcomes for the parents and developmental outcomes in their children. It included eight RCTs with 513 participants. Across all the studies there were 47 different outcomes compared between intervention and control groups, and in 19 of these there were statistically significant differences, all in favour of the intervention group. The authors conducted nine meta-analyses, each of which used data from two studies (data from four different studies was used in the meta-analyses). Of the meta-analyses, four showed statistically significant findings in favour of the intervention. The outcomes improved by the interventions were: parent responsiveness to the child (standard mean difference (SMD) −0.91, 95% CI −1.52 to −0.30, P=0.04), infant responsiveness to mother at follow-up (SMD −0.65, 95% CI −1.25 to −0.06, p= 0.03); and an overall measure of parent-child interactions post-intervention (SMD −0.71, 95% CI −1.31 to −0.11, p = 0.02), and at follow-up (SMD −0.90, 95% CI −1.51 to −0.30, p = 0.004). The authors concluded that, due to variations in the study populations, the interventions and the measures used, there were limits to the conclusions that could be drawn, however they considered that there was some evidence that parenting programmes may be effective in improving a number of aspects of parent-child interaction. They stated that more research is needed.

Other relevant publications

The Royal Australasian College of Physicians. 2015. **Position Statement: Sexual and Reproductive Health Care for Young People**. http://www.racp.edu.au/docs/default-source/advocacy-library/pa-pos-sexual-and-reproductive-health-care-for-young-people.pdf?sfvrsn=4

This position paper addresses the importance of sexuality and relationships education and sexual and reproductive health care for young people (adolescents and young adults between 12 and 24 years of age) in Australia and New Zealand. It includes recommendations for governments, health professionals and health services, and policies and legislative change. Recommendations are based on a review of relevant literature and an examination of key issues by the RACP Position Statement Working Party. There are short sections on young people, sexuality, sex and relationships; sexuality and relationships education; youth friendly sexual and reproductive healthcare; STI, HIV and viral hepatitis; contraception, termination and teenage pregnancy care; sexual abuse, sexual assault and intimate partner violence; sexual and reproductive health care for indigenous young people; young people who are same-sex attracted or gender diverse, and people with intersex variations; and young people with disabilities and long-term health conditions.

Myers A, Metzger N. 2014. **The importance of whānau, family in the lives of young parents**. Auckland: Thrive Teen Parent Support Trust.
http://www.thrive.org.nz/sites/default/files/Young%20Parents%20Research%20Document%20HI%20RES%20final.pdf

This research was commissioned by Thrive Teen Parent Support Trust. It aimed to identify the support needs of whānau and how the pregnancy and parenting sectors can strengthen whānau family support for pregnant teens, young parents, and their children. The research used qualitative methods and was based on interviews and focus groups conducted with 10 young parents (aged < 20) and eight whānau and family members including parents, siblings, aunties and close family friends. Recommendations arising from the research fell into three main areas: supporting whānau and families, supporting young parents, and developing young parent whānau-friendly communities.

Berlyn C, Wise S, Soriano G. 2008. **Engaging fathers in child and family services**. Canberra: Australian Government Department of Families, Housing, Community Services and Indigenous Affairs.
https://www.dss.gov.au/sites/default/files/documents/op22.pdf

This Australian study describes father participation in selected programmes and services that were part of the Australian Government's Stronger Families and Communities Strategy (SFCS) and identifies successful strategies for engaging with fathers. The research used a mixed methodology: a survey of SFCS program managers on father involvement and in-depth fieldwork with a sample of selected services and programmes. The researchers had one-on-one interviews with service managers and facilitators and held focus groups with father participants. The main findings of the study were: fathers were involved with a diverse range of services across the SFCS, although they had a far lower level of participation than mothers; various sociocultural, services and other factors acted as barriers to fathers' access to services and vice versa; by their very nature, services that were most successful in engaging with fathers were specifically tailored for men and were exclusive to fathers. Strategies used by service providers included: introducing flexible hours of operation; employing male facilitators; developing father-specific services; marketing services to men in male spaces; using male-friendly language and advertisements; and creating service venues where men felt comfortable.

TERMINATIONS OF PREGNANCY

Introduction

All District Health Boards in New Zealand are required to provide publicly funded termination of pregnancy services, although some DHBs have chosen to sub-contract these services to other DHBs.[222] Under New Zealand law, grounds for termination of pregnancy include serious danger to the life or mental or physical health of the woman and fetal abnormality.[223] The vast majority of abortions are carried out on the grounds of danger to a woman's mental health (97.6% in 2014).[122] Terminations of pregnancy have a very low rate of complications, but the rate of complications increases with gestational age so it is important that women have timely access to termination services and referral pathways are not unduly complicated.[224] Terminations of pregnancy can be conducted either medically or surgically. Medical terminations are less invasive and can be conducted much earlier in pregnancy (up until nine weeks' gestation) than surgical terminations, but in 2013 only 10% of induced abortions were medical.[122]

The 2014 report of the Abortion Supervisory Committee[122] contains New Zealand's latest abortion-related statistics. The Committee noted that there have been improvements in the provision of abortion services in provincial areas but expressed concern at the lack of a local abortion service for women living in South Auckland.[122] Abortion rates in New Zealand have been falling steadily over recent years, from 20.1 per 1,000 (women aged 15–44 years) in 2007 to 15.4 per 1,000 in 2013, but they are still higher than those in some other developed countries, such as the Netherlands (which has a rate of around nine per 1,000).[122]

The Committee noted the particularly sharp decline in rates for 15–19 year olds, and suggested that this was partly attributable to the licensing and funding of a long acting subcutaneous implant (Jadelle®) in August 2010.[122] Intra-uterine devices (IUDs) are another very effective form of long-acting reversible contraception and the American College of Obstetricians and Gynecologists states that IUDs are effective and safe in nulliparous adolescents.[211] Encouraging more effective use of contraception is key to reducing abortion rates as, among those having induced abortion in 2013, 54.7% had used no contraception and 25.4% had used condoms.[122]

The following section reviews terminations of pregnancy using information from the Abortion Supervisory Committee. Policy documents and evidence-based reviews which address the prevention unintended pregnancies are summarised at the end of this section.

Data sources and methods

Indicator

Legally induced terminations of pregnancy registered in New Zealand

Data sources

Source: Abortion Supervisory Committee

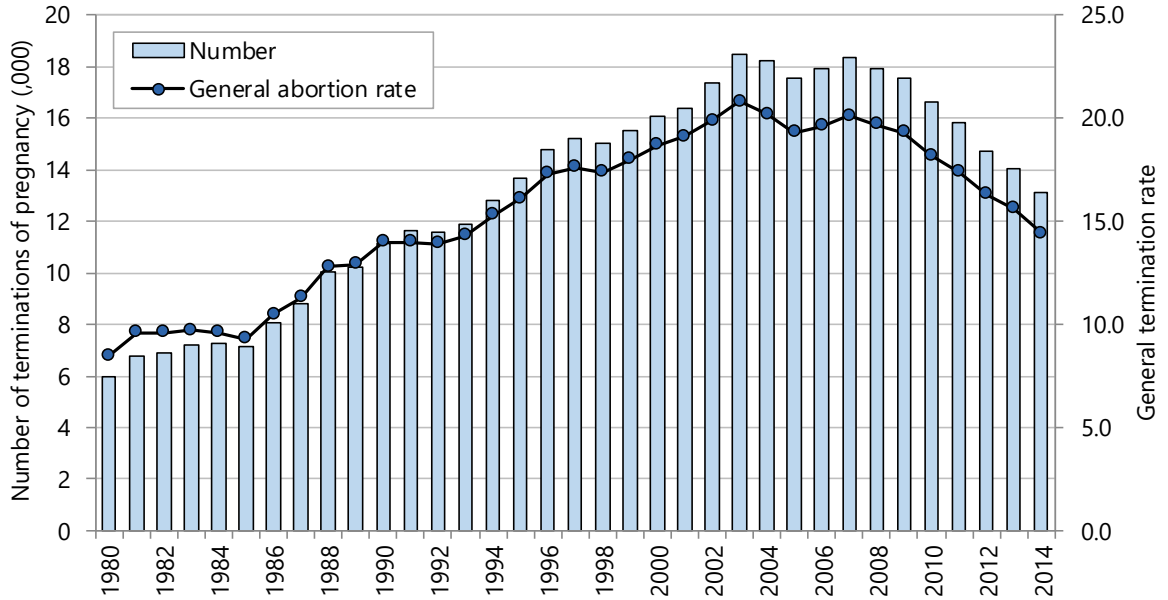
Notes on interpretation

Note 1: In New Zealand, information on the domicile of women presenting for a termination of pregnancy has only been recorded by the Abortion Supervisory Committee since 2004, with an agreement existing between the Committee and Statistics NZ that the only geographical breakdown of termination data will be at regional council level. Thus information on terminations of pregnancy by DHB or NZDep Index decile is unavailable.
Note 2: In its reporting of terminations, Statistics NZ uses total response ethnicity, and thus women will appear in each ethnic group with which they identified (in both the numerator and denominator).

National trends and distribution

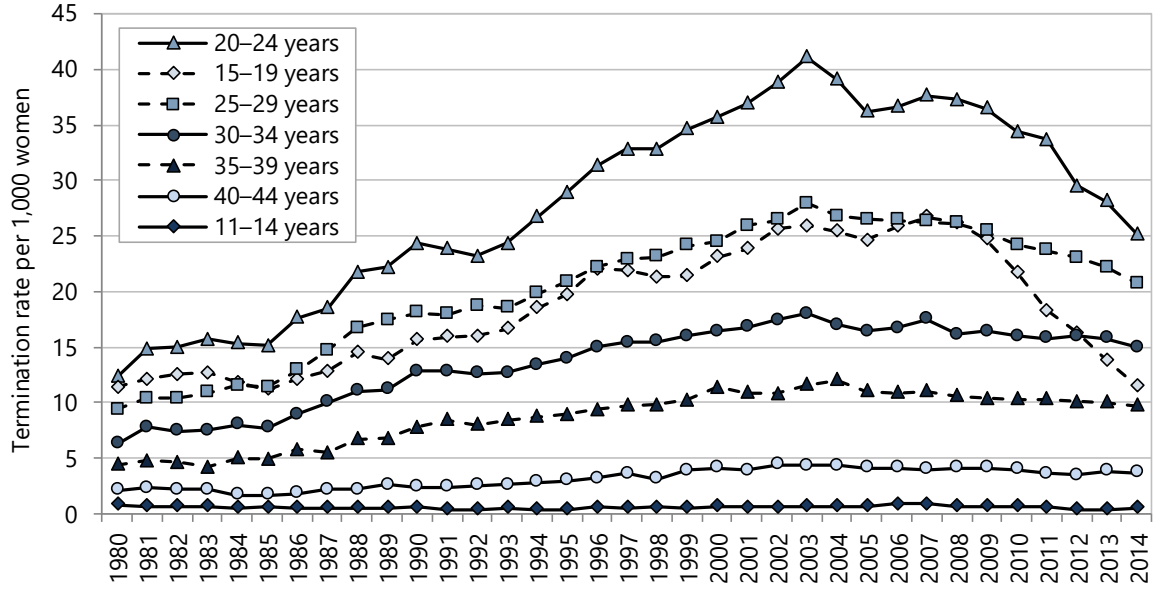
Termination of pregnancy rates rose from 1980 to 2002 and have since fallen overall particularly since 2007 **(Figure 189)**. The decline for 15–19 year olds and 20–24 year olds was more marked than for other age groups **(Figure 190)**.

Figure 189. Annual number and rate of terminations of pregnancy, New Zealand, 1980–2014



Abortion Supervisory Committee via Statistics New Zealand; General termination rate corresponds to abortions per 1,000 mean estimated number of women aged 15–44 years

Figure 190. Terminations of pregnancy, by age of woman, New Zealand 1980–2014

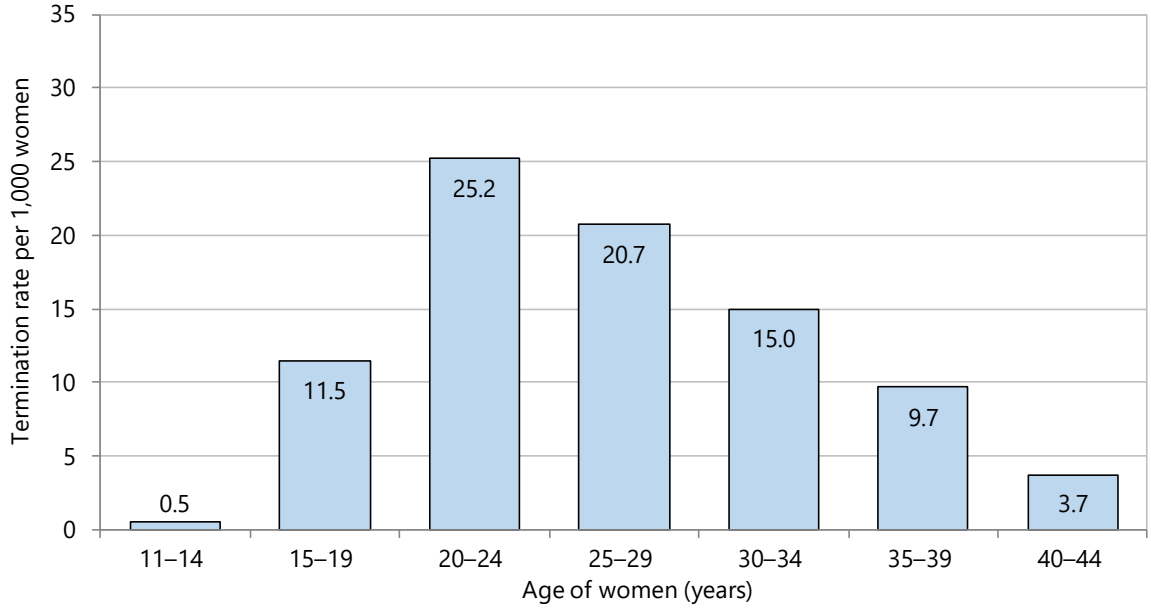


Abortion Supervisory Committee via Statistics New Zealand; Termination rate per 1,000 mean female estimated resident population in each age group

In 2014 termination of pregnancy rates were highest in women aged 20–24 years, followed by those aged 25–29 years, then those aged 30–34 years **(Figure 191)**.

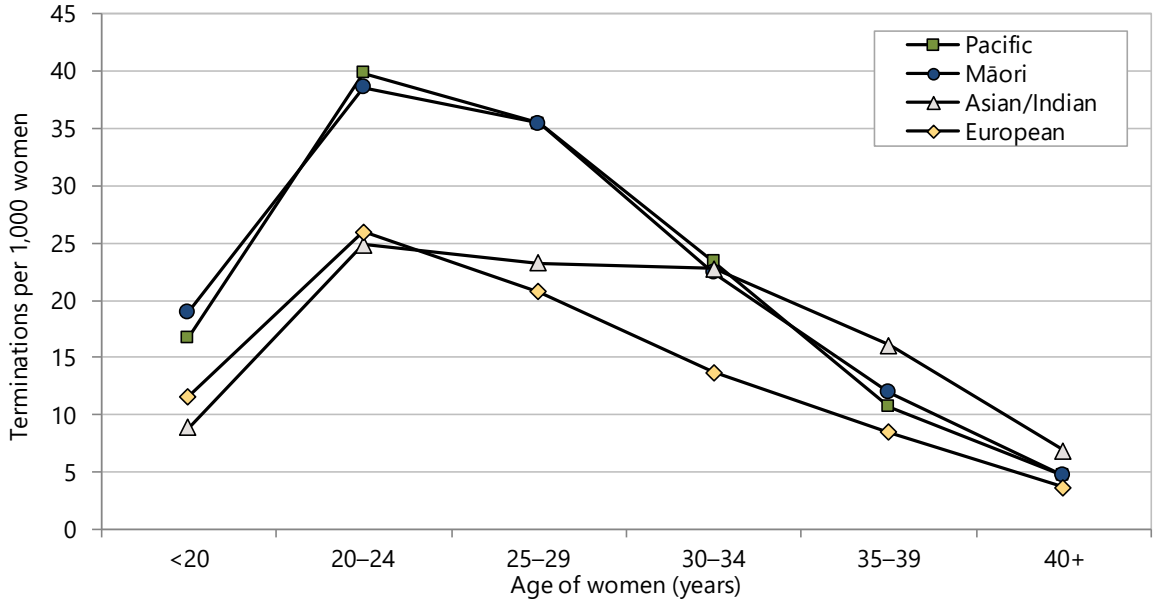
For women aged under 25 years, termination of pregnancy rates for Māori and Pacific women were higher than rates for European and Asian/Indian women in 2014 (**Figure 192**).

Figure 191. Terminations of pregnancy by age of women, New Zealand 2014



Abortion Supervisory Committee via Statistics New Zealand; Termination rate per 1,000 mean female estimated resident population in each age group

Figure 192. Termination of pregnancy rates, by ethnicity and age of women, New Zealand 2014

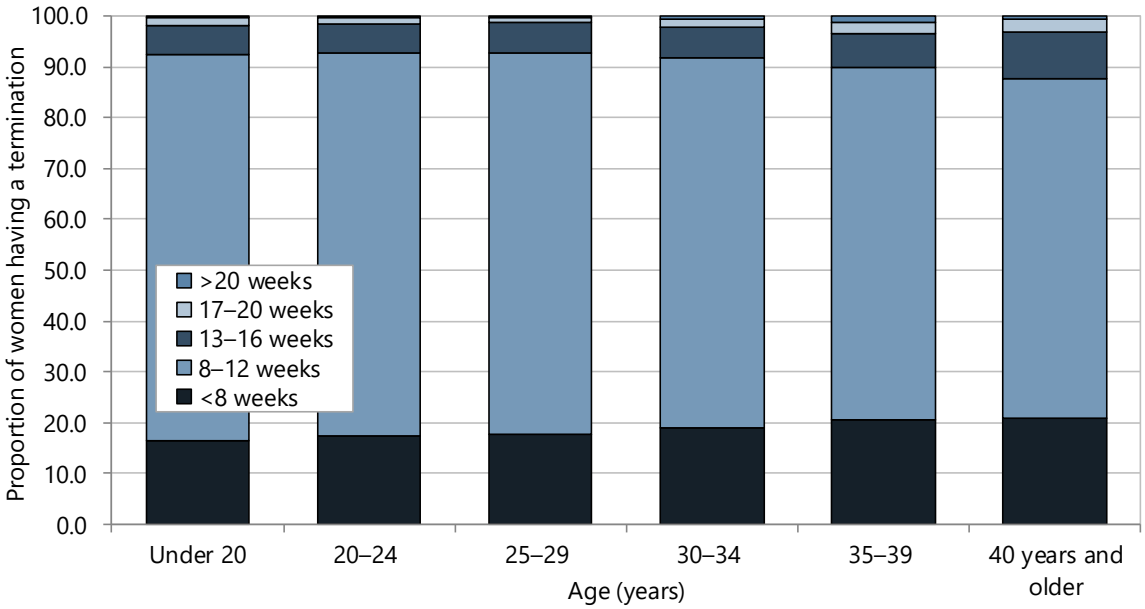


Source: Abortion Supervisory Committee via Statistics New Zealand; Denominator: Statistics NZ usually resident population (total response); Note: Ethnicity is total response; Denominator reproductive age range: 15–44 years

In 2014 the majority of terminations of pregnancy occurred between 8 and 12 weeks gestation, in all age groups. The next most frequent gestations were less than 8 weeks, followed by 13–16 weeks, with women aged 40+ years having a higher proportion of terminations at more than 12 weeks than those from other age groups

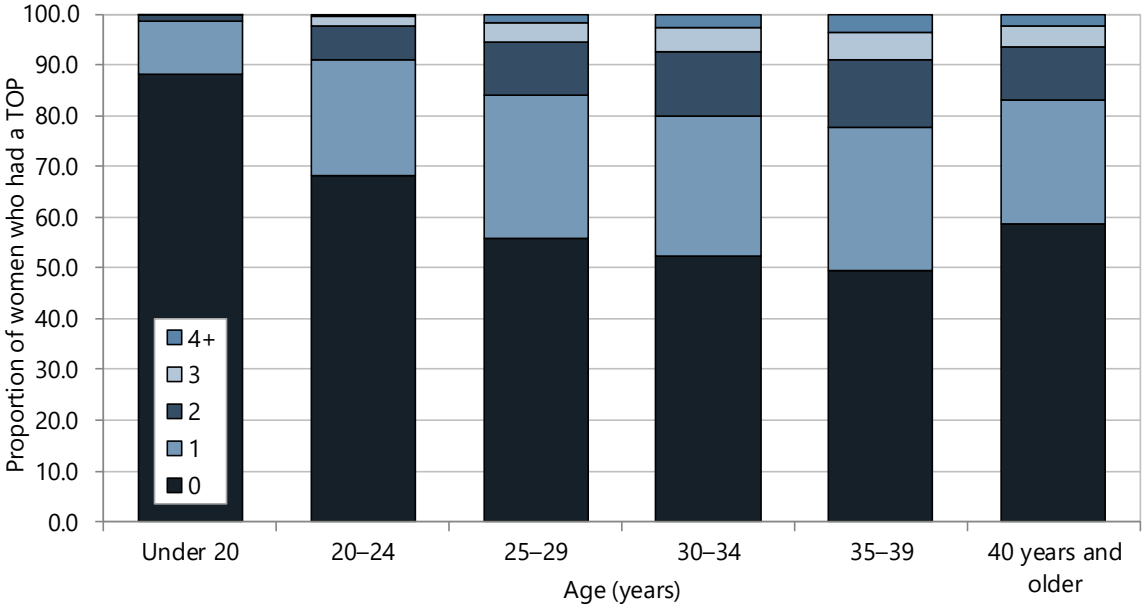
(Figure 193). The proportion of women who had a history of previous termination increased with increasing age to 35–39 years. **(Figure 194)**.

Figure 193. Proportion of women who had a termination, by age and gestation at termination, New Zealand, 2013



Abortion Supervisory Committee 2014 annual report; TOP corresponds to termination of pregnancy (i.e. induced abortion)

Figure 194. Proportion of women who had a termination, by age and number of previous terminations, New Zealand 2013



Abortion Supervisory Committee 2014 Annual Report; TOP corresponds to termination of pregnancy (i.e. induced abortion)

Distribution by region

Between 2010 and 2014 the number of terminations of pregnancy varied around the country **(Table 157)**.

Table 157. Terminations of pregnancy, by regional council of residence, New Zealand 2010–2014

Regional council	Number of terminations				
	2010	2011	2012	2013	2014
Northland	529	532	474	450	431
Auckland	6,553	6,412	5,919	5,530	5,138
Waikato	1,429	1,318	1,307	1,214	1,046
Bay of Plenty	837	821	773	726	667
Gisborne	184	159	146	158	140
Hawke's Bay	523	534	496	455	413
Taranaki	360	342	296	323	272
Manawatu-Wanganui	813	729	696	614	601
Wellington	2,009	1,898	1,666	1,589	1,521
Tasman	116	122	124	103	108
Nelson	168	197	177	171	160
Marlborough	120	134	125	117	95
West Coast	100	91	94	87	88
Canterbury	1,906	1,645	1,544	1,620	1,628
Otago	652	590	610	604	552
Southland	231	272	257	272	249
New Zealand	16,630	15,863	14,745	14,073	13,137

Abortion Supervisory Committee Annual Reports via Statistics NZ

Evidence for good practice for the prevention of unintentional pregnancies

Ministry of Health publications
Ministry of Health. 2003. **Sexual and Reproductive Health: A resource book for New Zealand health care organisations**. Wellington: Ministry of Health. http://www.health.govt.nz/publication/sexual-and-reproductive-health-resource-book-new-zealand-health-care-organisations This publication supports the Sexual and Reproductive Health Strategy and is designed to help DHBs and PHOs find ways of improving the uptake of effective contraception and safe sex practices in their populations. It notes that compared to some other developed countries, New Zealand has high rates of both abortions and teenage births. There is information on designing services, strategies for action, strategies for Māori, strategies for Pacific peoples, unintended and unwanted pregnancies, sexually transmitted infections, HIV and AIDS.
Ministry of Education publications
Ministry of Education. 2015. **Sexuality education: A guide for principals, boards of trustees and teachers**. Wellington: Ministry of Education. http://health.tki.org.nz/Teaching-in-HPE/Policy-guidelines/Sexuality-education-a-guide-for-principals-boards-of-trustees-and-teachers This guide is a revision of the 2002 guide of the same name. The overall aim of the revised guide is to support school boards, principals, and teachers to deliver effective, quality sexuality education programmes and, through them, to support the positive and holistic development and health of all students in New Zealand primary, intermediate, and secondary schools. It will also assist boards of trustees, principals, and teachers in all New Zealand state and state-integrated schools to comply with the requirements of the Education Act 1989 (as amended in 2001) to consult with the school community on the way in which the health curriculum should be implemented.
Other government publications
Families Commission. 2011. **Teenage pregnancy and parenting: An overview**. Wellington: Families Commission. http://www.superu.govt.nz/sites/default/files/teenage-pregnancy.pdf This report was produced in response to a Ministerial request that the Families Commission conduct research addressing two distinct questions: • What are the reasons behind high rates of teenage parenthood amongst young teenagers in specific regions of New Zealand? • What would discourage second or repeat teenage pregnancies? The report is divided into two sections. The first examines regional statistics for teenage pregnancy and parenthood. The second discusses how to prevent subsequent teenage births, by analysing the implications and motivations of first and subsequent pregnancies and by considering ways to strengthen support for teenage parents and prevent teenage pregnancies.
Families Commission. 2010. Young people's relationships: **Supporting young people as they have their first relationship**. Issues Paper 02. Wellington: Families Commission. http://www.superu.govt.nz/sites/default/files/young-peoples-relationships.pdf This is the report of a project which aimed to find out what support young people need as they have their first relationships. The project involved the Families Commission reviewing the limited literature and conducting focus groups and interviews with young people (77 participants), parents, grandparents and whānau (23 participants), youth workers (n= 14), school counsellors (n= 7) and social workers (n=3). Key messages that emerged from the study were: • Young people learn about relationships by watching their parents, whānau and the adults around them • Parents, whānau and other adults are key sources of support for young people • Young people want to learn more about the emotional side of relationships through the school curriculum • School support services may be under-resourced and need to be better connected with the young person's family and community services.
International Guidelines
Gavin L, Moskosky S, Carter M, et al. 2014. **Providing quality family planning services: Recommendations of CDC and the U.S. Office of Population Affairs**. MMWR Recomm Rep, 63(Rr-04), 1-54. http://www.cdc.gov/mmwr/pdf/rr/rr6304.pdf This report provides recommendations developed collaboratively by CDC and the Office of Population Affairs (OPA) of the U.S. Department of Health and Human Services (HHS). It is intended for use by providers of family planning services. It provides recommendations for how to help prevent and achieve pregnancy, emphasizes offering a full range of contraceptive methods for persons seeking to prevent pregnancy, highlights the special needs of adolescent clients, and encourages the use of the family planning visit to provide selected preventive health services for women, in accordance with the recommendations for women issued by the Institute of Medicine and adopted by HHS.
National Institute for Health and Care Excellence. 2014. **Contraceptive services with a focus on young people up to the age of 25**. London: National Institute for Health and Care Excellence. http://www.nice.org.uk/guidance/ph51 The recommendations in the NICE guidance cover: Assessing local need and capacity to target services; Commissioning coordinated and comprehensive services; Providing contraceptive services for young people; Tailoring services for socially disadvantaged young people; Seeking consent and ensuring confidentiality; Providing contraceptive services after a pregnancy; Providing contraceptive services after an abortion; Providing condoms in addition to other methods of contraception; Communicating with young people; and Training and continuing professional development. The evidence used as the basis for the recommendations, and supporting documents, can be found in the appendices.

World Health Organization Regional Office for Europe. 2011. **Evidence for gender-responsive actions to prevent and manage adolescent pregnancy**. Copenhagen: WHO Regional Office for Europe. http://www.euro.who.int/__data/assets/pdf_file/0008/158093/316637_WHO_brochure_226x226_5-AdolecentPregnancy.pdf?ua=1

This publication summarises current knowledge on what works in preventing and managing adolescent pregnancy. It takes the standpoint that young people's health is the responsibility of the whole society, and that interventions need to be gender responsive in order to be successful. It therefore looks at actions at various levels, such as cross-sector policies, families and communities' actions, and interventions by health systems and health services. It is intended to stimulate countries to further refine their national policies to make them more effective in contributing to the health and well-being of young people, and does not prescribe or recommend any particular course of action.

Clinical Effectiveness Unit. 2010. **Contraceptive Choices for Young People**. London: Faculty of Sexual and Reproductive Healthcare. http://www.fsrh.org/pdfs/ceuGuidanceYoungPeople2010.pdf

This British guideline is intended for use by health professionals providing contraceptive health services to young people. Recommendations are based available evidence and expert consensus opinion, and graded according to the level of evidence.

National Institute for Health and Care Excellence. 2007. **Prevention of sexually transmitted infections and under 18 conceptions**. London: National Institute for Health and Care Excellence. http://www.nice.org.uk/guidance/ph3

This guideline is intended for professionals working in sexual health services, including those working in contraceptive services, genito-urinary medicine, and school-based clinics. It provides guidance on one-to-one interventions to prevent sexually transmitted infections and under 18 conceptions. The evidence supporting the recommendations can be found at:

http://www.nice.org.uk/guidance/ph3/evidence.

National Institute for Health and Care Excellence. **Long-acting reversible contraception (update)**. London: National Institute for Health and Care Excellence, 2005 http://www.nice.org.uk/guidance/cg30

This guideline offers best-practice advice for all women of reproductive age who may wish to regulate their fertility using long-acting reversible contraception (LARC) methods. It covers specific issues for the use of these methods during the menarche and before the menopause, and by particular groups, including women who are younger than 16 years, women who have HIV, and women who have learning or physical disabilities. The full guideline, which includes the supporting evidence, and a 2014 addendum which provides updated recommendation's relating to progestogen-only subdermal implants, can be found here:

http://www.nice.org.uk/Guidance/CG30/Evidence.

Evidence-based medicine reviews

Brittain AW, Williams JR, Zapata LB, Pazol K, Romero LM, Weik TS. 2015. **Youth-Friendly Family Planning Services for Young People: A Systematic Review**. American journal of preventive medicine: 49(2 Suppl 1):S73-84. Epub 2015/07/21.

The aims of this review, which was conducted in 2011, were to summarise the effects of youth-friendly family planning services on reproductive health outcomes and to describe key characteristics of youth-friendly family planning interventions. Studies included in the review were published in English from January 1, 1985 through February 28, 2011 and were conducted in the US, Canada, Europe, Australia, or New Zealand. Earlier studies, those conducted in other countries, and those that focused exclusively on HIV or sexually transmitted diseases were excluded. The review team identified nineteen articles meeting their inclusion criteria. Six of these evaluated outcomes relevant to unintended pregnancy, contraceptive use, and knowledge or patient satisfaction. None of the six were RCTs. Risk of bias was rated high in four and moderate in two. Sample sizes ranged from 163 to 1,590. The other thirteen studies identified viewpoints on youth-friendly services. Most of the studies examining outcomes found positive effects (two of three for unintended pregnancy, three of three for contraceptive use, and three of three for knowledge or patient satisfaction). The studies that did not evaluate outcomes described nine key characteristics of youth-friendly family planning services. The review team concluded that there was limited evidence that youth-friendly services may improve reproductive health outcomes and they stated that they had identified service characteristics that might increase young people's receptivity to using these services. They also stated that although more rigorous studies are needed, the interventions and characteristics identified in their review should be considered in the development and evaluation of youth-friendly family planning interventions in clinical settings.

Brittain AW, Williams JR, Zapata LB, Moskosky SB, Weik TS. 2015. **Confidentiality in Family Planning Services for Young People: A Systematic Review**. American journal of preventive medicine: 49(2 Suppl 1):S85-92. Epub 2015/07/21.

Young people may be deterred from accessing family planning services if they fear that providers will not maintain confidentiality. This systematic review, conducted in 2011, summarises the evidence on the effect (as measured by reproductive health outcomes) of assuring confidentiality in family planning service to young people aged 10–24 years. Studies included in the review were published from January 1985 through February 2011 and were conducted in the US, Canada, Europe, Australia, or New Zealand. Earlier studies, those conducted in other countries, and those that focused exclusively on HIV or sexually transmitted diseases were excluded. The review authors identified nine studies meeting their criteria, four of which examined outcomes, including use of clinical services and intention to use services. The four outcomes studies were: one RCT, one pre-post study and two cross-sectional studies. Only the RCT was considered at low risk of bias. Sample sizes ranged from 53 to 1,715. Of the four outcome studies, three found a positive association between assurance of confidentiality and at least one outcomes of interest. Five studies provided information on the views of young people and these indicated that young people place a high value on confidentiality when receiving family planning services. The review authors concluded that there is limited research evidence examining whether confidentiality in family planning services for young people affects reproductive health outcomes and that, given the importance young people place on confidentiality, robust research in this area is needed. This review, and the one above, were used to inform the guideline: *Providing quality family planning services: Recommendations of CDC and the U.S. Office of Population Affairs* (see the International Guidelines above).

Cochrane Reviews on topics related to contraception

http://www.cochranelibrary.com/topic/Gynaecology/Contraception/?per-page=100&stage=review

The Cochrane collection contains many reviews on topics related to contraception. Only recent reviews of a more general nature and/or especially relevant to teenagers have been summarised below. The above link provides access to all the Cochrane reviews on contraception.

Krashin J, Tang JH, Mody S, Lopez LM. 2015. **Hormonal and intrauterine methods for contraception for women aged 25 years and younger**. Cochrane Database of Systematic Reviews (8). http://onlinelibrary.wiley.com/doi/10.1002/14651858.CD009805.pub3/abstract

The majority of women between the ages of 15 and 24 years wish to avoid pregnancy yet contraceptive failure rates are higher in young women than in older women. This review aimed to compare contraceptive failure (i.e. pregnancy) rates and continuation rates for hormonal and intrauterine contraception in women aged 25 years and younger. Five RCTs were included, involving a total of 1,503 women. Two studies compared different methods of intrauterine contraception (copper T308A IUD vs. the levonorgestrel intrauterine system with 20 µg/day initial release (LNG-IUS 20), 23 teenage participants; and LNG 12 vs.16 µg/day initial release, 2884 women most of whom had borne children, and of whom 1130 were aged 18–25 years). Three studies compared a combined oral contraceptive (COC) with another hormonal method: COC vs. LNG-IUS 20, 200 women aged 18–25 years; COC vs. transdermal contraceptive patch 20 women aged 15–19 years; COC vs. vaginal ring 130 women aged 15–21 years. In the three trials comparing two different types of methods there were no differences between study arms for contraceptive efficacy or continuation. The study comparing COC vs. LNG-IUS 20 found that in the group assigned to COC a significantly higher proportion of women discontinued use for 'other personal reasons' compared to the group assigned to the LNG-IUS 20 (OR 0.27, 95% CI 0.09 to 0.85). The review authors stated that this finding may have little clinic relevance. The trial that compared LNG-IUS 12 vs LNG-IUS 16 found similar efficacy over one and three years. In the trials examining different LNG-IUS, continuation was at least 75% at six to 36 months. The review authors concluded that the overall quality the evidence was moderate to low and that the current evidence was insufficient to compare efficacy and continuation rates in women aged 25 years and younger.

Smith C, Gold J, Ngo TD, et al. 2015. **Mobile phone-based interventions for improving contraception use**. Cochrane Database of Systematic Reviews (6). http://onlinelibrary.wiley.com/doi/10.1002/14651858.CD011159.pub2/abstract

Interventions delivered by mobile phone have been shown to be effective in non-contraceptive healthcare. This review aimed to assess the effects of mobile phone-based interventions for improving use of contraception. There were five RCTs that met the review's inclusion criteria. Three trials compared automated text messages vs. standard care for improving adherence to a specific method of contraception amongst existing or new contraception users. Two trials aimed to improve both uptake and adherence, to any effective method, in both users and non-users of contraception. No trials were at low risk of bias in all areas assessed. One US trial assessed an intervention comprising a range of uni-directional and interactive text messages and reported improved self-reported oral contraceptive (OC) continuation at six months (RR 1.19, 95% CI 1.05 to 1.35). One trial in Cambodia assessed an intervention involving automated interactive voice messages and phone counsellor support and found increased self-reported use of effective contraception at four months post abortion (RR 1.39, 95% CI 1.17 to 1.66). A US feasibility trial used reminder and healthy self-management text messages and reported a lower mean number of days between scheduled and completed attendance for the first but not subsequent Depo-Provera appointments using clinic records (mean difference (MD) −8.60 days, 95% CI −16.74 to −0.46). A small US trial found that simple text message OC reminders had no effect on missed pills as assessed by electronic medication monitoring (MD 0.5 missed pills, 95% CI −1.08 to 2.08). An intervention in Israel found no effect on reported contraception use amongst users of isotretinoin (a drug used for acne) from an intervention that provided health information via text messages and mail. One trial assessed potential adverse effects of the intervention and reported no evidence of effects on road traffic accidents or domestic abuse. The review authors concluded that there was limited evidence that mobile phone interventions can improve use of contraception but the cost-effectiveness and long-term effects of such interventions remains unknown.

Goesling B, Colman S, Trenholm C, et al. 2014. **Programs to reduce teen pregnancy, sexually transmitted infections, and associated sexual risk behaviors: A systematic review**. The Journal of adolescent health: official publication of the Society for Adolescent Medicine. 54(5):499-507. Epub 2014/02/15.

This systematic review deals only with studies evaluating programmes conducted in the US. It is, however, based on a systematic review of the literature, published or released from 1989 through early 2011. Studies were deemed eligible for inclusion if they: examined the impacts of an intervention using quantitative data and statistical analysis and hypothesis testing (both RCTs and quasi-experimental studies were included); measured programme impacts in terms of at least one measure of pregnancy, sexually transmitted infections (STIs), or associated sexual risk behaviours; examined programmes intended to reduce rates of teen pregnancy, STIs, or associated sexual risk behaviours through any combination of educational, skill-building, and/or psychosocial intervention. In total, 88 studies were included, 87% of which were RCTs. Studies assessed a range of programmes delivered in diverse settings. Analysis of the studies' findings identified 31 programs with evidence of effectiveness. The review authors stated that there is no single recipe for success in improving adolescent sexual health outcomes, and no single programme model is right for every population and setting, therefore it is important to have a variety of programmes available for implementation. They noted that most of the evidence comes from small scale trials conducted in closely managed settings, often by the programme developers, and they suggested that in the real world programme efficacy is likely to be less.

Lopez LM, Stockton LL, Chen M, et al.2014. **Behavioral interventions for improving dual-method contraceptive use**. Cochrane Database of Systematic Reviews (3). http://onlinelibrary.wiley.com/doi/10.1002/14651858.CD010915.pub2/abstract

Dual-method contraception is the use of condoms in addition to another modern method of contraception, such as oral contraceptives or an intra-uterine device. Dual protection can offer better protection against unintended pregnancy and sexually transmitted infections (STIs). This review examined comparative studies of behavioural interventions for improving use of dual method contraception. Studies were deemed eligible for inclusion if they were randomised or non-randomised studies that examined a behavioural intervention with an educational or counselling component to encourage or improve the use of dual methods and addressed the prevention of both pregnancy and STIs. The comparison could be another behavioural intervention to improve contraceptive use, usual care, other health education, or no intervention. The main outcome measure of interest was the investigator's assessment of consistent dual-method use or use at last sex and outcomes had to be measured at least three months after the behavioural intervention began. The review authors identified four studies meeting their criteria: three RCTs and a pilot study for one of the trials. The studies assessed diverse interventions: computer-delivered, individually tailored sessions; phone counselling added to clinic counselling; and case management plus a peer-leadership program. Only the latter study showed any significant effects. The intervention, which addressed multiple risks, showed an effect on contraceptive use. Compared to the control group, the intervention group were more likely to report consistent dual-method use: Relative risk (RR) at 12 months: 1.58 (95% CI 1.03 to 2.43) and RR at 24 months1.36 (95% CI 1.01 to 1.85). The other two RCTs did not show any significant difference between the study groups in reported dual-method use or in test results for pregnancy or STIs at 12 or 24 months. In their conclusions, the review authors stated that they found few behavioural interventions for improving dual-method contraceptive use

and little evidence of effectiveness. The multi-faceted intervention that showed some effect only had self-reported outcomes. The two trials that were more applicable to clinical settings did have objective outcome measures, but neither showed any effect. Although the included studies had adequate information on intervention fidelity and follow-up periods long enough for change to occur, the overall quality of the evidence was judged to be low because two trials had design limitations and two had high losses to follow up, as often occurs in contraceptive trials. The review authors stated that there is still a need for good quality studies of carefully designed and implemented programmes or services.

Halpern V, Raymond EG, Lopez LM. 2014. **Repeated use of pre- and postcoital hormonal contraception for prevention of pregnancy**. Cochrane Database of Systematic Reviews (9). http://onlinelibrary.wiley.com/doi/10.1002/14651858.CD007595.pub3/abstract

Regular use of post-coital contraception (the "morning after pill") is not currently recommended because it is less effective and has a higher incidence of side effects compared to other modern methods of contraception, but many women wish to use such a method. This review aimed to determine the effectiveness and safety of repeated use of pre- and post-coital hormonal contraception for pregnancy prevention. The review authors identified 22 relevant studies involving 12,400 women in total. Most studies were prospective non-randomised trials or case series. The results of these indicated that pericoital levonorgestrel (LNG) was reasonably efficacious and safe. The pooled Pearl Index (number of pregnancies per 100 woman-years) for the 0.75 mg dose of LNG was 5.4 (95% CI 4.1 to 7.0). The pooled Pearl Index for all doses of LNG was 5.0 (95% CI 4.4 to 5.6). Other hormonal drugs appeared promising but most had not been studied extensively. Menstrual irregularities were the most common side effects reported but there was no consistent evidence from the studies for a relationship between bleeding abnormalities and either frequency of pill intake or total dose of the drug. Non-menstrual side effects were reportedly mild and not tabulated in most studies. Most women liked the pericoital method despite frequent menstrual irregularities. The review authors noted that most studies were decades old and many had serious methodological issues, but they considered that the evidence was of moderate quality because of the large number of participants from diverse populations, the low pregnancy rates, and the consistent results across studies. They stated that there is still a need for rigorous research to confirm the efficacy and safety of pericoital use of LNG as a primary means of contraception among women with infrequent intercourse.

Halpern V, Lopez Laureen M, Grimes David A, et al. 2013. **Strategies to improve adherence and acceptability of hormonal methods of contraception**. Cochrane Database of Systematic Reviews (10). http://onlinelibrary.wiley.com/doi/10.1002/14651858.CD004317.pub4/abstract

Although hormonal contraceptive methods (birth control pills and injections) are theoretically very effective, in practice they are not as effective as they could be, partly because of difficulties in adherence to the contraceptive regimen (e.g. remembering to take pills) and low rates of long-term continuation. This review aimed to determine the effect of special counselling techniques to improve adherence to, and continuation of, hormonal methods of contraception. It included RCTs comparing an intensive counselling technique or other client-provider intervention to routine family planning counselling.

The review authors identified nine RCTs meeting their criteria. Five involved direct counselling and two of these also provided multiple telephone contacts. Four other trials provided intensive reminders, and two of these also provided health education information Three trials showed some benefit from the intervention under investigation. In a counselling intervention, compared to women who had routine counselling, women who received repeated structured information about the injectable depot medroxyprogesterone acetate (DMPA) were less likely to discontinue the method by 12 months (odds ratio 0.27; 95% CI 0.16 to 0.44) and also less likely to discontinue due to menstrual disturbances (OR 0.20; 95% CI 0.11 to 0.37). Another trial showed a group receiving phone calls in addition to special counselling was more likely than the special-counselling alone group to report consistent use of oral contraceptives (OC) at three months (OR 1.41; 95% CI 1.06 to 1.87), though not at 12 months. There were no significant differences between the special counselling only group and the group receiving standard care for any outcomes. The third trial compared daily text-message reminders about OCs plus health information to standard care. Women in the text-message group were more likely than the standard-care group to continue OC use by six months (OR 1.54; 95% CI 1.14 to 2.10). The text-message group was also more likely to avoid an interruption in OC use longer than seven days (OR 1.53; 95% CI 1.13 to 2.07).

The review authors considered the evidence to be of moderate quality and noted that several trials had small sample sizes and most had high losses to follow up. They stated that good personal communication between clients and providers is generally considered to be important for successful use of hormonal contraception and that there is some evidence from RCTs that the use of oral contraceptive and injectables can be improved with enhanced counselling or intensive reminders plus health information. They suggested that a combination of intensive counselling and multiple contacts and reminders may help improve adherence to, and acceptability of, these contraceptive methods.

Okusanya BO, Oduwole O, Effa EE. 2014. **Immediate postabortal insertion of intrauterine devices**. Cochrane Database of Systematic Reviews (7). http://onlinelibrary.wiley.com/doi/10.1002/14651858.CD001777.pub4/abstract

Immediate insertion of an IUD after an abortion can be advantageous as the pain of insertion may be less because the cervix is already open but there may be a higher risk that the device will be spontaneously expelled. This review aimed to assess the safety and efficacy of IUD insertion immediately after spontaneous or induced abortion. It included 12 RCTs, involving a total of 7,119 women, which either compared times for IUD insertion or compared different types of IUD. Five trials compared immediate to delayed insertion. One trial indicated that immediate insertion of the Copper 7 was associated with a higher risk of expulsion than delayed insertion (RR 11.98, 95% CI 1.61 to 89.35,1 study, 259 participants, moderate quality evidence). Moderate quality evidence from three trials (878 participants) suggested that both use and expulsion of levonorgestrel-releasing intrauterine system or CuT380A were more likely for immediate compared to delayed insertion risk ratio (RR) 1.40 (95% CI 1.24 to 1.58) and RR 2.64 (95% CI 1.16 to 6.00) respectively. Another trial, which randomised women to receive either the levonorgestrel IUD or Nova T provided moderate quality evidence that discontinuation rates due to pregnancy were likely to be higher for women in the Nova T group. (MD 8.70, 95% CI 3.92 to 13.48; 438 participants). Seven trials examined immediate insertion only and compared different types of IUD. Meta-analysis of two multi-centre trials indicated that pregnancy was less likely for the TCu 220C versus the Lippes Loop (RR 0.43, 95% CI 0.24 to 0.75; 2 studies; 2257 participants) as was expulsion (RR 0.61, 95% CI 0.46 to 0.81; 2 studies; 2257 participants). Estimates for the TCu 220 versus the Copper 7 were RR 0.42 (95% CI 0.23 to 0.77; 2 studies, 2,274 participants) and RR 0.68, (95% CI 0.51 to 0.91); 2 studies, 2,274 participants), respectively. Another study, with 400 participants, indicated that adding copper sleeves to the Lippes Loop improved efficacy (RR 3.40, 95% CI 1.28 to 9.04) and reduced expulsion (RR 3.00, 95% CI 1.51 to 5.97).

The review authors concluded that there is moderate quality evidence that insertion of an IUD immediately after an abortion is both safe and practical but that expulsion rates appear to be higher than for delayed insertions. However, IUD use at six months post abortion is greater among women who had immediate insertion instead of delayed insertion.

Lopez LM, Tolley EE, Grimes DA, et al. 2013. **Theory-based interventions for contraception**. Cochrane Database of Systematic Reviews (8). http://onlinelibrary.wiley.com/doi/10.1002/14651858.CD007249.pub4/abstract

Theories and models help to explain how behaviour change occurs. Most of the commonly theories and models in health behaviour are based on a social cognition approach. They include the Health Belief Model (HBM), Social Cognitive Theory (SCT), the Theory of Reasoned Action (TRA), the Theory of Planned Behaviour (TPB), and Protection Motivation Theory. Although theories and models have been used extensively in HIV-prevention research and in interventions for preventing sexually transmitted infections (STIs), educational interventions for contraception often have no stated theoretical base. This review assessed RCTs that tested a theoretical approach to inform contraceptive choice; encourage contraceptive use; or promote adherence to, or continuation of, a contraceptive regimen. Trials primarily related to HIV or STI prevention were excluded. Included trials had the following primary outcomes: pregnancy, contraceptive choice or use, and contraceptive adherence or continuation.

The review included 17 trials, three of which were new since the previous Cochrane review on this topic. Eight were rated as good quality. Eleven targeted adolescents. Twelve trials reported pregnancy and birth data and two of these had better results for a theory-based group. Twelve trials had data on birth control use (other than condoms) and six showed some positive effects of a theory-based intervention. Five out of 12 trials with data on condom use found a positive effect of a theory-based group. Almost all trials involved multiple sessions or contacts. Seven trials focussed on adolescents were based on SCT, of which five reported some effectiveness. Two other trials based on other social cognition models had some positive results with adolescents. The review authors suggested that family planning researchers and practitioners could adapt the effective interventions for their own use. They noted that most of the reviewed interventions focussed on teenagers and had group sessions.

Abdel-Aleem H, d'Arcangues C, Vogelsong KM, et al. 2013. **Treatment of vaginal bleeding irregularities induced by progestin only contraceptives**. Cochrane Database of Systematic Reviews (10). http://onlinelibrary.wiley.com/doi/10.1002/14651858.CD003449.pub5/abstract

Progestin-only contraceptives are very effective but women often have irregular bleeding when using them. This review evaluated preventive and therapeutic approaches to normalise bleeding irregularities associated with the use of progestin-only contraceptives. It included 33 RCTs enrolling 3,677 participants. Two-thirds of these were assessed as having low to moderate risk of bias. The treatments investigated included estrogen, combinations of oral ethinyl estradiol and levonorgestrel (i.e. combined oral contraceptives), mifepristone (alone and combined with estrogen), various NSAIDS, tamoxifen, tranexamic acid, and doxycycline. The review authors concluded that some women may benefit from these interventions, particularly for cessation of current bleeding. They stated that several interventions appear promising for regulating bleeding but larger trials are needed to reproduce positive findings. They also stated that the findings of their review do not support the routine clinical use of any of the regimens included in the trials particularly for long term effect.

Lopez LM, Otterness C, Chen M, et al. 2013. **Behavioral interventions for improving condom use for dual protection**. Cochrane Database of Systematic Reviews (10). http://onlinelibrary.wiley.com/doi/10.1002/14651858.CD010662.pub2/abstract

When used correctly and consistently, condoms can provide protections against both pregnancy and sexually transmitted infections (STIs), including HIV. This review examined comparative studies of behaviour interventions for condom use that had used objective biological outcome measures (such as pregnancy or STI test results). Seven RCTs were identified as meeting the review's inclusion criteria. Six randomised clusters and one, individuals. Five studies provided data on pregnancy, either from pregnancy tests or national records of abortions and live births. Four trials assessed the incidence or prevalence of HIV and HSV-2 (Herpes simplex type 2). Three trials examined other STIs. The trials showed or reported no significant differences between study groups for pregnancy or HIV, but favourable effects were evident for some STIs. The review authors concluded that there was little clinical evidence for interventions promoting condom use for dual protection. They state that the overall quality of evidence was moderate to low and losses to follow up were high. They stated that there is a need for effective interventions to promote condom use for dual protection and that interventions need to be feasible for resource-limited settings and tested using valid and reliable outcome measures (not self-report).

The American College of Obstetricians and Gynecologists. 2012. **Committee opinion no. 539: adolescents and long-acting reversible contraception: implants and intrauterine devices**. Obstetrics and gynecology: 120(4):983-8. Epub 2012/09/22.

This publication states that increasing adolescent access to long-acting reversible contraception (LARC) is a clinical and public health opportunity for obstetrician gynaecologists and that, because LARCs have top-tier effectiveness, high rates of satisfaction and continuation, and no need for daily adherence, LARC methods should be first-line recommendations for all women and adolescents. It provides information on: sexual behaviour and contraceptive use among American adolescents; counselling, consent, confidentiality and cost; guidance for adolescent health care providers to address common misconceptions; and postabortal long acting reversible contraception.

Chin HB, Sipe TA, Elder R, et al. 2012.**The Effectiveness of Group-Based Comprehensive Risk-Reduction and Abstinence Education Interventions to Prevent or Reduce the Risk of Adolescent Pregnancy, Human Immunodeficiency Virus, and Sexually Transmitted Infections: Two Systematic Reviews for the Guide to Community Preventive Services**. American journal of preventive medicine: 42(3):272-94.

These systematic reviews were conducted to provide a basis for recommendations by the US Community Preventive Services Task Force, an independent non-federal body of experts in public health research, practice and policy. They synthesised scientific evidence on the effectiveness of two strategies for group-based behavioural interventions for adolescents: (1) comprehensive risk reduction and (2) abstinence education, on preventing pregnancy, HIV, and other STIs. The outcomes measures used to assess the effectiveness of the interventions were reductions in sexual risk behaviours, pregnancy, HIV and other STIs and increases in protective sexual behaviours. In the US, until 2010, states could receive federal funding only to implement abstinence education programmes that taught that people should abstain from sexual activity until marriage. The literature search identified 66 US-based studies of comprehensive risk reduction risk reduction and 23 studies of abstinence education that assessed the effects of group-based interventions that addressed the sexual behaviour of adolescents and these were included in the review. The review team conducted meta-analyses for each strategy on the seven key outcomes identified by the team: current sexual activity; frequency of sexual activity; number of sex partners; frequency of unprotected sexual activity; use of protection (condoms and/or hormonal contraception); pregnancy; and STIs. The results of these meta-analyses indicated that comprehensive risk reduction strategies had favourable effects for all of the outcomes reviewed. For abstinence education, education, the meta-analysis showed a small number of studies, with inconsistent findings across studies that varied by study design and

follow-up time, leading to considerable uncertainty around effect estimates. The reviews authors concluded that group-based comprehensive risk reduction is an effective strategy to reduce adolescent pregnancy, HIV and STIs but that no conclusions could be drawn regarding the effectiveness or otherwise of group-based abstinence education.

The methods used for the above review are detailed in this paper:

Sipe TA, Chin HB, Elder R, Mercer SL, Chattopadhyay SK, Jacob V. 2012. **Methods for conducting community guide systematic reviews of evidence on effectiveness and economic efficiency of group-based behavioral interventions to prevent adolescent pregnancy, human immunodeficiency virus, and other sexually transmitted infections: comprehensive risk reduction and abstinence education**. American journal of preventive medicine. 42(3):295-303. Epub 2012/02/22.

A summary of the recommendations derived from the review is contained in the following paper:

Community Preventive Services Task Force. 2012. **Recommendations for Group-Based Behavioral Interventions to Prevent Adolescent Pregnancy, Human Immunodeficiency Virus, and Other Sexually Transmitted Infections: Comprehensive Risk Reduction and Abstinence Education**. American journal of preventive medicine: 42(3):304-7.

Tolli MV. 2012. **Effectiveness of peer education interventions for HIV prevention, adolescent pregnancy prevention and sexual health promotion for young people: a systematic review of European studies**. Health education research: 27(5):904-13. Epub 2012/05/30. http://her.oxfordjournals.org/cgi/pmidlookup?view=long&pmid=22641791

Peer education has been defined as 'the teaching or sharing of health information, values and behaviours by members of similar age or status". Peer education has been used for sexual health interventions on the assumption that a young person's peer group has a strong influence on the way he or she behaves. This review aimed to appraise all studies that described and evaluated interventions designed to be implemented, in full or partially, by peer educators, and that had as an objective the prevention of HIV, the prevention of adolescent pregnancy and/or the promotion of sexual health in young people, aged between 10 and 24 years, and met the following criteria: they were conducted in European Union countries; they were RCTs, non-randomised controlled studies or studies using a before-and-after design; they evaluated at least one of the review's outcomes of interest; they compared an intervention to no intervention or standard practice; and they were available in English, German or Spanish. The review authors identified 17 publications, corresponding to five interventions that met their criteria. Three interventions were sex education programmes and two were HIV prevention programmes. One intervention evaluated unintended pregnancy using data for abortions and live births and found no statistically significant difference between the intervention and control groups in the proportion of girls who had one or more live births by age 20.5 years. One study evaluated STDs using self-report and found no statistically significant difference between the intervention and control group. Three studies evaluated condom use and none found statistically significant effects. One study assessed sexual experience and found a statistically significant increase in sexual experience in the intervention group. All studies assessed knowledge as an outcome but only one found a statistically significant effect. Three studies evaluated skills for communication and negotiation: one found a non-significant trend in favour of the intervention group and two found non-significant differences. Three studies evaluated attitudes and one reported significant differences in favour of the intervention group. One study assessed intention to use a condom and found no statistically significant effects of the intervention. The review authors concluded that, overall, compared to standard practice or no intervention, there is no clear evidence for the effectiveness of peer education concerning HIV prevention, adolescent pregnancy prevention and sexual health promotion for young people in the countries of the European Union. They stated that further research is needed.

The CRD reviewed this review and found that its conclusions were likely to be reliable based on the evidence presented. The CRD summary can be found here: http://www.ncbi.nlm.nih.gov/pubmedhealth/PMH0049936/.

Cheng L, Che Y, Gülmezoglu AM. 2012. **Interventions for emergency contraception**. Cochrane Database of Systematic Reviews (8). http://onlinelibrary.wiley.com/doi/10.1002/14651858.CD001324.pub4/abstract

Emergency contraception involves either taking a drug (the "morning after pill") or getting a copper intrauterine device (Cu-IUD) shortly after unprotected intercourse. This review aimed to determine which EC method is the most effective, safe and convenient way to prevent pregnancy after unprotected intercourse. It included 100 trials involving 55,666 women, both RCTs and controlled clinical trials. Eighty-six were conducted in China. The review's conclusions were as follows: "Intermediate-dose mifepristone (25-50 mg) was superior to levonorgestrel (LNG) and Yuzpe regimens. Mifepristone low dose (< 25 mg) may be more effective than LNG (0.75 mg two doses), but this was not conclusive. UPA may be more effective than LNG. LNG proved to be more effective than the Yuzpe regimen. The copper IUD was the most effective EC method and was the only EC method to provide ongoing contraception if left in situ." The findings of this review relating to drugs for emergency contraception are of limited relevance to women in New Zealand where levonorgestrel is the only drug used for emergency contraception. (Mifepristone is used in higher dose in terminations of pregnancy and induction of labour for expulsion of a dead fetus following fetal death in utero.)

Arrowsmith ME, Aicken CRH, Saxena S, et al. 2012. **Strategies for improving the acceptability and acceptance of the copper intrauterine device**. Cochrane Database of Systematic Reviews (3). http://onlinelibrary.wiley.com/doi/10.1002/14651858.CD008896.pub2/abstract

Despite being highly effective (and reversible), IUDs are among the least commonly used methods of contraception. This review aimed to evaluate the effects of interventions intended to increase uptake of the copper IUD. It included nine studies involving 7690 women (seven RCTs and two controlled before and after studies) that reported IUD uptake following intervention. The review authors rated the quality of evidence moderate to low. Three studies on contraceptive counselling and referrals by community workers showed an increase in uptake of the IUD among intervention groups (Peto OR 2.00; 95% CI 1.40 to 2.85). Two studies on antenatal contraceptive counselling also favoured the intervention groups (Peto OR 2.33; 95% CI 1.39 to 3.91). One study on postnatal couple contraceptive counselling also showed an increase in IUD uptake compared to control (Peto OR 5.73; 95% CI 3.59 to 9.15). The results of one study evaluating postnatal home visits and two studies on enhanced post-abortion contraceptive counselling did not reach statistical significance. The review authors concluded that both community-based and antenatal contraceptive methods improved uptake of copper IUDs for contraception and they suggested that primary care practitioners could consider adopting these interventions. They also suggested that a cost-benefit analysis may be required to evaluate applicability.

Wakhisi AS, Allotey P, Dhillon N, Reidpath DD. 2011. **The Effectiveness of Social Marketing in Reduction of Teenage Pregnancies: A Review of Studies in Developed Countries**. Social Marketing Quarterly: 17(1):56-90.

This review aimed to determine the effectiveness of a social marketing approach in reduction of unintended teenage pregnancies. A social marketing intervention was defined as one which included the following six basic characteristics: consumer research, specific behaviour

change goal, segmentation and targeting, marketing mix, exchange, and competition. Through a literature search for the years between 1990 and 2008 the review authors identified 12 studies meeting their criteria. Nine were RCTs and three were before-and-after studies. There was variation between studies in intervention effects across specified outcomes (reduction in unintended pregnancies, delayed sexual initiation, contraceptive use at last intercourse, knowledge of contraception and reproductive health, and self-efficacy to refuse unwanted sex). Nine of the 12 studies reported significant effects on a least one of the outcomes. Long term interventions tended to be more effective than short term ones for most outcomes. In most studies there was minimal impact of the intervention on male participants' sexual behaviour. The authors concluded that, overall, social marketing seems to be an effective approach for reducing teenage pregnancies and influencing behaviour change, but the evidence is limited to particular outcomes and context. They stated that there is a need for more primary studies specifically designed around social marketing principles for more robust evaluations. They also stated that the minimal impact of interventions on male participants' behaviour warrants further investigation.

Oringanje C, Meremikwu M, Eko H, et al. 2009. **Interventions for preventing unintended pregnancies among adolescents**. Cochrane Database of Systematic Reviews, 2009(4). http://onlinelibrary.wiley.com/doi/10.1002/14651858.CD005215.pub2/abstract

This review included 41 RCTs involving 95,662 adolescents in many different countries and assessing a wide variety of interventions. There were both individual and cluster-randomised trials. The results indicated that combination interventions involving both education and contraceptive provision were effective in lowering rates of adolescent pregnancy. The evidence on the effect of interventions on secondary outcomes (age at first intercourse, use of birth control methods, abortion rates, childbirth rates and sexually transmitted diseases) was inconclusive. The variability in study populations, types of interventions, and outcomes measured and also the paucity of trials comparing different interventions made it impossible to draw any conclusions about which type of intervention is most effective.

Other relevant publications

National Institute of Demographic and Economic Analysis, University of Waikato. 2015. **Current trends for teenage births in New Zealand**. Hamilton: National Institute of Demographic and Economic Analysis, University of Waikato. http://www.superu.govt.nz/sites/default/files/Teen_Births_Report_0.pdf

This report outlines trends in teenage births in New Zealand and provides contextual information on age-related trends, ethnic trends, and international comparisons. This is followed by a discussion of the potential drivers of these trends, including direct drivers, such as contraceptive use and sexual activity, and also underlying drivers such as socio-economic circumstances, ethnic and cultural differences, and family characteristics. The report concludes by discussing the implications of these trends and offering suggestions for further research and action.

Clark TC, Crengle S, Sheridan J, et al. 2014. **Factors associated with consistent contraception and condom use among Māori secondary school students in New Zealand**. Journal of Paediatrics & Child Health, 50(4), 258-65.

This study used multivariate analysis to determine relationships between self-reported consistent contraception and condom use among all 2059 sexually active Māori participants in the 2007 New Zealand youth health and well-being survey of secondary school students. The results indicate that 40% of Māori students were currently sexually active; of these, 55.3% always used contraception, and 41.1% always used condoms. The following groups of students were less likely to use regular contraception: those with more than three sexual partners (males odds ratio (OR) 0.55, $P = 0.04$, females OR 0.35, $P = 0.04$) and females who were regular cigarette users (OR 0.52, $P = 0.02$). Students less likely to use condoms were 13- to 15-year-old females (OR for older students vs. younger students 1.95, $P < 0.01$) and females who enjoyed sex (vs. other female students OR 0.52, $P = 0.02$). Family connection was associated with increased use of condoms among males (OR 1.07, $P < 0.01$). The study authors stated that there is a need to improve the sexual health of Māori youth though reducing sexual risks, increasing opportunities for healthy youth development and family connectedness, and ensuring access to appropriate services.

Kaipuke Consultants Ltd. 2012. **Regional trends in teenage parenthood**. http://www.superu.govt.nz/sites/default/files/regional-trends-teenage-parenthood.pdf

This report was written as a background report to the Families Commission research report: *Teen Pregnancy and Parenting: An overview* (above). It analyses regional variation in teenage births and parenthood in New Zealand. It begins with an overview of New Zealand fertility trends over the past 50 years. This is followed by an analysis of national and regional trends in teenage births by age, ethnicity and socio-economic status (NZDep). Finally, there is a detailed analysis of nine selected regions with the highest rates and numbers of teenage births.

Rose SB, Lawton BA. 2012. **Impact of long-acting reversible contraception on return for repeat abortion**. Am J Obstet Gynecol, 206(1), 37.e1-6

This paper reports on a New Zealand study which aimed to determine the relationship between likelihood of return for repeat abortion and choice of contraceptive method, in the 24 months after an abortion. The study followed on from an intervention study which ran over 10 weeks at a public hospital abortion clinic and was designed to promote use of long-acting reversible contraception (LARC) methods that included depot medroxyprogesterone acetate (DMPA), the levonorgestrel intrauterine system (LNG-IUS), and copper multiload Cu375 (Cu-IUD). The intervention increased the use of LARC methods from 45% at baseline to 61% during the intervention, with a 6-fold increase in the choice of the LNG-IUS, from 6% to 36%. The follow up study was a prospective cohort study involving review of hospital notes for 510 women aged 13 to 44 years. It found that women using long-acting reversible contraceptive (LARC) methods (intrauterine device [IUD] and depot medroxyprogesterone acetate) had significantly lower return rates for repeat abortion (6.45%; 95% CI 4.0 to 9.8) than non-LARC users, of whom 14.5% returned (95% CI 9.9 to 20.2). A Cox proportional hazard analysis indicated that, after controlling for demographic factors and previous pregnancy history, the post-abortion method choice was significantly related to the likelihood of returning for a repeat abortion (P = .002). Using the pill as a reference group for risk of repeat abortion, the IUD hazard ratio (HR) was 0.36 (95% CI, 0.17 to 0.77), the depot medroxyprogesterone acetate HR was 0.55 (95% CI, 0.21 to 1.45), and the HR for all other methods was 1.8 (95% CI, 0.83 to 3.92). The authors stated that their study provided strong support for promoting immediate post-abortion access to LARC methods (especially IUDs) to prevent repeat abortions.

Rose SB, Wei Z, Cooper AJ, et al. 2012. **Peri-Abortion Contraceptive Choices of Migrant Chinese Women: A Retrospective Review of Medical Records**. PLoS One, 7(6). http://www.plosone.org/article/fetchObject.action?uri=info:doi/10.1371/journal.pone.0040103&representation=PDF

It has been reported that migrant Asian women in New Zealand have low levels of contraceptive use and high rates of abortion. Chinese are the largest group of migrant Asians in New Zealand. This study aimed to describe the contraceptive choices of Chinese women seeking

abortion, to investigate relationships between method choice and demographic characteristics (including length of stay), and to determine whether Chinese women were over-represented among women attending abortion clinics. It involved a retrospective review of medical records at a public hospital abortion clinic. Records for 305 Chinese women were compared with previously collected data for 277 European and 128 Māori women. Correlated of contraceptive choice were explored via regression analysis. Census data was used to determine rates of clinic attendance for each ethnic group. Analysis results indicated that Chinese women were not over-represented among clinic attendees, and had rates of contraceptive non-use pre-abortion similar to those of other women. Chinese women had lower rates of oral contraceptive pill use pre-abortion than other ethnic groups, but post abortion Chinese women's rates were similar to European women's (46.9%, 95% CI 41–52.7 and (43.7%, 95% CI 37.8–49.7, respectively). Post-abortion choice of an intrauterine device did not differ significantly between Chinese (28.9%, 95% CI 23.8–34.3) and Māori women (37%, 95% CI 28.4–45.7), but was higher than uptake of this method by European women (21.7%, 95% CI 17–27.0). Age, parity and previous abortion were significant predictors of post-abortion method choice by Chinese women ($p < 0.05$). The study authors concluded that, after counselling at the clinic, Chinese women chose post-abortion contraceptive methods that were more effective than those they had used previously. They stated that as the number of Chinese migrant women continues to increase, there is an urgent need for strategies to ensure that new arrivals are provided with appropriate information and advice about contraception and how to access it, so that they can avoid unplanned pregnancy.

Denny S, Robinson E, Lawler C, et al. 2012. **Association Between Availability and Quality of Health Services in Schools and Reproductive Health Outcomes Among Students: A Multilevel Observational Study**. Am J Public Health, 102(10), e14-20. http://www.ncbi.nlm.nih.gov/pmc/articles/PMC3490681/pdf/AJPH.2012.300775.pdf

This paper reports on a New Zealand study which used a 2-stage random sampling design to gather nationally representative data from 917 students from 96 high schools (the Youth '07 survey). Students self-reported whether they were sexually active, how often they used condoms or contraceptives, and whether they had contributed to a pregnancy. School administrators completed questionnaires about their school-based health services, providing information on team-based services, doctor and nurse hours per week, and health screening. The study authors undertook data analysis using multi-level models controlling for individual variables, with schools treated as random effects. The results indicated that there was an inverse association between hours of nursing and doctor time and pregnancy involvement among sexually active students, with fewer pregnancies among students in schools with more than 10 hours of nursing and doctor time per 100 students. There was no association between doctor visits, team-based services, health screening, and reproductive health outcomes. The study authors concluded that school health services are associated with fewer pregnancies among students, but only when the availability of doctor and nursing time exceeds 10 hours per 100 students per week.

Denny S, Farrant B, Cosgriff J, et al. 2012. **Access to private and confidential health care among secondary school students in New Zealand**. J Adolesc Health, 51(3), 285-91.

This study aimed to determine the prevalence of health care utilisation and private and confidential health care among a nationally representative population of New Zealand high school students (the Youth '07 survey). A total of 9107 students from 96 high schools participated (a two–stage cluster sample). Questions in the survey asked students when and where they had accessed health care, if their health care provider had explained that their health care was confidential, and if they had been seen in private by their health care provider. The results indicated that, although 83% of students had accessed health care in the previous 12 months, only 27% of students reported receiving private and confidential health care. Students who had accessed health care from a school-based health centre (adjusted relative risk 1.54, 95% CI 1.42 to 1.66) or family planning/sexual health clinics (adjusted relative risk 2.1, 95% CI 1.9 to 2.26) were more likely to report receiving private and confidential health care compared with students who had not accessed health care from these settings. The study authors stated that, while most young people access health care from their family doctor or general practitioner's clinic, rates of private and confidential health care were low which suggests that opportunities to adequately explore and respond to important yet sensitive topics are compromised in primary care settings.

Pihama L. 2011. **Overview of Māori teen pregnancy**. Wellington: Indigenous Analysis Ltd., for the Families Commission. http://www.superu.govt.nz/publication/overview-m%C4%81ori-teen-pregnancy

This was prepared for the Families Commission by Leonie Pihama of Māori and Indigenous Analysis Ltd. and is a background literature review for the Families Commission research report: *Teenage Pregnancy and Parenting. An Overview* (above). It provides an overview of views relating to Māori teen pregnancy. The author noted that there has been little dedicated research that is specific to the issue of Māori and teen pregnancy and she states that Western research which has taken deficit-based approaches to the "problem" of teen pregnancy is of limited usefulness for understanding Māori teen pregnancy. She cites research reporting that teen parents themselves have recognised many positive outcomes from parenthood including: a sense of direction and purpose, positive life changes such as getting off drugs and alcohol, re-engaging with their families and with education, and the joy and satisfaction of motherhood.

Copland RJ, Denny SJ, Robinson EM, et al. 2011. **Self-reported pregnancy and access to primary health care among sexually experienced New Zealand high school students**. J Adolesc Health, 49(5), 518-24

This study used data from the Youth '07 survey to determine the prevalence of self-reported pregnancy among sexually experienced New Zealand high school students, and the association between teenage pregnancy and access to primary health care. The dataset included 2,620 year 9 through 13 students who reported ever having sexual intercourse and responded to a question about whether they had ever been pregnant or ever caused a pregnancy (1,217 females and 1,403 males). Analysis of the data indicated that, nationwide, 10.6% of sexually experienced high school students self-reported that they had been pregnant (11.6%) or caused a pregnancy (9.9%). Māori (15.3%) and Pacific Island (14.1%) students had the highest self-reported pregnancy rates. Foregone health care was reported by 24.2% of sexually experienced students. Students who self-reported pregnancy reported greater difficulty accessing health care (41.7% vs. 20.6%; odds ratio: 2.6); however, when they accessed care, the majority received confidential care (67.4%) as compared with pregnancy-inexperienced peers (51.6%). The most common reason for not accessing health care was concern about privacy. Other barriers included uncertainty about how to access care and lack of transportation (all p values <.05). The study authors concluded that self-reported pregnancy rates are high among sexually active New Zealand high school students and that there are ethnic disparities. They noted that being pregnant or causing a pregnancy is associated with difficulty accessing health care and they stated that further research is needed to identify the drivers of ethnic disparities and the nature of the cause-and-effect relationship between teenage pregnancy and access to health care.

Clark T, Robinson E, Crengle S, et al. 2006. **Contraceptive use by Māori youth in New Zealand: associated risk and protective factors**. N Z Med J, 119(1228), U1816. https://www.nzma.org.nz/__data/assets/pdf_file/0003/17859/Vol-119-No-1228-27-January-2006.pdf

This study used data from the Youth2000 survey in a multiple logistic regression model to identify risk and protective factors associated with consistent contraception use by sexually active Māori secondary school students. There were 2340 survey participants (out of 9570 randomly selected secondary school students) who reported that they were Māori, 52.9% of whom were male and 76.1% of whom were aged 15 years or younger. The results indicated that half of the Māori students had experienced sexual intercourse and a third were currently sexually active (33% males; 34% females). Most Māori youth who had ever had sex used condoms for contraception (82%) and most sexually active Māori youth reported consistent use of contraception (71% males; 70% females). Māori youth who used contraception consistently were more likely to report getting enough time with a parent (OR 1.50; 95% CI 1.05 to 2.14; p=0.03) and less likely to report weekly marijuana use (OR 0.53; 95% CI 0.37 to 0.76; p=0.0006). The study authors concluded that, although consistent use of condoms is a common self-reported contraceptive practice by many young Māori, this behaviour is not universal and, in view of the significant sexual and reproductive health disparities that exist for Māori youth, sexual and reproductive health programmes need to adopt a broader strategy which promotes protective factors such as strengthening youth-parent relationships and discourages risk factors such as substance misuse.

Websites

The National Campaign to Prevent Teen and Unplanned Pregnancy. http://thenationalcampaign.org/

This US website contains a wealth of information and data on teen pregnancy and how to prevent it. The database of research reports, publications, fact sheets, videos, podcasts, PowerPoints, and other materials is searchable here:

http://thenationalcampaign.org/search/resource/results

Office of Adolescent Health, US Department of Health and Human Services. 2015. **Evidence-Based TPP Programs**. http://www.hhs.gov/ash/oah/oah-initiatives/tpp_program/db/

This web page provides a searchable database of evidence-based teen pregnancy prevention programmes identified by the US Department of Health and Human Services that have been shown, in at least one programme evaluation, to have a positive impact on preventing teen pregnancies, sexually transmitted infections, or sexual risk behaviours.

MENTAL HEALTH

IN-DEPTH TOPIC: MENTAL HEALTH ISSUES IN YOUTH AND YOUNG PEOPLE

By Dr Michael Butchard

Introduction

This chapter focuses on youth and young adults aged 15–24 years. The In-Depth chapter: *In-Depth Topic: Mental Health Issues in Children* in a previous NZCYES publication: *The Determinants of Health for Children and Young People* focused on children aged 0–14 years.[103] Most of the literature covered in this chapter is from research and policy concerning 15–19 years. There is much less research and policy covering the 20–25 years age group.

This chapter is not designed to review specialist treatments for specific disorders; its general focus is on the mental health service structure and primary level care. The first section of the chapter gives a brief historical context to mental health services in New Zealand. The current services and access for youth and young adults are then summarised. Various issues regarding the organisation of youth and young adult mental health services identified from the literature are discussed, including barriers to access, transitioning from child to adult care, workforce issues, the role of primary care, and school-based health services.

Secondly, the chapter examines the literature on primary level mental health, alcohol and other drug interventions. These interventions are mainly from health and educational settings, are delivered via traditional face-to-face, and computer and web-based interventions, and cover mental health disorders and alcohol and drug misuse. Lessons from some comprehensive systematic reviews are summarised. Suicide interventions and policy are not covered as a separate section within this In-depth chapter, but the recent literature since the previous 2012 NZCYES publication is summarised in a later section within this publication.

The final section focuses on three groups within the youth and young adult population who are at higher risk of mental illness, including suicide. Mental health services for Māori, Pacific and sexual minority youth and young adults are discussed. These are not the only groups at higher risk of mental health illness, and while some other vulnerable groups are not covered directly (including out-of-home care, the Youth Justice population, and refugees and migrants), some of the lessons drawn have general applicability.

Background

The previous NZCYES In-depth topic "Mental Health Issues in Children" provides a general historical background to children's mental health, and the key documents from the mid-1990s to 2012.[103] This chapter briefly summarises the recent historical context of mental health services in New Zealand since the mid-1990s, in as far as they relate to the evolving focus of present mental health services.

In New Zealand in the mid-1990s many people who needed specialist mental health services for serious disorders were not receiving them. The 1994 Ministry of Health document *Looking Forward: Strategic direction for the mental health services* noted that generally, services were under funded.[225] There was a lack of resources targeting children and their families, with youth mostly having to access adult services. *Looking Forward* set out a strategic direction of establishing youth services based on regional community mental health teams catering for Māori and non-Māori.[225] It also called for a coordinated approach between the Ministry of Health, the Department of Social Welfare and the Ministry of Education in developing services, and set a benchmark that specialist mental health services reach 3% of youth. In 1995 only 0.83% of the national population under 20 years of age were receiving specialist mental health services, with regional differences ranging from 0.54% to 1.26%.[226]

Over the following four years, the mental health service access target for the most severely affected youth was increased to 5%,[227] then refined in the 1998 Ministry of Health mental health strategy document, *New Futures*[228] to 1% for 0–9 year olds, 3.9% for 10–14 year olds, 5.5% for 15–19 year olds, and 3% for adults. The new targets were based on work by the Mental Health Commission for the *Blueprint for Mental Health Services in New Zealand*.[229] These targets are still used today in publications assessing mental health services.[230]

By 2003, access rates for 15–19 year olds were 2.0%.[231] Nationally, the service access target of 5.5% for 15–19 year olds was finally met in 2012.[230] In 2013, the latest published data, the access rate for 15–19 year olds was 5.84%, however the target has only been met by three of the four regional DHB groupings; the Northern DHBs' access rate for 15–19 year olds is 5.01%.[230] There are no published figures on access for 20–24 year olds, but in 2013, 3.5% of the whole population accessed specialist mental health and addiction services,[232] compared to around 1.5% in 1998. [233]

Over the past two decades, as more people have been accessing specialist services, the focus of key Mental Health Commission documents, such as *Blueprint II*, [234,235] and the Ministry of Health document, *Rising to the Challenge: The Mental Health and Addiction Service Development Plan 2012–2017*, [236] have broadened to address the needs of those who have mild to moderate mental health issues, recognising the benefits of early intervention in a person's life course and course of illness, and on building resilience. While noting several improvements, such as a strong NGO sector, culturally specific services, and increased involvement of service users, family and whānau in planning and delivery, *Rising to the Challenge* identified challenges for mental health services. These included that New Zealand has one of the highest youth suicide rates in the OECD; there is variation in access to services, especially for children and youth; and there are limited and variable primary mental health responses, variable waiting times, variable integration between DHBs and NGOs, and also between primary and specialist services.[236]

Rising to the Challenge has four overarching goals: using current resources more effectively; building infrastructure for integration between primary and specialist services; cementing and building on the gains in resilience and recovery for those with high needs, Māori, Pacific, refugees, people with disabilities and other groups; and increased access for infants, children and youth, adults with mild to moderate illness, and the growing older population.[236]

Current mental health services

This section summarises the *2014 Stocktake of Infant, Child and Adolescent Mental Health and Alcohol and Other Drug Services in New Zealand*. [230] For more detail, including regional breakdowns, please refer to that document.

The Mental Health Commission recommended infant, child and adolescent mental health services (ICAMHS) should receive 26% of total mental health funding, based on estimated need.[229] In 2013, children 0–19 years old made up 27% of the New Zealand population. Infant, Child and Adolescent Mental Health/ Alcohol and Other Drugs (ICAMH/AOD) services received 13% of mental health funding.[230] The 13% figure includes primary mental health funding for ICAMH. However, The Werry Centre noted that there are several unknown factors which make it difficult to assess the degree of underfunding: it is unknown what the relative cost of treatment of infants, children and adolescents is compared to adults; it is unknown what the cost impact on secondary services is of the increasing provision of primary health services; and it is also unknown how much provision of services for 17–19 year olds is provided by adult services.[230]

The 20 District Health Boards (DHBs) provide a range of inpatient and community based ICAMH/AOD services. Auckland, Capital & Coast, and Canterbury DHBs provide regional Child and Adolescent Mental Health (CAMH) inpatient services. ICAMH/AOD services are also provided by non-governmental organisations (NGOs) and Primary Health Organisations (PHOs) funded by DHBs. From June 2013 to July 2014, 112 NGOs provided DHB funded ICAMH/AOD.

Table 158. Child and Adolescent Mental Health/Alcohol and Other Drugs Services in New Zealand, 2014

Services	ICAMH/AOD service providers
Youth forensic	DHBs: Northland, Auckland, Taranaki, Capital & Coast, Nelson Marlborough, West Coast, Canterbury, South Canterbury & Southern NGOs: Waikato: Nga Ringa Awhina O Hauora Trust MidCentral: Te Upoko O Nga Oranga O Te Rae Canterbury: Odyssey House Trust Southern: Adventure Development & Miramare Ltd
Child and adolescent AOD (including co-existing problems)	15 DHBs 34 NGOs
Eating disorders	DHBs: Auckland, Hutt Valley & Canterbury; 14 additional DHBs provide Eating Disorder Services NGOs: Northland: Rubicon Charitable Trust Counties Manukau: Ohomairangi Trust Whanganui: Te Oranganui Trust Canterbury: St John of God Hauora Trust Southern: Miramare Ltd
AOD school-based programmes	Auckland: Odyssey House Trust: Amplify School Programme Counties Manukau: Odyssey House Trust: Stand Up; Youthline: AOD School Based Programme
Conduct disorder service	DHB: MidCentral DHB: CAMHS in collaboration with Group Special Education
Peer support	DHBs: Waikato, Whanganui, Capital & Coast, Wairarapa & South Canterbury NGOs: Counties Manukau: Raukura Hauora O Tainui Trust Bay of Plenty: Te Manu Toroa, Te Runanga Ngai Tamawhariua & Whakatohea Māori Trust Board Tairawhiti: Te Kupenga Net MidCentral: Te Upoko O Nga Oranga O Te Rae Canterbury: Depression Support Network.
Services for Māori	Two dedicated DHB Māori ICAMH services/teams: Counties Manukau: He Kakano Māori Mental Health Team Capital & Coast: Te Whare Marie Specialist Māori Mental Health Service Three DHB Māori services funded under adult services: Waitemata: Moko Māori Mental Health Service and Te Atea Marino Regional Māori AOD Service MidCentral: Oranga Hinengaro Māori Mental Health Services 22 NGOs: Northland: Ngati Hine Health Trust Counties Manukau: Mahitahi Trust & Raukura Hauora O Tainui Trust Waikato: Hauora Waikato, Pai Ake Solutions Ltd, Raukawa Charitable Trust, Waahi Whaanui Trust Lakes: Te Utuhina Manaakitanga Bay of Plenty: Maketu Health & Social Services, Pirirakau Hauora, Manu Toroa, Tuwharetoa Ki Kawerau Health, Education & Social Services, Whakatohea Māori Trust Board Tairawhiti: Ngati Porou Hauora Charitable Trust Taranaki: Tui Ora Ltd Hawke's Bay: Te Taiwhenua O Heretaunga MidCentral: Best Care (Whakapai Hauora) Charitable Trust, Te Runanga O Raukawa Nelson Marlborough: Te Kahui Hauora O Ngati Koata South Canterbury: Arowhenua Whānau Services Southern: Aroha Ki Te Tamariki Charitable Trust, Nga Kete Matauranga Pounamu Charitable Trust

Services	ICAMH/AOD service providers
Services for Pacific	DHBs: Three dedicated DHB Pacific ICAMH services - Waitemata DHB: Isa Lei Pacific Mental Health Service Counties Manukau DHB: Vaka Toa Pacific Island Team Capital & Coast DHB: Health Pasifika One DHB Pacific services funded under adult services: Waitemata DHB: Tupu Pacific Alcohol & Drug Service. NGOs: Counties Manukau: Penina Trust Waikato: K'aute Pasifika, Raukawa Charitable Trust Capital & Coast: Taeaomanino Trust Hutt: Q-Nique/WellTrust Canterbury: Pacific Trust Canterbury
Services for Asian	DHBs: There are Asian services that are available to Asian people operating within DHBs which are funded under adult services: in Auckland; the Asian Mental Health Team, and Waitemata: the Asian Health Support Services which includes the Asian Mental Health Client Coordination and Support Service. Counties Manukau: Asian Mental Health Service which is mainly a coordination service providing advice on available resources, mental health services and links to support groups
Migrant & refugee mental health service:	DHBs: Nelson Marlborough & Canterbury NGOs: Capital & Coast: Refugee Trauma Recovery Southern: Miramare Ltd.

*COPMIA and Early Intervention services not included in this summary. (p.24–26).[230]

Youth Mental Health Project

The Youth Mental Health Project (YMHP) consists of 26 initiatives targeting the needs of young people aged 12–19 with mild to moderate mental health issues.[237]

The four-year expected outcomes are:

- Improved knowledge of what works to improve youth mental health
- Increased resilience among youth
- More supportive schools, communities and health services
- Better access to appropriate information for youth and their families/whānau
- Early identification of mild to moderate mental health issues in youth
- Better access to timely and appropriate treatment and follow-up[237]

The initiatives span several settings: health, family and community, school, and online. The Werry Centre summarises these as presented in **Table 159**.

Table 159. The Youth Mental Health Project Initiatives

Health sector initiatives:
• Making primary health care more youth friendly ($11.3 million over four years for GPs, School Based Health Services & Youth One Stop Shops) • Improving wait-times in CAMHS and follow-up primary care especially for young people with AOD concerns • Reviewing referral pathways actioned by the Ministry of Social Development • Reviewing alcohol and drug education programmes
Family and community initiatives:
• Providing mental health information for parents, families and friends (NGO sector) • Providing a whānau ora approach to youth mental health • Training for providers working with truants and disengaged young people (Ministries of Education and Social Development) • Ensuring young people have a say on the types of services they need (Ministry of Youth Development)
School-based initiatives:
• Encouraging nurses in decile 3 secondary schools to use the HEEADSSS screening tool to increase access to health services and improve access to primary care services and referrals to mental health services. [deciles 1–2 already covered since 2008 (Denny et al., 2014)] • Training youth workers in mental health in low decile schools to work alongside existing health workers in schools with linkages to community based services (NGOs funded by Child, Youth and Family) • Trialling of the *Check and Connect* mentoring and monitoring programme for disengaged youth • Making schools more responsible for student well-being (Education Review Office, Ministry of Education) • Encouraging a positive culture in secondary schools with the implementation of *Positive Behaviour School Wide* (Ministry of Education)
Online initiatives:
• Providing accessible interactive computer based e-therapy for mild mental health issues that can help reduce a variety of barriers to accessing services. • Improving youth-friendliness of mental health resources. • Funding youth providers to keep their services technologically up to date via the *Social Media Innovations Funds* to enhance youth engagement.

Source: Werry Centre (p.12) [230]

A recent formative evaluation noted that "the five largest initiatives focused predominantly on three outcomes: more supportive schools, communities and health services; early identification of mild to moderate mental health issues in youth; and better access to timely and appropriate treatment and follow-up" (p.56).[237]

The formative evaluation found that:

- The project is moderately comprehensive in its coverage and settings, with family settings less obviously targeted.
- The initiatives are on track to achieve their intended goals, however:

  1) it is not known if the needs of Māori and Pacific youth are being met. Few initiatives have incorporated cultural components in design or implementation strategies. The review recommends that the project monitors whether initiatives adequately target and are being taken up by Māori and Pacific youth.

  2) there is no agreed monitoring framework to measure outcomes and most initiatives have not collected baseline data against which to measure improvement.
- It has taken more time than expected to establish effective collaboration between agencies and programmes. Linking YMHP services to the wider primary care system was identified as a general issue.

There are early signs that school based health services initiatives to treat mild to moderate mental health issues are having a positive effect. Specifically, Denny and colleagues report "there was less depression and suicide risk among students in schools that had higher levels of health services"(p.4).[158]

The initiatives have been designed and set up to deliver value, but there are not consistent metrics to measure individual initiative outcomes (clear baselines and budget mechanisms and meeting needs of target groups). A KPMG 'value for money' analysis identified the Primary Mental Health initiative and the CAMHS and Youth AOD Access initiative as requiring significant improvement. For the former, "a key challenge is to understand how the level of funding provided will achieve the overarching desired outcome, and whether this will be sustainable over the long term"(p.58).[237] For the latter, there is a "lack of knowledge of both take-up and the sustainability and impacts of outcomes" (p.58).[237]

The Children's Action Plan

The Children's Action Plan is an interagency service response (Ministry of Social Development, Ministry of Health, Ministry of Education, Ministry of Justice, NZ Police, the Ministry of Business, Innovation, and Employment, and Te Puni Kōkiri) targeted at vulnerable children. The key features are: a *Vulnerable Children's Hub* - a single point of contact for frontline professionals with concerns about a vulnerable child, in circumstances when concerns are not serious enough to contact Child, Youth and Family or the Police directly; *Children's Teams* - community professionals from across sectors, tasked with ensuring children at risk are identified early, assessed and receive appropriate services (including mental health and addiction services); the *Vulnerable Kids Information System (ViKI),* an electronic system to record and manage concerns about vulnerable children, and *Common assessment and planning* – a single plan, based on a whole-of-child assessment, co-ordinated by a lead professional.[238]

The Children's Action Plan is in its early stages, so there are no evaluations to date. The recent *Report to the Vulnerable Children's Board – March 2015* notes that establishing the Children's Teams has taken longer than anticipated due to the realisation that increased engagement with local communities was required, since the communities held the resources, and success depended on their will to succeed.[239]

Six Children's Teams are currently operating, in Whangarei, Rotorua, Horowhenua/Otaki, Marlborough, Hamilton and Tairāwhiti. There are plans to establish four more teams, in Eastern Bay of Plenty, Whanganui, Christchurch, and Clendon/Manurewa/Papakura.[238]

New Zealand Suicide Prevention Strategy

The New Zealand Suicide Prevention Strategy 2006–2016 comments that the previous suicide prevention strategy had a major focus on the 15–24 age group, and it is now appropriate to broaden the focus to all ages, since 80% of suicides in New Zealand occur in those aged 25 years and over.[240] The strategy notes that risk factors for youth suicide vary to those for older adults. Mental health issues are important for both age groups, but family related issues and trauma play a more significant role for youth.[240]

The New Zealand Suicide Prevention Action Plan 2013 – 2016 outlines 30 actions, grouped under 11 areas.[241] Youth and young people are specifically mentioned in relation to:

- Supporting community-based organisations in creating opportunities for young people to be involved in community development projects (Ministry of Youth Development to lead)
- Improving services and support for children and young people in contact with Child, Youth and Family (CYF), through specialist training to CYF carers and all care and protection and youth justice residential staff (CYF to lead)
- Ensuring information, tools and resources on good cyber citizenship and reducing cyber-bullying, continue to be available to schools, parents and young people (Ministry of Education to lead).

Issues identified in the literature

Barriers to accessing mental health services

A systematic review of factors that young people perceived to make health care youth-friendly found that accessibility, staff attitude (respectful and supportive, honest, trustworthy and friendly), communication (clarity of information and listening skills of the clinician), medical competency, guideline driven care (confidentiality, autonomy, and well-managed transition to adult health care), age appropriate environments, youth involvement and health outcomes were central to young people's positive experience of care.[242] This review was of health care in general, rather than mental health specifically, although these factors are universal.

Systematic reviews identified perceived barriers to help-seeking in young people, including severe depressive illness, lack of perceived need and poor mental health literacy, a preference for self-management and self-reliance, structural access issues (location of services, transport, cost, time), perceptions that treatment is ineffective, fear of being hospitalised, stigma and embarrassment (perhaps more prevalent for males), difficulty trusting adults, and perceived lack of culturally competent services (for example for sexual minority or ethnic minority youth).[243-245] Factors that encouraged help-seeking were positive past experiences, social support and encouragement from others, and the number of community mental health services for adolescents.[243-245]

Specifically regarding suicidal individuals, a review of factors and interventions that influence help-seeking found that for those with suicidal ideation, plans and/or attempts in the past year, only around 28% of adolescents and young adults sought mental health services.[244] The review found that limited progress has been

made in developing and testing interventions to improve help-seeking and service utilisation. Four types of interventions were identified: psychoeducation; peer training; gatekeeper training; and screening. Apart from screening interventions, behavioural changes in help-seeking have rarely been assessed, so the research has done little to progress improvements in treatment engagement.[244] In the North American context, a meta-analysis found that from 1968 to 2008, attitudes towards seeking mental health services among University students have become increasingly negative.[246]

In the New Zealand secondary school context, 82% of students with significant mental health issues had not sought help from a general practitioner (GP).[247] Rates of help seeking increased with age for girls, but decreased for boys. For students, factors associated with help-seeking behaviour were having a teacher get to know them and having a non-family adult to talk to.[247]

Stigma has been the focus of study internationally[248,249] and nationally.[250] A systematic review found that youth, ethnic minorities, men, military and health professionals were more likely to be deterred by stigma.[248] Stigma and silence surrounding mental health problems has also been identified as an issue for staff and students in universities.[251] A review of anti-stigma interventions for school and college students found that knowledge and attitudes can be influenced by education, that an education approach was more successful than direct contact with someone who has a mental health problem, that impacts were generally short-term, and that studies did not assess behavioural outcomes.[249]

In New Zealand, a review of the anti-stigma programme "Like Minds, Like Mine" based on 1135 survey responses (17% from 16–24 year olds) from mental health service users found that over half reported improvement in discrimination over the past 5 years, and 48% thought the "Like Minds, Like Mine" programme had assisted "moderately" or "a lot".[250] Despite this, 89% had experienced at least "a little" unfair treatment in the past year due to mental health problems.

Transition from child and adolescent to adult services

The Office of the Prime Minister's Science Advisory Committee publication *Improving the Transition: Reducing Social and Psychological Morbidity During Adolescence* notes that the regions of the brain associated with higher levels of executive functioning, such as judgement, impulse control, managing strong emotion, and task initiation and management only fully mature well into the 20s.[252] Adolescence and emerging adulthood is a more prolonged and unstable developmental stage than previously appreciated.[252-254] Adolescents are "more vulnerable to poor decision making and risk taking behaviour and… more sensitive to reward inducing stimuli such as peer pressure, drugs and alcohol" (p.24).[252] Young people moving into adulthood with serious mental health conditions often have poor functioning, high rates of homelessness, arrests, school dropout and unemployment.[255]

Lamb and Murphy give the context to the differences in theory and practice between CAMHS and adult mental health services (AMHS), often referred to as the 'CAMHS – AMHS divide'.[256] CAMHS caters for a wider range of clinical presentations, and circumstances, such as those in out-of-home care, young people involved with the criminal justice system, and young people who have experienced abuse and neglect. There are different training programmes for professionals working in each service, care between CAMHS and AMHS is often provided by different organisations, and governments often have separate policy and plans for each service.[256]. Young people, their families and carers want their views to be taken seriously, want to participate actively, want good information, consistent support from a key worker, and want flexible, non-stigmatising community-based age-appropriate services.[256] When moving from CAMHS to AMHS there is a change in service philosophy regarding the role of family, and there is also a gap for those who have been under CAMHS but will not qualify for AMHS.[256]

Specialist mental health services have traditionally followed a paediatric-adult split, with child and adolescent services catering for young people "until the largely arbitrary ages of 16 or 18 years". (p.103)[257] McGorry and colleagues label the 18 years old boundary as "artificial", resulting in "fundamentally flawed" service structures.[254] The Ministry of Health has previously stated that this age limit should be applied "positively and with sensitivity, rather than restrictively"(p. 2).[228] However, institutions are often bound by bureaucratic and legal definitions of adolescence.[258] Jones notes "from the perspective of brain development, services may require re-engineering to provide an appropriately seamless and developmentally sensitive approach to individuals on the two-decade journey from puberty to adulthood" (p.s9).[253] Several publications recommend aligning institutional and developmental transitions to achieve better mental health outcomes for young people.[254,255,257-262]

Newman and Birleson argue for a developmental approach, but note that youth mental health models that do not conform to the traditional CAMHS age boundaries raise the following questions. How separate should the

services be from AMHS? What are the most appropriate age boundaries? How should these services be integrated to minimise transition problems? What is the most cost-effective balance of community-based and hospital based services? Should services and teams be organised based on presenting problems/disorders or regionally or developmental phase-specific or treatment specific?[262] They note there is minimal evidence to date, so debate has been mostly "opinion based"(p.95).[262]

The Ministry of Health and a recent systematic review of the literature on transitioning to adult services concluded that there is a lack of high-quality evidence of transitional care models.[263,264] Some themes from the 19 studies in the review were that services needed to address stigma, provide accessible, age-appropriate services, and that parents/carers wanted more involvement with adult services.

McGorry and colleagues provide examples, from Australia, Ireland and the UK, that are redefining service structures for young people up to 25 years of age.[254] Headspace is a primary care model for youth mental health in Australia, which promotes and supports early intervention for young people aged 12–25 years.[254,265] The central feature is the creation of multidisciplinary, youth-friendly, highly accessible 'one-stop shops' with close links to specialist services and schools, and which complement existing primary care services. Preliminary evaluation results have been positive. Another Australian example of organising care according to developmental transition ages is Orygen Youth Health (evolved from the Early Psychosis Prevention and Intervention Centre (EPPIC) model), a Melbourne organisation providing specialised early intervention to 15–25 year olds with severe or complex mental health presentations. This model will be scaled up nationally in Australia to provide 16 early psychosis services catering for 15–24 year olds, and linked, where possible, to Headspace. The expansion of the EPPIC model is the subject of intensive debate regarding its merits.[266]

In Ireland, Headstrong, the National Centre for Youth Mental Health, implemented the Jigsaw model of service delivery, which caters for 15–25 year olds.[254] This model involved youth in the design, implementation and review of programmes, with the aim of making them accessible and non-stigmatising. The Jigsaw model partnered with key stakeholders, such as CAMHS, AMHS, primary care, youth sector services, education and local development groups. A commitment has been made by the Irish government to expand the service to 12 sites.

In Birmingham, England, the Birmingham and Solihull Mental Health Foundation Trust, in partnership with the Prince's Trust (a youth agency providing education, skills training and entrepreneurship programmes for young people), created the youth service programme, Youthspace, which delivers mental health services to young people up to 25 years of age.[254] The development of Youthspace involved extensive consultation with young people, and focuses on social inclusion and employment. Appelton and Pugh summarise further UK examples. [267] Young and colleagues point out that a national review of UK CAMHS concluded that transition should be flexible to the needs of young adults rather than focusing on age. [268]

New Zealand also has examples of models of care that span the traditional CAMHS – AMHS divide. One of these is Evolve Wellington Youth Service, part of Well Health Trust Primary Health Organisation.[269] Evolve is a Youth One Stop Shop for young people aged 10 to 25. The clinical team has 6 nurses, (3.6 Full-time equivalents (FTEs)), six doctors (1 FTE), a social worker, two youth workers, and counsellors. Relationships have been built with secondary mental health services, and referral and discharge meetings are held at Evolve with clients' key worker to improve transitions.

Sukhera and colleagues condense transition models into two categories: *Age-continuum* (of which Headspace, Orygen, Jigsaw and Youthspace are examples), which are designed for first episode presentation; and *Shared management*, which utilises transition coordinators, and targets young people with moderate to severe disorders[258]. There are pros and cons for both models compared to not using a transition model: age-continuum has potential cost savings, is youth focused and community based, but has high initial costs and increased transition points.[258] Shared management improves attendance, has less youth lost to follow up and has positive outcome data, but requires time and financial resources, and is not ideal for mild disorders or first presentations.[258]

Sukhera notes that a previous study [270] found "consistency in service, continuity of care, seamless transitions, clarity of roles, information sharing, alignment of assessment processes, resolution of funding issues, joint working prior to transfer, cooperation and flexibility and user and caregiver involvement were among the main factors" in ensuring a smooth transition from CAMHS to AMHS (p.3).[258]

The Ministry of Health published *Transition Planning Guidelines for Infant, Child and Adolescent Mental Health/Alcohol and Other Drugs Services 2014* as a guide to assist child and adolescent services in developing and implementing effective transition planning processes for young people transitioning from their service.[264] The guidelines are intended to cover various reasons for transitioning, including young people having achieved

the agreed goals of treatment, no longer wishing to continue with treatment, and transitioning to adult mental health services.

The guidelines list key aims:

Service provision is matched as closely as possible to the needs of the young person and delivered by the most appropriate service/s to meet those needs

The young person and their family/whānau are the key decision-makers regarding the services they receive

Care is delivered across a dynamic continuum of specialist and primary level services with decisions based on the needs and wishes of the young person and their family/whānau and not service boundaries

Processes are in place to identify and respond early should the young person experience a re-emergence of any mental health or AOD concern

ICAMH/AOD service resources are used efficiently, with regular reviews of the flow of young people through the services. (p.1)

The guidelines identify six principles from the transition planning literature:

- Transition planning is a structured process that begins at entry
- Health services should actively encourage young people to be involved in all aspects of planning for their treatment and follow-up
- A whānau/family inclusive approach should be encouraged whenever possible
- Clear, effective and timely communication is required between the service, the young person, the whānau/family, primary care and other key stakeholders
- A 'stepped care' approach, which is where services intervene in an optimally supportive level, depending on level of need, enabling a young person to enter and exit the service system at any point depending on their level of need
- Shared decision-making, involving the young person and their whānau/family, and members of the multi-disciplinary team

The New Zealand guidelines[264] are consistent with the shared management model identified by Sukhera,[258] but they do not contain reference to transition coordinators. Shared management models are a good way of meeting the needs of children with an established relationship with services, but not as good as age-continuum services for first presentations. The Government's YMHP initiative to support 'one stop shops' is an example of age-continuum services, but the 12–19 age range of the YMHP is not consistent with developmental age range evidence.

Workforce

Workforce development has been identified as an issue from at least 1994, particularly a lack of Māori mental health workers.[225] Workforce issues have been previously documented by the Werry Centre, who in 2006 made 38 recommendations to address them.[271] *Rising to the Challenge* notes that there is also need to enhance the skills and confidence of the primary care workforce to be able to deliver brief, effective interventions.[236] The Werry Centre notes there are still significant workforce shortages in the mental health sector, with a total vacancy rate of 8%, mostly in DHB clinical roles, and estimates that an additional 202 full time equivalent positions need to be filled to meet the Mental Health Commission's Resource Guidelines.[230] It also notes that while the shortages are acknowledged by services, there is a shortage of qualified clinical staff, and barriers to up skilling staff.[230]

The Werry Centre recommends:[230]

- Continued investment in the targeted recruitment of the workforce across all roles for Māori and other ethnicities
- Recruiting new graduates and training them in specialist ICAMH services
- Working to retain and develop the current ICAMH/AOD workforce
- Increasing the focus on developing the NGO workforce, since 25% of all clients are seen there
- Continuing to develop primary care services, since this may reduce demand on CAMH/AOD services

- Ensuring local schools, Youth One Stop Shops, PHOs, NGOs and DHBs are part of the strategic planning process
- Providing enhanced training, especially to those in the unregulated workforce, so they can support the specialist workforce
- Increasing dual clinical/cultural competency in mainstream services

The role of primary care

The Mental Health Commission, through *Blueprint II*, called for an increased role for primary health in mental health services.[234,235] For youth, *Blueprint II* called for increased screening and assessment of psychological and social functioning, use of brief problem solving consultations, motivational interventions or talking therapies such as Cognitive Behavioural Therapy (CBT) and phone support, and monitoring progress, especially for those on medication.[234,235] *Blueprint II* also called for increased availability of specialist advice and support.

Rising to the Challenge, the Ministry of Health's current mental health and addiction service development plan, calls on primary care to view responses to mental health needs as being as equally important as responses to physical health needs.[236] The Ministry of Health calls on primary care providers to work closely with DHB and NGO services to implement a seamless and well-integrated stepped-care approach to improve accessibility. As part of this, the Ministry of Health calls on youth specialist services to provide support and advice to primary care, such as:

- Consultation and liaison services (including one-off assessments)
- Prompt telephone advice
- Access to advice via telemedicine for primary care and general health teams in rural areas
- Urgent assessments for young people and their families and whānau in crisis
- Shared care arrangements that allow young people and their families and whānau to move quickly and efficiently between primary care and specialist services as their needs dictate
- Delivery of specialist services from schools and primary care sites, including youth one-stop shops, in combination with processes to ensure collegial working between specialist services, primary care and school-based guidance and health services
- Discharge planning that ensures effective hand-over to an identified primary care provider, with provision for on-going specialist advice as needed.[236]

The Ministry of Health asks primary care to build the skills and knowledge of staff so that they can:

- Identify emerging issues early, including by screening
- Involve and support family, whānau and friends
- Provide advice or brief interventions to address emerging mental health and AOD issues
- Recognise when specialist advice or referral is needed.[236]

The Ministry of Health also calls on primary care to implement youth-centred models of care to improve the responsiveness and effectiveness of mental health and AOD services, "including improving the integration with school-based health services, co-location of services in 'youth one-stop-shops' and wherever possible having the flexibility to respond to 'walk ins'" (p.43).[236] The sections that follow discuss some of the issues raised by Blueprint II and the Ministry of Health regarding calls to action for primary care.

Screening

Screening for paediatric mental health problems and adolescent depression is recommended in international literature, although Wissow and colleagues in a recent systematic review of universal mental health screening in paediatric primary care found the literature had few details regarding how screening tools should be used by clinicians, including how to explain their purpose and confidentiality to clients, how they should be administered, and how to explore screen results.[272] Another primary care focused systematic review of screening for and treatment of suicide risk by O'Connor and colleagues found that primary care screening tools have limited ability to detect suicide risk in adolescents, but might identify some adults at risk.[273] The review also found that effective interventions for high-risk adolescents are not proven. Stockings and colleagues conducted a systematic review and meta-analysis of reliability, validity and diagnostic utility of symptom screening scales

for detecting major depressive disorder in children and adolescents.[274] The review found that internal reliability was good, sensitivity and specificity were moderate and positive predictive power for identifying true cases was mostly poor, so may result in many false-positives.

Wissow and colleagues found that screening can increase willingness of parents, youth and primary care providers to discuss mental health issues.[272] The review found there is some evidence that parents and youth prefer screening that is framed as universal, confidential and designed to improve communication. Factors that promoted effective screening were: informing patients about clinical goals; using plain language; and discussing confidentiality. Wissow and colleagues also noted that there are risks involved in screening when there is insufficient support for clinical decision making, first-line treatment or linkage to specialty care.[272]

An earlier review of screening young people for emotional disorders by Sanci and colleagues found that improved outcomes and cost-effectiveness was not demonstrated.[275] The review found that readiness for care and availability of effective treatments may also affect results. Debated potential harms of false positives are related to stigma, and the increased burden on the health system, although the review found no strong evidence for these.[275] Sanci and colleagues conclude that if screening in primary care is to be effective, it needs to be paired with facilitated access to treatment, and best results are obtained through collaborative care models.[275]

Consultation liaison and collaborative models

In the above discussion, two models of care have been mentioned: consultation liaison (The Ministry of Health calls on specialists to provide this to primary health care)[236]; and collaborative models (Sanci and colleagues found that when screening is paired with this model, it delivers the best results).[275] Three recent systematic reviews define these two models of care and assess their effectiveness.[276-278] Two are Cochrane reviews, and used the traditional child – adult age boundary of 18 years, with the bulk of the studies involving adults,[276,278] while the other, by Asarnow and colleagues, used a search criteria of up to 21 years old.[277]

In the consultation liaison model, the primary care provider has the central role in delivering care, with the mental health specialist (psychiatrist, mental health nurse, psychologist, social worker, or a team of mental health care providers) providing consultative support.[278] A collaborative model involves a number of health professionals (often a medical doctor, a case manager with training in depression and anxiety, and a psychiatrist or other mental health specialist) working together to improve the mental health outcomes of the client.[276]

Gillies and colleagues found that there was no data that could inform consultation liaison practice for children and adolescents.[278] However, for the adult population there was evidence consultation liaison improved mental health, satisfaction with care, adherence to treatment, particularly in those with depression, and improved care by primary providers.[278] There was also some evidence that consultation liaison may not be as effective as collaborative care.[278]

In adolescents with depression, Archer and colleagues found that collaborative care was significantly more effective than usual care at six months when measured using dichotomous outcomes, but not when using continuous outcomes.[276] For the adult population, collaborative care was associated with significant improvement in depression and anxiety outcomes compared with usual care.[276]

Asarnow and colleagues 2015 systematic review and meta-analysis of integrated care (both collaborative care and other forms of integrated care, including consultation and colocation) is the only one to date for child and adolescent mental health and substance use.[277] They found integrated care models had an advantage over usual care. Overall, 66% of youth experienced better depression, anxiety and behavioural outcomes (a grouping that included conduct, attention and hyperactivity) following integrated treatment. Collaborative care had the strongest effect; 73% of youth experienced better outcomes. Treatment interventions had a greater effect than prevention interventions, which had a small, not statistically significant effect. Substance use treatment intervention effects were also not statistically significant. Asarnow and colleagues argue that it is not enough to adopt a collaborative care model; treatments with demonstrated efficacy and effectiveness need to be used.[277] Collaborative care has been criticised for being unlikely to be cost effective.[279] Kates and colleagues describe a long-running working example from Canada, however no cost-effectiveness comparison has been done with primary practices not involved in the programme.[280]

Taylor and Briggs describe a collaborative model of care in South Canterbury, New Zealand, where the Mental Health Brief Intervention Service allows primary care physicians to refer patients with mild to moderate mental health problems to up to 4 free sessions with a mental health clinician (nurse, social worker or occupational therapist).[281] Survey results from physicians found that they thought the programme improved outcomes by facilitating treatment for patients with depression, and reduced the need for referrals to secondary mental health

services. The authors do not provide information regarding the age of patients participating in the service, and do not discuss youth, adolescent or young people's mental health.

GP skills and training

General Practice care has strengths in continuity of care and frequency of contact, so educating GPs to perform brief assessments and management techniques could facilitate GPs to take the lead in early intervention in youth mental health and addiction.[282] Brown and Wissow describe a framework of skills required by primary care staff that includes: cross-cutting skills to build therapeutic alliance; broad-based, brief interventions for major clusters of mental health symptoms; and evidence-based interventions for diagnosis specific disorders.[283] Brown and Wissow, who are from the United States, are unaware of a curriculum for primary care staff that includes training in all three levels.

The factor within mental health treatment that has the greatest impact on outcomes is the therapeutic alliance.[284]Timimi and colleagues note that outcomes achieved by mental health interventions are similar to those achieved 30 years ago, and there is little evidence to support that any particular components of a therapeutic model are actually crucial. They advocate for a child and adolescent mental health service model that incorporates patient feedback on outcomes of therapy, and building the therapeutic alliance.[284]

Kolko and Perrin summarise some efforts to improve clinical outcomes through training primary care providers (PCPs).[285] They found some success regarding outcomes for children with ADHD following PCPs receiving focused academic detailing (face-to-face, non-commercial educational outreach training on evidenced-based care, commonly relating to prescription medication), and mixed results following training in broad health management skills, such as the cross-cutting skills mentioned above, or for training encouraging greater use of screening for depression.[285] Ambresin and colleagues found that providing a 9 hour training session on screening and motivational interviewing and two follow-up visits to practices was no better than a brief standard talk at increasing GPs' detection of mental health needs among young people.[286] The authors concluded that further research on other barriers to screening young people in primary care should be done before further training interventions.

In the New Zealand context, bpac^{nz} have recently published the first of a series addressing mental health in young people.[287] This article has a section on maximising engagement with young people in primary care, and includes information on continuing medical education resources and courses available in New Zealand. Training in youth mental health for frontline health and social sector staff is also offered as part of The Youth Mental Health Project.[288]

School-based health services

A systematic review of the effect of school environments on the emotional health of adolescents found limited evidence that the school environment has a major influence on mental health, although there was some evidence that individual perceptions of school connectedness and teacher support were associated with better emotional health.[289] In a New Zealand study of school influence on behavioural and emotional health symptoms, Denny and colleagues also found that overall, school effects were modest.[290] The study used survey data to measure the association between six school environment measures and two measures of provision of health and welfare services with alcohol problems, depressive symptoms and suicide behaviours (among other risk behaviours). For the first two of these three behaviours or symptoms, only one of the eight measures was found to be associated. For alcohol problems, 'school climate' was associated, and for depressive symptoms, 'wellbeing of staff was associated. None of the measures were associated with suicide behaviours.

Surveys of New Zealand secondary school students have revealed that between 2007 and 2012, there appear to have been slight increases in the proportion of students reporting low mood, depressive symptoms, emotional symptoms, hyperactivity, peer problems, and, self-harm (for those over 15 years), and there has been no change in reported suicidal ideation and attempts.[291] This last point is of particular concern, since the Ministry of Health recently noted the New Zealand youth suicide rate was the highest in the OECD.[292]

As part of a strategy to improve the mental health of youth, the New Zealand government currently funds school nurses or school-based health services in decile 1–3 secondary schools, teen parent units and alternative education facilities.[158] A recent review by Denny and colleagues revealed considerable variability in the provision of health services to New Zealand schools.[158] Twelve percent had no services other than the minimum first aid provisions. The review analysed survey data on the health and wellbeing of students at schools with and without services and found that "there was less depression and suicide risk among students in schools that had higher levels of health services" (p.4).[158] Services associated with less depression and suicide risk were: having health professionals on site; higher health professional time per week per student; health professionals trained in youth health and well supported by peer review; and where health professionals were well integrated with the

school and local community.[158] The review also found that students in schools with health services reported less hospital accident and emergency department use.

Primary care level interventions

In this section, primary care is defined broadly, including the settings of general practice, school, university and community settings. This is because the systematic review literature is sometimes ordered by illness category (Alcohol and drug interventions, anxiety and depression interventions, or all mental health interventions) in a combination of settings, and sometimes structured by settings, covering all mental health interventions. Also, there is a growing interest in computer and internet interventions (e-interventions), which are sometimes reviewed separately, and sometimes included with face-to-face interventions. This section will begin by summarising findings of systematic reviews based on the area of mental illness, starting with alcohol and other drug interventions. The next section will focus on computer and internet based interventions (e-interventions), which is a growing research area. There is some overlap with respect to mental illness in this final section, since e-interventions are now applied to various mental health conditions. The main settings covered are general practice, other health care, and education. These are not given separate sections, since much of the literature is organised by specific mental illness or broad age range, rather than by setting. Where a systematic review has focused on one setting, this will be noted.

The research literature makes a distinction between universal, selected and indicated interventions.[293] Universal interventions are applied to a whole population, such as a whole school or classroom; selected interventions target a subgroup deemed to be at higher-risk of developing symptoms, and indicated (also called 'treatment') interventions target people already exhibiting symptoms. Selected and indicated intervention studies are also sometimes referred to informally as 'targeted' interventions. Universal, selected and indicated interventions are complimentary, and schools are an ideal setting to implement a combination of all three.[293]

Alcohol and other drugs interventions

The Ministry of Health has asked for primary care to provide brief interventions to address emerging mental health and AOD issues.[236] The international literature focusing on brief interventions has a strong focus on alcohol and other drug use. Several major US organisations recommend to follow the screening, brief interventions and referral to treatment (SBIRT) model, which has been shown to reduce alcohol consumption among adults when delivered in primary practice.[294] A systematic review focusing on SBRIT for alcohol and drug use in adolescents found that there was limited evidence for effectiveness, and called for further research.[295] The review included one study in general practice, several in schools and several in emergency departments.

A 2015 systematic review and meta-analysis by Tanner-Smith and Lipsey, also focusing on brief alcohol interventions, included 185 studies and found modest but significant reductions in alcohol consumption and alcohol-related problems in adolescents (11–18 years), and smaller reductions for young adults (19–30 years).[296] The meta-analysis was used to model the hypothetical profile of characteristics of the most effective interventions. For adolescents, this is a single 15 minute motivational enhancement therapy (MET) session delivered in school that includes decision balance, goal-setting and norm referencing, and would not include blood alcohol concentration information, basic education/information, or personalised feedback.

According to the National Institute on Drug Abuse, MET "is a counseling approach that helps individuals resolve their ambivalence about engaging in treatment and stopping their drug use. This approach aims to evoke rapid and internally motivated change, rather than guide the patient stepwise through the recovery process. This therapy consists of an initial assessment battery session, followed by two to four individual treatment sessions with a therapist. In the first treatment session, the therapist provides feedback to the initial assessment, stimulating discussion about personal substance use and eliciting self-motivational statements. Motivational interviewing principles are used to strengthen motivation and build a plan for change".[297]

Tanner-Smith and Lipsey found that for young adults, the most effective hypothetical profile of an intervention would be a self-administered computerised expectancy challenge intervention conducted on a university campus, including blood alcohol concentration information, decisional balance, goal-setting, and money/cost information.[296] It would not include basic education/information or norm referencing. This is consistent with a systematic review by Foxcroft and colleagues, which found that social norm interventions were not effective enough to reduce alcohol misuse enough tertiary students.[298]

For both adolescents and young adults, Tanner-Smith and Lipsey found that the worst-case scenario included multi-session interventions, and delivery in an emergency department (as opposed to school or university

campus, primary care or self-administered).[296] While there are some commonalities between the profiles for adolescents and young adults, this review also illustrates that interventions are likely to be most successful when they tailor the settings, methodologies and content to the particular age-group. However, the meta-analysis indicated that the effects of brief alcohol interventions were similar across different formats (computerized, non-computerized, one-on-one, and group).[296]

A systematic review on alcohol screening and brief intervention for adolescents (10–21 years of age) concluded that "despite an increasing interest in applying screening and brief interventions to an adolescent population, there are no clear indications of which target population, setting, screening tool or intervention approach can be recommended"(p.210).[299] Most of the interventions were in acute medical or educational settings, and the review recommends further research to be done on adolescent specific health settings.

Two systematic reviews have focused solely on school-based alcohol interventions, and don't have a specific focus on brief interventions.[300,301] One was of universal school-based prevention programmes, and found a small but positive effect, regardless of the intensity of the programmes.[300] This effect was only found with studies that recorded continuous outcomes (frequency and quantity of alcohol use), but no effect was found with studies that measured categorical outcomes (proportion of students who drank alcohol). Age and gender were not moderators for effectiveness. The review found positive outcomes a year after completion of the intervention, but no significant findings beyond one year post-intervention.[300]

The other systematic review with a focused solely on school-based interventions, which included universal and indicated interventions, and found that some may be effective in reducing alcohol use. On average, the interventions were associated with 1.4 days reduction in drinking in the past month. [301] The review found that the most effective methodology was motivational enhancement therapy, and that individual, rather than group implementation was more effective. The authors warn that some therapies that work on an individual level may not be successful when used in groups. They speculate that this may be due to deviancy training; however, they also note that group interventions did not tend to use the most effective methodology - motivational enhancement therapy, so it may be successful if this methodology is incorporated.

In the New Zealand context, Gifford and colleagues tested the feasibility of routine alcohol screening in primary care for those aged 15 and over.[302] Data and analysis were not reported separately for 15–24 year olds. For the general population, over an eight month period in Whanganui general practices, 43% of patients were screened, 24% were drinking above recommended levels of the Alcohol Advisory Council of New Zealand, and of those, 36% received brief advice or referral. Behavioural outcomes were not assessed. The authors argue that the study demonstrated primary care can "routinely query patient alcohol use and offer brief advice" (p.17).[302]

Sellman and colleagues argue that the Whanganui primary care example is important, since increasing the availability of brief interventions for heavy drinkers is part of the World Health Organization's measures to reduce alcohol harm, summarised as the 5+ Solution.[303] However, they argue that it may require a 90% screening rate across 90% of practices in New Zealand for there to be an impact on public health. Sellman and colleagues also point out that the Whanganui intervention was well funded and resourced, and had good leadership, yet still only managed to reach 43% of patients.[304] In an international context, Heather discusses whether general practice screening and brief intervention can lead to population-level reductions in alcohol-related harm, and makes the same points: that if success is possible, high screening rates and implementation of environmental alcohol control measures will be needed.[305]

Other drugs

One systematic review of primary prevention of cannabis use in youth and young adults found that primary prevention programmes can be effective, but effect sizes are often small or not significant.[306] The authors also found that universal multi-modal approaches (which utilize family, peer, community, and school-based components) may be better than uni-modal or targeted interventions; non-teacher facilitators or multiple facilitators may be more effective than using teachers only; programmes involving early and middle adolescence may yield results, albeit small, whereas late adolescence may not be effective; programmes with booster sessions were generally more effective; and, inconsistent with some previous cannabis research, shorter interventions may be more effective than longer ones.[306] Apart from e-interventions for cannabis use, which are discussed in a later section, no systematic reviews of interventions for youth and young adult other drug use were found in the literature.

The Ministry of Health has recently published *New Zealand Practice Guidelines for Opioid Substitution Treatment 2014*, which while not specifically directed at young people, is relevant to this group. The guidelines also covers the effects of adult use of opioids on family members who are children.[307]

Other mental health intervention studies

In the past few years, several systematic reviews or meta-analyses assessing the effects of adolescent and youth interventions for various mental health issues have been published, including for preventing depression,[308-313] anxiety,[308,309,311-313] stress,[314] and eating disorders.[312] Three of these reviews exclusively cover school-based interventions,[308,309,312] one covers university students,[314] and the other reviews were not limited to a specific setting. No systematic reviews were found in the literature of the last five years that exclusively focused on general practice interventions for mental health issues for youth or young adults.

One systematic review illustrated that not all studies purporting to be prevention interventions are correctly defined, and many have no effect.[312] The review of universal school-based studies defined a 'prevention effect' as one where the control group has increased symptoms or cases at time of follow-up. If the intervention group showed reduced symptoms and cases at the time of follow-up, these studies were defined as 'treatment studies'. Of 18 depression prevention studies, three demonstrated prevention effects, eight demonstrated treatment effects and seven demonstrated no effects. Of four anxiety prevention studies, none demonstrated prevention effects, and four demonstrated treatment effects. Of 14 eating disorder interventions, three demonstrated a prevention effect, five demonstrated a treatment effect and six demonstrated no effect. Another systematic review of universal school-based prevention interventions, as opposed to selective or indicated interventions, found that the majority of interventions for depression (65%) and anxiety (73%) were effective, however effect sizes were small.[308]

Two meta-analyses examined universal, selective and indicated interventions for depression.[309,311] Depression intervention effect sizes in these reviews followed a gradient from smallest effect with universal, to greatest effect with indicated interventions. Nehmy and Wade note that for universal prevention programmes, a small effect size is to be expected, especially compared to selected and indicated interventions.[312] The authors explain this is because universal interventions by definition, are working with healthy individuals, so there is less scope for change or improvement in participant and control groups compared with selected or indicated interventions. Selected or indicated interventions are, by definition, working with participant and control groups who are either at high risk of developing symptoms or symptomatic already, and therefore have more scope to show measurable changes from baseline. Decisions on which approach to follow should not be based on looking at the effect size alone, since this makes the mistake of not appreciating the relative population health benefits of each approach. A universal intervention with a small but true effect can have a large impact on population health, due to the large numbers of people participating.[312,315]

Stockings and colleagues found a gradient for anxiety in the opposite direction to depression, and postulate that this finding could be due to the lack of data for selective and indicated samples.[311] A similar gradient for anxiety was found by an older systematic review, although the gradient was not tested for statistical significance.[316]

Having a psychological component, such as cognitive behavioural therapy (CBT) was a characteristic of successful interventions in two reviews[310,311] as opposed to exclusively educational (information provision without any cognitive restructuring techniques) or physical (for example, team sport).[311] However, one review found the same elements in both successful and unsuccessful interventions.[312] The number and duration of intervention sessions was not associated with a difference in outcomes.[309,311] One review found no difference between health clinic, prison, or home settings compared to school-based settings.[311]

For universal prevention interventions, one review found no significant difference between school staff versus research staff implementers,[309] while another found that after 12 months, there was a greater effect for teacher or school employee implementers as opposed to clinicians.[311] Duration of effect was generally found to be short term,[310] returning to baseline after 12 months.[309,311] Stockings and colleagues ask whether this is due to natural decay or a reduction in power. If the former, then participants of depression and anxiety interventions may need to have repeated exposures.[311] If the latter, then repeat exposures may not be justified. Gearing and colleagues found support for booster sessions in CBT interventions for youth managing mood or anxiety disorders.[313]

Studies suggest that approximately 50% of tertiary students experience significant levels of anxiety and/or depression.[314] A meta-analysis by Regehr and colleagues found that cognitive, behavioural and mindfulness interventions were effective in reducing stress in university students, with an important secondary outcome being lower levels of depression.[314] Results of studies were consistent and similar, despite variations in length of approach (most commonly 4–8 weekly sessions, but sometimes one session followed by independent practice) and components, such as cognitive restructuring, relaxation and meditation. Males were underrepresented in the studies, therefore approaches are needed that meet their needs.[314]

An comprehensive systematic review by Weare and Nind, of 52 systematic reviews and meta-analyses from 1990 to 2011 extracted general principles from the more effective school based interventions.[317] Similar to the

reviews above, the effect sizes were generally small, although Weare and Nind argue that the real-world impacts were relatively large and were similar or higher than many other established preventive and treatment interventions. The review found that the characteristics of more effective interventions included:

- Teaching social and emotional skills focusing on positive mental health, integrated into the general classroom curriculum, rather than in isolation
- Embedding work within a whole-school approach, involving the school ethos, teacher education, liaison with parents, and coordinated work with outside agencies
- Starting early with the youngest children and continuing with older children. Booster sessions for older students can help overcome the diminution of effects
- Being long-term, including over several years. Nine months to a year was generally found to be more effective than shorter durations, and no reviews concluded that single, brief interventions have any worthwhile role
- Having a combination of a universal programme focus with robust targeted components added. The review was unable to conclude the best balance between the two
- Being implemented consistent with principles of empowerment, autonomy, democracy and local adaptability, but also with clarity and fidelity, so that whole-school approaches do not become too diluted.[317]

Sandler and colleagues undertook a meta-analysis of 48 meta-analyses from 2000 to May 2013, which covered the effects of mental health related prevention and promotion programmes for children, youth and young adults.[318] They found small but significant effects to reduce depression, anxiety, antisocial behaviour and substance use. Other findings were:

- The largest effect size was for anxiety interventions, followed by those that promote healthy development, and the smallest effect sizes were for depression, substance use, and crime/antisocial behaviour
- Effects were sustained over time, with benefits on many outcomes lasting one or more years. Further detail of which interventions maintained an effect for more than one year was not given
- Effects were larger for those at higher risk, although universal interventions with a smaller effect size might have a larger impact on population health because they reach more people
- Interventions that use interactive strategies, such as discussion of the programme material and practice of programme skills were more effective than didactic learning approaches. Interactive strategies were consistent with CBT approaches, which were common
- Motivational interviewing for alcohol use in college was successful, but this methodology was not applied to any other problems in the meta-analyses
- There were inconsistent findings regarding what length of programme was most successful
- In general, insufficient detail was provided regarding the comparison conditions compared to the intervention group
- Better quality implementation was associated with better results, although the level of detail of analysis was limited to whether an intervention had ‘any problems’ or ‘no problems’
- Regarding the implementer, findings were mixed, making it important to identify the conditions under which different providers will be more effective:
- Several meta-analyses found mental health professionals were more effective providers than non-professionals or teachers
- One meta-analysis of an anti-social behaviour prevention intervention found the professional level of provider made no difference
- Several meta-analyses of substance use prevention found larger effects for peer leaders compared to teachers or non-peers
- Several meta-analyses found that higher levels of provider training were associated with larger effects

- Contextual factors such as stressors or environmental factors such as poverty, cultural incompatibility, gangs, social network influences on substance abuse, and school discipline policies, have rarely been studied.[318]

Recent New Zealand literature:

Clark and colleagues found that young people aged 10–24 who received free counselling support in schools, homes and community-based services that were convenient to the young person, through the "Your Choice" programme reported significant improvements in global social and psychiatric functioning.[319] The most common reason for referral was for personal relationships, followed by family stressors, low mood, anxiety, grief and loss, alcohol and drugs, and on medication for mental health concerns. The programme consisted of one paid coordinator and a multidisciplinary team and cross agency triage team (public health nurses, general practitioner, public health registrar, psychiatric nurses from Child and Adolescent Mental Health Services, specialist youth health doctor, adolescent nurse specialist, social worker, Tobacco, Alcohol, and Drugs worker, and a psychiatrist).

Collings and colleagues, in the setting of general practices in Wellington, tested clinician and patient satisfaction of a brief intervention for sub-threshold mental health syndromes, consisting of three 15–30 minute coaching sessions over a 5-week period, and found that the intervention was regarded positively and appeared to improve the psychological well-being of the patients.[320] This small feasibility test excluded those under 18 years, but the intervention is currently the subject of a large randomized controlled trial in the Wellington region, involving youth, low income, or people with Māori or Pacific Island heritage, with results due in 2016.[321] A small pilot study found that a version of the intervention specially adapted for Māori was rated favourably by Māori patients and clinicians.[322]

Dath and colleagues found that a brief psychological intervention by a visiting clinical psychologist in a general practice setting had substantial benefits for the patients (as measured by pre and post scores on patient-completed rating scales) and for the practice, however, the intervention was limited to those 18 years and over, and only included 5 people between the ages of 18 to 30.[323]

e-interventions: computer and web-based interventions

Rising to the Challenge, and *Hīkaka te Manawa: making a difference for rangatahi*, published by the Health and Disability Commissioner and Te Rau Matatini, both call for the use of "e-therapies" to improve accessibility of treatment.[236,324] Using the term 'therapy' in 'e-therapy' is potentially confusing or over restrictive, since many mental health interventions are not therapies for an illness; they are prevention programmes for asymptomatic individuals, designed to prevent symptoms of illness. Therefore, this section generally uses the term 'e-interventions'.

In recent years there have been several systematic reviews of e-intervention effectiveness for youth and young people, covering mental health promotion, and prevention and treatment of many mental health disorders, most commonly, anxiety and depression, and substance misuse [325-337]. Of these, four specifically limit the reviews to tertiary education-based interventions,[326-328,335] and one limits to school-based interventions.[333]

The most comprehensive of these reviews of mental health conditions was a 2014 publication by the National Collaborating Centre for Mental Health, UK, that included 63 e-interventions for mental health disorders, including anxiety and depression, phobias, obsessive compulsive disorder (OCD), post-traumatic stress disorder (PTSD), eating disorders, attention deficit hyperactivity disorder (ADHD), conduct disorder, substance misuse, autism, Tourette syndrome, and psychosis.[337]

Several meta-analyses for anxiety and depression report positive effects for universal, selected and indicated e-interventions, mostly using CBT.[325,326,329,334-337] e-interventions for depression using social networking appear to be less effective.[336] One meta-analyses showed a positive effect compared to inactive controls, but not compared to 'active-controls', such as control participants viewing computer-based materials about depression and anxiety.[335] Web-based and face-to-face additional support from therapists was associated with improved efficacy,[325,326] while parental involvement was not.[334] Completion rates were often low, although highest in school settings.[325] Poor study design and study variability limited the ability to draw further conclusions about successful study characteristics.[325,326,336]

Findings for social phobia/social anxiety showed some promise with CBT.[337] or were inconclusive,[329] Inconclusive or no effects were found for other phobias and PTSD.[329,337] For OCD, one review found no effect,[329] while another found some effect for group videoconference CBT, although this was based on one study.[337] For ADHD, cognitive training (attention and working memory training) showed some promise, as did computerised parent training for conduct disorder.[337]

There is some evidence of effectiveness for e-interventions for several other conditions, but positive findings were based on one intervention only: online group CBT for eating disorders (but not for CBT for general eating disorders or for binge eating disorder); video conference CBT for OCD; video conference behaviour therapy for Tourette syndrome; and computerised social skills training for autism.[337]

There is some evidence that e-interventions have a small benefit on alcohol use in school students[333] and tertiary students.[328,337] The one review of school-based e-interventions found that four out of four studies were associated with small reductions in alcohol use.[333] Characteristics that may be associated with positive outcomes were having at least 4 sessions, having booster lessons, using social learning or social cognitive principles, and the inclusion of a parenting component.[333]

One review that was mainly of interventions for at-risk tertiary students, found positive outcomes associated with using personalised normative feedback and multi-component interventions (personalised feedback, CBT based protective behavioural strategies, alcohol facts, and resources for those interested in taking action)[328]. Another review found weak evidence for e-interventions reducing alcohol use for the general adolescent population, with or without personalised normative feedback.[337] No effect was found for alcohol-related problems.[328]

Evidence to support e-interventions for cannabis use was either weak[337] or based on one study which had a small effect size[333] or only showed results in the short-term and not as effective as in-person treatment[338] or e-interventions have shown no effect.[327] Given the lack of success, it has been suggested that strategies should try targeting individuals who already have high contemplation of reducing use.[327]

New Zealand e-interventions for youth and young adults

The New Zealand e-intervention SPARX is currently supported as part of the Prime Minister's Youth Mental Health Project. It is a CBT e-intervention for adolescents seeking help for clinically significant depression.[339-341] SPARX is an interactive fantasy game, comprising of seven modules, delivered over four to seven weeks. Studies found that SPARX appears to be a promising treatment, and not inferior to treatment-as-usual,[341] including for those excluded from mainstream education.[339] Those deemed to be of high risk of self-harm were excluded from these studies. SPARX has also been successfully adapted for sexual minority youth. A small trial in 21 13–19 year old sexual minority youth found that the e-intervention 'Rainbow SPARX' was thought to be useful and liked by participants, and depressive symptoms decreased.[342]

The e-intervention 'Reach Out, Rise Up', a text-message based intervention for mild to moderate depression and anxiety, was trialled for use on 21 young people in New Zealand.[343] In this pre-post assessment design, the 10-week e-intervention pilot showed positive outcomes, as assessed by the GAD-7 for anxiety and the PHQ-9 for depression. Half of the participants were randomly assigned a trained supporter, who phoned once a week. Support from trained supporters or family and friends did not significantly change anxiety and depression scores. Having a trained supporter increased scores on 'Feeling encouraged and supported'. Having support from friends and family did not increase this score.

A web-based brief intervention for hazardous or harmful drinking was trialled on Māori students who had screened positive, at seven New Zealand universities[344]. The intervention included personalised feedback of screening scores, associated health risks, blood alcohol levels, traffic crash relative risk, monetary expenditure, comparisons of drinking with other students and the general population, and links to further information and support services. Compared to controls, those receiving the <10 minute e-intervention drank less often, less per drinking occasion, less overall and had fewer academic problems.

The same study reported findings separately for non-Māori students.[345] Non-Māori students who received the e-intervention compared to non-Māori students who did not, consumed less alcohol per drinking occasion, but did not drink less often, nor less overall, did not have fewer academic problems, and effects on binge drinking were not statistically significant. Non-Māori participants reduced their total alcohol consumption by 5% (not statistically significant) compared to 22% for Māori students in the same trial. The authors postulate that this could be because Māori students may be more influenced by social norm feedback, due to having "a stronger group identity, enhanced by being a small minority in the university setting, a view consistent with social identity theory" (p.1223).[345]

The authors conclude that web-based alcohol screening and brief intervention alone cannot be relied upon to reduce unhealthy alcohol use in the university student population; it has to be paired "with environmental interventions such as restriction in the physical availability and promotion of alcohol" (p.1223).[345] Some recommendations for alcohol legislation in the New Zealand context have been made by the Law Commission, including increasing the price, reducing the availability, increasing the minimum purchasing age, and restricting advertising and promotion.[346]

Further e-intervention issues identified in the literature

The National Collaborating Centre for Mental Health conducted focus groups with young people, which concluded that young people's views must be taken into account in the design of e-interventions.[337] Other conclusions were that e-interventions need to be interactive, engaging and up to date with current new technology, integrated with other services, and that "it was evident that young people want e-therapies to be a part of the help they are offered, not a replacement for face-to-face therapies, and to foster a young person's autonomy and agency"(p.115).[337]

A large number of e-interventions are available, so it is important the public is informed about which e-interventions have been evaluated and shown to work, and which have not yet been evaluated.[330] The Beacon website,[1] developed and delivered by the National Institute for Mental Health Research at the Australian National University, "provides users with a comprehensive directory of e-health applications (websites, mobile applications and internet support groups), and includes reviews, expert ratings and user comments".[347] Stasiak and colleagues note that most e-interventions have predominantly been of a Western culture.[330] They also point out that technology moves fast, so e-interventions are at risk of being outdated quickly; and development, maintenance and security is expensive, so cost-effectiveness, relative to traditional therapies, needs to be considered.

In an analysis that examines the generalizability or otherwise of anxiety and depression e-interventions, a systematic review of 34 e-interventions covering all ages found that 50% of participants receiving CBT experienced clinically significant change.[348] However, in these studies, 49% of people were excluded from participating, most commonly for risk of suicide (91.7% of studies), and for substance or alcohol abuse (75% of studies).[348] Wilks and colleagues found that the number of exclusion criteria was strongly and positively correlated with the proportion of participants experiencing clinically significant change for anxiety studies and conclude that effectiveness of CBT e-interventions may decline with clinical complexity.[348] The problem of limited generalizability due to exclusion criteria is not limited to e-interventions.[284]

Selected high-needs groups

Māori, Pacific and sexual minority youth are at high risk of poor mental health outcomes or have been identified as priority groups by the Ministry of Health.

Māori youth and young adult mental health

Te Puāwaiwhero: The Second Māori Mental Health and Addiction National Strategic Framework 2008–2015 notes that Māori youth (rangatahi) are particularly vulnerable, and addressing their needs is a priority.[349] *Te Puāwaiwhero* calls on DHBs to have early intervention strategies for rangatahi, and increased access to specialist mental health and addiction services.[349] In *Rising to the Challenge*, the Ministry of Health acknowledges that the Māori population experience more mental health issues, inpatient admissions, seclusion, compulsory treatment and have higher rates of youth suicide than non-Māori.[236] The Ministry of Health also acknowledges that Māori rates of mental disorders are not fully explained by socioeconomic status and age structure,[236] referencing findings in *Te Rau Hinengaro: The New Zealand Mental Health Survey*.[350] Baxter provides more detailed analysis of the prevalence of mental disorder among Māori from this survey.[95]

To address Māori mental health, the government aims to increase access to kaupapa Māori interventions, and calls on DHBs to offer kaupapa Māori services "where the number of Māori who need a service is sufficiently high and Māori are not achieving equitable outcomes relative to other populations from mainstream service use" (p. 35).[236] Since most Māori still access mainstream services, mental health clinicians are asked to "incorporate knowledge of tikanga, whānau ora and Māori models of care and cultural competence in working with Māori" (p 60).[236] There is evidence supporting this general approach; a systematic review found that making cultural adaptations to psychological treatments for depression improves outcomes.[351] The Ministry of Health strategy also makes reference to "developing a workforce that reflects the population served" (p 32),[236] which will be discussed in relation to the Māori workforce below.

The Werry Centre provides an overview of current Māori mental health services and access for 0–19 year olds.[230] An important finding is that secondary service access rates for Māori children and adolescent have improved in recent times, and are higher than the national average access rate, and higher than access rates for Pacific and Asian 0–19 year olds. For the 15–19 year olds, the access rate for Māori is 8.07%, compared to the

[1] https://beacon.anu.edu.au

whole population rate of 5.84%. All four DHB regions exceeded the national target for 15–19 year olds of 5.5%; from 7.58% in Midland to 8.45% in Northern.

The Werry Centre note that Māori have double the prevalence rates of mental health disorders compared to the general population, so rangatahi continue to be a population of high need for mental health services.[230] It is not clear from the literature whether Māori youth and young people have double the rates of all mental health disorders. *Te Rau Hinengaro: The New Zealand Mental Health Survey* data from 2003/2004 found that the 12 month prevalence of mental disorder for 16–24 year old Māori was 33.2% (95% CI 27.1, 40.1), slightly higher, but not statistically significantly different to the 12 month prevalence for all New Zealand 16–24 year olds, which was 28.6% (95% CI 25.1, 32.3).[95,350]

The 2012 national health and wellbeing survey of secondary school students found that 13.9% of Māori students reported depressive symptoms (up from 10.6% in 2007), which was not different from New Zealand European/Pakeha students.[338] However, 6.5% (compared to 6.9% in 2007) of Māori students reported making a suicide attempt in the previous 12 months (9.2% for females compared to few or none for males), which is twice that reported by New Zealand European/Pakeha students.[338] Among Māori students, 22.2% saw a health professional for emotional worries compared to 18.4% of the whole student population, although the difference was not statistically significant.[2112,338] The proportion of Māori students reporting good emotional wellbeing was similar to the whole student population (75.1% compared to 76.2%).[112] The 2012 national health and wellbeing survey found that among female students 15 years or older, Māori were more likely to drink alcohol weekly than New Zealand European/Pakeha students.[338] There was no difference for males.[338] Analysis of the Māori sample from the 2007 national youth health survey found that "Binge drinking was associated with poorer school performance, unsafe sex, unwanted sex, an injury, injuring someone else, motor vehicle crashes and 'doing things that could cause trouble'"(p.55).[112] Māori students were more likely to report using marijuana on a weekly basis than New Zealand European/Pakeha students.[338]

Youth suicide is an area where Māori youth have consistently had substantially higher rates than non-Māori.[292] In 2012, the Māori youth suicide rate (15–24 year olds) was 2.8 times the rate for non-Māori youth.[292] Māori youth suicide rates have been at least 1.7 times higher than for non-Māori from 2003 to 2012.[292] Provisional figures released by the Chief Coroner show that from 2007/2008 to 2014/2015, the number of Māori youth suicides peaked at 2011/2012 with 56 and has decreased since then to 42 in 2014/2015.[352]

The Werry Centre found a 12% increase in the total Māori ICAMH/AOD workforce between 2012 and 2014, which now makes up 18% of the total ICAMH/AOD workforce.[230] Given that Māori 0–19 year olds make up 25% of the total population and 31% of those accessing mental health and AOD secondary services,[230] the workforce still does not reflect the population served, which is an aim of *Rising to the Challenge.*[292]

Hīkaka te Manawa: making a difference for rangatahi, acknowledged that there was little evidence of which mental health services worked best for rangatahi, so gathered information from 21 Māori mental health services from across New Zealand to identify factors of success and common challenges.[324] The Factors facilitating positive outcomes were: implementing the Choice and Partnership Approach; incorporating Māori values and cultural models into service philosophy and delivery, which was most evident in kaupapa Māori services; using rangatahi-focused care settings; peer support, for example rangatahi using services encouraged to take on peer support roles; using a whānau-inclusive model, generally engaging with whānau in their own environments, on their terms; community involvement an cross-agency collaboration, for example, with school and youth justice system; having a committed, skilled and culturally competent workforce; and having a collaboratively planned exit strategy from the service.

The Choice and Partnership Approach is a clinical system that "aims to provide services to young people that are user-friendly, designed around their needs, accessible, safe and effective. The system uses quality parameters combined with processes to facilitate pathways through the service, attempting to avoid unnecessary waits. In doing so, it attempts to place the needs of families at the centre of CAMHS. There is a shift in clinician stance from 'expert with power' to 'facilitator with expertise'"(p.6).[353]

There were a number of challenges identified in *Hīkaka te Manawa* including the complexity of clinical presentations, the need for additional focusing or resources in several service areas, having to have multiple short-term contracts with differing reporting structures, contract parameters that restrict access to certain age groups, engaging whānau in the face of logistical and economic challenges, a shortage of specialist child and adolescent psychiatrists and clinicians, and a major shortage of a trained Māori workforce.[324]

Hīkaka te Manawa makes 14 recommendations to build on the strengths and address these challenges:[324]

[2] This measures a combination of prevalence and access, rather than prevalence alone.

Funding and planning

- Prioritise funding and planning for rangatahi mental health and addiction services that foster growth and development.
- Increase the capacity of NGOs, particularly kaupapa Māori NGOs in the specialist area as well as improving access to early intervention through primary care.
- Increase the availability of parenting programmes that work for whānau and rangatahi who are parents.
- Build the capacity and capability of funding and planning teams to strengthen links within the sector and between providers.
- Adopt a life-course approach to funding for rangatahi and for consistency in contracting, and close the gaps in service provision due to differing age groups in provider contracts.
- Adopt a more flexible funding model for contracting and reporting.

Workforce

- Prioritise activity to address youth workforce shortages to respond to the needs of rangatahi and whānau.
- Workforce centres must provide development and training solutions to increase competence in both clinical and cultural domains.
- Professional bodies should also support clinical and cultural competency requirements in the workforce.

A model/philosophy for services for rangatahi

- Promote a rangatahi development model at the primary care level whereby providers offer a range of services required for rangatahi development.
- Services must adopt an outward-looking approach in the sector and participate in community forums and networks to support the improved communication and linkages with other relevant services for their populations.
- Increase accessibility of e-therapies and other self-help options that increase access and positive outcomes for rangatahi.

Conduct disorder

- Early access to psychological support and therapies.
- Enable access and availability of psychological therapies or a rangatahi development model of service in primary care settings.

A study based on 30 interviews with rangatahi from six DHB CAMHS found several factors that rangatahi appreciated: formal and informal entry referral pathways into CAMHS, such as the emergency department or through whānau supporting them to access services; whānau being able to accompany them to the first referral, and clinicians with good listening skills, who valued rangatahi views; a whānau type environment rather than clinical, and a whānau partnership approach; services that helped rangatahi through cultural processes to enhance cultural identity; and help with goal setting and plans.[354]

Pacific youth and young people's mental health

In 2008, the Ministry of Health published *Pacific Peoples and Mental Health,*[355] which noted Pacific under 20 year olds had the lowest rates of use of services of all ethnicities. The publication noted the need for improved information and evidence to inform policy. In *Rising to the Challenge*, Pacific peoples are listed as a priority group.[236] In areas where there is a sufficiently large population of Pacific people experiencing inequities in mental health or addiction issues, DHBs are expected to reprioritised funding to Pacific services and evaluate whether these are more effective than mainstream services.[236]

The latest Ministry of Health plan for improving health outcomes for Pacific people *is 'Ala Mo'ui: Pathways to Pacific Health and Wellbeing 2014 – 2018.*[356] This reiterates the strategies of *Rising to the Challenge,*[236] and documents DHB initiatives and progress on access rates to mental health services (but not specifically for youth).[357]

The Pacific population in New Zealand is diverse, made up of more than 22 different ethnic groups.[358] It is also comparatively young; 41% of the Pacific population is aged 0–19 years.[230] Among the 0–19 years age group, 71% live within the Northern DHB regions, and of these, 55% live in Counties Manukau.[230] The Werry Centre Stocktake reports on services and service use of CAMH/AOD for the Pacific child and youth population, using prioritised ethnicity,[230] which may underestimate the Pacific population[359-361]. The Werry 2014 Stocktake findings are summarised below.[230]

Two DHBs, Counties Manukau and Capital & Coast, provide dedicated Pacific CAMH/AOD services. In Waitemata, Pacific children and youth have access to two services funded under adult services. Also, six NGOs across the country provide dedicated pacific CAMH/AOD services; one in each of Northern, Midland, and Southern region, and two in Central region. For 15–19 year olds, access rates to any CAMH/AOD service was 4.16%, below the Government target of 5.5%[228,230]. By DHB regions, access for Northern was 4.25%, Midland, 3.42%, Central, 4.56%, and Southern, 3.06%[230].

From 2012 to 2014 there was a 26% increase in the total Pacific ICAMH/AOD workforce, 13% in clinical roles. The Pacific workforce makes up 7% of the total ICAMH/AOD workforce. This compares with Pacific 0–19 year olds making up 10% of the 0–19 year old population and accounting for 6% of CAMH/AOD service use. This appears to show that the Pacific proportion of the workforce matches current Pacific access use. However, access use is lower than what would be expected if compared to the percentage of 0–19 year olds who are Pacific, especially since Pacific people are reported to have a higher burden of mental disorder than the general population.[355] Survey responses from Pacific CAMH/AOD services stated that some of the workforce staffing difficulties were related to shortages of senior qualified Pacific health professionals, loss of funding for targeted recruitment initiatives, and no positions available to fund any more staff.[230]

As is the case in Māori mental health, it is not clear from the literature whether Pacific youth and young people have higher rates of all mental health disorders, although high rates of deprivation exacerbate the Pacific population's poor mental health outcomes.[362] From *Te Rau Hinengaro: The New Zealand Mental Health Survey* data (2003/2004), 12 month prevalence of mental disorder for 16–24 year old Pacific people was 29.0% (95% CI 22.0, 37.0), slightly higher, but not statistically significantly different to that of all New Zealand 16–24 year olds, which was 28.6% (95% CI 25.1, 32.3).[350]

Pacific results for the 2012 national health and wellbeing survey of secondary school students have not been published to date.[363] Results from the 2007 survey found that compared to New Zealand European/Pakeha students, a higher proportion of Pacific students reported depressive symptoms and making an attempt to kill themselves.[364] The 2007 survey also reported that there was no difference in the prevalence of binge drinking and other illegal drug taking between Pacific and New Zealand European students, but Pacific students were more likely to be weekly marijuana smokers.[364]

Te Pou o Te Whakaaro Nui published a practice guide for effective talking therapies for Pasifika Peoples.[365] Youth are not the focus of the publication, although for child, adolescent and family services, the importance of storytelling and externalising difficulties is noted. The practice guide used a practice-based observations approach, due to limited published research on interventions for Pacific peoples. General features of successful therapies were that they used a strength-based approach, were holistic, and adapted to Pacific culture.[365] Pacific culture generally places importance on building relationships, spirituality, and has a "collective approach… governed by a complex set of inter-relationships between individuals, their families and their communities… often upheld through adherence to a set of core values and practices." (p.14)[365]

Regarding youth suicide in the New Zealand Samoan population, Tiatia notes that Samoan constructs of emotion, particularly anger and shame, must be considered for effective service delivery.[366] Other essential factors identified through interviews with Samoans who had made a suicide attempt and/or had suicidal ideation and were engaged in a mental health service, were the importance of cultural competency, family inclusion, and recognising the differences in Samoan and Western views of mental illness.[358] Regarding alcohol and Pacific youth, Suaalii-Sauni and colleagues found that key communities of influence on decision making were families (especially siblings), peers and the church.[367]

Sexual minority youth

Internationally, sexual minority youth (which can include lesbian, gay, bisexual, transsexual, intersex (LGBTI) or gender nonconforming, and questioning) are more likely to experience depression, suicidality, including attempts requiring medical attention, problematic substance use and alcohol use, and peer victimisation.[368-370] Homophobia and minority stress[3] status have been noted as the main threats to sexual minority youth mental

[3] "a cumulative burden of being reminded that one is different from the majority" (p 657) [369]

health.[369] The past decade has seen the development of several services tailored to sexual minority youth, offering "barrier-free" care, typically in urban 'one-stop-shop' settings.[368] Cultural competence of mainstream services and staff is important, since most sexual minority youth will be cared for in traditional health care settings.[368,369,371]

Results from 12 unique studies of lesbian, gay and bisexual youth indicated that the strongest risk factors for substance use were victimization, lack of supportive environments, psychological stress, internalizing/externalizing problem behaviour, negative disclosure reactions, and housing status.[371] The review suggests that interventions that address ways to avoid and cope with peer victimisation or provide mentoring to strengthen perceived support from adults at school may be more effective than universal interventions. Clinicians need to be prepared to promote positive relationships with family and friends, policies of no-tolerance of bullying in schools, inclusion of resources in schools, and promote on-site mental health services.[370]

In primary care, sexual minority youth often do not feel comfortable discussing issues related to their sexuality unless broached first by the clinician.[369] Factors that make discussing issues easier are having sexual minority brochures and symbols on display, having clinical and non-clinical staff use non-discriminatory language consistently, having unisex bathrooms, and just asking.[369]

In New Zealand, the Christchurch Health and Development Study and the Dunedin Multidisciplinary Health and Development Study have found increased risk of suicide attempts and other mental health problems in non-heterosexual youth and young people.[372] The New Zealand National Youth and Health Wellbeing Survey in 2012 found that sexual minority youth had higher odds of attempting suicide and were 3.7 times as likely to have depressive symptoms as other youth, which had increased from 2.4 times as likely in 2001.[340,373]

An email survey of mental health service providers and LGBTI stakeholders in New Zealand revealed five LGBTI-focused mental health services, from Auckland, Wellington and Christchurch.[372] These are Auckland CADS (Community Alcohol and Drug Services), OUTLine New Zealand, New Zealand AIDS Foundation (NZAF), Rainbow Youth, and City Associates. In relation to mental health, these services work mainly at a settings level (e.g. in schools) or at the personal level (e.g. counselling).[372] The 124 stakeholder informants and respondents (nine aged 20 years and under and 30 aged from 21–30 years) identified various issues in mental health services. Access to and competency of mental health services were the overarching issues. A lack of services, programmes and funding for LGBTI mental health initiatives by DHB public health units was identified. Cost was seen as a financial barrier to accessing services. Ensuring culturally safe and appropriate services was important, including mental health staff displaying appropriate attitudes, having the necessary skills for working with LGBTI, and avoiding making assumptions regarding sexual and gender identity. The safety of young people in schools was seen as important. Teachers need to be trained in suicide prevention, mental health promotion, preventing bullying and challenging homophobia.[372]

In 2013, the symposium "LGBTTI[4] Well-Being and Suicide" was held involving Affinity, Auckland DHB, the Mental Health Foundation, Rainbow Youth and Outline. A report following on from this symposium, *Rainbow Health: The Public health Needs of LGBTTI Communities in Aotearoa New Zealand with Policy Recommendations,* made five recommendations for the New Zealand health system (p.9):

- Rainbow community service users will receive equitable and culturally safe access to general and mental health services across their lifespan.
- The particular health needs of tangata takatāpui will be considered and addressed in line with the state's obligations and commitments under the Treaty of Waitangi and the principles of partnership, protection and participation.
- All health services will be supported and resourced to deliver culturally sensitive and appropriate services for Rainbow communities
- Rainbow communities will be actively involved with and consulted about the development and delivery and evaluation of appropriate policies, programmes and services.
- Research and data collection on the physical and mental health needs of Rainbow communities will be a priority for health research.[374]

Some other high-needs groups not covered in this chapter due to space are youth in out-of-Home Care, youth and young people in Forensic Services, and refugee youth and young people. Some of the lessons and recommendations in the literature from analysis of Māori, Pacific and sexual minority youth are also relevant to

[4] Lesbian, Gay, Bisexual, Transsexual, Transgender and Intersexual

these populations, such as having a culturally competent workforce and services, sensitive to and accepting of diversity.

For more information regarding youth In out of Home Care, see *Mental Health Services for Vulnerable Children and Young People: Supporting children who are, or have been, in foster care*.[375] For youth and young people in Forensic Services, see *Youth Forensic Services Development Guidance for the health and disability sector on the development of specialist forensic mental health, alcohol and other drug, and intellectual disability services for young people involved in New Zealand's justice system*,[376] *A Literature Review: Mental health & alcohol and other drug screening, assessment and treatment for Youth Justice populations*,[377] and Richardson and colleagues.[378] For refugee youth, see *Refugee Health Care: A Handbook for Health Professionals*,[379]and Tyrer and colleagues.[380]

Conclusion

There has been considerable change in mental health specialist service access for youth and young people over the past two decades. Access rates for 15–19 year olds are above current targets, and are highest for Māori, although Pacific youth are accessing services below target rates. Access rates for 20–25 year olds are not covered as well in the literature.

The focus twenty years ago was to increase access to those needing specialist services, and has now broadened to include the larger population of people who have mild to moderate illness. The Youth Mental Health Project and to a lesser extent, the Children's Action Plan cater for this population, through integrated services involving several government agencies and sectors.

Barriers still prevent most youth and young people with mental illness accessing mental health services. Social support, culturally competent and friendly health care workers, and services specifically tailored to this age group, such as Youth One Stop Shops, can increase access. Services are mostly not organised by children's developmental stages, causing problems when children transition from child to adult services. A combination of Age-continuum services, which cater for a wider age range, usually up to 25 years of age, and Shared management services, which utilise transition coordinators who help ease the transition from child to adult services, are needed in all mental health systems. Several examples of these models of care are operating internationally, and to a lesser extent, in New Zealand.

Workforce shortages and workforce development have been identified as issues for at least 20 years, and continue to be an issue, especially regarding recruiting a workforce that reflects the population of New Zealand (particularly Māori), and a general lack of specialist CAMH clinicians. In line with the focus on increasing services for those with mild to moderate illness, up skilling the primary care and mainstream workforce has been recommended.

Primary care has been given a greater focus in recent Mental Health strategies. General practice has been asked to take a greater role by screening for mental health illness and treating mild to moderate illness using integrated models of care involving mental health specialists. The literature has identified that more guidance and research is needed for primary care level screening tools, and specialist care must be accessible to the primary care clinician. This can be in the form of consultation liaison or collaborative models; the latter appears to more effective, although may not be cost-effective.

GP training, including in skills that increase the therapeutic alliance, may make clinicians and services more appealing for youth and young adults, and may reduce the burden on specialist services. GP training in brief interventions for general pretentions and in evidence-based interventions for specific diagnoses has been recommended, but there is no clear evidence on what this training should be.

School environments can influence the mental health of their students. The mental health of students is associated with schools with more health services. Students are also more likely to seek help for a mental health issue if a teacher at school knows them.

There is evidence that primary care mental health and alcohol interventions, e-interventions or otherwise, can have positive outcomes. However, not all interventions do. There is a vast amount of literature covering many settings, illnesses, and populations. The same programme characteristics are found in successful and unsuccessful programmes, making it difficult to make general conclusions for future programme implementers to follow. To some extent, what will work best will depend on the local situation. However, the discussion above includes guidance from several systematic reviews and meta-analyses. Given many interventions have no effect and that studies' exclusion criteria may limit generalisability, evaluation of outcomes is important.

Special attention needs to be paid to several high risk youth and young person groups, including Māori, Pacific, and sexual minority youth and young people. Some themes are common to many of these groups, including having culturally competent, friendly, non-judgemental mental health staff, who are aware of the increased mental health needs of these groups. The mainstream health workforce and others who work with youth and young adults also need these skills and knowledge. Having a mental health workforce that reflects the population it is serving is also important. The aim is to provide culturally sensitive and developmentally appropriate services designed around youth and young people. Having youth and young people involved in the service design and incorporating Māori, Pacific and other cultural models into practice will assist with this.

ACCESS TO MENTAL HEALTH SERVICES

Introduction

Globally, mental health and substance use disorders are the leading cause of disability in those aged 0–24 years.[381] Most high prevalence disorders emerge during adolescence and early adulthood, with an earlier age of onset associated with a longer duration of untreated illness and poorer outcomes.[382] Risk factors for the development of mental disorders in children can be divided into child characteristics and family characteristics[383-386]. Child characteristics include gender, age, ethnicity, sexual orientation, physical health, alcohol, drugs, lifetime history of environmental exposures to toxins (lead), social environment and stressful life events. Family characteristics include parental education, age, social class, employment, psychiatric and medical history, family function and structure, and neighbourhood and broader contextual influences on the health of children and their families. Neighbourhood problems that have been linked to common mental disorders are poverty, poor living conditions and social stressors such as violence and victimisation. A parental history of mental disorders is one of the most consistent risk factors for the development of mental disorders in children.

In New Zealand, research on the community prevalence of mental health disorders in children and young people is scarce. The most recent data are from the Youth2000 Survey Series.[112] The 2012 survey found that among secondary students almost 9% of males and over 16% of females had significant depressive symptoms and slightly higher percentages of males and females had suicidal ideation.[291] The 12-month prevalence for any mental disorder in 16–24 year olds was almost 30%[350] and was highest for Māori, followed by Pacific people and non-Māori non-Pacific peoples, although these differences reduced after adjustment for age, sex, education and household income.[96] Older studies showed that at the age of 15 years, almost 30% of females and over 15% of males met diagnostic criteria for at least one mental health condition. By 18 years, this had increased to almost 45% of females and 42% of males.[386] For those aged 18 years the 12-month prevalence of mental health disorders was over 36% and the most prevalent disorders being major depressive episode, alcohol dependence and social phobia.[387]

In most countries provision of mental healthcare for children and young people does not provide satisfactory care, and the gap between need and access is broadest for those aged 12–25 years.[388] Those with the most severe disorders tend to receive mental health services, but fewer than half of young people with current mental disorders receive mental health specialty treatment.[384] Some factors affecting access are stigma, healthcare costs, restricted human resources, cultural aspects, artificial age boundaries of services, and clinical presentation. However e-technologies, collaborative care and innovative models based on developmental stages of children and young people are being implemented to improve access.[388] Help-seeking, clinical diagnosis and treatment of child and adolescent mental health disorders has increased over recent decades with evidence for increased prevalence of some conditions but not all.[389]

In New Zealand the proportion of children and young people accessing specialist services has increased.[230,231] and the focus of services has broadened to address the needs of those who have mild to moderate mental health issues, recognising the benefits of early intervention in a person's life course and course of illness, and on building resilience.[234-236] Pacific peoples and Māori were significantly less likely than non-Māori non-Pacific peoples to have had a visit to any service for a mental health problem, suggesting that relative to need, Pacific people and Māori are less likely than non-Māori non-Pacific peoples to have contact with services.[96]

The following section uses data from the Programme for the Integration of Mental Health Data (PRIMHD) to review mental health service provision including substance use disorders for 0-24 year olds. In addition an in-depth topic mental health issues in 15–24 year olds explores mental health issues and services with a focus on the mental health service structure and primary level care. Gidelines and international systematic reviews that consider the effectiveness of interventions to improve mental health outcomes for children published since the NZCYES 2012 report[103] are summarised at the end of this section.

Data source and methods

Indicators

Number of 0–24 year olds accessing mental health services
Number of 0–24 year olds accessing mental health services with a mental health diagnosis

Data sources

Numerator: PRIMHD (Programme for the Integration of Mental Health Data)

Denominator: Statistics NZ Estimated Resident Population

Definition

Clients accessing mental health services refers to any individual that has had a contact within the period of interest as captured within PRIMHD

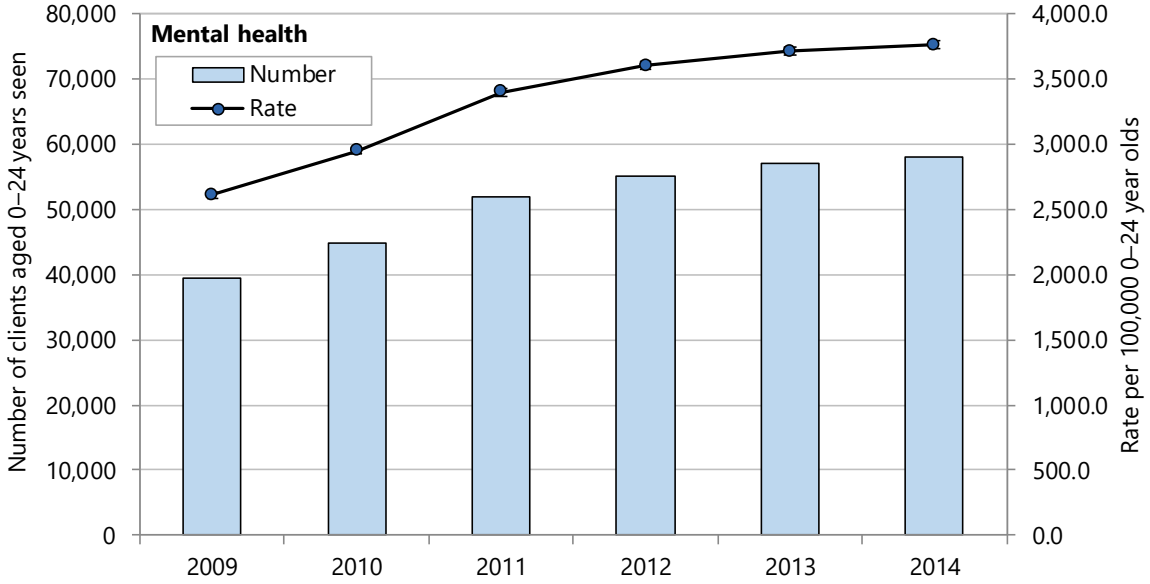
Notes on interpretation

Note 1: PRIMHD is the Ministry of Health's national database covering the provision of publicly funded secondary mental health and alcohol and drug services. Commencing on 1 July 2008, it integrates information from the previous Mental Health Information National Collection (MHINC) and the MH-SMART data collection. It includes secondary inpatient, outpatient and community care provided by hospitals and non-government organisations (although data from NGOs are incomplete). It does not include information on outpatient visits to paediatricians. If local referral pathways result in children seeing a paediatrician rather than a mental health professional for behavioural or emotional problems, this may significantly underestimate the prevalence of mental health issues (e.g. autism, ADHD, learning disorders) in the community. Referral pathways are likely to vary both by region (depending on the availability of specialist child and youth mental health services) and by age (with the role of the paediatrician decreasing with increasing age). Paediatric outpatient data are currently not coded by diagnosis, making it difficult to assess the underlying prevalence of mental health conditions in the community. The PRIMHD may provide a better reflection of access to secondary services for mental and behavioural issues in young people.
Note 2. Between 2009 and 2012 more NGOs began reporting to PRIMHD and some of the reported rate increases will represent an increase in reporting rather than an increase in services accessed.[390]
Note 3: Age is derived from first contact in year.
Note 4: The known practice and data quality issues with PRIMHD data may be more significant for children and youth than for adults, as practitioners may be reluctant to confirm a diagnosis at a young age due to developmental stage, uncertainties about diagnosis, and the potential stigma and discrimination. PRIMHD has utilised multiple coding systems for capturing mental health diagnoses. It also records principal, secondary, and provisional diagnoses for clients at each contact, in a large number of cases diagnoses were missing or deferred. Therefore analyses on diagnoses have not been presented.

National trends and distribution

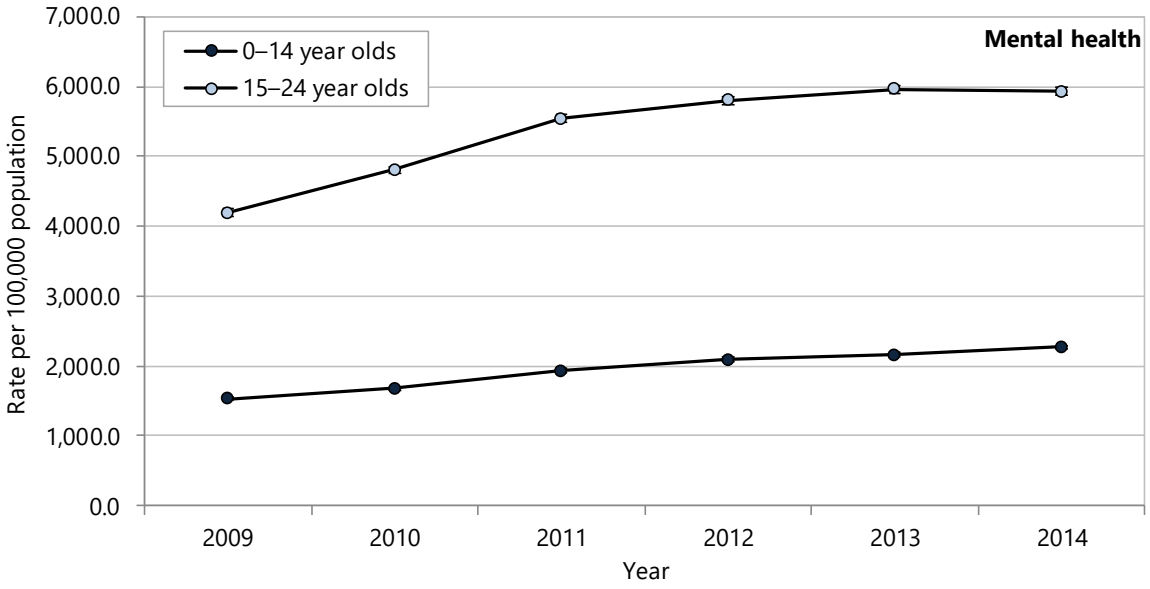
The number and rates of 0–24 year olds being seen by mental health services, as captured within PRIMHD, steadily increased from 2009 to 2012 before starting to flatten to 2014 **(Figure 195)**. Similar patterns were seen within the age groups, although the rates of 0–14 year olds accessing services were considerably lower than for 15–24 year olds **(Figure 196)**. It must be remembered that there are significant practice and data quality issues with PRIMHD and these increases may be a reflection of other factors, such as increased reporting and data capture, rather than solely an increase in engagement.[390]

Figure 195. Clients aged 0–24 years seen by mental health services, New Zealand 2009–2014



Numerator: PRIMHD; Denominator: Statistics NZ Estimated Resident Population; Some clients may be seen in multiple years

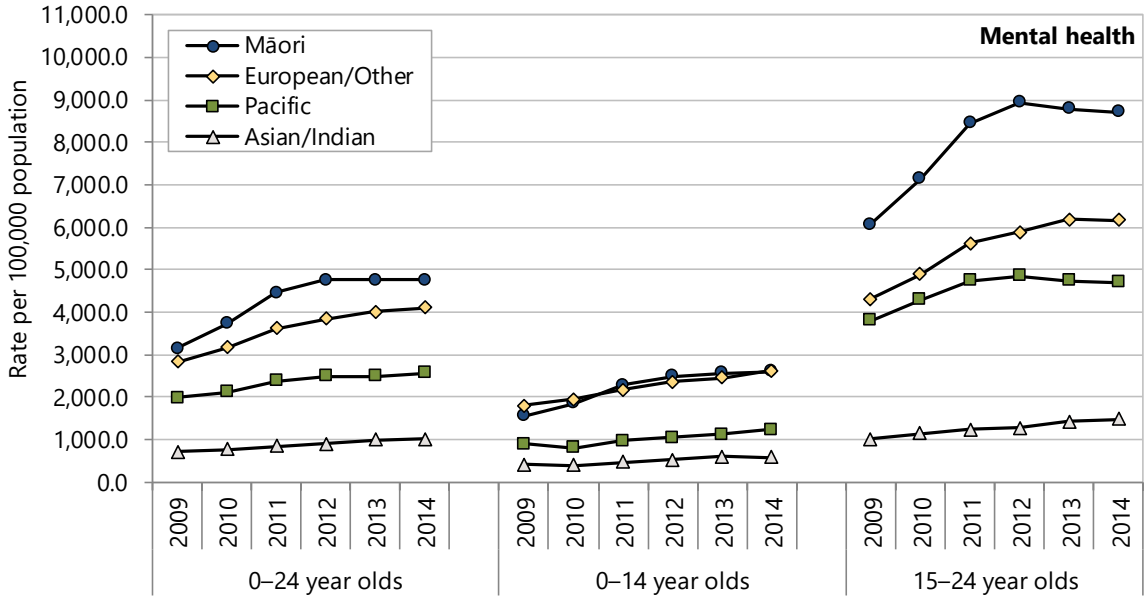
Figure 196. Clients aged 0–24 years seen by mental health services, by age group, New Zealand 2009–2014



Numerator: PRIMHD; Denominator: Statistics NZ Estimated Resident Population; Age is derived from first contact in year; Some clients may be seen in multiple years

Rates at which 0–24 year olds were recorded as being seen by mental health services from 2009 to 2012 were consistently highest for Māori, followed by European/Other, Pacific and then Asian/Indian. Rates for 15–24 year olds followed the same pattern by ethnicity as for 0–24 year olds. For 0–14 year olds, rates for Māori and European/Other were similar and highest, followed by Pacific, then Asian/Indian **(Figure 197)**.

Figure 197. Clients aged 0–24 years seen by mental health services, by age group and ethnicity, New Zealand 2009–2014

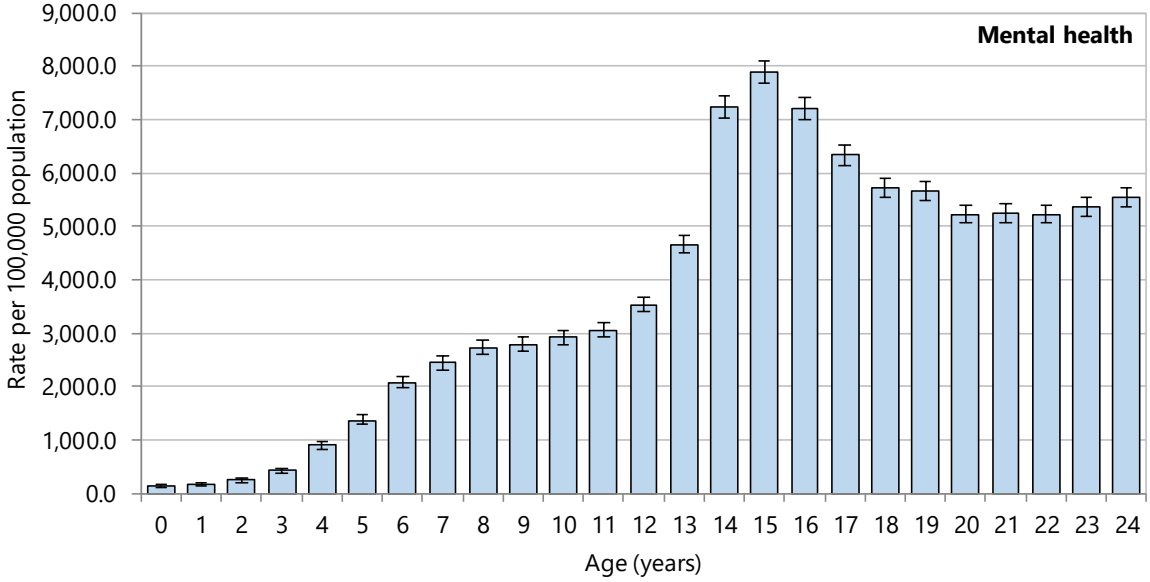


Numerator: PRIMHD; Denominator: Statistics NZ Estimated Resident Population; Ethnicity is level 1 prioritised

Distribution by demographic factors

In 2014 few children aged less than three years were seen by mental health services. From ages 3–8 years, there was a steady increase in the rate of being seen with increasing age. The increase until the age of 11 years was more gradual but from 12–15 years, there was a steep increase in young people being seen which peaked at 15 years before a steady decrease in the late teenage years. Rates were similar for young people through their early 20s **(Figure 198)**.

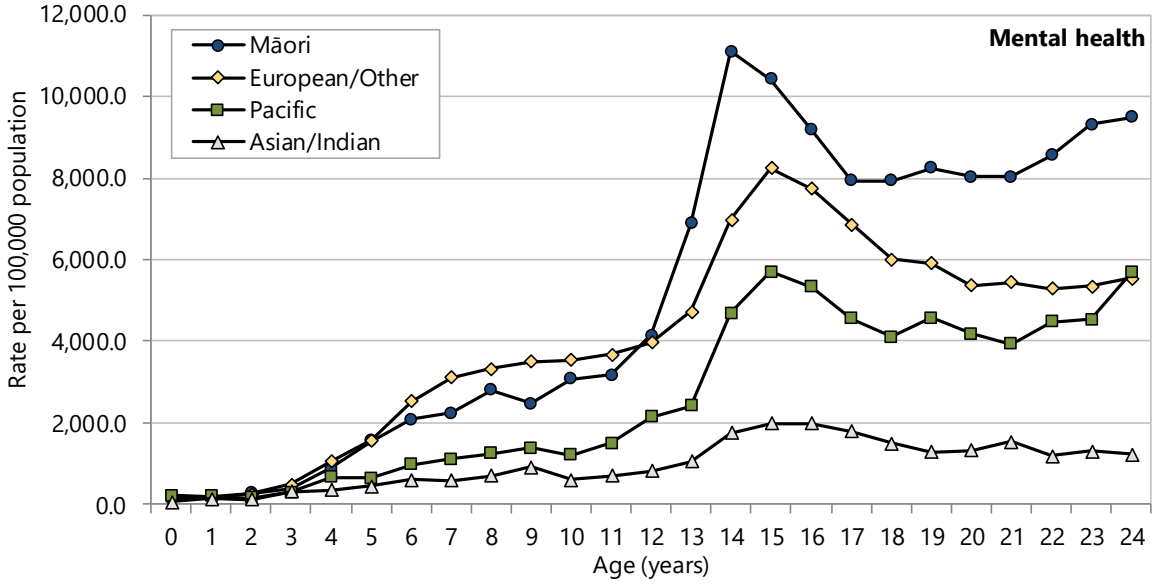
Figure 198. Clients aged 0–24 years seen by mental health services, by age at first contact of year, New Zealand, 2014



Numerator: PRIMHD; Denominator: Statistics NZ Estimated Resident Population; Age is derived from first contact in year

Similar patterns of being seen by mental health services were seen by age for all ethnic groups in 2014. Until age 12 years, European/Others had the highest rates, followed by Māori, Pacific and Asian/Indian. From age of 2–24 years Māori had the highest rates, followed by European/Other, Pacific and Asian/Indian. By age 24 years, the rates for Pacific and European/Others converged **(Figure 199)**.

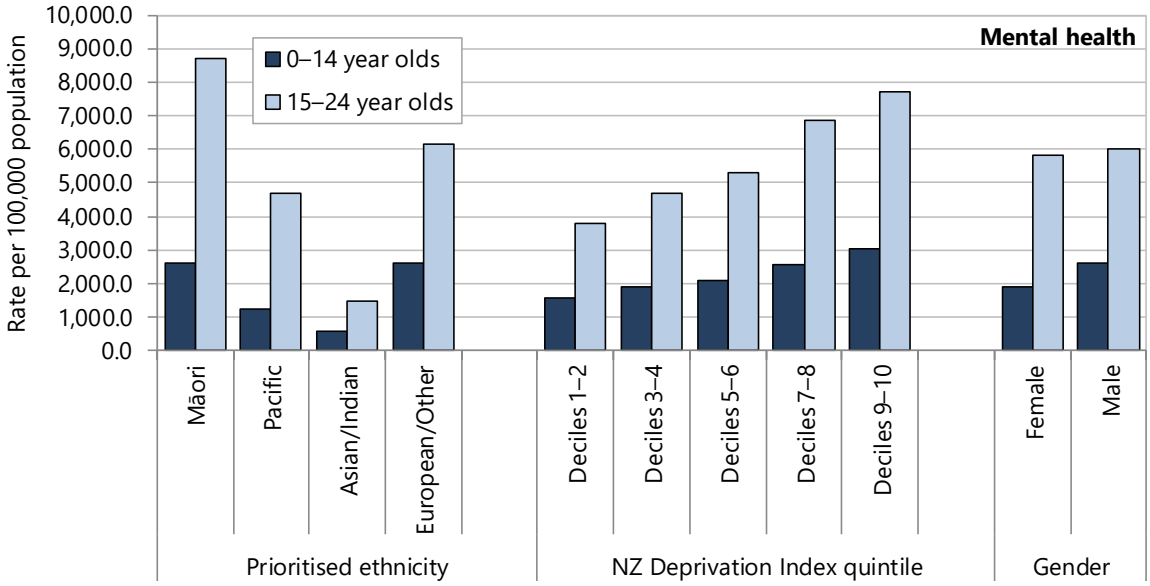
Figure 199. Clients aged 0–24 years seen by mental health services, by age and ethnicity, New Zealand 2014



Numerator: PRIMHD; Denominator: Statistics NZ Estimated Resident Population; Age is derived from first contact in year; Ethnicity is level 1 prioritised

In 2014 the rates for 0–14 year olds seen by mental health services were higher for Māori and European/Others, followed by Pacific and Asian/Indian. Rates for 15–24 year olds were highest for Māori followed by European/Other then Pacific and then Asian/Indian. Rates for males were higher than for females for both age groups. There was a social gradient and rates increased with each quintile of increasing NZDep2013 deprivation scores for both age groups **(Figure 200)**.

Figure 200. Clients aged 0–24 years seen by mental health services, by age group and demographic factors, New Zealand 2014

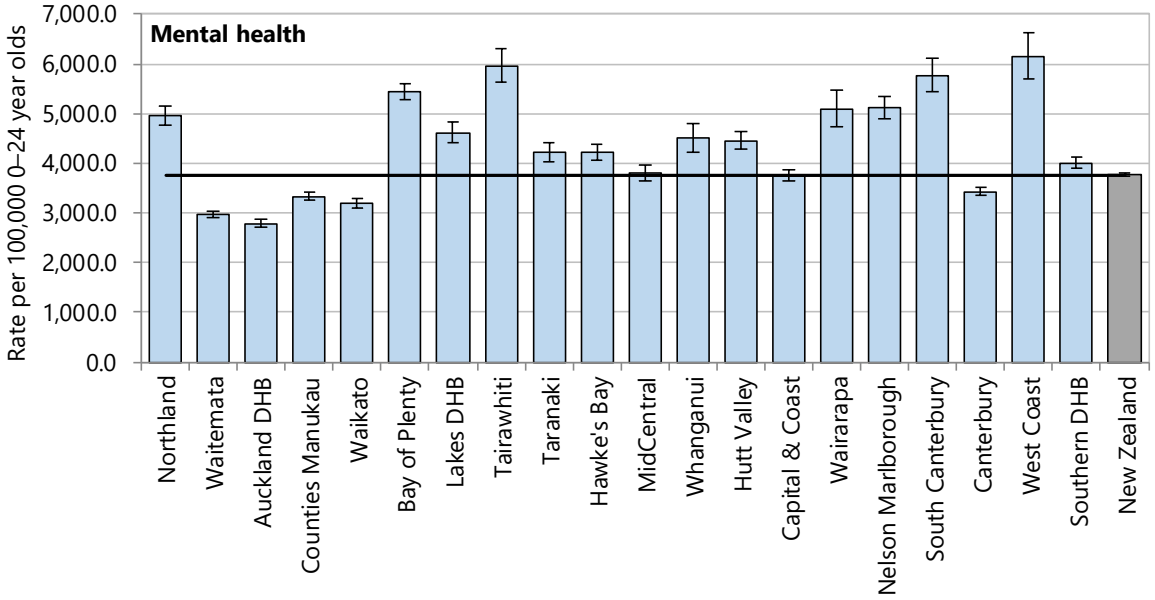


Numerator: PRIMHD; Denominator: Statistics NZ Estimated Resident Population; Rate ratios are unadjusted; Ethnicity is level 1 prioritised; Decile is NZDep2013

Distribution by region

During 2014 the rates for 0–24 year olds being seen by mental health services were *significantly higher* than the national rate in the Northland, Bay of Plenty, Lakes, Tairawhiti, Taranaki, Hawke's Bay, Whanganui, Hutt Valley, Wairarapa, Nelson Marlborough, South Canterbury, West Coast and Southern DHBs. The rates for Waitemata, Auckland, Counties Manukau, Waikato, and Canterbury DHBs were *significantly lower* than the New Zealand rate. Rates in the remaining DHBs were *not significantly different* from the national rate **(Figure 201**, **Table 160)**.

Figure 201. Clients aged 0–24 years seen by mental health services, by district health board, New Zealand 2014



Numerator: PRIMHD; Denominator: Statistics NZ Estimated Resident Population

Table 160. Clients aged 0–24 years seen by mental health services, by district health board, New Zealand 2014

DHB	Number: 2014	Rate per 100,000 population	Rate ratio	95% CI
Clients seen by mental health services				
0–24 year olds				
Northland	2,788	4,959.97	1.32	1.27–1.37
Waitemata	5,701	2,968.98	0.79	0.77–0.81
Auckland	4,414	2,782.88	0.74	0.72–0.76
Counties Manukau	6,569	3,332.49	0.89	0.86–0.91
Waikato	4,391	3,198.64	0.85	0.82–0.88
Bay of Plenty	3,878	5,446.63	1.45	1.40–1.49
Lakes	1,691	4,617.88	1.23	1.17–1.29
Tairawhiti	1,075	5,955.21	1.58	1.49–1.68
Taranaki	1,603	4,222.23	1.12	1.07–1.18
Hawke's Bay	2,286	4,212.72	1.12	1.07–1.17
MidCentral	2,261	3,804.38	1.01	0.97–1.05
Whanganui	923	4,507.46	1.20	1.12–1.28
Hutt Valley	2,161	4,457.90	1.18	1.14–1.24
Capital & Coast	3,822	3,748.69	1.00	0.96–1.03
Wairarapa	677	5,096.25	1.35	1.26–1.46
Nelson Marlborough	2,152	5,115.46	1.36	1.30–1.42
South Canterbury	990	5,769.23	1.53	1.44–1.63
Canterbury	5,707	3,431.37	0.91	0.89–0.94
West Coast	612	6,153.40	1.63	1.51–1.77
Southern	4,164	4,013.38	1.07	1.03–1.10
New Zealand	58,047	3,763.58	1.00	

Numerator: PRIMHD; Denominator: Statistics NZ Estimated Resident Population; Rate ratios are unadjusted

Northern region distribution and trends

During 2014 the rates for 0–24 year olds being seen by mental health services were *significantly higher* than the national rate in Northland. The rates for Waitemata, Auckland and Counties Manukau DHBs were *significantly lower* than the national rate **(Table 161)**. Similar patterns were seen within the 0–14 and 15–24 age groups.

Table 161. Clients aged 0–24 years seen by mental health services, Northern DHBs vs New Zealand 2014

DHB	Number: 2014	Rate per 100,000 population	Rate ratio	95% CI
Clients seen by mental health services				
0–24 year olds				
Northland	2,788	4,959.97	1.32	1.27–1.37
Waitemata	5,701	2,968.98	0.79	0.77–0.81
Auckland	4,414	2,782.88	0.74	0.72–0.76
Counties Manukau	6,569	3,332.49	0.89	0.86–0.91
New Zealand	58,047	3,763.58	1.00	
0–14 year olds				
Northland	1,021	2,789.40	1.23	1.16–1.31
Waitemata	2,007	1,761.48	0.78	0.74–0.81
Auckland	1,184	1,414.60	0.62	0.59–0.66
Counties Manukau	2,438	2,034.82	0.90	0.86–0.94
New Zealand	20,675	2,267.76	1.00	
15–24 year olds				
Northland	1,767	9,012.02	1.52	1.45–1.59
Waitemata	3,694	4,731.05	0.80	0.77–0.83
Auckland	3,230	4,311.59	0.73	0.70–0.75
Counties Manukau	4,131	5,343.72	0.90	0.87–0.93
New Zealand	37,372	5,926.03	1.00	

Numerator: PRIMHD; Denominator: Statistics NZ Estimated Resident Population; Rates are per 1,000 age-specific population

Evidence based reviews relevant to mental health issues in children

International guidelines
National Institute for Health and Care Excellence. 2015. **Addendum to clinical guideline 28, depression in children and young people: Clinical guideline addendum 28.1 Methods, evidence and recommendations** http://www.nice.org.uk/guidance/cg28/evidence/addendum-193488882 Hopkins K, et al. 2015. **Diagnosis and management of depression in children and young people: summary of updated NICE guidance**. Bmj, 350, h824. http://www.bmj.com/content/350/bmj.h824 This update to the NICE clinical guideline 28 makes recommendations on the choice of psychological therapy and the combination of antidepressant treatment with psychological therapy. It found there was little clear evidence to recommend one psychological therapy over another for the treatment of depression in children and young people. Recommendations included the following. For initial treatment of mild depression, after 4 weeks of watchful waiting, offer psychological therapy. For moderate to severe depression, offer 3 months of psychological therapy. Do not offer antidepressant medication except in combination with a concurrent psychological therapy. Combined therapy (Fluoxetine and psychological therapy) for initial treatment of moderate to severe depression in 12–18 year olds can also be considered. If there is no response to psychological therapy alone, following multidisciplinary review, offer fluoxetine to 12–18 year olds, but for 5–11 year olds, fluoxetine's effectiveness is not established, so it's use should be cautiously considered. Fluoxetine was the only antidepressant with UK marketing authorisation for use for children and young people aged 8 to 18 years.
Maglione MA, et al. 2012**. Nonmedical interventions for children with ASD: Recommended guidelines and further research needs.** Pediatrics, 130(Supplement 2), S169-S78. This systematic review of 33 systematic reviews and 68 intervention studies summarised findings to formulate consensus guidelines on non-medical interventions that address cognitive function and core deficits in children with autism spectrum disorder (ASD). There was some evidence that more hours of treatment per week, and greater duration of treatment led to better outcomes. The guidelines recommend at least 25 hours per week of comprehensive intervention to address social communication, language, play skills, and maladaptive behaviour. Several interventions have shown efficacy, including applied behavioural analysis, integrated behavioural/developmental programs, the Picture Exchange Communication System, and various social skills interventions.
Evidence-based medicine reviews: attention-deficit/hyperactivity disorder, oppositional defiant disorder and conduct disorder
Charach A, et al. 2013. **Interventions for preschool children at high risk for ADHD: a comparative effectiveness review.** Pediatrics, 131(5), 2012-0974. This review assessed 55 studies, covering parent behaviour training (PBT), combined home and school/day care interventions, and methylphenidate use in children less than 6 years of age with clinically significant disruptive behaviour, including attention-deficit/hyperactivity disorder (ADHD). There were eight good quality studies examining PBT in a total of 424 participants. The strength of evidence was high for PBT improving child behaviour. Only one good study evaluated methylphenidate, in 114 participants, so the strength of evidence was low. Combined home and school/day care interventions showed inconsistent results.
Daley D, et al. 2014. **Behavioral interventions in attention-deficit/hyperactivity disorder: a meta-analysis of randomized controlled trials across multiple outcome domains.** Journal of the American Academy of Child & Adolescent Psychiatry, 53(8), 835-47. This review assessed 32 randomised controlled trials (RCTs) of behavioural interventions for ADHD in 2,057 children and adolescents. When assessment was probably unblended, there were significant improvements in parenting quality, parenting self-concept, and child ADHD, conduct problems, social skills, and academic performance. When assessment was probably blinded to the intervention, the review found a lack of evidence of ADHD symptom decrease, however behavioural interventions still had positive effects on parenting, conduct problems, and possibly a more positive parenting self-concept, but not improved parent wellbeing.
Furlong M, et al. 2013. **Cochrane Review: Behavioural and cognitive-behavioural group-based parenting programmes for early-onset conduct problems in children aged 3 to 12 years (Review)**. Evidence-Based Child Health: A Cochrane Review Journal, 8(2), 318-692. http://onlinelibrary.wiley.com/doi/10.1002/14651858.CD008225.pub2/pdf This review included 13 trials (10 RCTs and three quasi-randomised trials) of behavioural and cognitive-behavioural group-based parenting programmes, including 1,078 participants, and assessed the effects on child conduct problems, parent mental health and parenting skills. The review found that whether assessed by parents or by independent assessors, the interventions were effective and cost-effective for improving child conduct problems, parental mental health, and reduced negative or harsh parenting practices in the short term. The cost of programme delivery compared to a waiting list control group was approximately $2,500 USD, which the review considered to be modest when compared to the long-term health, social, educational and legal costs associated with childhood conduct problems.
Tarver J, et al. 2014. **Are self-directed parenting interventions sufficient for externalising behaviour problems in childhood? A systematic review and meta-analysis.** European child & adolescent psychiatry, 23(12), 1123-37. This review assessed 11 RCTs of self-directed (SD) parenting interventions for externalising behaviour problems (ADHD, oppositional-defiant disorder (ODD) and conduct disorder) in childhood. SD interventions had a large effect on parent-reported externalising child behaviour, but this was not upheld by analysis of observed child behaviour. There were small to moderate effects for parenting

behaviour, parental mood and stress and parenting efficacy. On parent-reported measures of externalising child behaviour, there was no significant difference between SD interventions and therapist-led parenting interventions.

Evidence-based medicine reviews: anxiety

James AC, et al. 2015. **Cognitive behavioural therapy for anxiety disorders in children and adolescents** The Cochrane Library. DOI: 10.1002/14651858.CD004690.pub4 http://onlinelibrary.wiley.com/enhanced/doi/10.1002/14651858.CD004690.pub4

This review included 41 studies of CBT interventions for children and adolescents with diagnosed anxiety. The studies included 1,806 child and adolescent participants. The review found that CBT was more effective than no therapy in reducing symptoms of anxiety; however CBT was not more effective than non-CBT active control treatments or treatment as usual in the 6 studies which examined this. No difference in outcome was found between individual, group and family/parental interventions. In the four studies that examined longer-term outcomes, evidence for treatment gains was limited and inconclusive. Only three studies included participants younger than 7 years of age. Analysis of separate age groups was limited by use of age-stratification in studies. The review references one study that indicated younger children may respond better to behavioural components, rather than the more demanding cognitive components, but concludes that more research is required.

Sawyer MC & Nunez DE. 2014. **Cognitive-Behavioral Therapy for Anxious Children: From Evidence to Practice**. Worldviews on Evidence-Based Nursing, 11(1), 65-71. http://onlinelibrary.wiley.com/doi/10.1111/wvn.12024/epdf

This review included 10 studies, which each included a minimum of 12 hour-long sessions of individual CBT for anxiety in children. The age range of participants was 4–18 years, with all studies including children aged at least as young as 8 years. The review found that anxiety was reduced in children who received individual CBT, compared to controls. Other findings were that individual CBT was as effective or superior to comparison therapies, with one exception; CBT combined with pharmacological management was more effective.

Thulin U, et al. 2014. **The effect of parent involvement in the treatment of anxiety disorders in children: a meta-analysis**. Cognitive behaviour therapy, 43(3), 185-200.

This review included 16 studies, which directly compared parent-involved CBT treatments with child only CBT treatments for children with anxiety disorders. For the 1,102 participants, aged from 5 to 17 years, with a mean age of 10.6 years, the results showed a small effect in favour of child only treatments. The authors explain the results by proposing that interactions between anxious children and their parents are characterised by factors that maintain, rather than reduce the anxious behaviours.

Evidence-based medicine reviews: depression

Arnberg A & Öst L-G. 2014. **CBT for children with depressive symptoms: A meta-analysis**. Cognitive behaviour therapy, 43(4), 275-88.

This review included 10 RCTs assessing the effectiveness of CBT for depressive symptoms, in participants aged 12 years or less that were diagnosed with depression or reported elevated depressive symptoms. A total of 523 participants were included in either intervention or comparison groups. The effect size of CBT was moderate, and was more effective that attention placebo and wait-list. Earlier publication year, older participants and more treatment sessions were associated with a larger effect size.

Cox GR, et al. 2014. **Psychological therapies versus antidepressant medication, alone and in combination for depression in children and adolescents**. Cochrane Database of Systematic Reviews 2014, Issue 11. Art. No.: CD008324. DOI: 10.1002/14651858.CD008324.pub3. http://onlinelibrary.wiley.com/doi/10.1002/14651858.CD008324.pub3/epdf/standard

This review included 11 studies, involving 1,307 participants, aged eight to 18 years old. Separate analysis was not done for younger children compared to adolescents. The main conclusion of the review was that there was insufficient evidence to determine whether psychological therapy, antidepressant medication or a combination of the two is most effective in treating depression in children and adolescents. The review was limited by the small number of studies, which varied regarding the comparisons used. The review found limited evidence (based on two studies involving 220 participants) that antidepressant medication was more effective than psychotherapy on measures of clinician defined remission immediately post-intervention; limited evidence (based on three studies involving 378 participants) that combination therapy was more effective than antidepressant medication alone in achieving higher remission from a depressive episode immediately post-intervention; and no evidence that combination therapy was more effective than psychological therapy alone, based on clinician rated remission immediately post-intervention. The review found that in one study involving 188 participants, rates of suicidal ideation were significantly higher in the antidepressant medication group (18.6%) compared with the psychological therapy group (5.4%).

Hetrick SE, et al. 2012. **Newer generation antidepressants for depressive disorders in children and adolescents**. Cochrane Database Syst Rev, 11. Art. No.: CD004851. DOI:10.1002/14651858.CD004851.pub3. http://onlinelibrary.wiley.com/doi/10.1002/14651858.CD004851.pub3/pdf

This review included 19 trials of a range of newer antidepressants (those made available since tricyclic antidepressants) compared with placebo, containing 3,335 children and adolescents with clinically diagnosed depression. Based on 14 of the studies, there was evidence that newer antidepressants reduced depression severity by a small amount, compared to placebo. Based on 17 studies, there was evidence of an increased risk of suicide, compared to placebo. There was no evidence that one antidepressant had a larger effect than another, although the review suggested that fluoxetine is likely to be the first choice, given guidelines. For subgroup analysis on children aged 6–12 receiving newer antidepressants, compared to placebo: there was a statistically significant reduction in depression symptoms

compared to placebo; in two trials, there was no significantly significant increase in the percentage of those who responded/remitted; in two trials , there was no evidence that antidepressants improved functioning; and there was a non-statistically significant increase in the risk of suicide.

Evidence-based medicine reviews: autism spectrum disorder

Oono IP, et al. 2013. **Parent-mediated early intervention for young children with autism spectrum disorders (ASD)**. Cochrane Database of Systematic Reviews 2013, Issue 4. Ar t. No.: CD009774. DOI: 10.1002/14651858.CD009774.pub2. http://onlinelibrary.wiley.com/doi/10.1002/14651858.CD009774.pub2/pdf/standard

This review of parent-mediated early intervention for ASD included 17 studies, which recruited 919 children. There was some evidence for the intervention's effectiveness in positively changing parent-child interactions and for parent-reported improvements in child language comprehension. There was no statistical evidence for most aspects of language communication, whether directly assessed or reported; frequency of child initiations in observed parent-child interaction; child adaptive behaviour; and parents' stress. The review was limited by differences in outcome measures between studies.

Reichow B, et al. 2012. **Early intensive behavioral intervention (EIBI) for young children with autism spectrum disorders (ASD)**. Cochrane Database of Systematic Reviews 2012, Issue 10. Art. No.: CD009260. DOI: 10.1002/14651858.CD009260.pub2. http://onlinelibrary.wiley.com/doi/10.1002/14651858.CD009260.pub2/epdf

This review included one RCT and four clinical control trials (CCTs), with a total of 203 participants. The review found that children receiving EIBI treatment performed better than children in the comparison groups after about two years of treatment on tests of adaptive behaviour, intelligence, social skills, communication and language, autism symptoms, and quality of life. The review warns that the current state of evidence is limited because of the reliance on a small number of children, and non-randomised studies.

Strauss K, et al. 2013. **Parent inclusion in early intensive behavior interventions for young children with ASD: a synthesis of meta-analyses from 2009 to 2011**. Research in developmental disabilities, 34(9), 2967-85.

This paper synthesised six meta-analyses on early intensive behavioural interventions (EIBI) for young children with ASD. Results suggested that EIBI generally had positive medium to large effects for intellectual functioning, language skills and adaptive behaviours. Meta-analysis found that EIBI programmes including parents in treatment provision were more effective. Treatment intensity and presence of parent training improved outcomes. Higher language and adaptive behaviour functioning at intake benefited most from EIBI. The review was limited by only two studies using random allocation of participants, and the literature generally lack studies that use a treatment as usual or treatment comparison for controls.

Reichow B, et al. 2013. **Non-specialist psychosocial interventions for children and adolescents with intellectual disability or lower-functioning autism spectrum disorders: a systematic review**. PLoS Med 10(12): e1001572. doi:10.1371/journal.pmed.1001572. http://www.plosmedicine.org/article/fetchObject.action?uri=info:doi/10.1371/journal.pmed.1001572&representation=PDF

This review included 29 studies of psychosocial interventions delivered by non-specialist providers to children with intellectual disabilities or lower-functioning ASD. 1,305 participants were included. Fifteen of the studies included children exclusively with ASD, and 15 of the studies were RCTs. For behaviour analytic interventions, the best outcomes were shown for development and daily skills. Cognitive rehabilitation, training, and support interventions were found to be most effective for improving developmental outcomes. Parent training interventions were found to be most effective for improving developmental, behavioural, and family outcomes. Limitations included reliance on non-randomised studies and performance bias.

Evidence-based medicine reviews: post-traumatic stress disorder

de Arellano MAR, et al. 2014. **Trauma-focused cognitive-behavioral therapy for children and adolescents: assessing the evidence**. Psychiatric Services, 65(5), 591-602.

This review assessed ten RCTs of Trauma-focused cognitive-behavioural therapy (TF-CBT) interventions applied to post-traumatic stress disorder (PTSD), depression, and behavioural problems. The review found that there was high-level evidence for TF-CBT interventions for PTSD, but the evidence was less clear for symptoms of depression or behaviour problems. Of the ten RCTs, 7 involved TF-CBT developers, so the authors had concerns regarding investigator bias. The authors also conclude that more research is needed on implementation in different settings, and in individuals with varied ethnic and trauma histories, symptoms and cognitive, social and emotional development.

Gillies D, et al. 2013. **Psychological therapies for the treatment of post-traumatic stress disorder in children and adolescents (Review)**. Evidence-Based Child Health: A Cochrane Review Journal, 8(3), 1004-116. http://onlinelibrary.wiley.com/doi/10.1002/14651858.CD006726.pub2/epdf

This review included 14 RCTs including 758 children and adolescents ranging in age from 3 to 18 years. Separate analysis was not done for younger older children within this age range. The types of trauma related to PTSD were sexual abuse, civil violence, natural disaster, domestic violence and motor vehicle accidents. Psychological therapies used in the studies were CBT, exposure-based, psychodynamic, narrative, supportive counselling, and eye movement desensitisation and reprocessing (EMDR). Most studies compared a psychological therapy to a control group. No study compared psychological therapies to medications or medications in combination with a psychological therapy. The review found that across all psychological therapies, improvement was significantly better, and symptoms of PTSD, anxiety and depression were significantly lower within a month of completing therapy compared to a control group. CBT

therapy had the best evidence for effectiveness, with improvements and lower PTSD scores still significant after one year compared with controls; however there was no clear evidence for one psychological therapy compared to others.

Other evidence-based medicine reviews

Arbesman M, et al. 2013. **Systematic review of occupational therapy and mental health promotion, prevention, and intervention for children and yout**h. American journal of occupational therapy, 67(6), e120-e30.

This systematic review of 124 articles included studies with occupational therapy interventions, and outcome measures of social or peer interactions or compliance with adult directives or social rules and norms. The age range of participants was 3–21 years. The review concludes there was strong evidence universal occupation- and activity-based interventions focusing on social–emotional learning; school wide bullying prevention; and after-school, performing arts, and stress management activities were effective. At the targeted level, the review found strong evidence indicating that social and life skills programmes for children who were aggressive, had been rejected, or who were teenage mothers were effective. The review reported strong evidence that children with intellectual impairments, developmental delays, and learning disabilities benefited from social skills programming and play, leisure, and recreational activities. The review also found strong evidence that social skills programmes for children requiring intensive mental health services improved social behaviours and self-management.

MENTAL HEALTH HOSPITALISATIONS

Introduction

The following section contains information on hospitalisations in New Zealand using the National Minimum Dataset.

Data source and methods

Indicator

Hospitalisations of 15–24 year olds with a mental health diagnosis

Data sources

Numerator: National Minimum Dataset

Denominator: Statistics NZ Estimated Resident Population (with linear extrapolation being used to calculate denominators between Census years).

Definition

Hospitalisations of 15–24 year olds with a primary diagnosis of a mental or behavioural disorder, excluding hospitalisations with an Emergency Medicine specialty code on discharge. Refer to **Appendix 6** for the codes included.

Notes on interpretation

Note 1: The limitations of the National Minimum Dataset are discussed in the appendices. The reader is urged to review this information before interpreting any analyses based on hospital admission data. In particular, due to inconsistent uploading of Emergency Department (ED) cases to the NMDS, all admissions with an ED health specialty code on discharge have been excluded.

National trends and distribution

There were 20,063 hospitalisations of 0–24 year olds for mental health conditions between 2010 and 2014, of which 17,759 (88.5%) were of 15–24 year olds **(Table 162)**.

Table 162. Hospitalisations for mental health conditions in 0–24 year olds, by age group, New Zealand 2010–2014

	Number: 2010–2014	Number: annual average	Rate per 100,000 population	95% CI
Mental health hospitalisations				
New Zealand				
0–14 year olds	2,304	461	50.87	48.83–52.99
15–24 year olds	17,759	3,552	569.04	560.75–577.44
0–24 year olds	20,063	4,013	262.26	258.66–265.91

Numerator: National Minimum Dataset; Denominator: Statistics NZ Estimated Resident Population

The most common mental health diagnoses among hospitalised 0–14 year olds were eating disorders, followed by mood (affective) disorders, pervasive developmental disorders, and mental and behavioural disorders due to substance use. For 15–24 year olds, the most common diagnoses were mood (affective) disorders, followed by schizotypal and delusional disorders, schizophrenia, and mental and behavioural disorders due to substance use **(Table 163)**.

Table 163. Hospitalisations for mental health conditions in 0–24 year olds, by age group and primary diagnosis, New Zealand 2010–2014

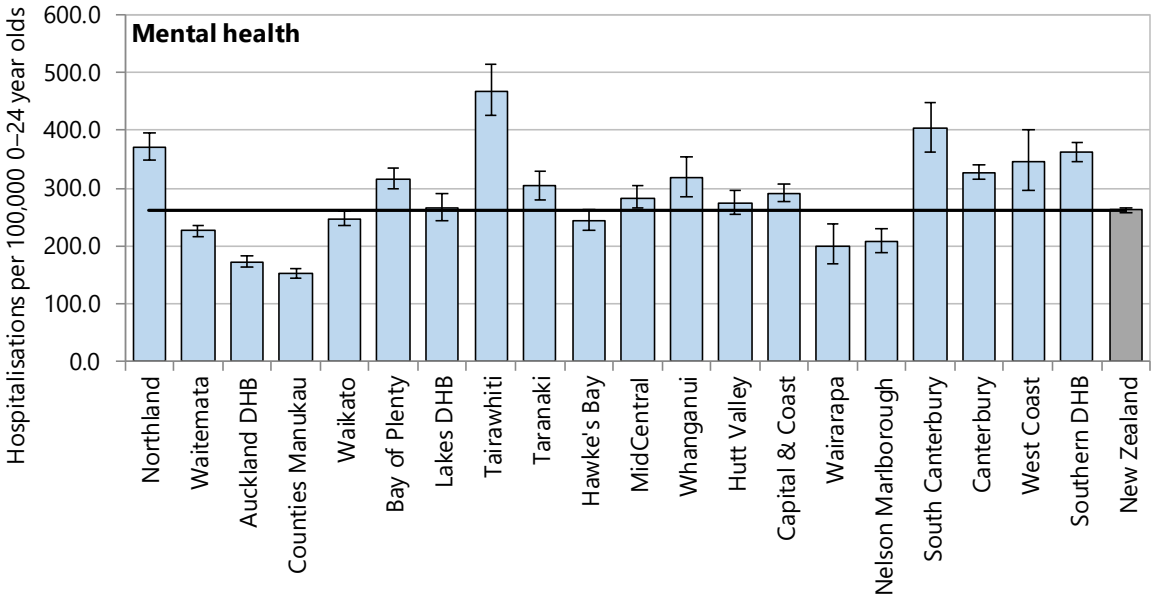
Primary diagnosis	Number: 2010–2014	Number: annual average	Rate per 100,000 population	95% CI	Per cent
Mental health hospitalisations					
0–14 years olds					
Eating disorders	314	63	6.93	6.21–7.74	13.6
Mood (affective) disorders: total	297	59	6.56	5.85–7.35	12.9
Depression (single and recurrent)	*231*	*46*	*5.10*	*4.48–5.80*	*10.0*
Mania or bipolar affective disorders	*26*	*5*	*0.57*	*0.39–0.84*	*1.1*
Other mood disorders	*40*	*8*	*0.88*	*0.65–1.20*	*1.7*
Pervasive developmental disorders	212	42	4.68	4.09–5.35	9.2
Mental and behavioural disorders due to substance use: total	142	28	3.14	2.66–3.69	6.2
Alcohol	*112*	*22*	*2.47*	*2.06–2.98*	*4.9*
Cannabis	*16*	*3*	*0.35*	*0.22–0.57*	*0.7*
Other specified drugs	*14*	*3*	*0.31*	*0.18–0.52*	*0.6*
Reaction to severe stress and/or adjustment disorder	131	26	2.89	2.44–3.43	5.7
Anxiety disorders	121	24	2.67	2.24–3.19	5.3
Conduct disorders	120	24	2.65	2.22–3.17	5.2
Other mental health and behavioural issues	967	193	21.35	20.05–22.74	42.0
Total	2,304	461	50.87	48.83–52.99	100.0
15–24 years olds					
Mood (affective) disorders: total	4,591	918	147.11	142.91–151.42	25.9
Depression (single and recurrent)	*2,862*	*572*	*91.70*	*88.41–95.12*	*16.1*
Mania or bipolar affective disorders	*1,409*	*282*	*45.15*	*42.85–47.57*	*7.9*
Other mood disorders	*320*	*64*	*10.25*	*9.19–11.44*	*1.8*
Schizophrenia	2,878	576	92.22	88.91–95.65	16.2
Schizotypal and delusional disorders	2,917	583	93.47	90.14–96.92	16.4
Mental and behavioural disorders due to substance use: total	1,973	395	63.22	60.49–66.07	11.1
Alcohol	*806*	*161*	*25.83*	*24.10–27.67*	*4.5*
Cannabis	*530*	*106*	*16.98*	*15.60–18.49*	*3.0*
Other specified drugs	*637*	*127*	*20.41*	*18.89–22.06*	*3.6*
Reaction to severe stress and/or adjustment disorder	1,464	293	46.91	44.57–49.37	8.2
Eating disorders	1,055	211	33.80	31.83–35.91	5.9
Personality and behaviour disorders	1,081	216	23.87	32.63–36.76	6.1
Other mental health and behavioural issues	1,800	360	39.74	55.07–60.40	10.1
Total	17,759	3,552	569.04	560.75–577.44	100.0

Numerator: National Minimum Dataset; Denominator: Statistics NZ Estimated Resident Population

Distribution by region

From 2010 to 2014, mental health hospitalisation rates for 0–24 year olds were *significantly higher* than the national rate in the Northland, Bay of Plenty, Tairawhiti, Taranaki, MidCentral, Whanganui, Capital & Coast, South Canterbury, Canterbury, West Coast, and Southern DHBs. Rates were *significantly lower* than the national rate in the Waitemata, Auckland, Counties Manukau, Waikato, Wairarapa and Nelson Marlborough DHBs. Rates in the remaining DHBs were *not significantly different* from the New Zealand rate **(Figure 202, Table 164)**.

Figure 202. Hospitalisations for mental health conditions in 0–24 year olds, by district health board, New Zealand 2010–2014



Numerator: National Minimum Dataset; Denominator: Statistics NZ Estimated Resident Population

Table 164. Hospitalisations for mental health conditions in 0–24 year olds, by district health board, New Zealand 2010–2014

DHB	Number: 2010–2014	Number: annual average	Rate per 100,000 population	Rate ratio	95% CI
Mental health hospitalisations					
0–24 year olds					
Northland	1,033	207	371.78	1.42	1.33–1.51
Waitemata	2,141	428	226.56	0.86	0.83–0.90
Auckland	1,356	271	173.13	0.66	0.62–0.70
Counties Manukau	1,473	295	151.64	0.58	0.55–0.61
Waikato	1,680	336	247.89	0.95	0.90–0.99
Bay of Plenty	1,115	223	316.40	1.21	1.14–1.28
Lakes	488	98	264.92	1.01	0.92–1.10
Tairawhiti	423	85	468.74	1.79	1.62–1.97
Taranaki	572	114	303.49	1.16	1.07–1.26
Hawke's Bay	661	132	244.02	0.93	0.86–1.01
MidCentral	845	169	283.71	1.08	1.01–1.16
Whanganui	333	67	318.01	1.21	1.09–1.35
Hutt Valley	674	135	274.41	1.05	0.97–1.13
Capital & Coast	1,468	294	290.97	1.11	1.05–1.17
Wairarapa	132	26	200.67	0.77	0.64–0.91
Nelson Marlborough	437	87	208.44	0.79	0.72–0.87
South Canterbury	344	69	403.76	1.54	1.38–1.71
Canterbury	2,708	542	326.93	1.25	1.20–1.30
West Coast	172	34	344.89	1.32	1.13–1.53
Southern	1,875	375	363.00	1.38	1.32–1.45
New Zealand	20,063	4,013	262.26	1.00	

Numerator: National Minimum Dataset; Denominator: Statistics NZ Estimated Resident Population; Rate ratios are unadjusted

Northern region distribution and trends

From 2010 to 2014, mental health hospitalisation rates for 0–24 year olds and 15–24 year olds were *significantly higher* than the national rate in Northland, while rates were *significantly lower* in Waitemata, Auckland, and Counties Manukau DHBs. Rates for 0–14 year olds were *significantly higher* than the national rate in Auckland, *significantly lower* in Waitemata and Counties Manukau, and *not significantly different* from the national rate in Northland **(Table 165)**.

Table 165. Hospitalisations for mental health conditions in 0–24 year olds, Northern DHBs vs New Zealand 2010−2014

DHB	Number: 2010−2014	Number: annual average	Rate per 100,000 population	Rate ratio	95% CI
Mental health hospitalisations					
0–24 year olds					
Northland	1,033	207	371.78	1.42	1.33–1.51
Waitemata	2,141	428	226.56	0.86	0.83–0.90
Auckland	1,356	271	173.13	0.66	0.62–0.70
Counties Manukau	1,473	295	151.64	0.58	0.55–0.61
New Zealand	20,063	4,013	262.26	1.00	
0–14 year olds					
Northland	93	19	51.27	1.01	0.82–1.24
Waitemata	248	50	44.16	0.87	0.76–0.99
Auckland	280	56	67.88	1.33	1.18–1.51
Counties Manukau	179	36	30.15	0.59	0.51–0.69
New Zealand	2,304	461	50.87	1.00	
15–24 year olds					
Northland	940	188	974.45	1.71	1.60–1.83
Waitemata	1,893	379	493.74	0.87	0.83–0.91
Auckland	1,076	215	290.24	0.51	0.48–0.54
Counties Manukau	1,294	259	342.63	0.60	0.57–0.64
New Zealand	17,759	3,552	569.04	1.00	

Numerator: National Minimum Dataset; Denominator: Statistics NZ Estimated Resident Population

Northern region distribution by cause

In Northland, Auckland and Counties Manukau DHBs the most common mental health diagnoses for which 0–24 year olds were hospitalised were schizophrenia, and schizotypal and delusional disorders, while mood (affective) disorders were the most common in Waitemata **(Table 166**, **Table 167)**.

Table 166. Hospitalisations for mental health conditions in 0–24 year olds, by primary diagnosis, Northland, Waitemata and Auckland DHBs 2010–2014

Primary diagnosis	Number: 2010–2014	Number: annual average	Rate per 100,000 0–24 year olds	95% CI	Per cent
Mental health hospitalisations of 0–24 years olds					
Northland					
Schizophrenia	452	90	162.68	148.37–178.37	43.8
Schizotypal and delusional disorders	123	25	44.27	37.11–52.81	11.9
Disorders due to substance use: total	122	24	43.91	36.78–52.42	11.8
Alcohol	61	12	21.95	17.09–28.20	5.9
Cannabis	19	4	6.84	4.38–10.68	1.8
Other specified drugs	42	8	15.12	11.18–20.43	4.1
Mood (affective) disorders: total	120	24	43.19	36.12–51.64	11.6
Depression (single and recurrent)	79	16	28.43	22.82–35.43	7.6
Mania or bipolar affective disorders	33	7	11.88	8.46–16.68	3.2
Other mood disorders	8	2	2.88	1.46–5.68	0.8
Other mental health and behavioural issues	216	43	77.74	68.04–88.82	20.9
Total	1,033	207	371.78	349.83–395.11	100.0
Waitemata					
Mood (affective) disorders: total	415	83	43.92	39.89–48.35	19.4
Depression (single and recurrent)	237	47	25.08	22.08–28.48	11.1
Mania or bipolar affective disorders	142	28	15.03	12.75–17.71	6.6
Other mood disorders	36	7	3.81	2.75–5.27	1.7
Schizotypal and delusional disorders	368	74	38.94	35.16–43.13	17.2
Schizophrenia	358	72	37.88	34.16–42.02	16.7
Disorders due to substance use: total	213	43	22.54	19.71–25.78	9.9
Alcohol	90	18	9.52	7.75–11.70	4.2
Cannabis	28	6	2.96	2.05–4.28	1.3
Other specified drugs	95	19	10.05	8.22–12.29	4.4
Eating disorders	186	37	19.68	17.05–22.72	8.7
Reaction to severe stress and/or adjustment disorder	156	31	16.51	14.11–19.31	7.3
Other mental health and behavioural issues	445	89	47.09	42.91–51.67	20.8
Total	2,141	428	226.56	217.17–236.35	100.0
Auckland DHB					
Schizotypal and delusional disorders	273	55	34.86	22.95–30.15	20.1
Schizophrenia	206	41	26.30	30.96–39.24	15.2
Mood (affective) disorders: total	214	43	27.32	23.90–31.24	15.8
Depression (single and recurrent)	102	20	13.02	10.73–15.81	7.5
Mania or bipolar affective disorders	102	20	13.02	10.73–15.81	7.5
Other mood disorders	10	2	1.28	0.69–2.35	0.7
Eating disorders	144	29	18.39	15.62–21.64	10.6
Disorders due to substance use: total	96	19	12.26	10.04–14.97	7.1
Alcohol	25	5	3.19	2.16–4.71	1.8
Cannabis	25	5	3.19	2.16–4.71	1.8
Other specified drugs	46	9	5.87	4.40–7.83	3.4
Other mental health and behavioural issues	423	85	54.01	49.10–59.40	31.2
Total	1,356	271	173.13	164.16–182.58	100.0

Numerator: National Minimum Dataset; Denominator: Statistics NZ Estimated Resident Population

Table 167. Hospitalisations for mental health conditions in 0–24 year olds, by primary diagnosis, Counties Manukau DHBs 2010–2014

Primary diagnosis	Number: 2010–2014	Number: annual average	Rate per 100,000 0–24 year olds	95% CI	Per cent
Mental health hospitalisations of 0–24 years olds					
Counties Manukau					
Schizophrenia	371	74	38.19	34.50–42.28	25.2
Schizotypal and delusional disorders	326	65	33.56	30.11–37.41	22.1
Mood (affective) disorders: total	242	48	24.91	21.97–28.25	16.4
Depression (single and recurrent)	125	25	12.87	10.80–15.33	8.5
Mania or bipolar affective disorders	96	19	9.88	8.09–12.07	6.5
Other mood disorders	21	4	2.16	1.41–3.31	1.4
Reaction to severe stress and/or adjustment disorder	89	18	9.16	7.45–11.27	6.0
Disorders due to substance use: total	85	17	8.75	7.08–10.82	5.8
Alcohol	25	5	2.57	1.74–3.80	1.7
Cannabis	31	6	3.19	2.25–4.53	2.1
Other specified drugs	29	6	2.99	2.08–4.29	2.0
Other mental health and behavioural issues	360	72	37.06	33.42–41.09	24.4
Total	1,473	295	151.64	144.09–159.57	100.0

Numerator: National Minimum Dataset; Denominator: Statistics NZ Estimated Resident Population

SUICIDE AND SELF-HARM

Introduction

New Zealand has the highest youth suicide rate in the OECD, based on the latest country data available.[292] In New Zealand, 15–24 year old males have the highest rate of suicide of any age group. The Māori youth suicide rate is around twice the non-Māori rate.[292] For the population as a whole, suicide rates are higher in areas with the highest index of deprivation scores and in rural areas.[292]

Population-level risk factors for suicide include: barriers to accessing health care; stigma associated with help-seeking behaviour; assimilation, disruption of traditional social structure, and stressors of acculturation particularly for indigenous and displaced people; economic crises resulting in unemployment, particularly for men; disasters; media reporting, especially if methods of suicide are provided, if the decedent was a celebrity, and if the suicide was romanticised rather than reported in association with relevant mental illness and the effect the suicide had on survivors; direct access or proximity to means (including pesticides, firearms, heights, railway tracks, poisons, and medications).[391-394] Individual risk factors include: past suicide attempts, psychopathology; feelings of hopelessness; male gender; a family history of suicidal behaviours; genetic factors; sexual minority status; exposure to early-life adversity such as parental neglect, childhood physical, sexual or emotional abuse; status-loss, such as job-loss, loss of property or home, or divorce; discrimination and isolation; and exposure to suicidal behaviour from others. Interpersonal conflict; impulsive aggression; conduct disorder; antisocial behaviour and substance misuse are particularly important risk factors for young people.[391,393-397] Māori ethnicity, socioeconomic disadvantage and child welfare care are also associated with higher suicide rates among young people in New Zealand.[398,399]

The degree to which mental illness contributes to suicide is debated[400-404] although around 90% of suicide cases may have a mental disorder.[405] The mental disorder with the highest relative risk of suicide is borderline personality disorder, followed by depression and bipolar disorder.[406] Major depressive episodes account for at least half of deaths by suicide.[391] Younger age at suicide is associated with cluster B personality disorders and substance misuse disorders.[391]

The evidence base for suicide and self-harm interventions in young people is not well-established.[407,408] Interventions with the strongest evidence are teaching those who are primary points of contact for high-risk youth, to identify, assess and manage risk of suicidality and refer when appropriate (gatekeeper training), reduction in access to the means of suicide, and good-quality mental health care.[409] There are few studies of suicide prevention programmes targeting indigenous youth, and the study designs make drawing conclusions difficult.[410,411] A caring parent or other family member and a fair, safe school environment with higher levels of health services appear to be protective against suicide attempts.[158,396]

The risk factor profiles for suicide mortality and hospital admissions for intentional self-harm differ; in 2012 hospitalisation rates for self-harm were highest for young women aged 15 to 19 years.[292] The 2012 Youth2000 secondary school survey found that in the past year, among secondary students, over one-fifth of females and almost 10% of males had suicidal ideation; 6% of females and 2% of males had attempted suicide; and 29% of females and 18% of males had self-harmed.[291] Risk of suicidal ideation, a suicide plan, or a suicide attempt are significantly higher in young people, compared to those aged over 25 years.[350] The risk of suicidal behaviours was also increased in those with low household incomes and those living in areas with high index of deprivation scores.[350] For Māori youth, risk factors for suicide attempt were found to be depressive symptoms, having a close friend or family member commit suicide, being 12–15 years old compared to 16–18 years old, having anxiety symptoms, witnessing family violence, and being uncomfortable in New Zealand European social settings.[412]

A variety of psychosocial interventions for self-harm are probably efficacious including cognitive and other behavioural therapies; family, interpersonal, and psychodynamic approaches; and mentalisation-based therapy.[413,414] Some school, community and healthcare based interventions have a significant effect on suicidal ideation, suicide attempts or deliberate self-harm including psychotherapeutic interventions and also less formal approaches such as social support, psychoeducation and motivational interviewing. A combination of individual therapy, particularly for suicidal ideation, and group therapy for suicide attempts, may achieve the best results.[415] Early intervention is important to support young people who self-injure and successful interventions may be those that promote mindfulness, resilience and self-esteem.[416]

The following section uses information from the National Minimum Dataset and the National Mortality Collection to review hospital admissions for intentional self-harm and mortality from suicide in 0–24 year olds.

Data source and methods

Indicator

Deaths from suicide among 0–24 year olds

Data sources

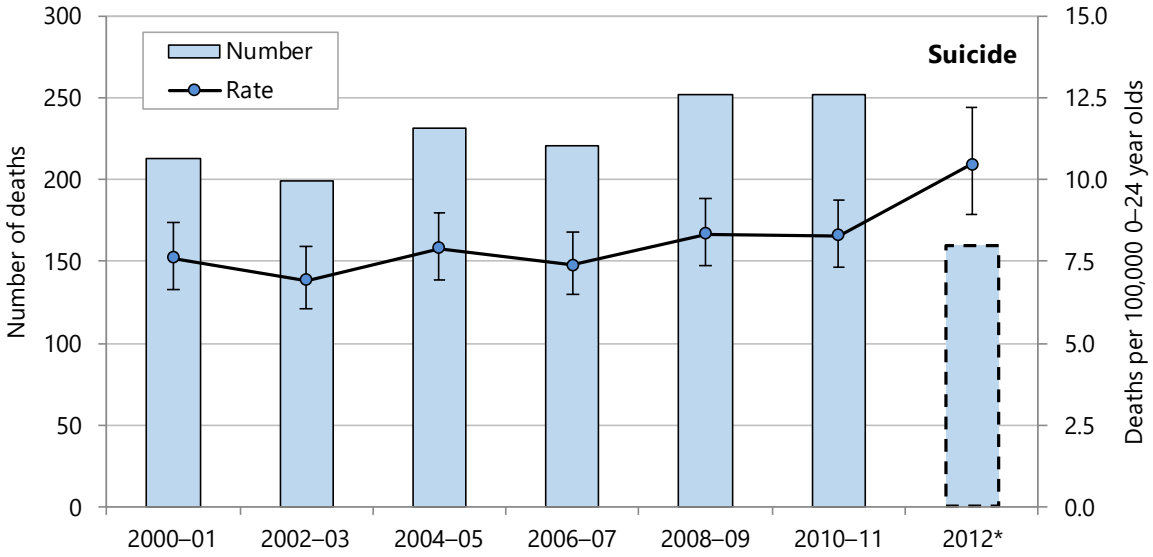
Numerator: National Mortality Collection

Denominator: Statistics NZ Estimated Resident Population (with linear extrapolation being used to calculate denominators between Census years)

National suicide trends and distribution

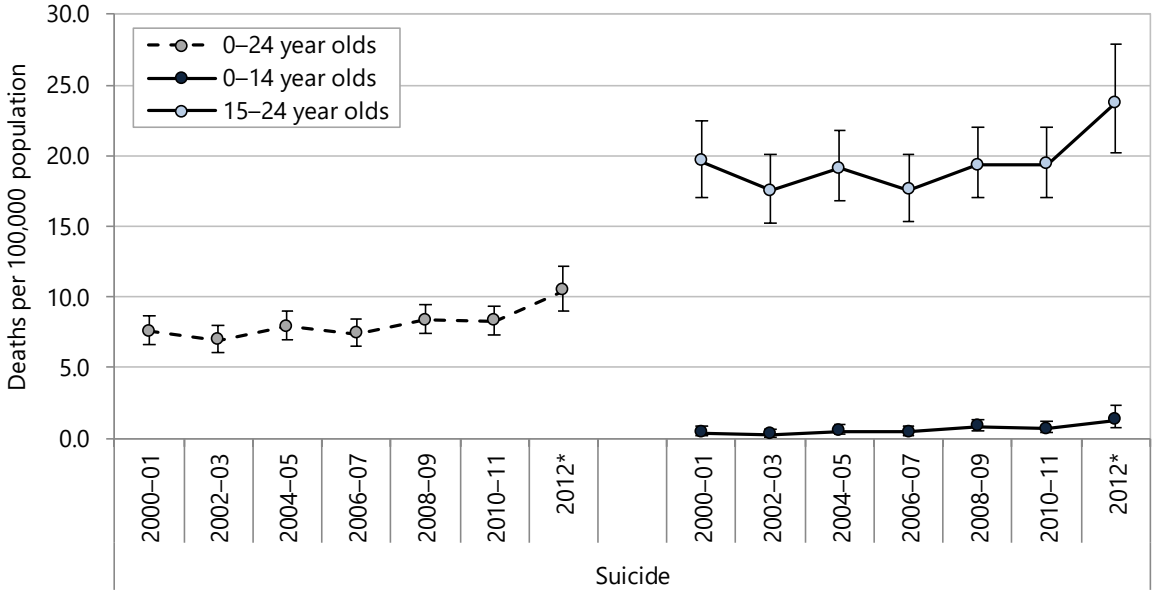
From 2000 to 2011 suicide rates in 0–24 year olds remained relatively stable and the apparent rate increase in 2012 is *not significantly different* to 2008–09 and 2010–11 rates. On average during this period, 118 young people aged under 25 years died each year as the result of suicide **(Figure 203)**. Suicide rates for 15–24 year olds were *significantly higher* than rates for 0–14 year olds in this time period **(Figure 204)**.

Figure 203. Deaths from suicide among 0–24 year olds, New Zealand 2000–2012



Numerator: National Mortality Collection; Denominator: Statistics NZ Estimated Resident Population; Numbers and rates are per two year period except for 2012, which is for a single year

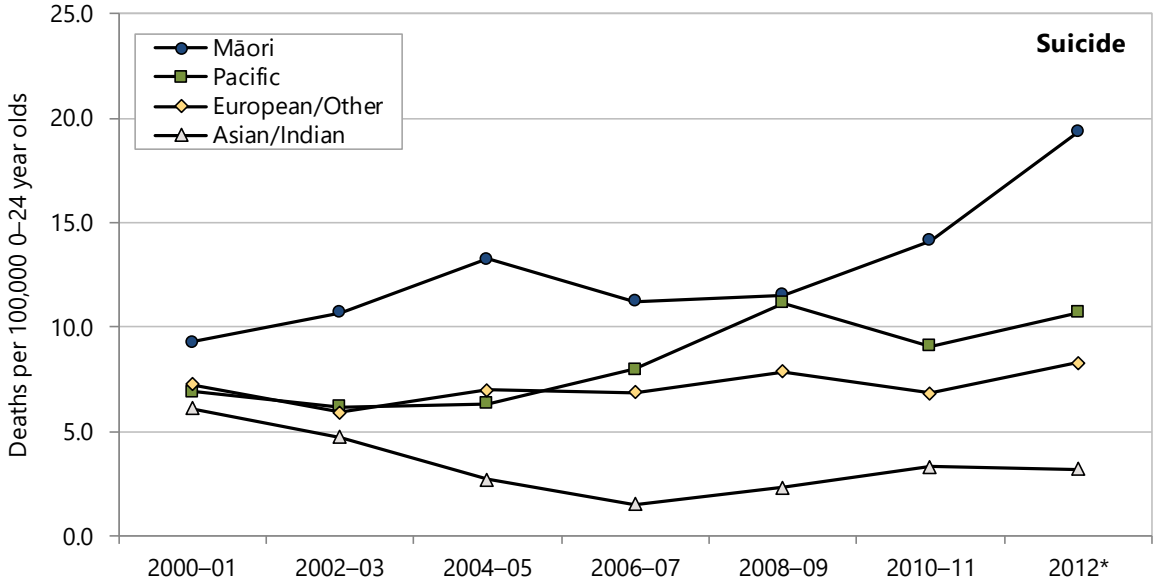
Figure 204. Deaths from suicide in 0–24 year olds, by age group, New Zealand 2000–2012



Numerator: National Mortality Collection; Denominator: Statistics NZ Estimated Resident Population; Rates are per two year period except for 2012, which is for a single year

From 2000 to 2012 the suicide rate was consistently highest for Māori and lowest for Asian/Indian, and within this time period from 2008–09 to 2012 the suicide rate for Māori rose substantially compared with other ethnic groups **(Figure 205)**.

Figure 205. Deaths from suicide in 0–24 year olds, by ethnicity, New Zealand 2000–2012

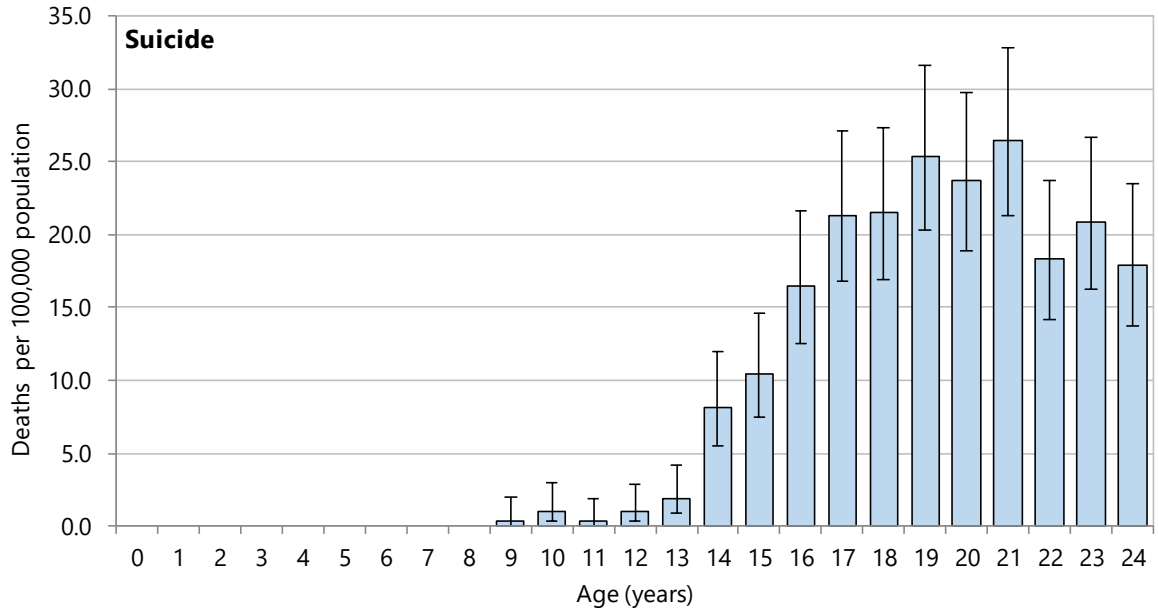


Numerator: National Mortality Collection; Denominator: Statistics NZ Estimated Resident Population; Rates are per two year period except for 2012, which is for a single year

Distribution by demographic factors

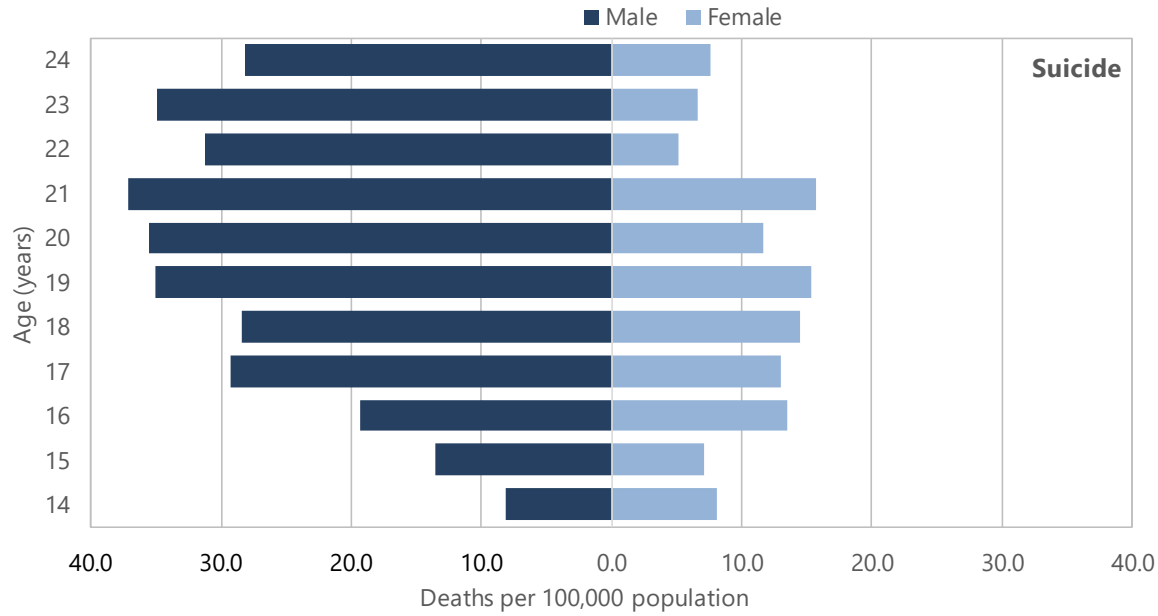
Between 2008 and 2012 there were no deaths from suicide at ages eight years or under and few deaths from age 9–13 years. From age 14, suicide rates increased sharply with increasing age, before peaking in the early 20s. For 16–24 year olds the suicide rates were *not statistically different* by year of age **(Figure 206)**. Suicide rates were higher for males than females from age 15 years **(Figure 207)**.

Figure 206. Deaths from suicide in 0–24 year olds, by age, New Zealand 2008–2012



Numerator: National Mortality Collection; Denominator: Statistics NZ Estimated Resident Population; Caution: rates for those aged less than 14 years are affected by small number variation

Figure 207. Deaths from suicide in 0–24 year olds, by age and sex, New Zealand 2008–2012



Numerator: National Mortality Collection; Denominator: Statistics NZ Estimated Resident Population; Rates suppressed for those aged less than 14 years

Between 2008 and 2012 there was a social gradient in suicide rates for 0–24 year olds; areas with higher NZDep2013 scores (deciles 5–10) had *significantly higher* suicide rates than areas with the lowest scores (deciles 1–2). Compared with European/Other, rates were *significantly higher* for Māori, *significantly lower* for Asian/Indian, and *not significantly different* for Pacific. Male suicide rates were *significantly higher* than female rates. The suicide rate was much higher for 15–24 year olds compared with 0–14 year olds; 625 deaths (94.1%) were in the older age group and 39 deaths (5.9%) in 0–14 year olds **(Table 168)**.

Table 168. Deaths from suicide in 0–24 year olds, by demographic factors, New Zealand 2008–2012

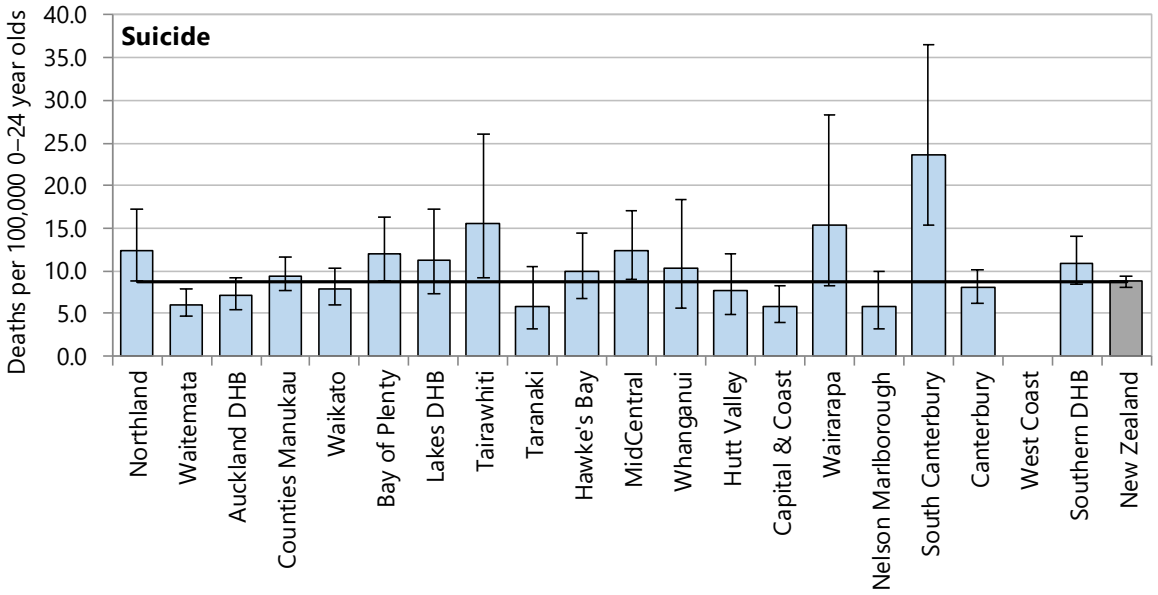
Variable	Number: 2008–2012	Rate per 100,000 0–24 year olds	Rate ratio	95% CI
Suicide among 0–24 year olds				
New Zealand				
NZDep2013 Index of deprivation quintile				
Deciles 1–2	71	5.18	1.00	
Deciles 3–4	84	6.39	1.23	0.90–1.69
Deciles 5–6	135	9.45	1.82	1.37–2.43
Deciles 7–8	140	8.69	1.68	1.26–2.23
Deciles 9–10	233	12.50	2.41	1.85–3.15
Prioritised ethnicity				
Māori	247	14.19	1.86	1.57–2.19
Pacific	70	10.22	1.34	1.03–1.73
Asian/Indian	26	2.90	0.38	0.25–0.57
MELAA	<5	s	s	s
European/Other	319	7.65	1.00	0.86–1.17
Gender				
Female	186	5.01	1.00	0.82–1.23
Male	478	12.34	2.47	2.08–2.92
Age group				
0–14 years	39	0.87		
15–24 years	625	20.24		

Numerator: National Mortality Collection; Denominator: Statistics NZ Estimated Resident Population; Rates are per 100,000 0–24 year olds; Rate ratios are unadjusted; Decile is NZDep2013

Distribution by region

Between 2008 and 2012 suicide rates among 0–24 year olds varied by district health board **(Figure 208).** For the same period, suicide rates for 15–24 year olds were *significantly higher* than the national rate in Northland, Bay of Plenty, Tairawhiti, and South Canterbury DHBs, and *significantly lower* in Waitemata, Auckland and Capital & Coast DHBs. In remaining district health boards there was *no significant difference* from the national rate **(Figure 207, Table 169)**.

Figure 208. Deaths from suicide in 0–24 year olds, by District Health Board, New Zealand 2008–2012



Numerator: National Mortality Collection; Denominator: Statistics NZ Estimated Resident Population; Rate ratios are unadjusted

Table 169. Deaths from suicide in 15–24 year olds, by district health board, New Zealand 2008–2012

DHB	Number: 2008−2012	Number: annual average	Rate per 100,000 population	Rate ratio	95% CI
Suicide					
15–24 year olds					
Northland	29	6	30.56	1.51	1.04–2.19
Waitemata	53	11	14.08	0.70	0.53–0.92
Auckland	52	10	14.17	0.70	0.53–0.93
Counties Manukau	85	17	23.05	1.14	0.91–1.43
Waikato	52	10	19.57	0.97	0.73–1.28
Bay of Plenty	37	7	29.94	1.48	1.06–2.06
Lakes	19	4	28.61	1.41	0.90–2.23
Tairawhiti	13	3	41.41	2.05	1.18–3.54
Taranaki	11	2	15.99	0.79	0.44–1.43
Hawke's Bay	26	5	26.80	1.32	0.89–1.96
MidCentral	35	7	27.68	1.37	0.97–1.92
Whanganui	9	2	22.48	1.11	0.58–2.15
Hutt Valley	19	4	19.87	0.98	0.62–1.55
Capital & Coast	28	6	12.30	0.61	0.42–0.89
Wairarapa	9	2	38.67	1.91	0.99–3.69
Nelson Marlborough	12	2	15.83	0.78	0.44–1.38
South Canterbury	20	4	63.18	3.12	2.00–4.87
Canterbury	63	13	17.84	0.88	0.68–1.14
West Coast	0	..	..	..	..
Southern	52	10	22.00	1.09	0.82–1.44
New Zealand	625	125	20.24	1.00	

Numerator: National Mortality Collection; Denominator: Statistics NZ Estimated Resident Population; Rate ratios are unadjusted

Northern region distribution and trends

Comparison with New Zealand

Between 2008 and 2012, the suicide mortality rate in 0−24 year olds was *significantly lower* than the national rate in Waitemata. Differences from the national rate for 0−24 year olds were *non-significant* in the other northern DHBs. In all the Northern DHBs, the majority of suicides were in the 15−24 age group. Compared to the national rate, suicide rates in 15−24 year olds were *significantly higher* in Northland, *significantly lower* in Waitemata and Auckland, and *not significantly different* in Counties Manukau **(Table 170)**.

Table 170. Mortality from suicide in 0–24 year olds, by age group, Northern DHBs vs New Zealand 2008–2012

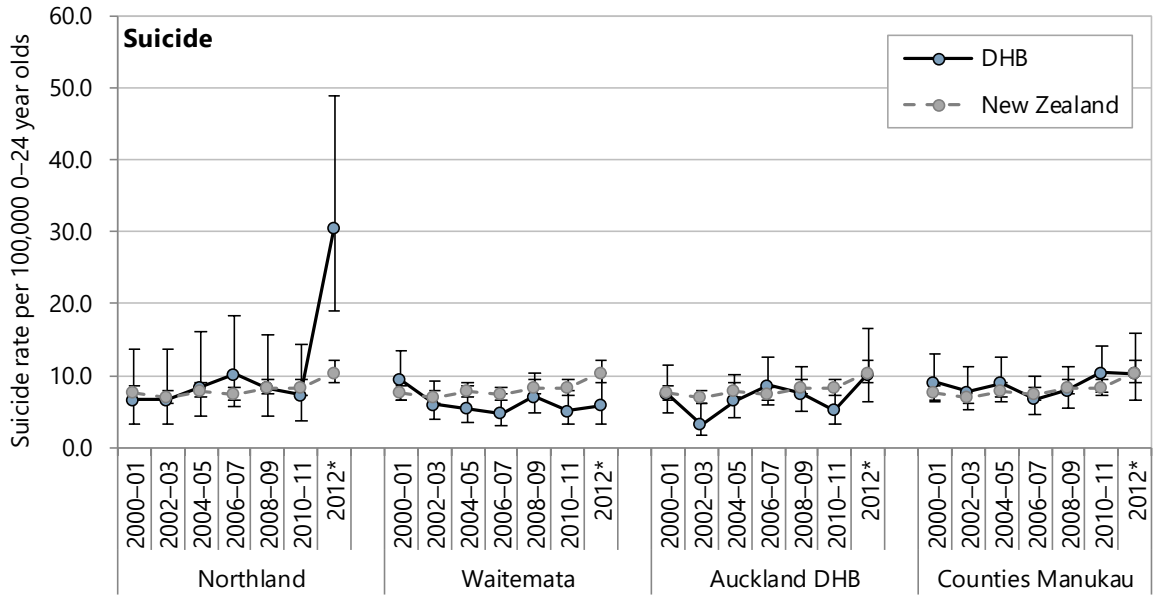
DHB	Number: 2008–2012	Number: annual average	Rate per 100,000 population	Rate ratio	95% CI
Suicide					
0–24 year olds					
Northland	34	7	12.38	1.41	1.00–2.00
Waitemata	56	11	6.02	0.69	0.52–0.90
Auckland	55	11	7.11	0.81	0.62–1.07
Counties Manukau	90	18	9.40	1.07	0.86–1.34
New Zealand	664	133	8.75	1.00	
0–14 year olds					
Northland	5	1	2.78	3.21	1.27–8.14
Waitemata	<5	s	s	s	s
Auckland	<5	s	s	s	s
Counties Manukau	5	1	0.85	0.98	0.39–2.49
New Zealand	39	8	0.87	1.00	
15–24 year olds					
Northland	29	6	30.56	1.51	1.04–2.19
Waitemata	53	11	14.08	0.70	0.53–0.92
Auckland	52	10	14.17	0.70	0.53–0.93
Counties Manukau	85	17	23.05	1.14	0.91–1.43
New Zealand	625	125	20.24	1.00	

Numerator: National Mortality Collection; Denominator: Statistics NZ Estimated Resident Population

Regional trends

From 2000 to 2012, the year to year variations in rates (the result of small numbers) made precise interpretation of suicide trends difficult **(Figure 209)**.

Figure 209. Mortality from suicide in 0–24 year olds, Northern DHBs vs New Zealand 2000–2012



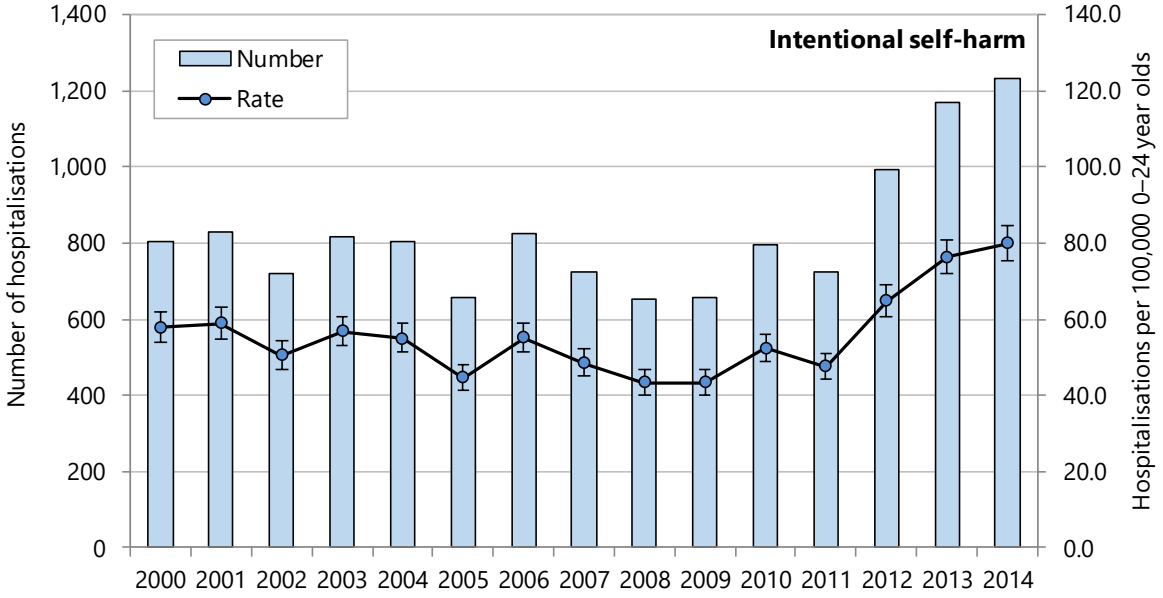
Numerator: National Mortality Collection; Denominator: Statistics NZ Estimated Resident Population

Intentional self-harm

New Zealand trends

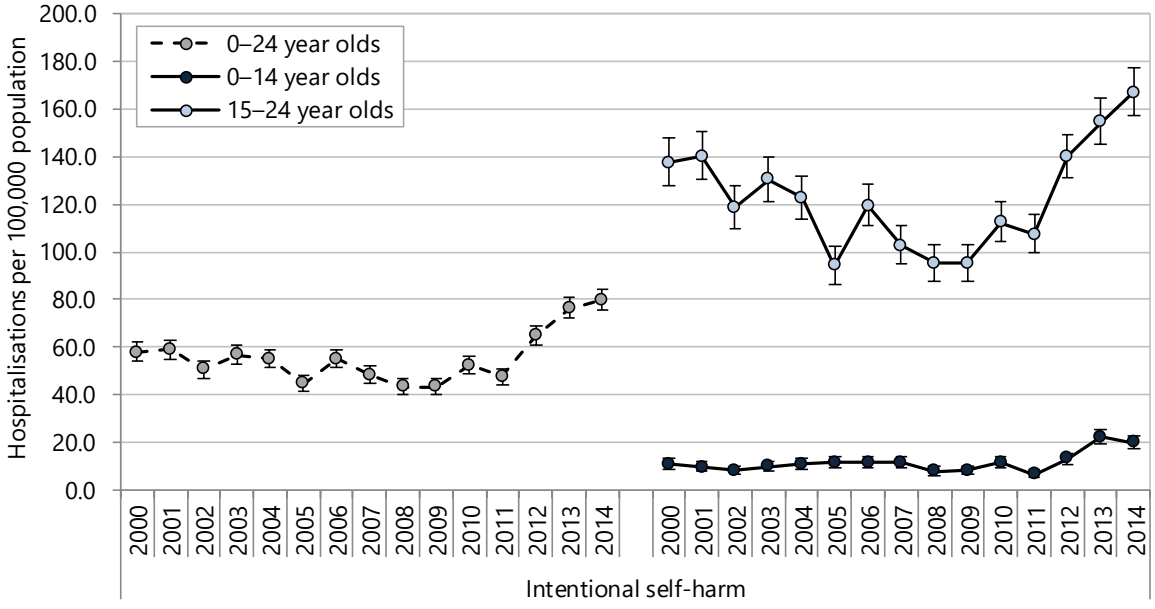
From 2000 to 2011 hospitalisation rates of 0–24 year olds for intentional self-harm remained stable between 40 and 60 hospitalisations per 100,000. Since 2012 rates have increased, and in 2014 reached a high of 79.88 hospitalisations per 100,000, *significantly higher* than for the period 2000–2012. On average from 2000 to 2014 there were 827 hospitalisations of 0–24 year olds each year due to intentional self-harm **(Figure 210)**. From 2000 to 2014 hospitalisations for intentional self-harm for 15–24 year olds were *significantly higher* than for 0-14 year olds **(Figure 211)**.

Figure 210. Hospitalisations for intentional self-harm in 0–24 year olds, New Zealand 2000–2014



Numerator: National Minimum Dataset (excludes emergency department cases); Denominator: Statistics NZ Estimated Resident Population

Figure 211. Hospitalisations for intentional self-harm in 0–24 year olds, by age group, New Zealand 2000–2014

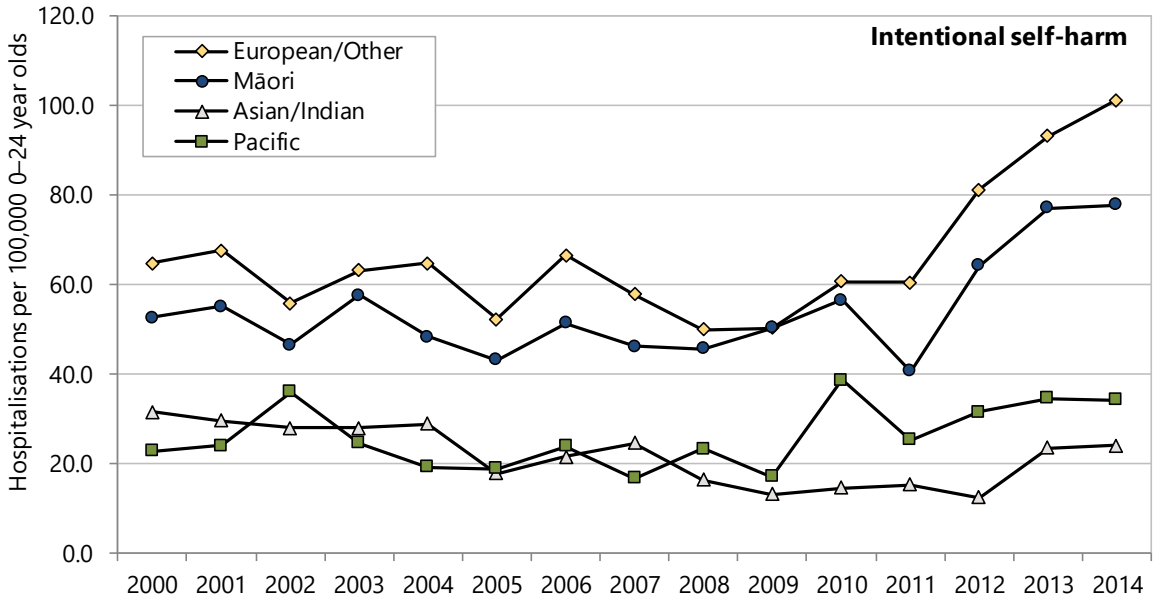


Numerator: National Minimum Dataset (excludes emergency department cases); Denominator: Statistics NZ Estimated Resident Population

Intentional self-harm hospitalisation rates for 0–24 year olds differed by ethnic group. From 2000 to 2014 European/Other hospitalisation rates for intentional self-harm were consistently higher than for all other ethnic

groups, though only marginally so in 2009. Since 2011, European/Other and Māori hospitalisation rates have increased more than Pacific and Asian/Indian rates **(Figure 212)**.

Figure 212. Hospitalisations for intentional self-harm in 0–24 year olds, by ethnicity, New Zealand 2000–2014

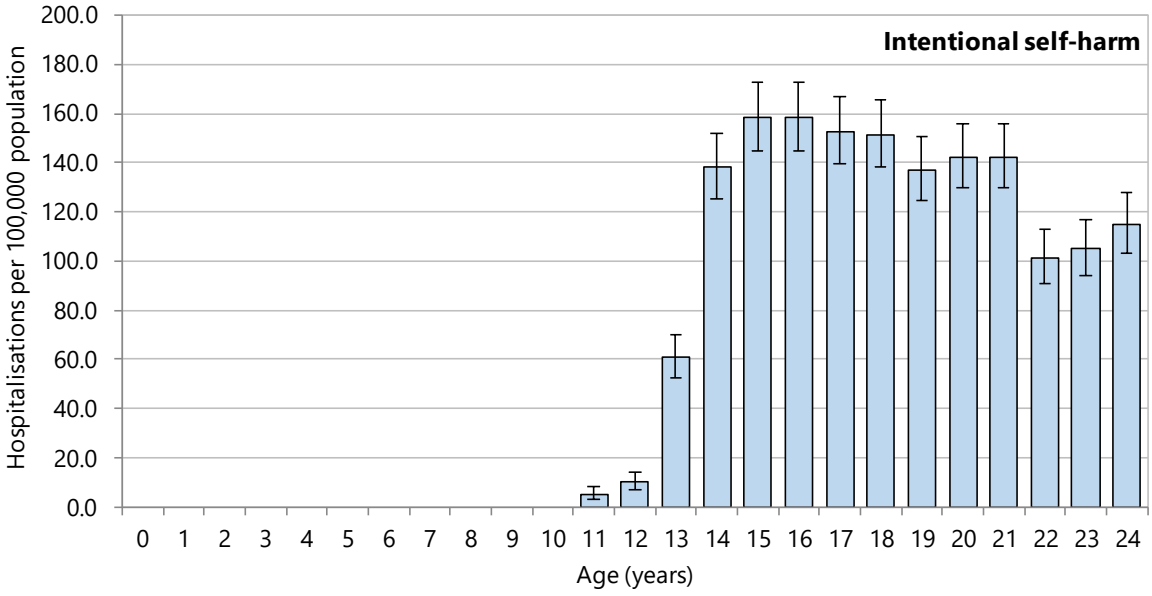


Numerator: National Minimum Dataset (excludes emergency department cases); Denominator: Statistics NZ Estimated Resident Population

Distribution by demographic factors

From 2010 to 2014 there were no hospitalisations for intentional self-harm for children aged under eight years, fewer than five hospitalisations each at ages eight, nine and ten, and few hospitalisations for 11–12 year olds. From age 13 years, age-specific hospitalisation rates for intentional self-harm increased sharply before peaking in the mid-teenage years. Hospitalisation rates for 22–24 year olds were *significantly lower* than for those in their mid-teenage years **(Figure 213)**.

Figure 213. Hospitalisations for intentional self-harm in 0–24 year olds, by age, New Zealand 2010–2014



Numerator: National Minimum Dataset (excludes emergency department cases); Denominator: Statistics NZ Estimated Resident Population

From 2010 to 2014 hospitalisation rates for intentional self-harm for 0–24 year olds were *significantly higher* in areas with higher NZDep2013 scores (deciles 3–10) compared with areas with the lowest scores (deciles 1–2). Compared with European/Other, hospitalisation rates were *significantly lower* for Māori, Pacific and

Asian/Indian and *not significantly different* for MELAA. The rates for females were *significantly higher* than for males. The majority (86.6%) of intentional self-harm hospitalisations were for 15–24 year olds **(Table 171)**.

Table 171. Hospitalisations for intentional self-harm in 0–24 year olds, by demographic factor, New Zealand 2010–2014

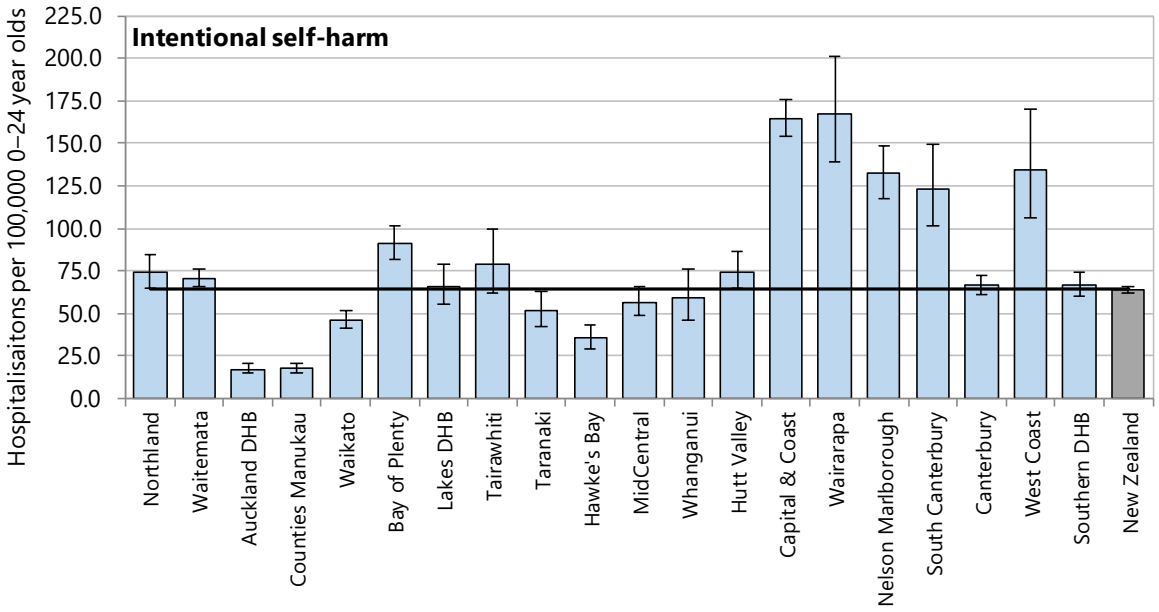
Variable	Number: 2010−2014	Rate per 100,000 0–24 year olds	Rate ratio	95% CI
Intentional self-harm in 0–24 year olds				
New Zealand				
NZDep2013 Index of deprivation quintile				
Deciles 1–2	704	50.19	1.00	
Deciles 3–4	878	66.05	1.32	1.19–1.45
Deciles 5–6	895	62.27	1.24	1.12–1.37
Deciles 7–8	1,259	77.71	1.55	1.41–1.70
Deciles 9–10	1,160	62.37	1.24	1.13–1.36
Prioritised ethnicity				
Māori	1,131	63.44	0.80	0.74–0.85
Pacific	230	32.82	0.41	0.36–0.47
Asian/Indian	169	18.01	0.23	0.19–0.26
MELAA	61	62.19	0.78	0.61–1.01
European/Other	3,290	79.66	1.00	
Gender				
Female	3,609	96.46	1.00	
Male	1,305	33.39	0.35	0.32–0.37
Age group				
5–14 years	658	22.02		
15–24 years	4,256	136.37		

Numerator: National Minimum Dataset (excludes emergency department cases); Denominator: Statistics NZ Estimated Resident Population; Rate ratios are unadjusted; Ethnicity is level 1 prioritised; Decile is NZDep2013

Distribution by region

Between 2010 and 2014 hospitalisation rates for intentional self-harm in 0–24 year olds were *significantly higher* than the New Zealand rate in Waitemata, Bay of Plenty, Capital & Coast, Wairarapa, Nelson Marlborough, South Canterbury, and West Coast. Rates were *significantly lower* than the New Zealand rate in Auckland, Counties Manukau, Waikato, Taranaki and Hawke's Bay. Rates in the remaining DHBs were *not significantly different* from the New Zealand rate **(Figure 214**, **Table 172)**.

Figure 214. Hospitalisations for intentional self-harm in 0–24 year olds, by district health board, New Zealand 2010–2014



Numerator: National Minimum Dataset (excludes emergency department cases); Denominator: Statistics NZ Estimated Resident Population

Table 172. Hospitalisations for intentional self-harm in 0–24 year olds, by district health board, New Zealand 2010–2014

DHB	Number: 2010–2014	Number: annual average	Rate per 100,000 0–24 year olds	Rate ratio	95% CI
Intentional self-harm					
0–24 year olds					
Northland	206	41	74.14	1.15	1.00–1.33
Waitemata	669	134	70.79	1.10	1.02–1.19
Auckland	135	27	17.24	0.27	0.23–0.32
Counties Manukau	173	35	17.81	0.28	0.24–0.32
Waikato	314	63	46.33	0.72	0.64–0.81
Bay of Plenty	320	64	90.81	1.41	1.26–1.58
Lakes	121	24	65.69	1.02	0.85–1.22
Tairawhiti	71	14	78.68	1.22	0.97–1.55
Taranaki	98	20	52.00	0.81	0.66–0.99
Hawke's Bay	96	19	35.44	0.55	0.45–0.68
MidCentral	168	34	56.41	0.88	0.75–1.02
Whanganui	62	12	59.21	0.92	0.72–1.18
Hutt Valley	183	37	74.50	1.16	1.00–1.34
Capital & Coast	831	166	164.71	2.56	2.38–2.76
Wairarapa	110	22	167.23	2.60	2.16–3.14
Nelson Marlborough	277	55	132.12	2.06	1.82–2.32
South Canterbury	105	21	123.24	1.92	1.58–2.33
Canterbury	549	110	66.28	1.03	0.94–1.13
West Coast	67	13	134.35	2.09	1.64–2.66
Southern	347	69	67.18	1.05	0.94–1.17
New Zealand	4,914	983	64.23	1.00	

Numerator: National Minimum Dataset (excludes emergency department cases); Denominator: Statistics NZ Estimated Resident Population

Northern region distribution and trends

Comparison with New Zealand

Between 2010 and 2014 hospitalisation rates for intentional self-harm in 0–24 year olds compared to the national rate were *significantly higher* in Waitemata, *significantly lower* in Auckland and Counties Manukau, and not significantly different in Northland **(Table 173)**.

Table 173. Hospitalisations for intentional self-harm in 0–24 year olds, Northern DHBs vs New Zealand 2010–2014

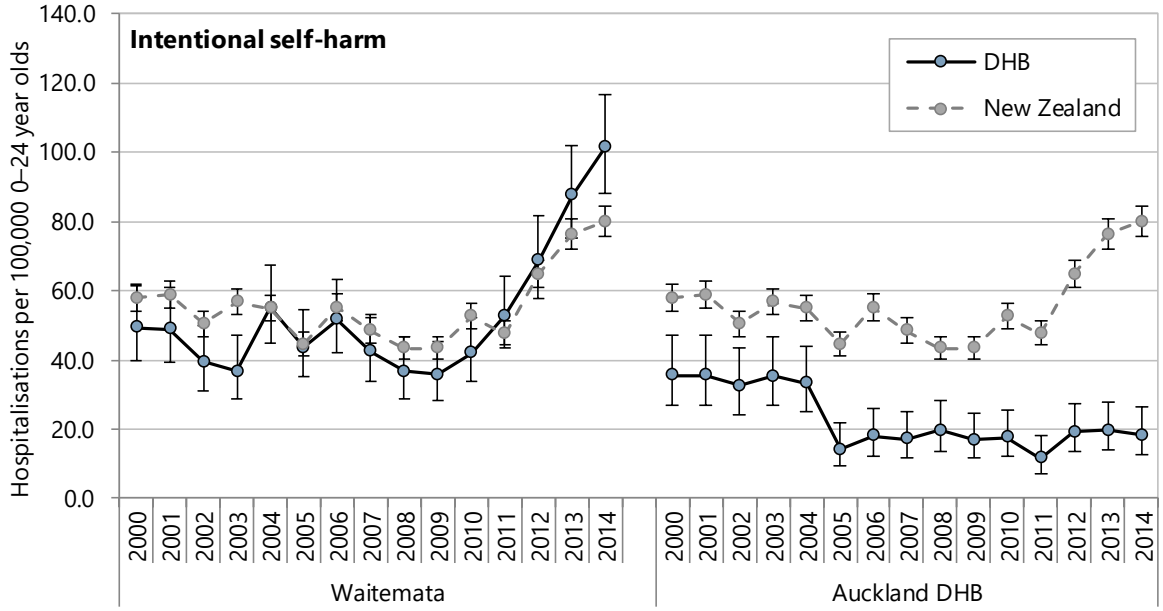
DHB	Number: 2010–2014	Number: annual average	Rate per 100,000 0–24 year olds	Rate ratio	95% CI
Intentional self-harm					
0–24 year olds					
Northland	206	41	74.14	1.15	1.00–1.33
Waitemata	669	134	70.79	1.10	1.02–1.19
Auckland	135	27	17.24	0.27	0.23–0.32
Counties Manukau	173	35	17.81	0.28	0.24–0.32
New Zealand	4,914	983	64.23	1.00	

Numerator: National Mortality Collection; Denominator: Statistics NZ Estimated Resident Population

Regional trends

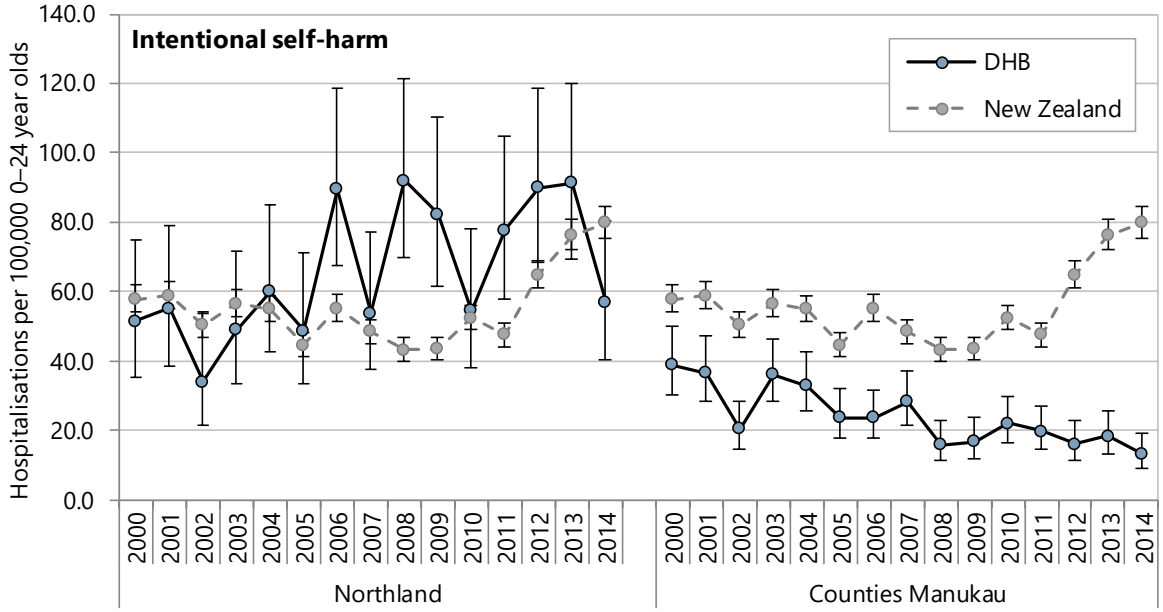
In Northland during 2000–2014, self-harm hospitalisation rates in 0–24 year olds were variable, but generally similar to national rates. In Counties Manukau, rates were consistently lower than national rates, and decreased over time (unlike the national rate which increased). Waitemata rates closely followed the national trend and increased over the period, while Auckland rates were steady from 2005 onwards **(Figure 215, Figure 216)**.

Figure 215. Hospitalisations for intentional self-harm in 0–24 year olds, Northland and Counties Manukau DHBs vs New Zealand 2000–2014



Source: Numerator: National Mortality Collection; Denominator: Statistics NZ Estimated Resident Population

Figure 216. Hospitalisations for intentional self-harm in 0–24 year olds, Waitemata and Auckland DHBs vs New Zealand 2000–2014



Numerator: National Mortality Collection; Denominator: Statistics NZ Estimated Resident Population

APPENDICES AND REFERENCES

APPENDIX 1: SEARCH METHODS FOR POLICY DOCUMENTS AND EVIDENCE-BASED REVIEWS

One of the features of this reporting series is the inclusion of sections which briefly review local policy documents (e.g. Ministry of Health Strategies and Toolkits) and international evidence-based reviews that are relevant to the prevention and or management of child and youth health issues. The approaches taken in these sections borrow heavily from the principles of the Evidence-Based Medicine (EBM) movement, which has emerged in recent years as a means of providing busy clinicians with up to date overviews of the evidence in particular areas.[417,418] Such overviews generally rely on reviewers collating all of the available evidence (published and unpublished trials, observational studies etc.), evaluating it in a rigorous manner, and then publishing the resulting synthesis of the evidence in a format which allows clinicians to evaluate quickly the effectiveness of the intervention(s) reviewed. While the evidence base for population level interventions is much less developed than that for individual patient therapies (as such interventions often have longer follow up times, more diffuse outcomes, and less readily identifiable "control" groups[419]), there is nevertheless a reasonable body of evidence emerging about the effectiveness of specific population level interventions.

The brief overviews presented in this report therefore aim to provide busy DHB staff with a logical starting point from which to consider the types of interventions available to address particular child and youth health issues. In preparing these overviews the methodology used was not exhaustive but rather involved searching a number of EBM journals and databases (e.g. the Cochrane Library) as well as Ovid MEDLINE and PubMed for systematic reviews of population level interventions in child and youth health (see Text Box below).

Methodology used in preparing policy/evidence-based review sections

New Zealand (health) policy documents

Each review section aims to provide an overview of Ministry of Health (or where appropriate, other Government Agency) policy documents and strategies relevant to the area. The Ministry of Health's website (http://www.moh.govt.nz/moh.nsf) was searched for key documents. All identified documents were then scanned and the most relevant summarised, focussing on those which provided strategic guidance to DHBs on the prevention/population level management of the issues in question.

Evidence-based and other reviews

The five databases listed below were searched for reviews considering the effectiveness of population level interventions to prevent and/or manage each of the issues in question. While this list is not exhaustive, the databases were selected on the basis of the calibre of the institutions publishing the reviews. In addition, the search strategy concentrated on publications which attempted to synthesise all of the available evidence, thereby providing as broad as possible coverage of the relevant literature. In general, only literature from 2000 onwards was searched, although earlier publications were included if there was a paucity of more recent information. While individual trials and protocols were not specifically sought, if there was no other relevant information available, an attempt was made to locate individual research reports or recommendations. While they are not totally comprehensive, it is nevertheless hoped that these brief overviews will provide a useful starting point for DHBs wishing to explore strategies to address particular child and youth health issues.

Evidence-Based Medicine Reviews This database allows seven EBM resources to be searched at once including The Database of Reviews of Effects (DARE), Health Technology Assessments (HTA) and the NHS Economic Evaluation Database (NHSEED) all produced by National Health Services' Centre for Reviews and Dissemination at the University of York, U.K., The Cochrane Database of Systematic Reviews, and the ACP Journal Club.

National Guideline Clearinghouse http://www.guideline.gov/ This is a searchable database of evidence-based clinical practice guidelines maintained by the Agency for Healthcare Research and Quality in the United States.

Centre for Reviews and Dissemination (CRD): This is a department of the University of York and is part of the National Centre for Health Research (NCHR) (http://www.york.ac.uk/inst/crd/). While CRD produces the database of Review Effects (DARE), captured in the Evidence-Based Medicine Review Database, searching the CRD site identifies other reviews not captured by DARE. This database is available through most local library services.

National Institute for Health and Clinical Excellence (NICE): This is an independent organisation based in the United Kingdom which provides national guidance on the promotion of good health and the prevention and treatment of ill health. (http://www.nice.org.uk/)

Guide to Community Preventive Services: Systematic Reviews and Evidence Based Recommendations: This guide was developed by the non-federal Task Force on Community Preventive Services whose members are appointed by the Director of the Centre for Disease Control and Prevention (CDC). The Community Guide summarises what is known about the effectiveness, economic efficiency, and feasibility of interventions to promote community health and prevent disease. (http://www.thecommunityguide.org/about/)

While undertaking this task it quickly became apparent that the quality of evidence varied considerably depending on the issue reviewed. In addition, in many cases, the research provided reasonably strong guidance about what did not work (e.g. current evidence suggests additional social support is ineffective in preventing preterm birth in high-risk women), but little advice on effective interventions.

Thus in many cases these brief overviews serve to highlight the current paucity of evidence on population level interventions to address child and youth health needs (although the absence of systematic/other reviews does not rule out the existence of individual studies in particular areas). In this context, while the search strategy utilised did not primarily aim to identify individual studies, or reviews of individual patient therapies, in cases where such studies were identified, and where no other systematic reviews were available, they were included under the heading of *Other Relevant Publications*. In such cases the reader needs to be aware that these studies were identified in a non-systematic manner and that their findings should therefore not be given the same weight as systematic reviews (e.g. Cochrane reviews) where all of the available evidence has been rigorously evaluated. The evidence-based review tables also include some topical New Zealand research publications.

APPENDIX 2: STATISTICAL SIGNIFICANCE TESTING

Inferential statistics are used when a researcher wishes to use a sample to draw conclusions about a larger population as a whole (for example, weighing a class of 10 year old boys, in order to estimate the average weight of all 10 year old boys in New Zealand). The findings obtained from the sample provide an estimate for the population, but will always differ from it to some degree, simply due to chance. Similarly, samples are used when a researcher questions whether the risk of developing a particular condition is different between two groups, and the fit of the estimate obtained from the samples to the actual population needs to be carefully considered. An example of this would be a study examining whether lung cancer is more common in smokers or non-smokers: researchers using sample groups would have to consider the possibility that some of the differences observed arose from chance variations in the populations sampled.

Over time, statisticians have developed a range of measures to quantify the uncertainty associated with random sampling error. These measures can assign a level of confidence to estimates and conclusions drawn from samples, allowing researchers to assess, for example, whether the average weight of boys in the sample reflects the true weight of all 10 year old boys, or the rates of lung cancer in smokers are really different to those in non-smokers. Two of the most frequently used statistical significance tests are:

P values: The p value from a statistical test measures the probability of finding a difference at least as large as the one observed between groups, if there were no real differences between the groups studied. For example, if statistical testing of the difference in lung cancer rates between smokers and non-smokers resulted in a p value of 0.01, this tells us that the probability of such a difference occurring if the two groups were identical is 0.01 or 1%. Traditionally, results are considered to be statistically significant if the p value is <0.05; that is, when the probability of the observed differences occurring by chance is less than 5%.[420]

Confidence Intervals: When sampling from a population a confidence interval is a range of values that contains the measure of interest. While a confidence interval for the average height of 10 year old boys could be 20cm to 200cm, for example, the smaller range of 130cm to 150cm is a more informative statistic. A 95% confidence interval suggests that if you were to repeat the sampling process 100 times, 95 times out of 100 the confidence interval would include the true value.[420]

Statistical significance testing in this report

When tests of statistical significance have been applied in a particular section, the statistical significance of the associations presented has been signalled in the text with the words *significant*, or *not significant* in italics. Where the words *significant* or *not significant* do not appear in the text, then the associations described do not imply statistical significance or non-significance.

Several data sources are used in this report... In general they belong to one of two groups: 1) population surveys or 2) routine administrative datasets. The relevant statistical testing for each of these data sources are as follows:
Population surveys: Some of indicators reported on here are derived from data from national surveys where information from a sample has been used to make inferences about the population as a whole. In this context, statistical significance testing is appropriate and, where such information is available in published reports, it has been included in the text accompanying graphs and tables. In a small number of cases, information on statistical significance was not available, and any associations described do not imply statistical significance.

Numbers derived from routine administrative data: A large number of the indicators included in this report are based on data from New Zealand's administrative datasets, for example the National Mortality Collection, which capture information on all of the events occurring in a particular category.

Rate ratios derived from routine administrative data: To facilitate comparisons between different time periods, and for examining the data from New Zealand in a wider context, whenever measures of association (rate ratios) are presented in this report, 95% confidence intervals have been provided.[421]

APPENDIX 3: DATASETS USED IN THIS REPORT

This report contains information derived from several national administrative datasets. These are described briefly below, and limitations to be aware of when interpreting results drawn from these sources are outlined.

The National Mortality Collection

The National Mortality Collection is a dataset managed by the Ministry of Health which contains information on the underlying cause, or causes, of death along with basic demographic data for all deaths registered in New Zealand since 1988. Fetal and infant death data are a subset of the Mortality Collection, with cases in this subset having additional information on factors such as birth weight and gestational age.[2] Each of the approximately 28,000 deaths occurring in New Zealand each year is coded manually by Ministry of Health staff. For most deaths the Medical Certificate of Cause of Death provides the information required, although coders also have access to information from other sources such as Coronial Services, Police, NZ Transport Agency, the NZ Cancer Registry, the Institute of Environmental Science and Research, and Water Safety NZ.[422]

The National Minimum Dataset

The National Minimum Dataset (NMDS) is national hospital discharge dataset and is maintained by the Ministry of Health. It is used for policy formation, performance monitoring, and research purposes, providing key information about the delivery of hospital inpatient and day patient health services both nationally and on a provider basis. It is also used for funding purposes.[423]
Information in the NMDS includes principal and additional diagnoses, procedures, external causes of injury, length of stay and sub-specialty codes; and demographic information such as age, ethnicity and usual area of residence. Data have been submitted by public hospitals electronically since the original NMDS was implemented in 1993, with additional data dating back to 1988 also included. The private hospital discharge information for publicly funded events has been collected since 1997. The current NMDS was introduced in 1999.[423]

The Birth Registration Dataset

Since 1995 all NZ hospitals and delivering midwives have been required to notify the Department of Internal Affairs within five working days of the birth of a live or stillborn baby. This applies to stillborn babies born at or more than 20 weeks gestation, or those weighing 400g or more; prior to 1995, only stillborn babies reaching more than 28 weeks of gestation required birth notification. Information on the hospital's notification form includes maternal age, ethnicity, multiple birth status, and the baby's sex, birth weight and gestational age. In addition, parents must jointly complete a birth registration form as soon as reasonable practicable after the birth, and within two years of delivery, which duplicates the above information with the exception of birth weight and gestational age. Once both forms are received by Internal Affairs the information is merged into a single entry. This two-stage process it is thought to capture 99.9% of births occurring in New Zealand and cross-checking at the receipting stage allows for the verification of birth detail.[424]

PRIMHD

PRIMHD (Programme for the Integration of Mental Health Data) is the Ministry of Health's dataset that contains information on mental health and addiction service activity and outcomes for people using services. The district health boards and non-governmental organisations (NGOs) working in mental health provide data on client referrals and service activities to the Ministry and DHBs also provide information on any outcomes.

The Ministry of Health's "*NGO Guide to PRIMHD*" explains that the information gathered is intended to enhance service planning and provision by service providers at national and local levels. The intention is for PRIMHD to help determine whether services are being provided to people who need them, whether services are being provided at the right time and in the right place, and what effects on outcomes services are having. Further information is available on PRIMHD on the Ministry of Health's website: http://www.health.govt.nz/nz-health-statistics/national-collections-and-surveys/collections/primhd-mental-health-data

Dataset limitations

There are limitations when using any of these datasets. The following are of particular relevance to this report.

Clinical coding accuracy and coding changes over time

The quality of data submitted to the administrative national datasets may vary. While the data for the National Mortality Collection and the Birth Registration Dataset are coded by single agencies, the clinical information held in the NMDS is entered by health providers before being collated by the Ministry of Health. In a 2001 review of the quality of coding in the data submitted to the NMDS, 2,708 events were audited over ten sites during a three month period. Overall the audit found that 22% of events required a change in coding, although this also included changes at a detailed level. Changes to the principal diagnosis involved 11% of events, to additional diagnoses 23%, and to procedure coding, 11%. There were 1,625 external causes of injury codes, of which 15% were re-coded differently.[425] These findings were similar to an audit undertaken a year previously. While the potential for such coding errors must be taken into consideration when interpreting the findings of this report, the average 16% error rate indicated by the 2001 review may be an overestimate as, in the majority of the analyses undertaken in this report, only the principal diagnosis is used to describe the reason for admission. Changes in the coding systems used over time may result in irregularities in time series analyses.[422] New Zealand hospitals use the clinical coding classification developed by the World Health Organization and modified by the National Centre for Classification in Health, Australia. The current classification is called The International Statistical Classification of Diseases and Related Health Problems, Tenth Revision, Australian Modification (ICD-10-AM), the Australian Classification of Health Interventions (ACHI) and Australian Coding Standards (ACS). The introduction of ICD-10-AM represented the most significant change in classification in over 50 years, expanding the number of codes from ~5,000 to ~8,000, to provide for recently recognised conditions and allow greater specificity about common diseases.

From 1988 until 1999, clinical information in the NMDS was coded using versions of the ICD-9 classification system. From July 1999 onwards, the ICD-10-AM classification system has been used. Back and forward mapping between the two systems is possible using predefined algorithms,[426] and for most conditions there is a good correspondence between ICD-9 and ICD-10-AM codes. Care should still be taken when interpreting time series analyses which include data from both time periods as some conditions may not be directly comparable between the two coding systems.

Variation in reporting hospitalisations to the NMDS

Historically, there have been differences in the way New Zealand's 20 district health boards (DHBs) have reported their emergency department (ED) hospitalisations to the NMDS, which can affect the interpretation of hospitalisation data. Inconsistent recording of ED cases has resulted from differing definitions of the time spent in the ED, and at what point this time constitutes an admission. This is important in paediatrics where hospitalisations for acute onset infectious and respiratory diseases in young children especially are mainly of short duration. In addition, there are regional differences in treatment processes for paediatric emergency cases. This report includes all ED day cases in its analyses of hospitalisations for medical conditions. This approach differs from that commonly used by the Ministry of Health when analysing NMDS hospital discharge data, which the Ministry of Health uses to minimise the impact of the inconsistent reporting of ED cases. Short stay ED events are often excluded from the Ministry's analyses to improve comparability between regions. However, as noted above, the treatment of children in acute cases differs from that of adults, and the inclusion of ED day cases is justified when considering hospitalisations for medical conditions, despite inconsistencies in the dataset. The Ministry of Health's practice of filtering out ED day cases for hospitalisations for injuries is followed in this report as it is considered that the processes for injury assessments are relatively consistent around the country. Further information on the details of the inconsistencies can be seen in earlier reports by the NZCYES www.otago.ac.nz/ncyes

Changes in the way ethnicity information has been recorded over time

Due to inconsistencies in the way ethnicity information was recorded in the health sector, and in census data before 1996, all ethnic group specific analyses in this report are for the year 1996 onwards. See Appendix 4 for a brief review of the changes in the recording of ethnicity information over the past 35 years in New Zealand.

APPENDIX 4: ETHNICITY DATA

Because of inconsistencies in the manner in which ethnicity information in New Zealand was collected prior to 1996, all ethnic group specific analyses presented in this report are for the 1996 year onwards, and reflect self-identified concepts of ethnicity. Details of the changes made in the census question on ethnicity, and why they were made, can be found on the Statistics New Zealand website www.stats.govt.nz
This report presents ethnic-specific analyses for 1996 onwards and, unless otherwise specified, prioritised ethnic group has been used to ensure that each health event is only counted once.

Despite significant improvements in the quality of ethnicity data in New Zealand's national health collections since 1996, care must still be taken when interpreting the ethnic-specific rates as the potential still remains for Māori and Pacific children and young people to be undercounted in our national data collections. The authors of Hauora IV developed a set of adjusters which could be used to minimise the bias such undercounting introduced when calculating population rates and rate ratios. These, or similar, adjusters were not utilised in this report because previous research has shown that ethnicity misclassification can change over time and ethnic misclassification may vary significantly by district health board.22 Adjusters developed using national level data (as in Hauora IV21) may not be applicable to district health board level analyses, with separate adjusters needing to be developed for each.

In addition, the development of adjusters requires the linkage of the dataset under review with another dataset for which more reliable ethnicity information is available, and this process is resource-intensive and not without error, particularly if the methodology requires probabilistic linkage of de-identified data. The development of a customised set of period and age specific adjusters was seen as being beyond the scope of the current project. The data presented in this report may undercount Māori and Pacific children to a variable extent depending on the dataset used, and that in the case of the hospital admission dataset for Māori, this undercount may be as high as 5–6%.

APPENDIX 5: NZ DEPRIVATION INDEX

The NZ index of deprivation (NZDep) was first created using information from the 1991 census, and has been updated following each census. It is a small area index of deprivation, and is used as a proxy for socioeconomic status. The main concept underpinning small area indices of deprivation is that the socioeconomic environment in which a person lives can confer risks or benefits which may be independent of their own social position within a community.[427] They are aggregate measures, providing information about the wider socioeconomic environment in which a person lives, rather than information about their individual socioeconomic status. The latest index, NZDep2013, combines nine variables from the 2013 census to reflect eight dimensions of material and social deprivation **(Table 174)**. Each variable represents a standardised proportion of people living in an area who lack a defined material or social resource. These are combined to give a score representing the average degree of deprivation experienced by people in that area. Individual area scores are ranked and placed on an ordinal scale from 1 to 10, with decile 1 reflecting the least deprived 10% of small areas and decile 10 reflecting the most deprived 10% of small areas.[428]

The advantage of the NZDep2013 is its ability to assign measures of socioeconomic status to the older population, the unemployed and to children, to whom income and occupational measures often don't apply, as well as to provide proxy measures of socioeconomic status for large datasets when other demographic information is lacking. Small area indices have limitations, however, as not all individuals in a particular area are accurately represented by their area's aggregate score. While this may be less of a problem for very affluent or very deprived neighbourhoods, in average areas, aggregate measures may be much less predictive of individual socioeconomic status.[427] Despite these limitations, the NZDep2013 has been shown to be predictive of mortality and morbidity from a number of diseases in New Zealand.

Table 174. Variables used in the NZDep2013

Dimension	Variable in order of decreasing weight in the index
Communication	People aged < 65 with no access to the Internet at home
Income	People aged 18 - 64 receiving a means tested benefit
Income	People living in equivalised* households with income below an income threshold
Employment	People aged 18 - 64 unemployed
Qualifications	People aged 18 - 64 without any qualifications
Owned home	People not living in own home
Support	People aged < 65 living in a single parent family
Living space	People living in equivalised* households below a bedroom occupancy threshold
Transport	People with no access to a car

*The setting of the household equivalised income threshold was based on two principles: 1) the proportion of the population identified as being socioeconomically deprived by the threshold should be broadly consistent with the other variables in the index, and 2) the threshold should be broadly consistent with other measures of income poverty.[428]

APPENDIX 6: CLINICAL CODES USED

Select health specialty codes

Category	Health specialty codes
Emergency Medicine	M05–M08

Select procedures

Category	ICD-10-AM codes
Grommets	41632-00, 41632-01
Tonsillectomy ± adenoidectomy	41789-00, 41789-01

Diagnosis codes used for identifying ambulatory sensitive hospitalisations

Category	ICD-10-AM codes	ICD-9-CM codes
Asthma and wheeze	J45–46, R06.2	493.00, 493.01
Bronchiectasis	J47	494
Skin infections	H00.0, H01.0, J340, L01–L04, L08, L98.0	680–684, 685.0, 686, 910.(1,3,5,7,9)–917.(1,3,5,7,9), 919.(1,3,5,7,9)
Constipation	K59.0	564.0
Dental caries/other dental conditions	K02, K04, K05	521.0, 522, 523
Dermatitis and Eczema	L20–30	690–693, 698
Gastroenteritis	A02–A09, R11, K529	001–009, 787.0, 558.9
Gastro-oesophageal reflux	K21	530.11, 530.81
Nutritional Deficiency	D50–D53, E40–E46, E50–E56, E58–E61, E63–E64	260–269, 280–281
Bacterial or non-viral pneumonia	J13–J16, J18	481–483, 485, 486
Rheumatic fever and /or rheumatic heart disease	I00–I09	390–398
Otitis media	H65–H67	381.0–381.4, 382
Acute upper respiratory tract infections*	J00–J03, J06	460–463, 465, 464.0, 464.1, 464.2
Urinary Tract Infections	N10, N12, N30.0, N39.0, N30.9, N13.6	590, 595.0–595.3, 595.9, 599.0
Vaccine-preventable:		
Neonatal or obstetric tetanus	A33, A34	771.3, 670.04
Congenital Rubella	P35.0	771.0
Pertussis	A37	033
Diphtheria	A36	032
Hepatitis B	B16, B18.0, B18.1	070.2, 070.3
Polio	A80	045
Tetanus	A35	037
Measles, Mumps, Rubella	B05, B06, B26, M01.4	055, 056, 072, 056.71

Selected diagnosis codes

Category	ICD-10-AM codes	ICD-9-CM codes
Acute upper respiratory tract infections excl croup	J00–J03, J06	460–463, 465, 464.0, 464.1, 464.2
Acute URTI: Acute nasopharyngitis (common cold)	J00	460
Acute URTI: Acute pharyngitis	J02	462
Acute URTI: Acute sinusitis	J01	461
Acute URTI: Acute tonsillitis	J03	463
Acute URTI: Croup, acute laryngitis, or tracheitis	J04, J05.0	464.0–464.2, 464.4–464.5
Acute URTI: multiple or unspecified sites	J06	465
Asthma and wheeze	J45–46, R06.2	493.00, 493.01
Bronchiectasis	J47	494

Bronchiolitis	J21	466.1
Chorioamnionitis	P02.7	762.7
Compression of umbilical cord	P02.5	762.5
Congenital anomalies	Q00–Q99	740–759
Congenital anomalies: chromosomal	Q90–Q99	758
Congenital anomalies: CNS	Q00–Q07	740–742
Congenital anomalies: CVS	Q20–Q28	745–747
Congenital anomalies: other	Q08–Q89	743–759
Congenital pneumonia	P23	770
Constipation	K59.0	564.0
Dental caries or other dental conditions	K02, K04, K05	521.0, 522, 523
Dermatitis and eczema	L20–30	690–693, 698
Epiglottitis	J05.1	464.3
Extreme prematurity	P07.2	765
Fetal blood loss	P50	772.0
Gastroenteritis	A00–A09, R11, K52.9	001–009, 558.9, 787.0
Hydrops fetalis (non-haemolytic disease)	P832	778
Hypertrophy of the tonsils and/or adenoids	J35.1–J35.3	474.10–474.12
Incompetent cervix or premature rupture of membranes	P01.0, P01.1	761.0, 761.1
Infections specific to perinatal period	P35–P39	771
Inhalation and ingestion of food causing obstruction of the respiratory tract	W79	
Inhalation of gastric contents	W78	
Injury	S00–T79	800–904, 910–995
Injury or poisoning	V01–Y36	800–999
Intentional self-harm	X60–X84	950–959
Intrauterine hypoxia	P20.0	768.0–768.4
Intrauterine hypoxia or birth asphyxia	P20, P21	768
Malnutrition or slow fetal growth	P05	764
Maternal hypertensive disorders	P00.0	760.0
Meningococcal disease	A39	036.0–036.9
Middle ear or mastoid: Cholesteatoma of the middle ear	H71	385.3
Middle ear or mastoid: Chronic tonsillitis	J35.0	474.0
Middle ear or mastoid: Eustachian tube disorders	H68, H69	381.5–381.9
Middle ear or mastoid: Mastoiditis and related disorders	H70	383
Middle ear or mastoid: Other disorders of the middle ear or mastoid	H74–H75	385.0–385.2, 385.4–385.9
Middle ear or mastoid: Otitis media	H65–H67	381.0–381.4, 382
Middle ear or mastoid: Perforation or other disorders of the tympanic membrane	H72–H73	384
Multiple pregnancy	P01.5	761.5
Neonatal aspiration of meconium, amniotic fluid, or mucus	P240, P241	770.1
Nutritional deficiency	D50–D53, E40–E46, E50–E56, E58–E61, E63–E64	260–269, 280–281
Oligohydramnios	P01.2	761.2
Other abnormalities of placenta	P02.2	762.2
Other or unspecified chronic diseases of tonsils or adenoids	J35.8–J35.9	474.2–474.9
Other perinatal conditions	P00–P19; P22–P96	760–779
Pertussis or whooping cough	A37	033
Pertussis: Whooping cough due to *Bordetella parapertussis*	A37.1	033.1
Pertussis: Whooping cough due to *Bordetella pertussis*	A37.0	033.0
Pertussis: Whooping cough due to other *Bordetella* species	A37.8	033.8
Pertussis: Whooping cough, unspecified	A37.9	033.9
Placenta praevia or placental separation and haemorrhage	P02.0, P02.1	762.0, 762.1

Placental transfusion syndromes	P02.3	762.3
Pneumonia: bacterial, non-viral, or unspecified	J13–J16, J18	481–483, 078.88, 485, 486, 514
Pneumonia: viral	J10.0, J11.0, J12	487.0, 480
Polycythaemia neonatorum	P611	776.4
Prematurity or low birthweight	P07.0, P07.2	765
Rheumatic Fever and Rheumatic Heart Disease	I00–I09	390–398
Skin infections: Acute lymphadenitis	L04	683
Skin infections: Cellulitis	L03	682
Skin infections: Cutaneous abscess, furuncle, or carbuncle	L02	680
Skin infections: Impetigo	L01.0, L01.1	684
Skin infections: Infected, unspecified, or other dermatitis	L30.3, L30.8, L30.9	690.8, 702.8
Skin infections: Infections of other anatomical sites	A46, H00.0, H05.0, H60.0, H60.1, H60.2, H60.3, H62.0, H62.4, J34.0, K61.0, N48.2, N49.2, N49.9, N76.4	035, 373.1, 376.01, 380.10, 380.14, 380.13, 478.1, 566, 607.2, 608.4, 616.4
Skin infections: Insect or spider bites	S10.13, S10.83, S10.93, S20.13, S20.33, S20.43, S20.83, S30.83, S30.93, S40.83, S50.83, S60.83, S70.83, S80.83, S90.83, T09.03, T11.08, T13.03, T14.03, T63.3, T63.4, T00.9	910.4, 910.5, 911.4, 911.5, 912.5, 912.6, 913.4, 913.5, 914.5, 915.5, 916.4, 916.5, 917.4, 917.5, 919.4, 919.5, 919.8, 989.5
Skin infections: Other infections of skin and subcutaneous tissue	L08	686
Skin infections: Pilonidal cyst with abscess	L05.0	685.0
Skin infections: Post traumatic or open wound infection	T79.3, T89.01, T89.02	958.3
Skin infections: Scabies	B86	133.0
Skin infections: Varicella with other complications	B01.8	052.7, 052.8
Sleep apnoea	G47.3	780.51
SUDI: inhalation of gastric contents or food	W78, W79	E911
SUDI: SIDS	R95	798
SUDI: suffocation or strangulation in bed	W75	E913.0
SUDI: unspecified	R96, R98, R99	798.1, 798.2, 798.9
Tuberculosis	A15–A19	010–018
Unspecified cause of fetal death	P95, R99	768.0, 799.9

Selected diagnosis codes for unintentional injury

Category	ICD-10-AM codes	ICD-9-CM codes
Falls	W00–W19	880–888
Inanimate mechanical forces	W20–W49	914–916, 918–925
Animate mechanical forces	W50–W64	906, 917
Drowning or submersion	W65–W74	910
Suffocation	W75–W84	911–915
Thermal injury	W85–X19	890–899, 926
Poisoning	X40–X49	850–869
Intentional self-harm	X60–X84	950–959
Assault	X85–Y09	960–969
Undetermined intent	Y10–Y34	980–989
Road traffic		
Vehicle occupant	V40–V48.(5, 6, 7, 9), V50–V58.(5, 6, 7, 9), V60–V68.(5, 6, 7, 9), V70–V78.(5, 6, 7, 9)	810–819.(0, 1)
Motorbike	V20–V28.(4, 5, 9), V29.(4, 5, 6, 9)	825.2, 81x.(2, 3)
Cyclist	V10–V18.(4, 5, 9), V19.(4, 5, 6, 9)	81x.6
Pedestrian	V00–V06.(1), V09.(2, 3)	814, 81x.7

Other land transport	V30–V38.(5, 6, 7, 9), V39.(4, 5, 6, 9), V81.1, V82.(1, 9), V83–V86.(0, 1, 2, 3)	
Non-traffic land transport incidents		
Vehicle occupant	V40–V48.(0, 1, 2, 3), V50–V58.(0, 1, 2, 3), V60–V68.(0, 1, 2, 3), V70–V78.(0, 1, 2, 3), V49.(0, 1, 2, 3), V59.(0, 1, 2, 3), V69.(0, 1, 2, 3), V79.(0, 1, 2, 3)	820–825.(0, 1)
Motorbike	V20–V28.(0, 1, 2), V29.(0, 1, 2, 3)	820–825.(2, 3)
Cyclist	V10–V18.(0, 1, 2), V19.(0, 1, 2, 3)	826, 82x.6
Pedestrian	V00–V06.(0), V09.(0, 1)	82x.7
Other land transport	V30–V38.(0, 1, 2, 3), V39.(0, 1, 2, 3), V87, V89.(2, 3), V81.0, V82.0, V83–V86.(5, 6, 7, 9), V88, V89.(0, 1)	
Land transport: other or unspecified	V00–V89, V98–V99	800–829
Other transport	V90–V97	830–845

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