



Health and wellbeing of
under-five year olds in
Aotearoa New Zealand
2017

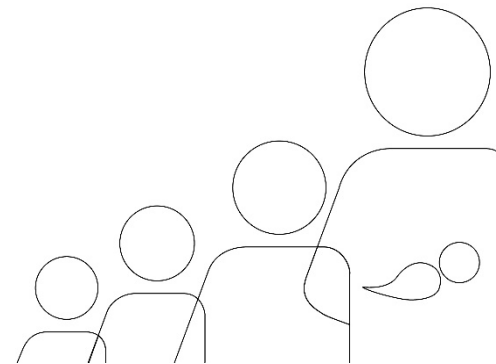




New Zealand Child and Youth
Epidemiology Service

Health and wellbeing of under-five year olds in New Zealand 2017

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This report has been prepared for the Ministry of Health and Paediatric Society of New Zealand

While every endeavour has been made to use accurate data in this report, there are currently variations in the way data are collected from DHB 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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I. INTRODUCTION

In this report the New Zealand Child and Youth Epidemiology Service (NZCYES) provides data and information to contribute to the effective planning and funding of services to improve, promote and protect the health and wellbeing of New Zealand children in their earliest years. The indicators of child health and wellbeing reported in this report begin in the prenatal period and extend to around five years of age. Indicators to be reported in 2018 and 2019 will extend further along the life course, to around age 14 years and age 24 years respectively. Indicator data for this report were extracted in 2017 from a range of routinely collected datasets. For each indicator the report provides an analysis of the most recent data available at the time of writing, followed by evidence for good practice derived from current policies, guidelines and the evidence-based literature. Where possible, the evidence for good practice includes discussion of equity issues relevant to each indicator, to inform service planning and delivery.

The 2017 report begins with the very earliest days in a child's development, the prenatal period. Early enrolment with a lead maternity carer or district health board (DHB) primary maternity service, maternal smoking and maternal weight are sentinel indicators of the health and wellbeing of women who are pregnant.

The next section presents birth outcome data including gestation at birth and birthweight, as well as data about fetal deaths (also known as stillbirths). Birth outcome data can also be used to help quantify the need for care for babies born prematurely or with low birthweight. Birth outcomes are associated with a number of factors, including access to high quality antenatal care (which can help to reduce rates of preterm birth, low birthweight, and stillbirth and also to identify when a newborn baby may require additional services).

The mortality rate for children aged under five years is a high-level indicator of child health and wellbeing within a population. The 2017 report presents data on all deaths of under-five-year-olds, on deaths of infants in the first year of life, including sudden unexpected death in infancy (SUDI), and deaths of 1–4 year olds.

Immunisation and Well Child/Tamariki Ora (WCTO) services provide a foundation for child health and wellbeing. The next three sections of the report present data on breastfeeding, immunisation coverage, and child weight.

Hospitalisations for ambulatory care-sensitive conditions (ASCH) may provide an indication, at a community level, of accessibility of primary care services. However, ACSH rates are also influenced by other factors at a local level, including overall social determinants of health, and must be interpreted in the light of each DHB's specific circumstances. The final section of this report provides data from the community oral health service on oral health of five-year-olds in the community, with further data on hospitalisations of under-five-year-olds for dental conditions.

Two review topics were selected by DHBs for inclusion in this report: *Making health easier: Reducing inequalities in child health through addressing low health literacy* (by Dr Judith Adams) and *Factors that influence inequity of oral health in New Zealand and what we can do about them* (by Deanna M Beckett and Alison M Meldrum, from the University of Otago Dental School). These two sections of the report can inform strategies to promote health and wellbeing for all children. Health services can provide information in a way that supports parents to build their knowledge and skills to keep their children well and safe. Healthy public policy and supportive environments are key components to promote good oral health for all children from their earliest years.

The report appendices provide detail that may be helpful when interpreting information presented in the report. They include detailed descriptions of the methods used to develop evidence for good practice, and the statistical methods used in the data analyses, descriptions of the data sources used for various indicators reported, explanation about classification of ethnicity and social and material deprivation in the report, and a list of the clinical codes relevant to each indicator.

In summary, the 2017 report on health and wellbeing of under-five-year-olds presents data and interpretation on a set of relevant indicators extracted from national health datasets. The data used were the most recent available at the time of writing, and provide a snapshot of achievements and challenges in these areas. This report cannot address questions that require outpatient data, as these are not yet available at a national level. Systems that can provide a fuller picture of outpatient and primary health care data are important to inform child health service planning at national and DHB level.

II. ANTENATAL CARE

Good healthcare for pregnant women has the potential to produce substantial and long-lasting effects on both individual and population health.¹ Lack of antenatal care is associated with higher rates of preterm and low birthweight babies and with more neonatal deaths.² Antenatal care includes assisting women with decision-making during pregnancy, planning and preparation for birth, education, support, and preparation for parenting.³

Maternal factors, including use of tobacco and alcohol, nutrition, and weight management are associated with child health outcomes including fetal and neonatal death, preterm birth and low birthweight.¹ Maternal smoking is associated with lower birthweights, and with adverse child health outcomes including increased risk of sudden unexpected death in infancy.¹ Maternal alcohol use can cause fetal alcohol spectrum disorder, a constellation of physical and neurodevelopmental impairments with lifelong consequences for an affected child.⁴ Maternal underweight and low weight gain in pregnancy are associated with preterm birth and low birthweight. Preconception obesity and excessive weight gain during pregnancy have been linked to neural tube and congenital heart defects as well as to adverse health effects in childhood.¹

The State Services Commission has tasked the public service sector with ensuring pregnant women engage early with antenatal maternity care to promote better pregnancy outcomes and normal healthy births.⁵ ‘Healthy mothers and babies’ is one of the ten specific results of the Better Public Services programme, which has set the target ‘By 2021, 90% of pregnant women are registered with a Lead Maternity Carer in the first trimester, with an interim target of 80% by 2019, with equitable rates for all population groups’.⁵

This section presents data on antenatal care from the Maternity dataset.

Data sources and methods

Indicator

1. *Registration for antenatal care*
2. *Maternal smoking in pregnancy*
3. *Maternal weight*

Data source and definition(s)

National Maternity Collection (MAT)

Registration for antenatal care

Numerator: Number of women who registered for antenatal care during their pregnancy (based on status at delivery)

Denominator: Total number of women that delivered

Maternal smoking in pregnancy

Maternal smoking during antenatal and/or postnatal period

Numerator: Number of registered women identified as smokers at either first registration or two weeks after delivery

Denominator: Total number of women that delivered and were registered with antenatal maternity service providers (LMC or DHB)

Quantity of cigarettes smoked during antenatal and/or postnatal period

Numerator: Number of cigarettes smoked per day at first registration and two weeks after delivery

Denominator: Total number of women that delivered, reported smoking and were registered with antenatal maternity service providers (LMC or DHB)

Maternal weight

Registered women with reported BMI values at first registration

Numerator: Number of registered women in each BMI weight range as reported at first registration

Denominator: Total number of women that delivered, with a documented BMI and were registered with antenatal maternity service providers (LMC or DHB)

BMI weight ranges

Underweight	<18.5 kg/m ²
Healthy weight	18.5–<25.0 kg/m ²
Overweight	25.0–<30.0 kg/m ²
Obese	≥30.0 kg/m ²

Additional information

This section presents information as held within the National Maternity Collection (MAT). An overview of MAT is provided in the appendices. Collection of the pregnant woman's height, weight and smoking status on the Section 88 registration form was implemented in July 2007.

Some district health boards have technical issues with the upload of data to MAT for women receiving antenatal care within their DHB. This means that the proportion of women registered with DHB maternity services at delivery may be under-represented and the proportion of 'unbooked' women at delivery may be overestimated

Analyses within the maternal smoking and weight sections have been limited to women registered with Lead Maternity Carer (LMC) or District Health Board (DHB) primary maternity services as documented at delivery.

Smokers are classified as registered women that indicated 'Y' to smoking or stated a cigarette quantity at either time point

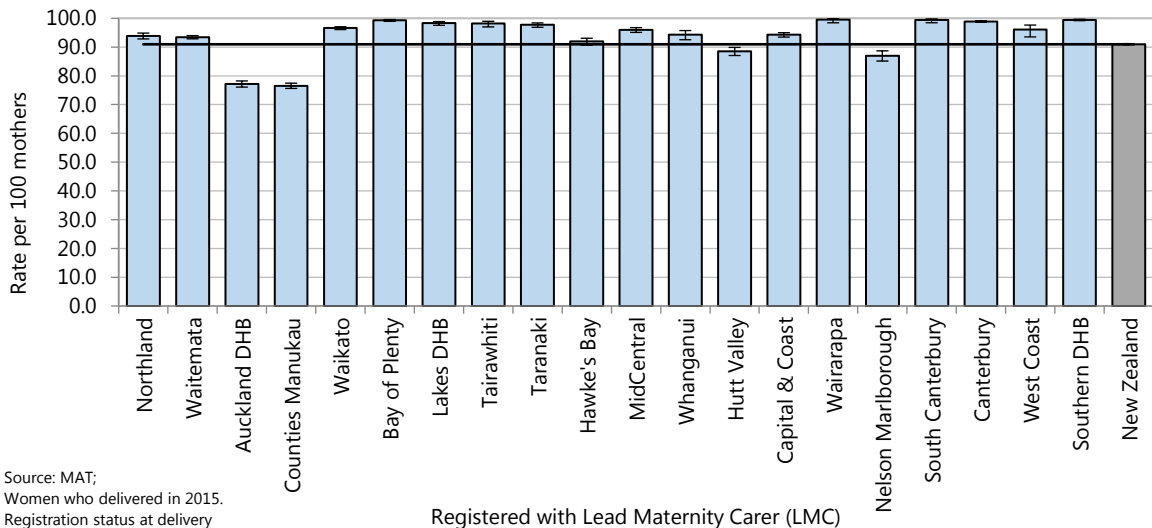
Body mass index (BMI) was calculated based on height (100–215 cm) and weight (40–180 kg) measurements considered valid. Analyses are confined to women registered with LMC or DHB primary maternity services as documented at delivery.

Registration for antenatal care

For some district health boards, the recorded number of unregistered (unbooked) women may be an artefact of a technical issue with upload of data to the National Collection for women receiving antenatal care from DHBs. This section presents information as held within the National Maternity Collection.

The majority of women who delivered in 2015 were registered with a Lead Maternity Carer (LMC) at delivery (Figure II-1, Table II-2). The proportion of women registered with a LMC ranged from 76.6% in Counties Manukau DHB to 99.6% in the Wairarapa.

Figure II-1. Women registered with a Lead Maternity Carer (LMC), by district health board, 2015



Source: MAT;
Women who delivered in 2015.
Registration status at delivery

Table II-1 and Table II-3 present the proportion of women who were either not registered with a LMC at delivery or received antenatal maternity care from DHB-led primary maternity services. Auckland DHB had the highest proportion of women registered with DHB primary maternity services, and Counties Manukau had the highest recorded rate of unregistered women, as recorded in the National Maternity Collection.

Table II-1 Not registered (unbooked) at delivery, by district health board, New Zealand 2015

DHB	2015 (n)	Rate per 100 women	Rate ratio	95% CI
Registration status (at delivery) of women who gave birth in 2015				
Not registered (unbooked)				
Northland	47	2.20	0.49	0.37–0.66
Waitemata	114	1.51	0.34	0.28–0.41
Auckland	124	2.10	0.47	0.40–0.56
Counties Manukau	1,318	16.09	3.62	3.40–3.85
Waikato	155	2.94	0.66	0.56–0.77
Bay of Plenty	14	0.50	0.11	0.07–0.19
Lakes	20	1.33	0.30	0.19–0.46
Tairāwhiti	5	0.68	0.15	0.06–0.37
Taranaki	12	0.79	0.18	0.10–0.31
Hawke's Bay	75	3.75	0.84	0.67–1.06
MidCentral	81	3.84	0.86	0.70–1.07
Whanganui	44	5.40	1.21	0.91–1.62
Hutt Valley	61	3.10	0.70	0.54–0.90
Capital & Coast	135	3.82	0.86	0.72–1.02
Wairarapa	<5	s	s	s
Nelson Marlborough	182	12.84	2.89	2.51–3.33
South Canterbury	<5	s	s	s
Canterbury	56	0.90	0.20	0.16–0.26
West Coast	14	3.92	0.88	0.53–1.48
Southern	15	0.44	0.10	0.06–0.16
New Zealand	2,620	4.45	1.00	

Source: MAT; Rate per 100 women. Rate ratios are unadjusted. Data as held within the National Maternity Collection

Table II-2 Registered with Lead Maternity Carer (LMC) at delivery, by district health board, New Zealand 2015

DHB	2015 (n)	Rate per 100 women*	Rate ratio	95% CI
Registration status (at delivery) of women who gave birth in 2015				
Registered with Lead Maternity Carer (LMC)				
Northland	2,008	93.9	1.03	1.02–1.04
Waitemata	7,069	93.4	1.03	1.02–1.03
Auckland	4,555	77.2	0.85	0.84–0.86
Counties Manukau	6,270	76.6	0.84	0.83–0.85
Waikato	5,098	96.6	1.06	1.06–1.07
Bay of Plenty	2,772	99.3	1.09	1.09–1.10
Lakes	1,482	98.3	1.08	1.07–1.09
Tairāwhiti	722	98.2	1.08	1.07–1.09
Taranaki	1,482	97.8	1.07	1.07–1.08
Hawke's Bay	1,841	92.0	1.01	1.00–1.02
MidCentral	2,026	96.0	1.06	1.05–1.07
Whanganui	769	94.4	1.04	1.02–1.05
Hutt Valley	1,740	88.5	0.97	0.96–0.99
Capital & Coast	3,334	94.3	1.04	1.03–1.05
Wairarapa	461	99.6	1.09	1.09–1.10
Nelson Marlborough	1,233	87.0	0.96	0.94–0.98
South Canterbury	655	99.4	1.09	1.09–1.10
Canterbury	6,132	98.9	1.09	1.08–1.09
West Coast	343	96.1	1.06	1.03–1.08
Southern	3,396	99.5	1.09	1.09–1.10
New Zealand	53,611	91.0	1.00	

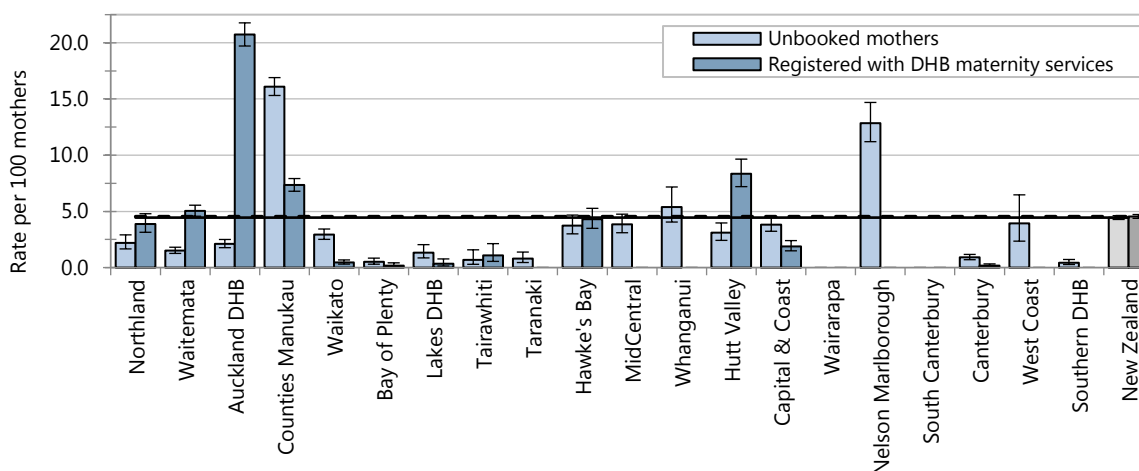
Source: MAT; Rate per 100 women who delivered in 2015. Rate ratios are unadjusted. Data as held within the National Maternity Collection

Table II-3 Registered with DHB maternity services at delivery, by district health board, New Zealand 2015

DHB	2015 (n)	Rate per 100 women	Rate ratio	95% CI
Registration status (at delivery) of women who gave birth in 2015				
Registered with DHB maternity services				
Northland	83	3.9	3.14–4.79	0.85
Waitemata	381	5.0	4.57–5.55	1.11
Auckland	1,223	20.7	19.71–21.77	4.56
Counties Manukau	601	7.3	6.79–7.92	1.61
Waikato	24	0.5	0.31–0.68	0.10
Bay of Plenty	5	0.2	0.08–0.42	0.04
Lakes	5	0.3	0.14–0.77	0.07
Tairāwhiti	8	1.1	0.55–2.13	0.24
Taranaki	<5	s	s	s
Hawke's Bay	86	4.3	3.49–5.27	0.95
MidCentral	<5	s	s	s
Whanganui	<5	s	s	s
Hutt Valley	164	8.3	7.20–9.65	1.84
Capital & Coast	67	1.9	1.49–2.40	0.42
Wairarapa	0	..	..	..
Nelson Marlborough	<5	s	s	s
South Canterbury	0	..	..	..
Canterbury	11	0.2	0.10–0.32	0.04
West Coast	0	..	..	..
Southern	<5	s	s	s
New Zealand	2,678	4.5	4.38–4.72	

Source: MAT; Rate per 100 women who delivered in 2015. Rate ratios are unadjusted. Data as held within the National Maternity Collection

Figure II-2 Women who were recorded in National Maternity Collection as not registered (unbooked) or registered with DHB maternity services, by district health board 2015



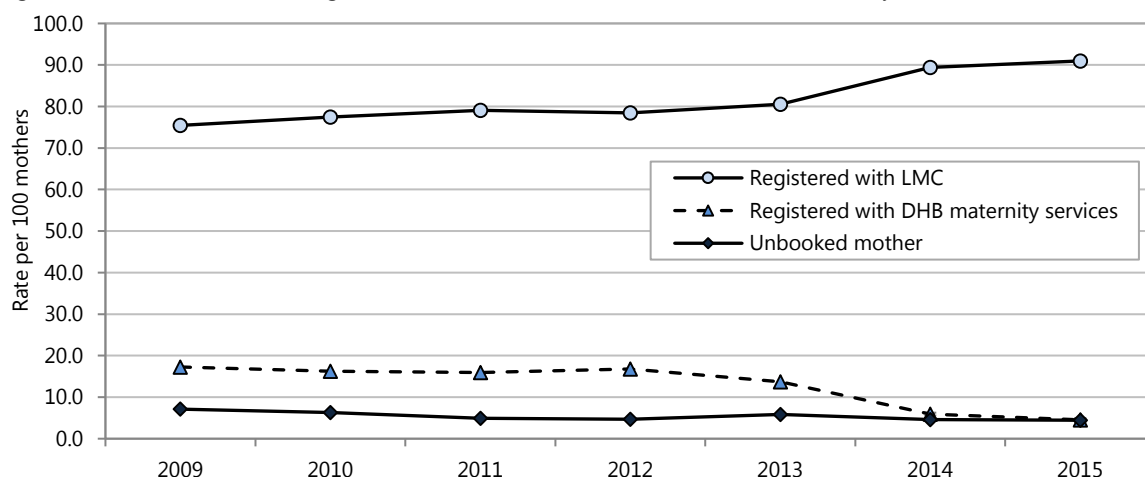
Source: MAT; Women who delivered in 2015. Registration status at delivery

The proportion of women registered with a LMC has gradually increased since 2009 (Figure II-3).

Table II-4 presents the proportion of women by their registration status (at delivery) during 2015. The majority of women had registered with a midwife. Nearly 5% of women were registered with DHB primary maternity services and just over 5% were registered with an obstetrician.

Table II-5 presents the trimester in which women first registered with an antenatal care provider whether that is a LMC or DHB primary maternity services. Of the women recorded as registered for antenatal care, either with a LMC or with DHB maternity services, nearly 70% registered in the first trimester. These rates for 2015 are lower than the interim Better Public Service 2019 target of 80% of pregnant women registered with a Lead Maternity Carer in the first trimester (90% by 2021).

Figure II-3 Trends in maternal registration status for antenatal care at the time of delivery, New Zealand 2009–2015



Source: MAT;
Registration status at delivery

Table II-4 Maternal registration status for antenatal care at the time of delivery, New Zealand 2015

Maternal registration status at delivery	n	Rate
Women who gave birth in 2015		
Antenatal maternity provider (at delivery)		
Unregistered/Unbooked	2,620	4.45
Lead Maternity Carer (LMC)	53,611	90.97
GP	151	0.26
Midwife	50,395	85.51
Obstetrician	3,065	5.20
District Health Board (DHB) maternity team	2,678	4.54
Other or unknown registration	24	0.04
Total	58,933	100.00

Source: MAT; Rate per 100 women that delivered. *Registration with a LMC or a DHB maternity team

Table II-5 Trimester of pregnancy in which registration occurred among all registered women, New Zealand 2015

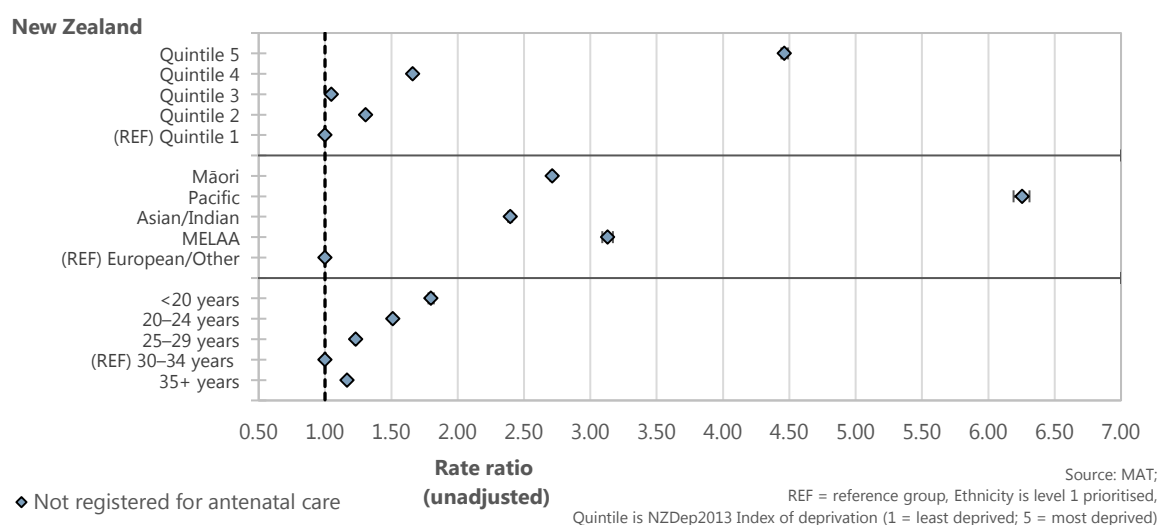
	n	Rate
Women who gave birth in 2015		
Trimester of registration for antenatal care*		
First	38,623	68.6
Second	15,107	26.8
Third	2,390	4.2
Total*	56,289	100.0
Registered with a Lead Maternity Carer		
First	37,733	70.4
Second	13,791	25.7
Third	2,084	3.9
Total*	53,611	100.0
Registered with a District Health Board maternity team		
First	890	33.2
Second	1,316	49.1
Third	306	11.4
Total*	2,678	100.0

Source: MAT; Rate per 100 women that delivered. Total* includes those with an unspecified trimester

Figure II-4 presents the national proportion of unregistered (unbooked) women by the residential deprivation score (NZDep2013 index of deprivation score), maternal age, and ethnicity. The unadjusted rate ratio presents the gap, if any, between the groups and the reference group. The following associations were observed, bearing in mind that this univariate analysis does not quantify the independent effect of each demographic factor:

- The national rate of unregistered women was highest for those residing in areas with the highest NZDep2013 scores (quintile 5; deciles 9–10). This proportion was significantly higher than the rate of unregistered women residing in areas with the lowest NZDep2013 scores (quintile 1; deciles 1–2).
- The proportion of unregistered women was significantly lower for European/Other women compared with unregistered women of other ethnic groups.
- The highest proportion of unregistered women was for women aged under 20 years. The proportion of unregistered women was significantly lower among women aged 30–34 years compared to the unregistered women within the other age groups.

Figure II-4 Unregistered women, by demographic factor, New Zealand 2015



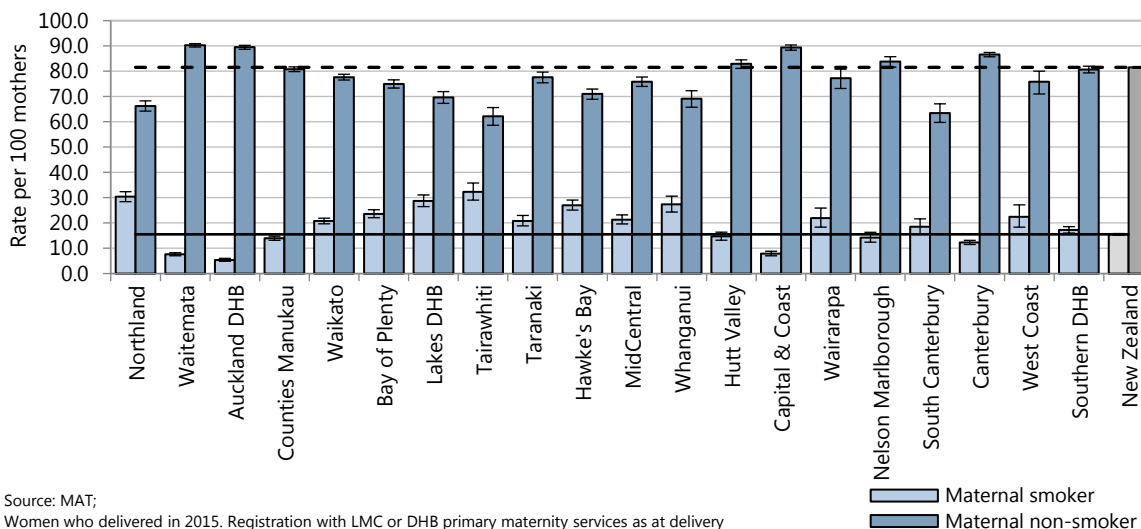
Maternal smoking

Figure II-5, Table II-6 and Table II-7 present for each district health board the proportion of women who delivered in 2015 and who were registered for antenatal care (either with a Lead Maternity Carer (LMC) or with DHB primary maternity services) by reported smoking status either at first registration and/or at two weeks post-delivery. The majority of registered women were recorded as not smoking (DHB range: 62.3% in Tairāwhiti to 90.3% in Waitemata).

Rates of maternal smoking were significantly lower than the national rate in Waitemata, Auckland, Capital & Coast, and Canterbury DHBs and were not significantly different from the national rate in Hutt Valley and Nelson Marlborough DHBs; the remaining DHBs had maternal smoking rates significantly higher than national rate (Figure II-5, Table II-6).

Nationally the proportion of registered women reported as not smoking has gradually increased since 2008 (Figure II-6).

Figure II-5 Maternal smoking status, by district health board 2015



Source: MAT; Women who delivered in 2015. Registration with LMC or DHB primary maternity services as at delivery

Maternal smoker
Maternal non-smoker

Table II-6 Maternal smoker at delivery, by district health board, New Zealand 2015

DHB	2015 (n)	Rate per 100 women*	Rate ratio	95% CI
Women registered for antenatal care who gave birth in 2015				
Maternal smoker				
Northland	635	30.4	1.96	1.83–2.09
Waitemata	567	7.6	0.49	0.45–0.53
Auckland	312	5.4	0.35	0.31–0.39
Counties Manukau	958	13.9	0.90	0.84–0.96
Waikato	1,063	20.8	1.34	1.26–1.42
Bay of Plenty	656	23.6	1.52	1.42–1.63
Lakes	427	28.7	1.85	1.70–2.01
Tairāwhiti	236	32.3	2.08	1.87–2.32
Taranaki	309	20.8	1.34	1.21–1.49
Hawke's Bay	521	27.0	1.74	1.62–1.88
MidCentral	433	21.3	1.38	1.26–1.50
Whanganui	211	27.4	1.76	1.57–1.98
Hutt Valley	280	14.7	0.95	0.85–1.06
Capital & Coast	268	7.9	0.51	0.45–0.57
Wairarapa	101	21.9	1.41	1.19–1.68
Nelson Marlborough	176	14.3	0.92	0.80–1.05
South Canterbury	121	18.5	1.19	1.01–1.40
Canterbury	755	12.3	0.79	0.74–0.85
West Coast	77	22.4	1.45	1.19–1.76
Southern	586	17.2	1.11	1.03–1.20
New Zealand	8,734	15.5	1.00	

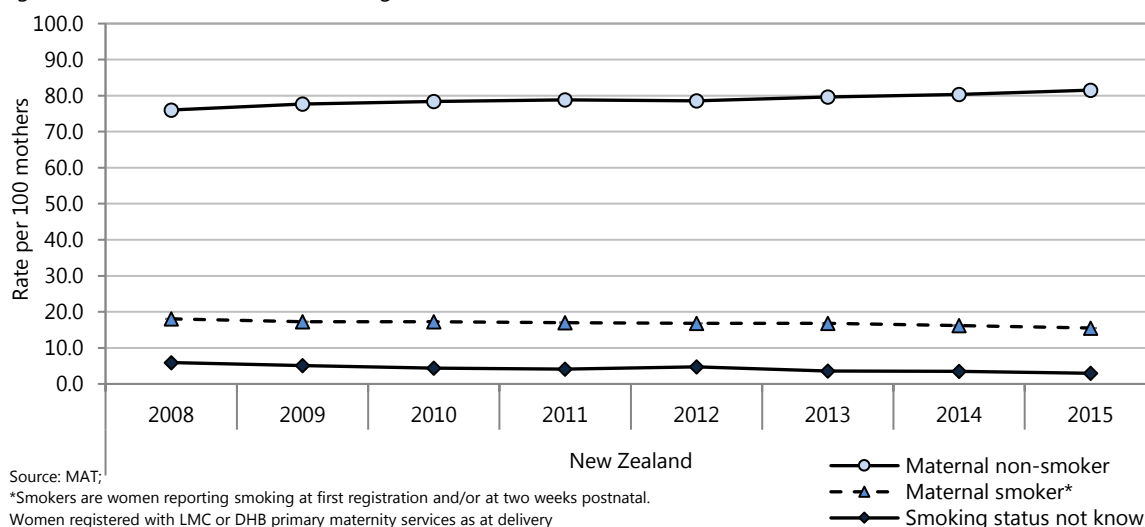
Source: MAT; Rate per 100 registered women who delivered in 2015. Registration with LMC or DHB primary maternity services as at delivery. Rate ratios are unadjusted

Table II-7 Maternal non-smoker at delivery, by district health board, New Zealand 2015

DHB	2015 (n)	Rate per 100 women*	Rate ratio	95% CI
Women registered for antenatal care who gave birth in 2015				
Maternal non-smoker				
Northland	1,386	66.3	0.81	0.79–0.84
Waitemata	6,725	90.3	1.11	1.10–1.12
Auckland	5,170	89.5	1.10	1.09–1.11
Counties Manukau	5,552	80.8	0.99	0.98–1.00
Waikato	3,979	77.7	0.95	0.94–0.97
Bay of Plenty	2,083	75.0	0.92	0.90–0.94
Lakes	1,036	69.7	0.85	0.83–0.88
Tairāwhiti	454	62.2	0.76	0.72–0.81
Taranaki	1,151	77.6	0.95	0.93–0.98
Hawke's Bay	1,368	71.0	0.87	0.85–0.90
MidCentral	1,540	75.9	0.93	0.91–0.95
Whanganui	533	69.1	0.85	0.81–0.89
Hutt Valley	1,578	82.9	1.02	1.00–1.04
Capital & Coast	3,040	89.4	1.10	1.08–1.11
Wairarapa	356	77.2	0.95	0.90–1.00
Nelson Marlborough	1,035	83.8	1.03	1.00–1.05
South Canterbury	416	63.5	0.78	0.73–0.83
Canterbury	5,319	86.6	1.06	1.05–1.07
West Coast	260	75.8	0.93	0.88–0.99
Southern	2,743	80.7	0.99	0.97–1.01
New Zealand	45,892	81.5	1.00	

Source: MAT; Rate per 100 registered women who delivered in 2015. Registration with LMC or DHB primary maternity services as at delivery. Rate ratios are unadjusted

Figure II-6 Trends in maternal smoking status, New Zealand 2008–2015



Source: MAT;
*Smokers are women reporting smoking at first registration and/or at two weeks postnatal.
Women registered with LMC or DHB primary maternity services as at delivery

Table II-8 presents the proportion of registered women by their smoking status during 2015. Of the registered women that reported smoking, many had indicated smoking at first registration and also at two weeks post-natal (69.3% of 8,735).

Table II-9 presents the quantities of cigarettes smoked daily by registered women who indicated smoking at both points. Nationally, the majority of women who smoked indicated smoking less than 10 cigarettes a day. However, a smaller proportion reported smoking 10–20 or more than 20 cigarettes a day, with a small number of women changing the quantity of cigarettes smoked between first registration and two weeks postnatal.

Table II-8 Maternal smoking status at first registration and/or at two weeks post-delivery, New Zealand 2015

Maternal smoking status	2015 (n)	Rate per 100 women	
Women registered with antenatal care* who gave birth in 2015			
New Zealand			
Non-smoker	45,894	81.53	
Smoker†	8,735	15.52	
Unknown‡	1,663	2.95	
Maternal smoking status by time point			
first registration	two weeks postnatal		
Non-smoker	Non-smoker	45,892	81.53
	Smoker	506	0.90
	Not known	1,546	2.75
Smoker	Non-smoker	1,707	3.03
	Smoker	6,051	10.75
	Not known	460	0.82
Not known	Non-smoker	77	0.14
	Smoker	0	..
	Not known	40	0.07
Total	56,289	100.00	

Source: MAT; *Maternal registration with LMC or DHB primary maternity service. †Smokers classified as registered women that indicated 'Y' to smoking or stated a cigarette quantity at either time point. ‡Unknown indicated at either time point

Table II-9 Reported quantities of cigarettes smoked daily at first registration and at two weeks post-delivery among all registered women who reported smoking, New Zealand 2015

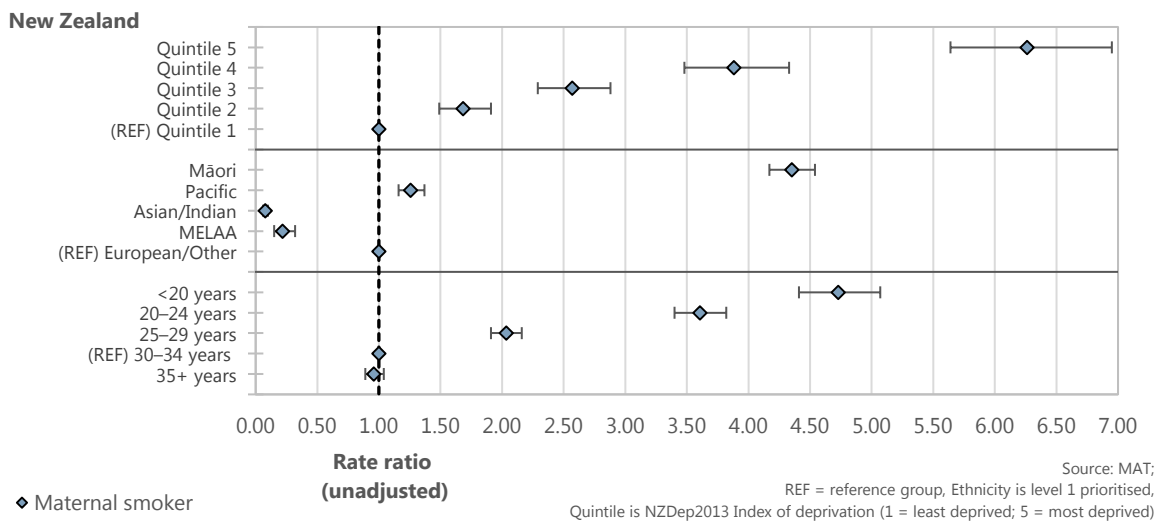
	n	Rate	n	Rate	n	Rate	n	Rate	
Women registered with antenatal care* who gave birth in 2015									
New Zealand									
Number of cigarettes smoked daily	At two weeks post-delivery								
		<10		10–20		>20		Total	
At first registration	<10	3,497	57.9	263	4.4	29	0.5	3,789	62.7
	10–20	507	8.4	1,479	24.5	30	0.5	2,016	33.4
	>20	42	0.7	50	0.8	142	2.4	234	3.9
	Total	4,046	67.0	1,792	29.7	201	3.3	6,039	100.0

Source: MAT; Rate per 100 maternal smokers. Quantities as reported at first registration and at two weeks post-delivery

Figure II-7 presents the national proportion of registered women who reported smoking by the residential deprivation score (NZDep2013 index of deprivation score), maternal age, and ethnicity. The unadjusted rate ratio presents the gap, if any, between the groups and the reference group. The following associations were observed, bearing in mind that this univariate analysis does not quantify the independent effect of each demographic factor:

- Maternal smoking rates were higher for those residing in areas with the higher (quintiles 2–5; deciles 3–10) NZDep2013 scores compared with quintile 1 (deciles 1–2)
- The proportion of maternal smokers were significantly higher for Māori and Pacific women, compared with European/Other
- The maternal smoking rates were significantly higher among registered women under 30 years of age compared with registered women aged 30–34 years

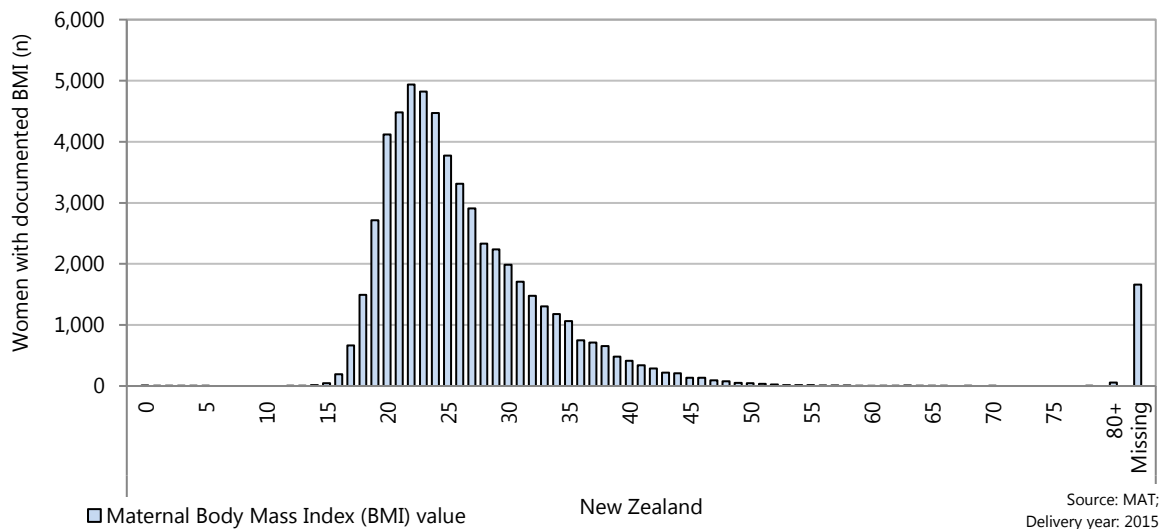
Figure II-7 Maternal smoking status, by demographic factor, New Zealand 2015



Maternal weight

Figure II-8 presents the spread of BMI values reported to the National Maternity Collection (MAT) for women who delivered in 2015. Given the wide range of BMI values reported (range from 1 to 3954 kg/m²), subsequent analyses have been limited to values between 10 and 80 kg/m² for women who were registered either with a Lead Maternity Carer (LMC) or with DHB primary maternity services.

Figure II-8 Distribution of BMI values at first registration, New Zealand 2015



The proportion of registered women who delivered in 2015 with BMI values reported at first registration are presented in Table II-10. Nearly 50% of the registered women had a reported BMI within the healthy/normal weight range, while around 24% of women had BMI within the obese range (Table II-10).

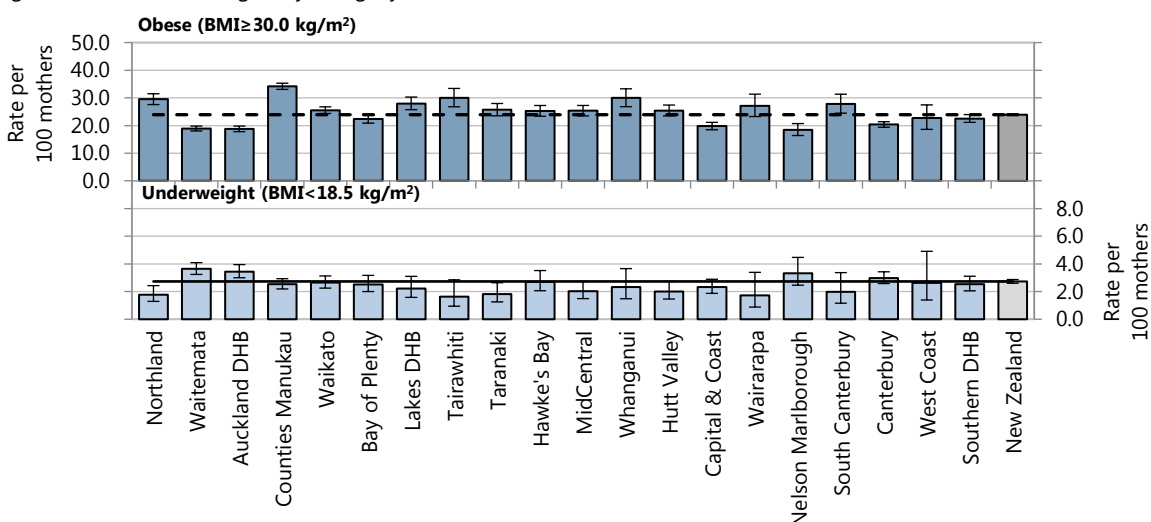
Table II-10 Maternal weight at first registration, New Zealand 2015

BMI (kg/m ²) at first registration	2015 (n)	Rate per 100 women
Women registered with antenatal care who gave birth in 2015		
New Zealand		
Underweight (<18.5)	1,538	2.73
Healthy weight (18.5–<25.0)	26,468	47.02
Overweight (25.0–<30.0)	14,480	25.72
Obese (≥30.0)	13,466	23.92
Not stated	337	0.60
Total	56,289	100.00

Source: MAT; Maternal registration with LMC or DHB primary maternity service. Body mass index (BMI) in kg/m²

Figure II-9 and Table II-11 to Table II-13 present for each district health board the proportion of women who delivered in 2015 with BMI values at first registration reported in the underweight or obese weight ranges. Rates of women with weight in the obese range prior to pregnancy were significantly higher than the national rate in Northland, Counties Manukau, Waikato, Lakes, Tairāwhiti, Whanganui, and South Canterbury DHBs. The rates of maternal obesity for remaining DHBs were similar to or significantly lower than the national rate (Figure II-9, Table II-13). A quarter of registered women were reported with weights within the overweight range. Rates of maternal underweight were significantly higher than the national rate in Waitemata and Auckland DHBs.

Figure II-9 Maternal weight, by category and district health board, 2015



Source: MAT; Women who delivered in 2015. Registration with LMC or DHB primary maternity services as at delivery

Table II-11 Maternal BMI categorised as underweight, by district health board, New Zealand 2015

DHB	2015 (n)	Rate	95% CI	Rate ratio	95% CI (RR)
Women who gave birth in 2015					
BMI: underweight (<18.5 kg/m ²)					
Northland	37	1.77	1.29–2.43	0.65	0.47–0.89
Waitemata	271	3.64	3.24–4.09	1.33	1.17–1.51
Auckland	199	3.44	3.00–3.95	1.26	1.09–1.46
Counties Manukau	174	2.53	2.19–2.93	0.93	0.79–1.08
Waikato	136	2.66	2.25–3.13	0.97	0.82–1.16
Bay of Plenty	70	2.52	2.00–3.17	0.92	0.73–1.17
Lakes	33	2.22	1.58–3.10	0.81	0.58–1.14
Tairāwhiti	12	1.64	0.94–2.85	0.60	0.34–1.06
Taranaki	27	1.82	1.25–2.64	0.67	0.46–0.97
Hawke's Bay	52	2.70	2.06–3.52	0.99	0.75–1.30
MidCentral	41	2.02	1.49–2.73	0.74	0.54–1.01
Whanganui	18	2.33	1.48–3.66	0.85	0.54–1.35
Hutt Valley	38	2.00	1.46–2.73	0.73	0.53–1.00
Capital & Coast	79	2.32	1.87–2.89	0.85	0.68–1.06
Wairarapa	8	1.74	0.88–3.39	0.64	0.32–1.26
Nelson Marlborough	41	3.32	2.46–4.47	1.22	0.90–1.65
South Canterbury	13	1.98	1.16–3.37	0.73	0.42–1.25
Canterbury	183	2.98	2.58–3.43	1.09	0.94–1.27
West Coast	9	2.62	1.39–4.91	0.96	0.50–1.83
Southern	86	2.53	2.05–3.11	0.93	0.75–1.15
Otago	44	2.27	1.69–3.03	0.83	0.62–1.12
Southland	42	2.88	2.14–3.87	1.06	0.78–1.43
New Zealand	1,538	2.73	2.60–2.87	1.00	

Source: MAT; Rate per 100 registered women who delivered in 2015. Registration with LMC or DHB primary maternity services as at delivery. Rate ratios are unadjusted

Table II-12 Maternal BMI categorised as overweight, by district health board, New Zealand 2015

DHB	2015 (n)	Rate	95% CI	Rate ratio	95% CI (RR)
Women who gave birth in 2015					
BMI: overweight (25.0–<30.0 kg/m ²)					
Northland	567	27.12	25.25–29.06	1.05	0.98–1.13
Waitemata	1,732	23.25	22.30–24.22	0.90	0.87–0.94
Auckland	1,266	21.91	20.86–23.00	0.85	0.81–0.90
Counties Manukau	1,743	25.37	24.35–26.41	0.99	0.94–1.03
Waikato	1,359	26.53	25.34–27.76	1.03	0.98–1.08
Bay of Plenty	741	26.68	25.07–28.36	1.04	0.97–1.10
Lakes	449	30.20	27.91–32.58	1.17	1.09–1.27
Tairāwhiti	211	28.90	25.73–32.30	1.12	1.00–1.26
Taranaki	414	27.92	25.69–30.25	1.09	1.00–1.18
Hawke's Bay	526	27.30	25.35–29.33	1.06	0.99–1.14
MidCentral	568	27.99	26.08–29.99	1.09	1.01–1.17
Whanganui	220	28.53	25.46–31.82	1.11	0.99–1.24
Hutt Valley	504	26.47	24.54–28.50	1.03	0.95–1.11
Capital & Coast	842	24.76	23.34–26.24	0.96	0.91–1.02
Wairarapa	136	29.50	25.52–33.82	1.15	1.00–1.32
Nelson Marlborough	322	26.07	23.70–28.59	1.01	0.92–1.11
South Canterbury	182	27.79	24.49–31.34	1.08	0.95–1.22
Canterbury	1,621	26.39	25.30–27.50	1.03	0.98–1.07
West Coast	92	26.82	22.41–31.75	1.04	0.87–1.24
Southern	932	27.42	25.95–28.94	1.07	1.01–1.13
Otago	528	27.19	25.26–29.21	1.06	0.98–1.14
Southland	404	27.73	25.49–30.08	1.08	0.99–1.17
New Zealand	14,480	25.72	25.36–26.09	1.00	

Source: MAT; Rate per 100 registered women who delivered in 2015. Registration with LMC or DHB primary maternity services as at delivery. Rate ratios are unadjusted

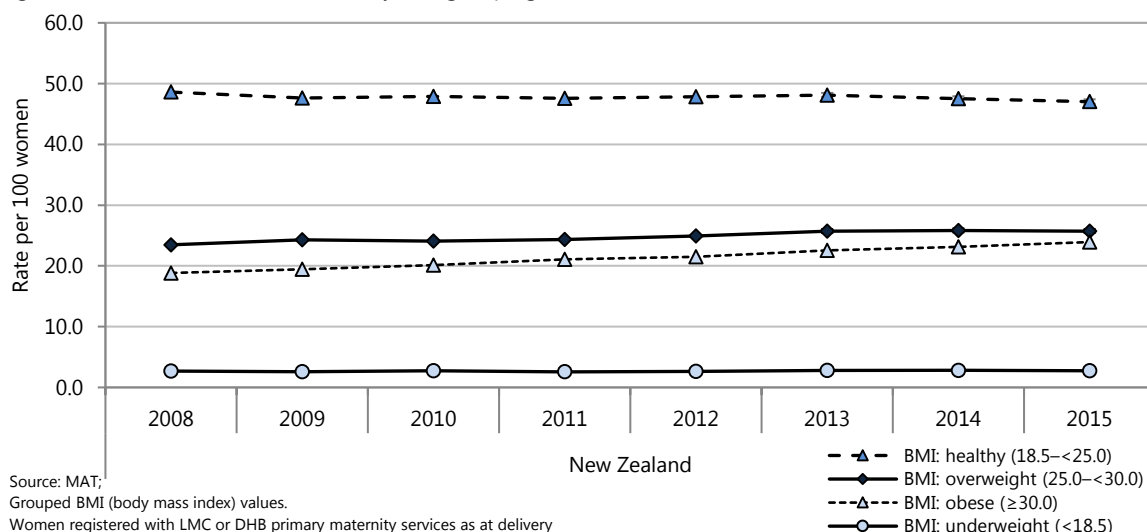
Table II-13 Maternal BMI categorised as obese, New Zealand 2015

DHB	(n)	Rate	95% CI	Rate ratio	95% CI (RR)
Women who gave birth in 2015					
BMI: obese (≥ 30.0 kg/m ²)					
Northland	617	29.51	27.59–31.50	1.23	1.15–1.32
Waitemata	1,410	18.93	18.05–19.83	0.79	0.75–0.83
Auckland	1,086	18.80	17.81–19.82	0.79	0.74–0.83
Counties Manukau	2,349	34.19	33.07–35.32	1.43	1.38–1.48
Waikato	1,309	25.56	24.38–26.77	1.07	1.02–1.12
Bay of Plenty	622	22.40	20.89–23.99	0.94	0.87–1.00
Lakes	416	27.98	25.75–30.31	1.17	1.08–1.27
Tairāwhiti	219	30.00	26.79–33.42	1.25	1.12–1.40
Taranaki	381	25.69	23.53–27.98	1.07	0.98–1.17
Hawke's Bay	487	25.27	23.38–27.26	1.06	0.98–1.14
MidCentral	514	25.33	23.49–27.27	1.06	0.98–1.14
Whanganui	231	29.96	26.83–33.29	1.25	1.12–1.40
Hutt Valley	484	25.42	23.52–27.42	1.06	0.98–1.15
Capital & Coast	673	19.79	18.48–21.16	0.83	0.77–0.89
Wairarapa	125	27.11	23.26–31.35	1.13	0.98–1.32
Nelson Marlborough	228	18.46	16.40–20.72	0.77	0.69–0.87
South Canterbury	182	27.79	24.49–31.34	1.16	1.03–1.32
Canterbury	1,251	20.36	19.38–21.39	0.85	0.81–0.90
West Coast	78	22.74	18.62–27.46	0.95	0.78–1.16
Southern	766	22.54	21.16–23.97	0.94	0.88–1.00
Otago	429	22.09	20.30–23.99	0.92	0.85–1.01
Southland	337	23.13	21.04–25.36	0.97	0.88–1.06
New Zealand	13,466	23.92	23.57–24.28	1.00	

Source: MAT; Rate per 100 registered women who delivered in 2015. Registration with LMC or DHB primary maternity services as at delivery. Rate ratios are unadjusted

Figure II-10 presents the trends for the various maternal weight ranges. The proportion of registered women reported within the healthy weight range at first registration has been consistently around 48% since 2008. The proportion of registered women with overweight or obese weights has gradually increased over time.

Figure II-10 Trends in maternal BMI, by BMI grouping, New Zealand 2008–2015



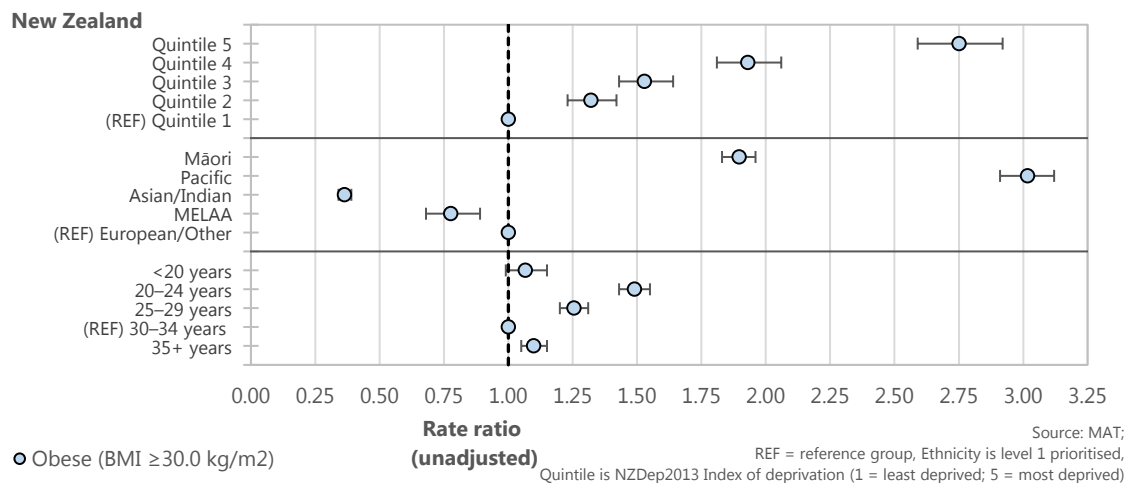
Source: MAT; Grouped BMI (body mass index) values. Women registered with LMC or DHB primary maternity services as at delivery

Figure II-11 presents the proportion of registered women who were reported with weight in the obese range by the residential deprivation score (NZDep2013 index of deprivation score), maternal age, and ethnicity. The unadjusted rate ratio presents the gap, if any, between the groups and the reference group.

The following associations were observed, bearing in mind that this univariate analysis does not quantify the independent effect of each demographic factor: At first registration:

- The proportion of women who were considered obese was significantly lower among registered women residing in areas with the lowest (quintile 1; deciles 1–2) NZDep2013 scores compared with quintiles 2–5
- The proportion of women considered obese was significantly higher for Māori and Pacific women, compared with European/Other
- Compared with registered women aged 30–34 years, obesity rates were significantly higher for women aged 20–29 and 35 years and older.

Figure II-11 Maternal obesity, by demographic factor, New Zealand 2015



Evidence for good practice

A baby’s growth and development in the womb affects not only their health as a newborn but also their health in childhood and adulthood. The evidence for good practice includes evidence to improve provision of, and women’s engagement with, antenatal care, and evidence for smoking cessation interventions for pregnant women. For an overview of good practice regarding preterm births, refer to the Birth Outcomes section of this report.

Antenatal care

Common causes of problems at birth are prematurity, fetal growth restriction, congenital abnormalities and asphyxia.⁶ Good antenatal care can prevent or ameliorate some of these problems.⁶ Early engagement with antenatal care facilitates screening for sexually transmitted infections, congenital abnormalities, maternal mental health issues and family violence.⁷ It also allows identification of any medical conditions that may affect the pregnancy, such as diabetes, hypertension, a family history of genetic disease, or a previous history of preterm delivery or preeclampsia.⁷

There is increasing evidence that a person’s chronic disease risk in adulthood is affected by the woman’s nutrition during pregnancy.⁸ Attention to modifiable lifestyle risks such as smoking, alcohol and drug abuse, obesity, malnutrition, and inadequate folic acid intake is especially important.⁶

Smoking cessation in pregnancy

Tobacco smoking in pregnancy is probably the single most important modifiable risk factor for adverse pregnancy outcomes.^{9,10} It is associated with fetal growth restriction, and increased risks of premature delivery, placental abruption, stillbirth and sudden unexpected death in infancy.¹¹ Children of mothers who smoked during pregnancy have measureable impairment in lung function, increased hospitalisation for respiratory infections, and increased prevalence of wheeze and asthma.¹²

There is high quality evidence that counselling increases smoking cessation in late pregnancy.¹³ There is also high quality evidence that financial incentive interventions are more effective than alternative interventions.¹³ There is moderate quality evidence that feedback increases smoking cessation (compared to usual care) when it

is provided together with other strategies such as counselling.¹³ The effects of health education and social support are less certain.¹³

Nicotine replacement therapy (NRT) is effective in helping non-pregnant smokers to quit.¹⁴ The SNAP RCT of nicotine replacement patches in pregnant women (15mg per 16 hours) found that the patches had no significant effect on smoking cessation rates at delivery (9.4% in the NRT and 7.6% in the placebo group, odds ratio 1.26, 95% CI 0.82 to 1.96); however, at two years old the children born to the mothers who took NRT were more likely to have no developmental impairment (72.6% vs. 65.5%, OR 1.40, 95% CI 1.05 to 1.86).¹⁵ Numbers of adverse pregnancy and birth outcomes were similar in trial groups, except that there were more caesarean deliveries in the NRT group. A 2017 review¹⁶ of the possible adverse effects of NRT concluded that, for the more commonly studied reproductive/developmental outcomes (including fetal loss, spontaneous abortion, birthweight, prematurity, neonatal intensive care admissions, overall incidence of congenital abnormalities and ADHD), the available evidence suggests a lack of effect of NRT.

Equity

There are large disparities in perinatal health between countries and between different population groups within countries.¹⁷ The latest report from New Zealand's Perinatal and Maternal Mortality Review Committee¹⁸ indicates that increasing socioeconomic deprivation is associated with increasing odds of stillbirth and neonatal death (after adjusting for maternal age, ethnicity, multiple pregnancy, baby sex and year of birth). The Growing Up in New Zealand (GUINZ) study conducted in 2009-10 found that factors independently associated with delayed engagement with lead maternity carer were non-European ethnicity, first pregnancy, age < 20 years and socio-economic deprivation.¹⁹ Research conducted in Counties Manukau DHB in 2011 found that women were more likely to book late (after 18 weeks' gestation) if they had limited resources, no tertiary education or were not living with a husband or partner.²⁰ Women who have lives complicated by difficult social circumstances, or psychiatric or addiction problems, need appropriate care from multidisciplinary services.⁷

The research conducted in Counties Manukau DHB in 2011 also found that Māori and Pacific women were almost six times more likely to book late than European/other women.²⁰ Research that interviewed young Māori women (aged < 20 years) about their experiences with maternity care found that, contrary to other published literature, young pregnant Māori women were engaging early with health services (GP services and school and youth health services), but that they faced system level barriers connecting with midwifery care.²¹ It was common for the women to be given a list of midwives' phone numbers and left to find their own midwife. They often found the process difficult, having to ring a number of midwives to find one who was available to care for them. Support from health professionals and family and whānau helped some of these young women connect with a midwife. It is clearly important for the first health professional a woman sees in her pregnancy to offer to help with finding a lead maternity carer.

Smoking in pregnancy is a major contributor to the inequality in birth outcomes between high and low socioeconomic status women, as the prevalence of smoking in pregnancy is much higher among disadvantaged women.²² One of the barriers to Māori women quitting smoking in pregnancy is living or socialising with others who smoke so it is important to include the family in smoking cessation interventions.²³ Anti-smoking campaigns need to beware of stigmatising already marginalised groups and recognise the low self-esteem, low self-efficacy, poverty, stress and increased caring responsibilities that are common in women who continue to smoke in pregnancy.^{13,24}

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Royal College of Obstetricians and Gynaecologists (UK) guidelines <https://www.rcog.org.uk/en/guidelines-research-services/guidelines/>

The RCOG has numerous clinical guidelines relating to aspects of maternity care, some of the more general of which are listed below.

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III. BIRTH OUTCOMES

Gestation

The length of a normal pregnancy is between 37–42 completed weeks gestation; babies born before 37 completed weeks are described as preterm, and those born after 42 completed weeks are described as post-term.^{1,2} Although most preterm births happen spontaneously, they may also result from early induction of labour or caesarean birth for medical or non-medical reasons.¹ Common causes of spontaneous preterm birth include multiple pregnancies, infections and chronic maternal health conditions (such as diabetes and high blood pressure), and there may also be genetic influences.¹

Preventing deaths and complications from preterm birth starts with a healthy pregnancy and high quality antenatal care. Counselling about healthy diet and optimal nutrition, support to stop tobacco and substance use, and interventions to measure fetal growth and detect multiple pregnancies can all help to reduce preterm birth rates and to provide appropriate care to babies born preterm. Cost-effective care for preterm babies includes: essential care during child birth; antenatal steroid injections given to pregnant women at risk of preterm labour to improve infant outcomes; placing the baby close to the mother with skin-to-skin contact and frequent breastfeeding ('kangaroo care'), and antibiotic use to treat newborn infections.¹

Data sources and methods

Indicator

1. Gestational age of liveborn babies
2. Preterm births

Data source and definition(s)

National Maternity Collection (MAT)

Gestational age of liveborn babies

Numerator: Number of liveborn babies born with a documented gestational age

Denominator: Total number of liveborn babies

Gestational age groups were defined in accordance with WHO criteria²

Preterm: less than 37 completed weeks (less than 259 days) of gestation

Term: from 37 completed weeks to less than 42 completed weeks (259 to 293 days) of gestation

Post-term: 42 completed weeks or more (294 days or more) of gestation

Preterm births

Numerator: Number of liveborn babies born under 37 weeks gestation

Denominator: Total number of liveborn babies

Preterm births were classified into:^{1,2}

Extremely preterm: less than 28 completed weeks

Very preterm: 28 completed weeks to less than 32 completed weeks

Moderate to late preterm: 32 completed weeks to less than 37 completed weeks

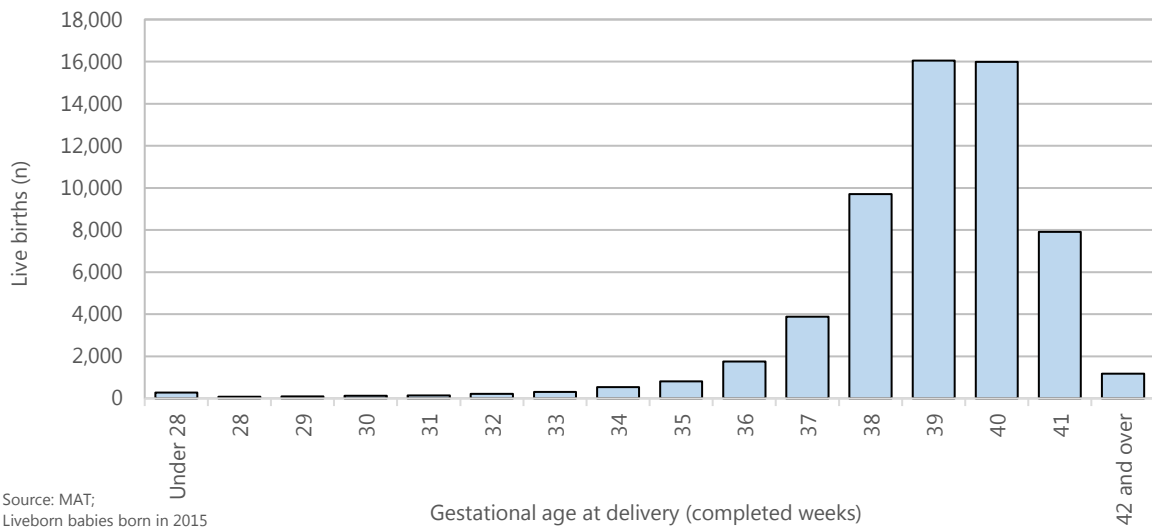
Additional information

An overview of the National Maternity Collection (MAT) is provided in the appendices.

Gestational age is the duration of pregnancy in completed weeks. Duration is measured from the first day of the last normal menstrual period and the date of delivery.²

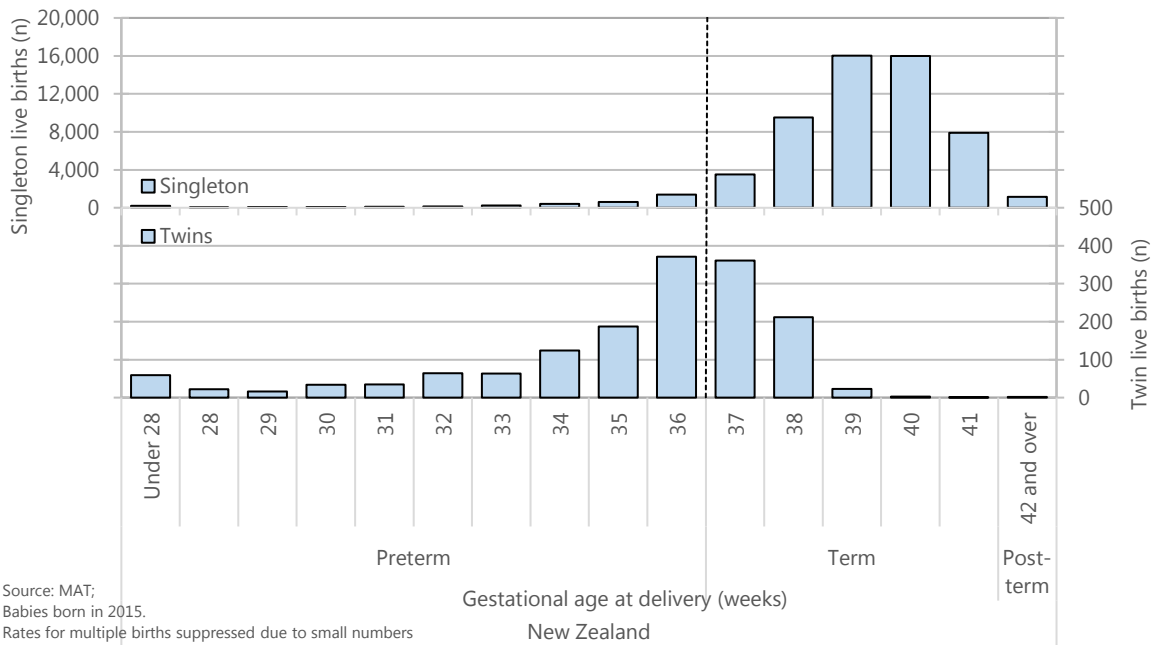
The majority of babies born in 2015 with a known gestation had a gestation between 37 and 41 completed weeks (Figure III-1). Figure III-2 presents the gestational age of liveborn babies by plurality for singleton and twin births. Multiple babies born from a single pregnancy are more likely to be born preterm.

Figure III-1 Distribution of livebirths, by gestational age, New Zealand 2015



Source: MAT;
Liveborn babies born in 2015

Figure III-2 Distribution of livebirths, by gestational age and plurality, New Zealand 2015

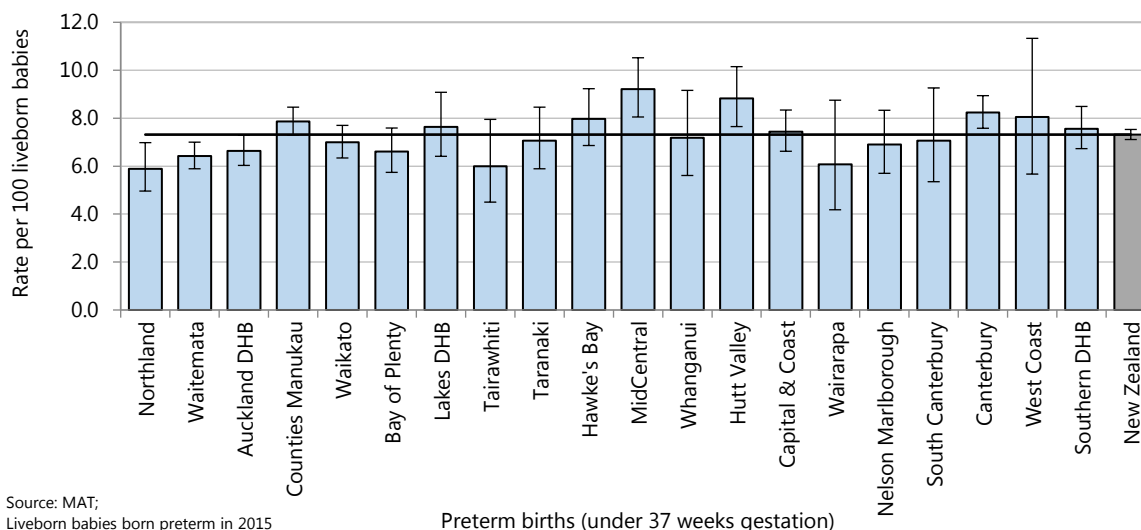


Source: MAT;
Babies born in 2015.
Rates for multiple births suppressed due to small numbers
New Zealand

Preterm births

Figure III-3 and Table III-1 present the proportion of liveborn babies born preterm (before 37 weeks gestation) for each district health board and nationally during 2015. The preterm birth rates were significantly higher than the national rate in MidCentral, Hutt Valley, and Canterbury DHBs. For the remaining DHBs, the rate was similar to or lower than the national rate, as shown in Figure III-3.

Figure III-3 Preterm births (under 37 weeks gestation), by district health board 2015



Source: MAT;
Liveborn babies born preterm in 2015

Table III-1 Preterm births, New Zealand 2015

DHB	2015 (n)	Rate per 100 liveborn babies	Rate ratio	95% CI
Babies born in 2015				
Preterm births (under 37 weeks gestation)				
Northland	124	5.9	0.81	0.68–0.96
Waitemata	488	6.4	0.88	0.80–0.96
Auckland	395	6.6	0.91	0.82–1.00
Counties Manukau	649	7.9	1.07	0.99–1.16
Waikato	375	7.0	0.96	0.86–1.06
Bay of Plenty	184	6.6	0.90	0.78–1.04
Lakes	116	7.6	1.04	0.87–1.25
Tairāwhiti	44	6.0	0.82	0.61–1.09
Taranaki	108	7.1	0.97	0.80–1.16
Hawke's Bay	160	8.0	1.09	0.94–1.27
MidCentral	195	9.2	1.26	1.10–1.44
Whanganui	59	7.2	0.98	0.77–1.26
Hutt Valley	175	8.8	1.21	1.04–1.39
Capital & Coast	264	7.4	1.02	0.90–1.15
Wairarapa	26	6.1	0.83	0.57–1.21
Nelson Marlborough	99	6.9	0.94	0.78–1.14
South Canterbury	47	7.1	0.96	0.73–1.27
Canterbury	515	8.2	1.13	1.03–1.23
West Coast	29	8.1	1.10	0.78–1.56
Southern	260	7.6	1.03	0.92–1.17
New Zealand	4,322	7.3	1.00	

Source: MAT; Rate per 100 liveborn babies who delivered in 2015. Rate ratios are unadjusted

The 2015 preterm birth rate for New Zealand was 7.3 per 100 liveborn babies (Table III-2). Of the preterm babies, over 80% were born between 32 and 36 completed weeks gestation (moderate to late pre-term), and three quarters were singletons.

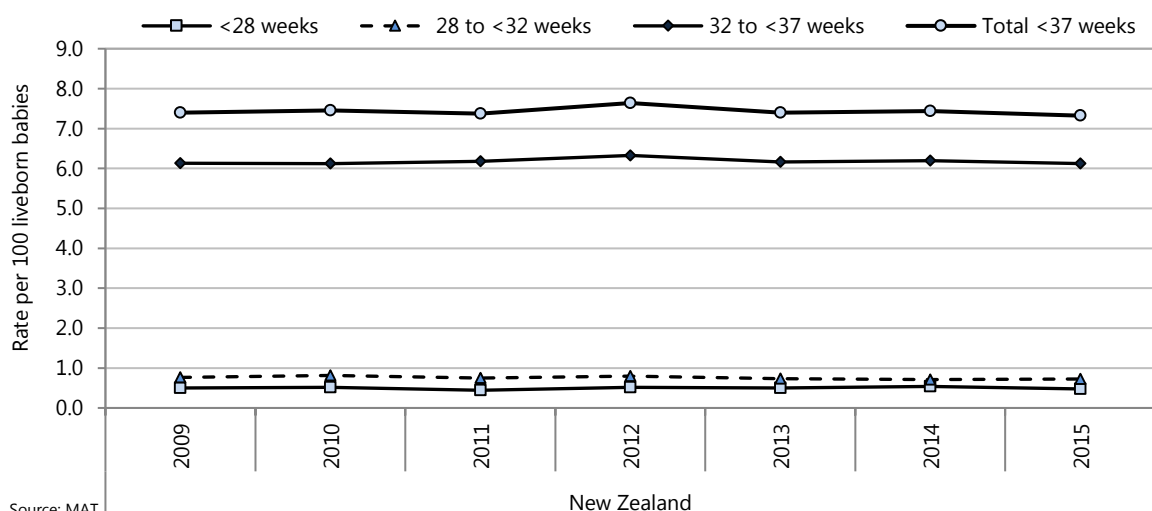
As presented in Figure III-4, the national rate of preterm births has remained fairly stable since 2009 overall and when broken down by gestational age.

Table III-2 Preterm births, by maturity and plurality, New Zealand 2015

	n	Rate per 100 liveborn babies	Rate per 100 preterm births
Babies born in 2015			
New Zealand			
Gestational age of liveborn babies			
Under 20 weeks	10	0.0	
20–36 weeks	4,312	7.3	
37 weeks and over	54,699	92.6	
Total livebirths	59,081	100.0	
Preterm babies			
Extremely preterm (<28 weeks)	279	0.5	6.5
Very preterm (28 to <32 weeks)	428	0.7	9.9
Moderate to late preterm (32 to <37 weeks)	3,615	6.1	83.6
Total preterm babies	4,322	7.3	100.0
Plurality of preterm babies			
Singleton	3,305	5.6	76.5
Twin	975	1.7	22.6
Multiple birth	41	0.1	0.9

Source: MAT; Rate per 100 liveborn babies.

Figure III-4 Trends in premature births, by prematurity, New Zealand 2009–2015

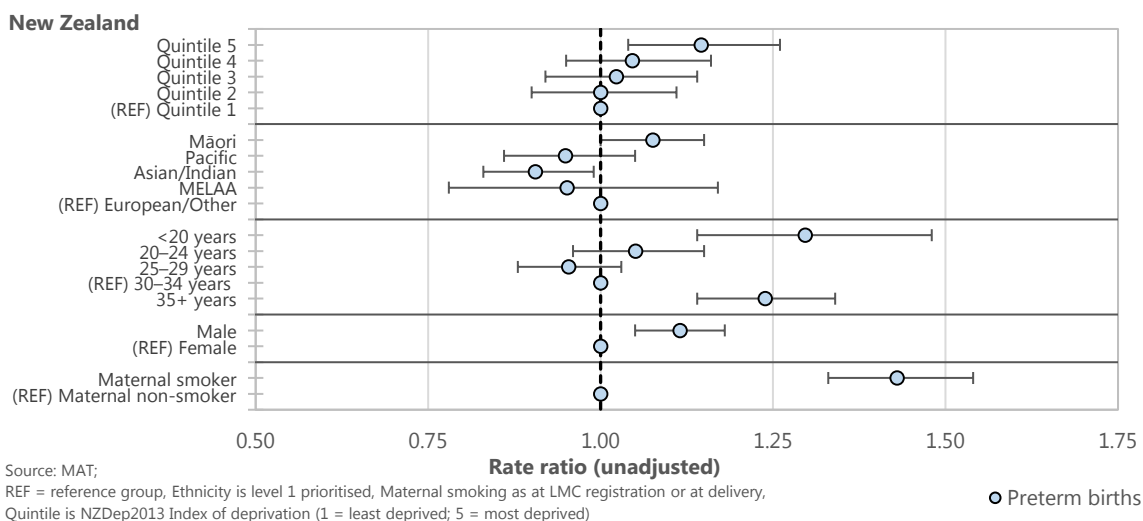


Source: MAT

Figure III-5 presents the national preterm birth rate by the residential deprivation score (NZDep2013 index of deprivation score), maternal age, ethnicity, sex, and maternal smoking (at first registration with a Lead Maternity Carer or at delivery). The unadjusted rate ratio presents the gap, if any, between the groups and the reference group. The following associations were observed, bearing in mind that this univariate analysis does not quantify the independent effect of each demographic factor, nor account for completeness of reporting:

- The preterm birth rate was higher for those residing in areas with the highest NZDep2013 scores (quintile 5; deciles 9–10) compared with quintile 1
- There were no significant differences in preterm birth rate by ethnicity
- Compared with infants born to mothers aged 30–34 years, preterm birth rates were significantly higher among mothers aged under 20 years and over 35 years
- Male babies were more likely to be born preterm compared with females
- The preterm birth rate was significantly higher for babies born to mothers who smoked compared with non-smoking mothers (based on reporting at first registration with a LMC and/or at delivery).

Figure III-5 Preterm births, by demographic factor, New Zealand 2015



Birthweight

Low birth weight is defined by the World Health Organization (WHO) as weight at birth less than 2,500 grams. Low birth weight continues to be a significant public health problem globally and is associated with a range of both short- and long-term consequences.³ Low birth weight is complex and includes both preterm neonates (born before 37 weeks of gestation) and small for gestational age neonates at term. It is difficult to separate effects on infant outcomes of birthweight and effects of gestational age, and adjusting for gestational age in analyses can introduce bias.^{4,5} There are multiple causes of low birth weight, including early induction of labour or caesarean birth (for medical or non-medical reasons), multiple pregnancies, infections and maternal chronic conditions such as diabetes and high blood pressure.³

Data sources and methods

Indicator

Numerator: Number of liveborn babies (at any gestation) with a documented birthweight

Denominator: Total number of liveborn babies

Birthweight groups were classified in accordance with WHO criteria²

- High birthweight: 4,500 grams and over
- 'Normal' birthweight: 2,500 to 4,499 grams
- Low birth weight: less than 2,500g (up to, and including, 2,499g)
- Very low birth weight: less than 1,500g (up to, and including, 1,499g)
- Extremely low birth weight: Less than 1,000g (up to, and including, 999g)

Data source and definition(s)

National Maternity Collection (MAT)

Additional information

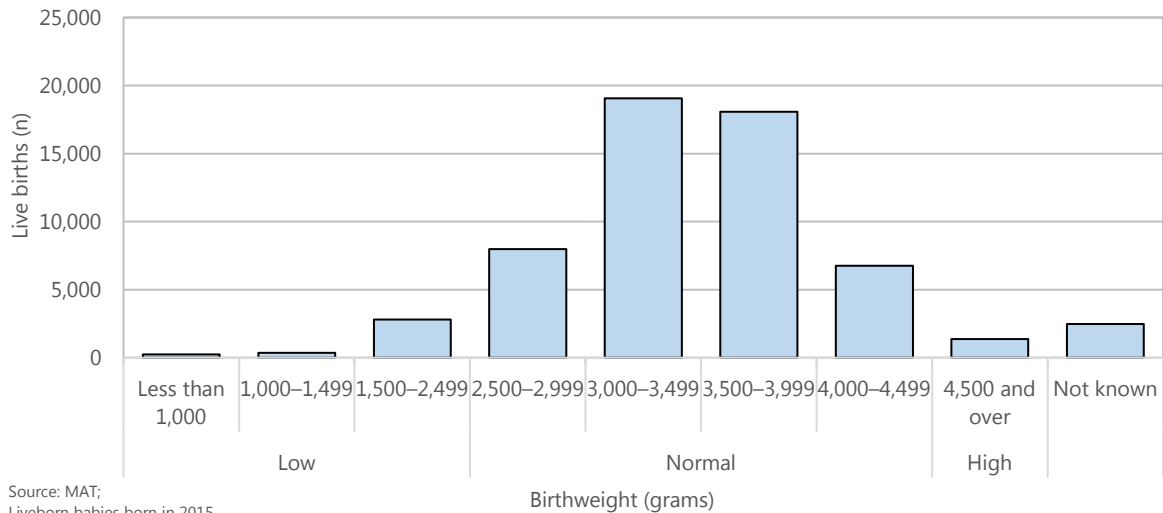
Birthweight is the first weight of the fetus or baby obtained after birth.

An overview of the National Maternity Collection is provided in the appendices.

Figure III-6 presents the birthweight of live babies born in 2015. The majority of liveborn babies in New Zealand were born with healthy/normal birthweights (2.5–<4.5kg). Most of the babies had a birthweight between 3–4kg. As presented in Table III-3, the majority of babies were born within the normal/healthy weight range. The proportion of babies with a low birthweight was 5.7% and 2.3% were in the high birthweight range.

Figure III-7 presents the trends in birthweight categories, all of which have been relatively stable since 2009.

Figure III-6 Distribution of livebirths, by birthweight, New Zealand 2015



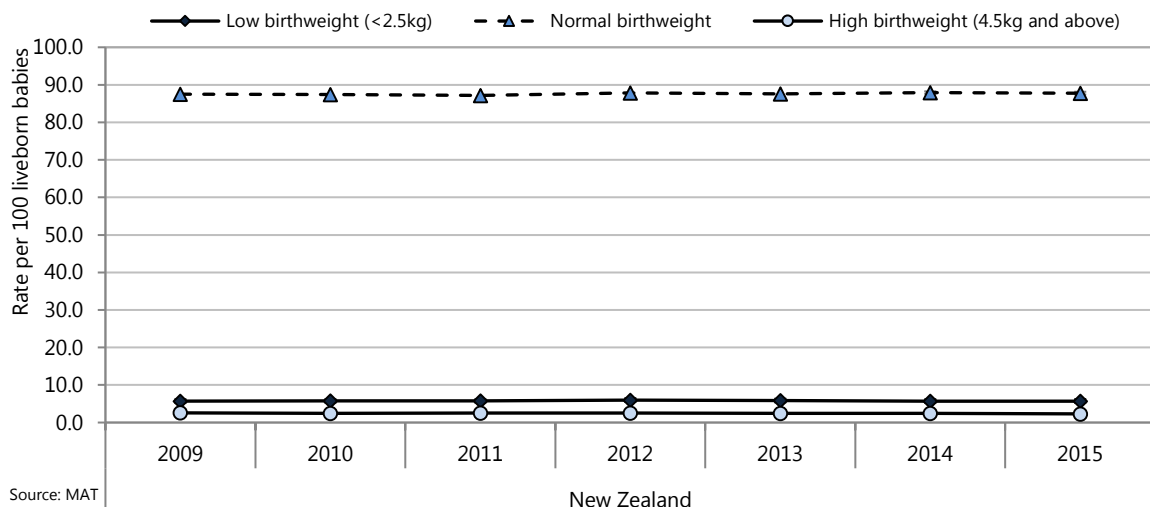
Source: MAT; Liveborn babies born in 2015

Table III-3 Birthweight of liveborn babies, New Zealand 2015

Birthweight	2015 (n)	Rate per 100 liveborn babies
Liveborn babies born in 2015		
New Zealand		
Low birthweight (under 2.5kg)	3,382	5.72
Normal birthweight (2.5–<4.5kg)	51,859	87.78
High birthweight (4.5kg and over)	1,364	2.31
Not known	2,476	4.19
Total liveborn babies	59,081	100.00

Source: MAT; Liveborn babies born in 2015. Rate ratios are unadjusted

Figure III-7 Trends in livebirths, by birthweight, New Zealand 2009–2015

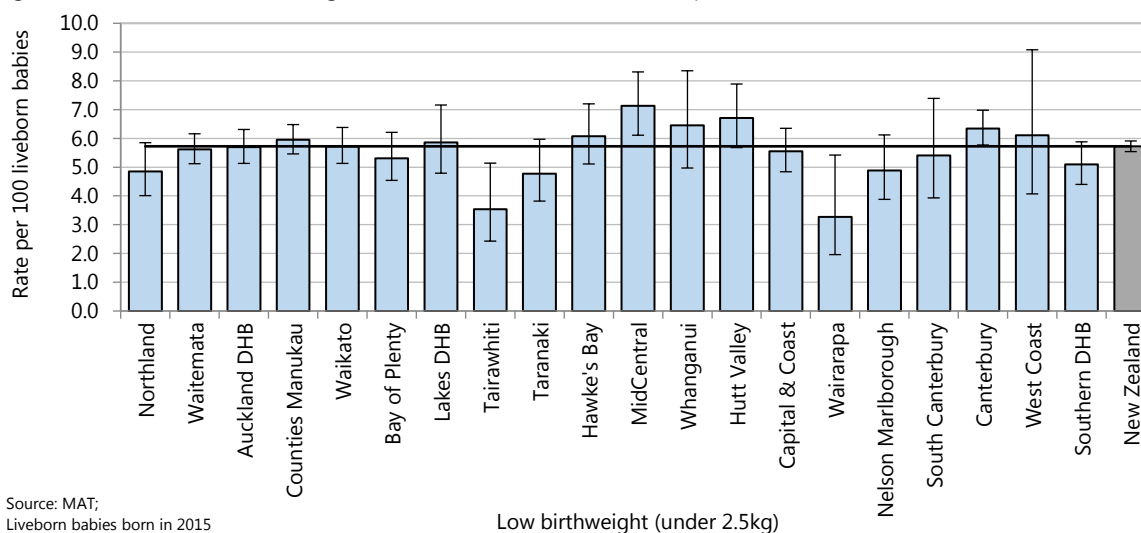


Source: MAT

Low birthweight babies

Figure III-8 and Table III-4 present the proportion of babies born within the low birthweight range (below 2.5kg). The rate of low birthweight among babies born in MidCentral DHB was slightly but significantly higher than the national rate, while rates were significantly lower in Tairawhiti and Wairarapa DHBs which both had relatively low numbers (Figure III-8, Table III-4). The remaining DHBs had no statistically significant differences to the national low birthweight rate.

Figure III-8 Rates of low birthweight babies, district health board compared to New Zealand, 2015



Source: MAT;
Liveborn babies born in 2015

Table III-4 Low birthweight babies, by district health board, New Zealand 2015

DHB	2015 (n)	Rate per 100 liveborn babies	Rate ratio	95% CI
Babies born in 2015				
Low birthweight (under 2.5kg)				
Northland	102	4.85	0.85	0.70–1.03
Waitemata	427	5.62	0.98	0.89–1.08
Auckland	339	5.69	0.99	0.89–1.11
Counties Manukau	491	5.95	1.04	0.95–1.14
Waikato	307	5.72	1.00	0.89–1.12
Bay of Plenty	148	5.31	0.93	0.79–1.09
Lakes	89	5.86	1.02	0.83–1.26
Tairawhiti	26	3.54	0.62	0.42–0.90
Taranaki	73	4.78	0.83	0.67–1.05
Hawke's Bay	122	6.07	1.06	0.89–1.26
MidCentral	151	7.13	1.25	1.06–1.46
Whanganui	53	6.46	1.13	0.87–1.47
Hutt Valley	133	6.70	1.17	0.99–1.38
Capital & Coast	197	5.55	0.97	0.84–1.11
Wairarapa	14	3.27	0.57	0.34–0.96
Nelson Marlborough	70	4.88	0.85	0.68–1.07
South Canterbury	36	5.41	0.94	0.69–1.30
Canterbury	397	6.35	1.11	1.00–1.23
West Coast	22	6.11	1.07	0.71–1.60
Southern	175	5.09	0.89	0.77–1.03
New Zealand	3,382	5.72	1.00	

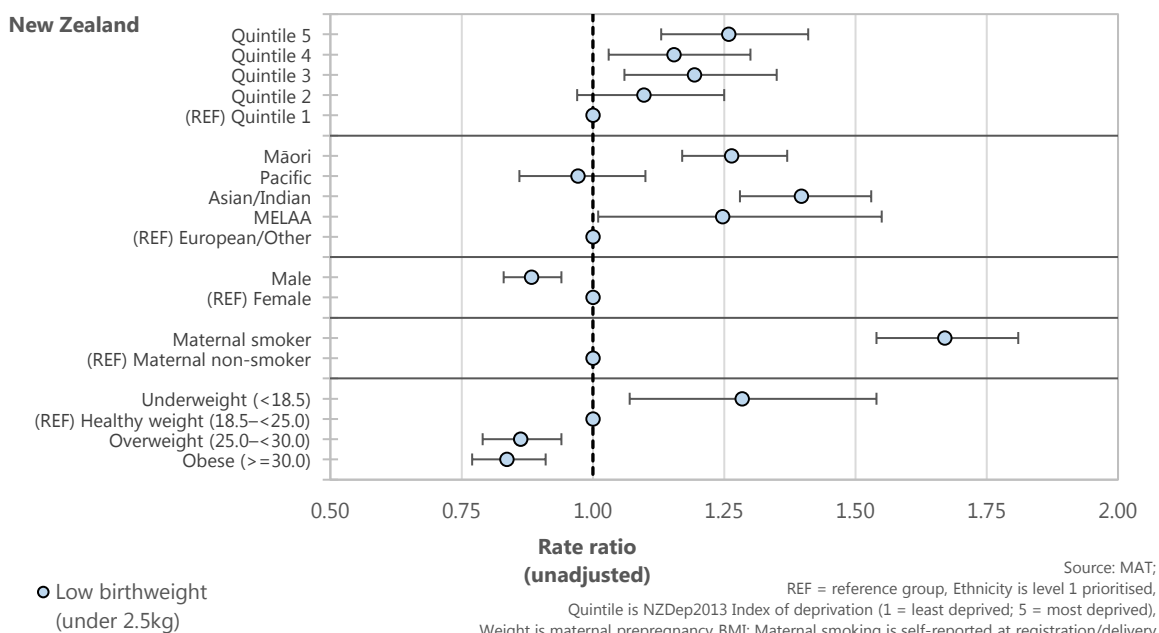
Source: MAT; Rate ratios are unadjusted

Figure III-9 presents the proportion of low birthweight babies by the residential deprivation score (NZDep2013 index of deprivation score), ethnicity, sex, plurality, gestational age group, maternal smoking status and maternal weight. The unadjusted rate ratio presents the gap, if any, between the groups and the reference group.

The following associations were observed, bearing in mind that this univariate analysis does not quantify the independent effect of each demographic factor:

- Rates of low birthweight babies were significantly higher for those residing in areas with moderate to high (quintiles 3–5; deciles 5–10) NZDep2013 scores compared with quintile 1
- Māori and Asian/Indian babies had significantly higher low birthweight rates compared with European/Other babies
- Boys had significant lower rates of being low birthweight compared with girls
- Low birthweight rates were nearly 30 times higher for babies born preterm than the rates for babies born at term
- The rate of low birthweight babies born to mothers who reported smoking (at registration with a Lead Maternity Carer or at delivery) was significantly high compared to low birthweight babies born to non-smoking mothers
- Low birthweight rates were significantly higher for babies born to mothers who were underweight at first registration

Figure III-9 Low birthweight babies, by demographic factor, New Zealand 2015



Fetal deaths

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”.⁶ The Perinatal and Maternal Mortality Review Committee uses this definition to define a fetal death.⁷ 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). Most countries require registration of fetal deaths but the gestation beyond which a fetal death must be registered varies between countries.⁶ In New Zealand, the Births, Deaths, Marriages, and Relationships Registration Act 1995 requires that all stillbirths are registered; a still-born child is 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.⁸

In high income countries around one in two hundred babies who reaches 22 weeks gestation or more is stillborn.⁹ In such countries major contributors to stillbirth are factors related to placental dysfunction and very pre-term birth.⁹ In a significant minority of cases (27 percent in New Zealand in 2012)⁷ no cause is identified. The most significant potentially modifiable risk factors for stillbirth are maternal obesity and smoking.^{7,9}

Data sources and methods

Indicator

Fetal deaths

Data sources

Numerator: Number of fetal deaths (or stillbirths)

Source: National Mortality Collection (MORT)

Denominator: Total births—the number of fetal deaths plus the number of livebirths

Source: Birth Registration Dataset (BDM; livebirths only) and National Mortality Collection (MORT)

Definition

Fetal death is when the baby is born deceased, weighing 400 grams or more, or is issued from its mother after the 20th week of pregnancy.¹⁰

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.

Additional information

An overview of the Birth Registration and National Mortality Collections are provided in the appendices.

Cause of death was the main underlying cause of death. Maternal cause of death was the first maternal cause of death. Refer to **Appendices** for the corresponding codes.

Death registration data does 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.

Figure III-10 and Table III-5 present the total births and fetal deaths (or stillbirths) registered for New Zealand by each district health board during 2010–2014. Nationally there were 2,124 fetal deaths (6.87 per 1,000 births). The fetal death rate was significantly lower than the national rate for Capital & Coast DHB, and marginally lower for Bay of Plenty, while Counties Manukau DHB was significantly higher. The remaining DHBs had fetal death rates similar to the national rate.

Figure III-10 Fetal deaths, by district health board, 2010–2014

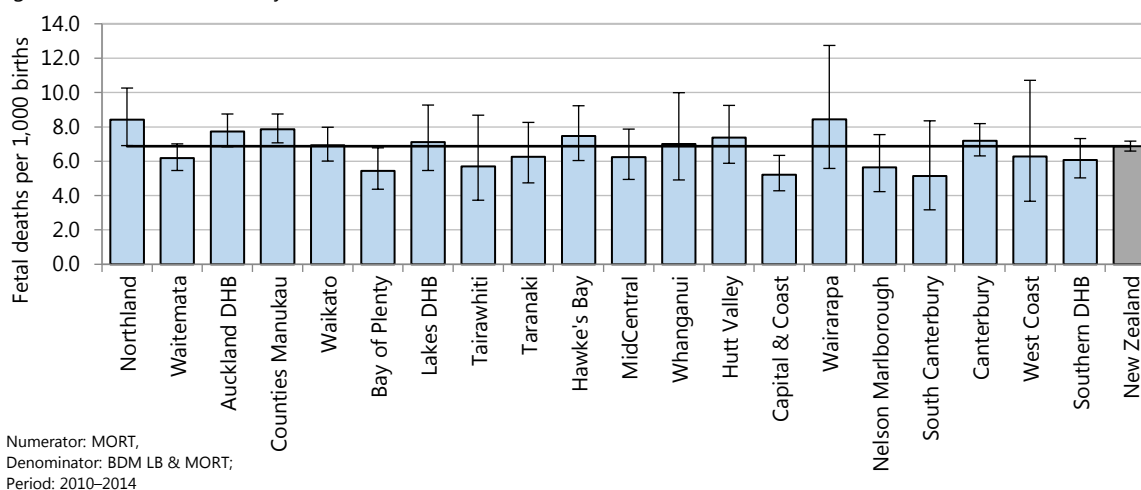


Table III-5 Fetal deaths, by district health board, New Zealand 2010–2014

DHB	Births (n) 2010–2014	Fetal deaths				
		2010–2014 (n)	Annual average	Rate per 1,000 births	Rate ratio	95% CI
Northland	11,524	97	19	8.42	1.22	1.00–1.50
Waitemata	39,599	245	49	6.19	0.90	0.79–1.03
Auckland	32,319	250	50	7.74	1.13	0.99–1.28
Counties Manukau	42,967	338	68	7.87	1.14	1.02–1.28
Waikato	27,294	189	38	6.92	1.01	0.87–1.17
Bay of Plenty	14,514	79	16	5.44	0.79	0.63–0.99
Lakes	7,591	54	11	7.11	1.03	0.79–1.35
Tairāwhiti	3,690	21	4	5.69	0.83	0.54–1.27
Taranaki	7,832	49	10	6.26	0.91	0.69–1.21
Hawke's Bay	11,250	84	17	7.47	1.09	0.87–1.35
MidCentral	11,227	70	14	6.23	0.91	0.72–1.15
Whanganui	4,281	30	6	7.01	1.02	0.71–1.46
Hutt Valley	10,035	74	15	7.37	1.07	0.85–1.35
Capital & Coast	19,009	99	20	5.21	0.76	0.62–0.93
Wairarapa	2,608	22	4	8.44	1.23	0.81–1.86
Nelson Marlborough	7,963	45	9	5.65	0.82	0.61–1.10
South Canterbury	3,108	16	3	5.15	0.75	0.46–1.22
Canterbury	31,011	223	45	7.19	1.05	0.91–1.20
West Coast	2,072	13	3	6.27	0.91	0.53–1.57
Southern	17,958	109	22	6.07	0.88	0.73–1.07
New Zealand	309,018	2,124	425	6.87	1.00	

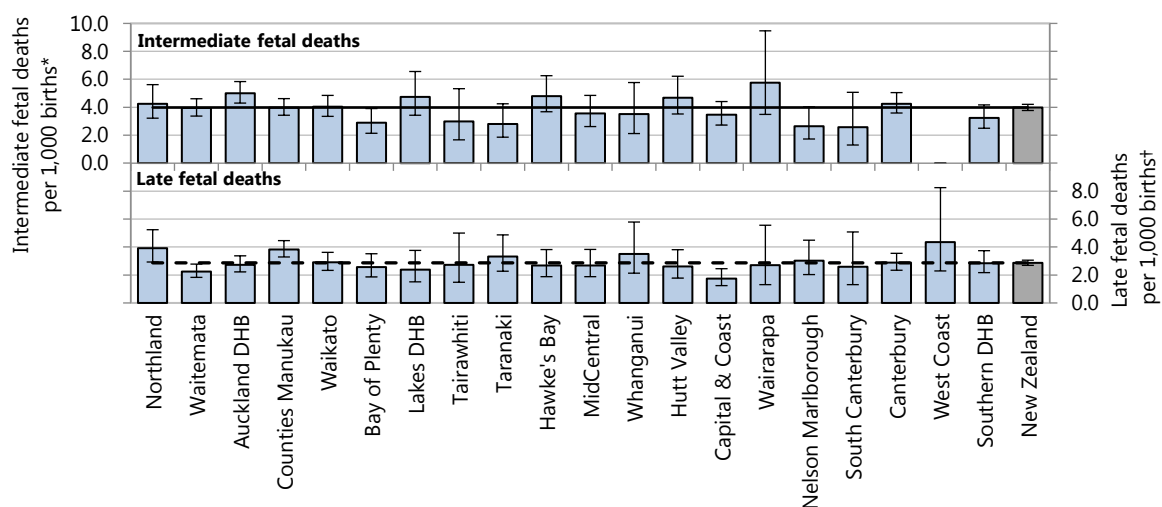
Numerator: MORT, Denominator: BDM LB & MORT; Rate per 1,000 births (livebirths and fetal deaths). Rate ratios are unadjusted

Over half of the fetal deaths occurred between 20 and 27 weeks gestation (intermediate fetal deaths) and the remaining occurred from 28 weeks gestation (late fetal deaths). Table III-6, Table III-7 and Figure III-11 present the rates of fetal deaths for the different gestational groups.

The rates of both intermediate and late fetal deaths in all DHBs were close to the New Zealand rate, although the intermediate fetal death rate in Auckland DHB was statistically higher than the national rate, and the late fetal death rate in Capital & Coast DHB was significantly lower than the national rate.

Nationally, the fetal death rate has remained relatively constant since 1990 with the year-to-year fluctuations around an average of 6.84 deaths per 1,000 births (Figure III-12).

Figure III-11 Fetal deaths, by type and district health board, 2010–2014



Numerator: MORT, Denominator: BDM LB & MORT;

*Births = live births & fetal deaths 20+weeks gestation, †Births = live births & fetal deaths 28+weeks gestation

Table III-6 Intermediate fetal deaths, by district health board, New Zealand 2010–2014

DHB	2010–2014 (n)	Annual average	Rate per 1,000 births*	Rate ratio	95% CI
Intermediate fetal deaths					
Northland	49	10	4.25	1.07	0.80–1.42
Waitemata	156	31	3.94	0.99	0.84–1.17
Auckland	162	32	5.01	1.26	1.07–1.48
Counties Manukau	171	34	3.98	1.00	0.85–1.17
Waikato	110	22	4.03	1.01	0.83–1.23
Bay of Plenty	42	8	2.89	0.73	0.53–0.99
Lakes	36	7	4.74	1.19	0.86–1.66
Tairāwhiti	11	2	2.98	0.75	0.41–1.35
Taranaki	22	4	2.81	0.71	0.46–1.07
Hawke's Bay	54	11	4.80	1.20	0.92–1.58
MidCentral	40	8	3.56	0.89	0.65–1.22
Whanganui	15	3	3.50	0.88	0.53–1.46
Hutt Valley	47	9	4.68	1.18	0.88–1.57
Capital & Coast	66	13	3.47	0.87	0.68–1.12
Wairarapa	15	3	5.75	1.44	0.87–2.40
Nelson Marlborough	21	4	2.64	0.66	0.43–1.02
South Canterbury	8	2	2.57	0.65	0.32–1.29
Canterbury	132	26	4.26	1.07	0.89–1.28
West Coast	<5	s	s	s	s
Southern	58	12	3.23	0.81	0.62–1.05
New Zealand	1,231	246	3.98	1.00	

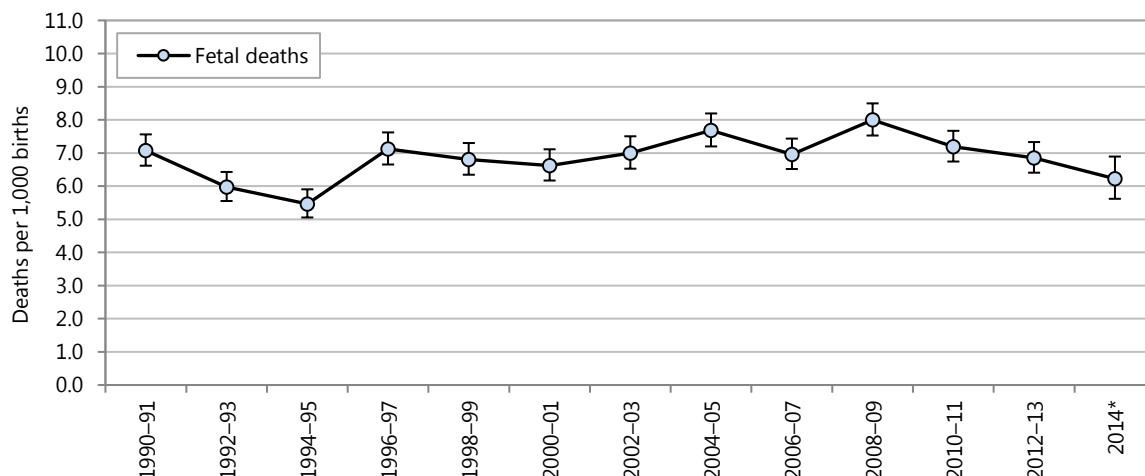
Numerator: MORT, Denominator: BDM LB & MORT; *Rate per 1,000 births (livebirths and fetal deaths of 20 weeks gestation or more). Rate ratios are unadjusted

Table III-7 Late fetal deaths, by district health board, New Zealand 2010–2014

DHB	2010–2014 (n)	Annual average	Rate per 1,000 births†	Rate ratio	95% CI
Late fetal deaths					
Northland	45	9	3.92	1.37	1.01–1.84
Waitemata	89	18	2.26	0.79	0.63–0.98
Auckland	88	18	2.74	0.95	0.77–1.19
Counties Manukau	164	33	3.83	1.34	1.13–1.58
Waikato	79	16	2.91	1.01	0.80–1.27
Bay of Plenty	37	7	2.56	0.89	0.64–1.24
Lakes	18	4	2.38	0.83	0.52–1.32
Tairāwhiti	10	2	2.72	0.95	0.51–1.77
Taranaki	26	5	3.33	1.16	0.79–1.71
Hawke's Bay	30	6	2.68	0.93	0.65–1.34
MidCentral	30	6	2.68	0.93	0.65–1.34
Whanganui	15	3	3.52	1.23	0.74–2.04
Hutt Valley	26	5	2.60	0.91	0.61–1.34
Capital & Coast	33	7	1.74	0.61	0.43–0.86
Wairarapa	7	1	2.70	0.94	0.45–1.98
Nelson Marlborough	24	5	3.02	1.05	0.70–1.58
South Canterbury	8	2	2.58	0.90	0.45–1.80
Canterbury	89	18	2.88	1.00	0.81–1.25
West Coast	9	2	4.35	1.52	0.79–2.92
Southern	51	10	2.85	0.99	0.75–1.32
New Zealand	883	177	2.87	1.00	

Numerator: MORT, Denominator: BDM LB & MORT; †Rate per 1,000 births (livebirths and fetal deaths of 28 weeks gestation or more). Rate ratios are unadjusted

Figure III-12 Fetal deaths, New Zealand 1990–2014



Numerator: MORT, Denominator: BDM LB & MORT;
 *2014 is a single year of data. *fetal deaths 20+wks gestation, #fetal deaths 28+wks gestation

Figure III-13 compares the national fetal death rate by demographic factors. The unadjusted rate ratio presents the gap, if any, between the groups and the reference group. The following associations were observed, bearing in mind that this univariate analysis does not quantify the independent effect of each factor:

- The fetal death rate was higher for those residing in areas with the highest scores on the NZDep2013 index of deprivation (quintile 5; deciles 9-10) than for those residing in areas with lower NZDep2013 scores (quintiles 1-4; deciles 1-2)
- Babies born to mothers aged under 25 years or over 34 years had significantly higher fetal death rates compared with those born to mothers aged 30–34 years
- There was no significant difference in fetal death rates between the ethnic groups or by sex.

Figure III-13 Fetal deaths, comparison by demographic factors, New Zealand 2010–2014

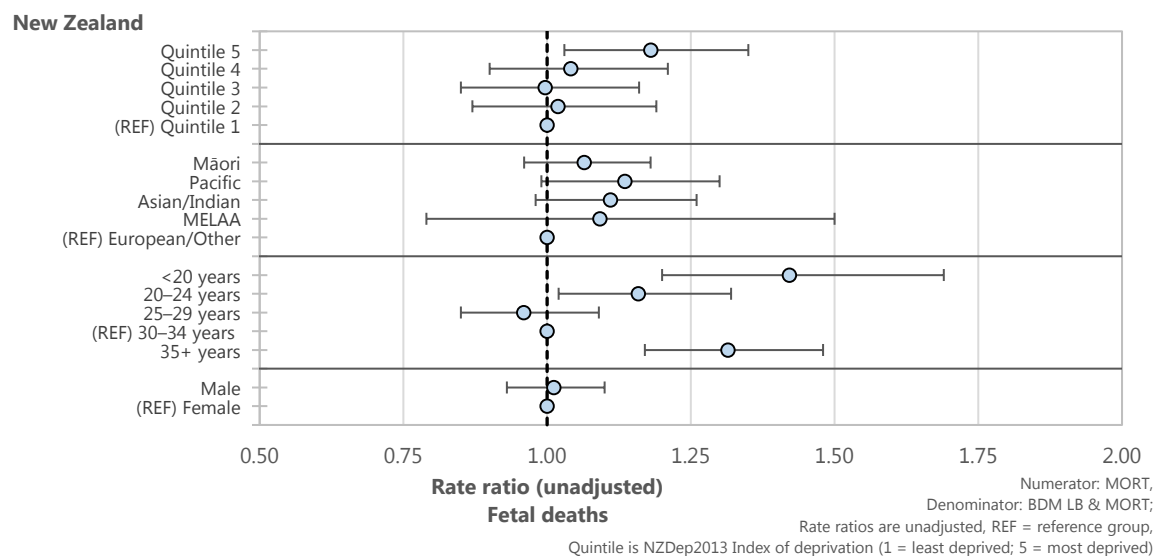


Table III-8 and Table III-9 present the main causes of fetal deaths during 2010–2014. Where a cause of fetal death was specified, the most frequent causes were congenital anomalies, malnutrition or slow fetal growth, and prematurity or low birth weight. Where listed, the predominant maternal causes of fetal deaths were placenta praevia or placental separation and haemorrhage, other abnormalities of the placenta, and incompetent cervix or premature rupture of membranes.

Table III-8 Fetal deaths, by main cause of fetal death, New Zealand 2010–2014

Cause of death	2010–2014 (n)	Annual average	Rate per 1,000 births	%
Fetal deaths				
Congenital anomalies	585	117	1.89	27.5
Malnutrition or slow fetal growth	192	38	0.62	9.0
Prematurity or low birth weight	133	27	0.43	6.3
Intrauterine hypoxia	62	12	0.20	2.9
Fetal blood loss	67	13	0.22	3.2
Infections specific to perinatal period	34	7	0.11	1.6
Congenital pneumonia	23	5	0.07	1.1
Neonatal aspiration*	23	5	0.07	1.1
Hydrops fetalis (non-haemolytic disease)	24	5	0.08	1.1
Polycythaemia neonatorum	18	4	0.06	0.8
Other causes	94	19	0.30	4.4
Unspecified cause of fetal death	869	174	2.81	40.9
Total	2,124	425	6.87	100.0

Numerator: MORT, Denominator: BDM LB & MORT; *Neonatal aspiration of meconium, amniotic fluid, or mucus

Table III-9 Fetal deaths, by main maternal cause of fetal death, New Zealand 2010–2014

Main maternal cause of fetal death	2010–2014 (n)	Annual average	Rate per 1,000 births	%
Fetal deaths				
Placenta praevia/placental separation and haemorrhage	166	33	0.54	7.8
Other abnormalities of placenta	146	29	0.47	6.9
Incompetent cervix/premature rupture of membranes	119	24	0.39	5.6
Chorioamnionitis	116	23	0.38	5.5
Compression of umbilical cord	87	17	0.28	4.1
Maternal hypertensive disorders	72	14	0.23	3.4
Multiple pregnancy	86	17	0.28	4.0
Placental transfusion syndromes	61	12	0.20	2.9
Oligohydramnios	40	8	0.13	1.9
Other causes	301	60	0.97	14.2
No listed maternal cause	930	186	3.01	43.8
Total	2,124	425	6.87	100.0

Numerator: MORT, Denominator: BDM LB & MORT

Evidence for good practice

Preterm birth is defined as being born alive before 37 completed weeks of pregnancy.¹¹ It is a leading cause of fetal and infant deaths. Around 82% of the fetal deaths and 60% of the infant deaths registered in 2014 in New Zealand were preterm (< 37 weeks gestation), and most of these were very preterm (< 28 weeks gestation).¹² Preterm birth, especially very preterm birth, is associated with an increased risk of developmental problems including cognitive and learning disorders, motor problems, such as cerebral palsy, and emotional and behavioural problems, and physical and sensory disorders, such as chronic lung disease and visual and hearing impairments.¹³ The majority of cases of preterm birth, around two-thirds, are spontaneous following spontaneous onset of labour, preterm rupture of membranes, or premature dilation of the cervix (cervical insufficiency).¹⁴ The remaining third are medically induced (iatrogenic) due to maternal or fetal complications.¹⁴

Equity

In New Zealand, there is little variation in preterm birth rates by either ethnicity or deprivation.¹⁵ Internationally, socioeconomic status has been found to be associated with preterm birth in some studies but not others.¹⁶ It has been suggested that the increase in iatrogenic preterm births over recent decades is responsible for this inconsistency.^{16,17} A Canadian study examined spontaneous and iatrogenic preterm singleton births separately to address this issue.¹⁷ It found that spontaneous, but not iatrogenic, preterm births were somewhat higher in women in the lowest family income group versus the highest (rate ratio 1.14, 95% confidence interval 1.03 to 1.25). Adjustment for maternal characteristics, including maternal age, parity, marital status, pre-pregnancy

weight, and smoking status, abolished this relationship. This suggests that modifiable factors are major contributors to socioeconomic inequalities in spontaneous preterm birth rates.

Possibilities for prevention

Prevention of preterm birth is challenging because the causes are multiple and not well understood and the risk factors may not be avoidable.¹⁴ The most significant risk factor for spontaneous preterm birth is having had a previous preterm birth.¹⁴ Other maternal risk factors include (in roughly decreasing order of relative risk): low socioeconomic status, carrying a male fetus, an inter-pregnancy interval of less than six months, an underweight pre-pregnancy BMI, a family history of preterm birth, and smoking.¹⁴

Common reasons why a preterm birth may be medically indicated (because the risk to the baby of remaining in utero is greater than that of being born early) are pregnancy complications such as preeclampsia, intrauterine growth retardation (IUGR) and placental abruption.¹⁸ Collectively these three conditions have been termed ischaemic placental disease. Their causes are unknown but suspected to be related to poor development of the placenta in early pregnancy and subsequent placental insufficiency.¹⁹ There are currently no ways to prevent or treat ischaemic placental disease.¹⁹ Risk factors for all three conditions include maternal age of < 20 years or ≥35 years, multiple pregnancy, chronic hypertension, diabetes, cocaine use, and a previous history of any of the three conditions.²⁰ Obesity increases the risk of preeclampsia, while underweight increases the risk of IUGR.²⁰ Cigarette smoking increases the risk of placental abruption and IUGR (but decreases the risk of preeclampsia).²⁰

Risk scoring systems have been developed to estimate a woman's risk of preterm birth based on factors such as age, height and weight, marital and socioeconomic status, smoking, threatened miscarriage, previous low birthweight baby, and previous stillbirth. Such risk scoring systems have not been subjected to randomised controlled trials, so a 2015 Cochrane review concluded that the value of such systems is unknown.²¹

Cervical insufficiency (when the cervix starts to shorten and dilate too early in pregnancy) is a cause of late miscarriage and preterm birth.²² Cervical cerclage is a surgical technique which involves putting a stitch around the neck of the womb (the cervix) to provide mechanical support to the cervix and keep it closed. In women with a singleton pregnancy who are at high risk of pregnancy loss because of a previous history of late miscarriage or preterm birth, and/or a clinical examination or ultrasound finding of a short cervix, cerclage reduces the risk of preterm birth and probably reduces the risk of perinatal deaths.²² For women with multiple pregnancy, limited data provides no evidence that cervical cerclage is effective for preventing preterm births and reducing perinatal deaths or neonatal morbidity.²³

Although in high income countries it is common for women with a previous history of giving birth preterm to attend specialised antenatal clinics, a 2011 Cochrane review found no evidence that this reduces the numbers of preterm births. The trials included in the review were all conducted in the 1980s and the review authors noted that this was before many of the tests currently used in specialised clinics had been developed. They stated that, since specialised clinics are now an established part of antenatal care, it is unlikely that further randomised trials will be possible.²⁴

Bed rest at home or in hospital has been recommended for the prevention of preterm births, but a 2015 Cochrane review found no evidence either supporting or refuting this practice.²⁵ The authors noted that bed rest may be disruptive to a woman's home and work life. Another 2015 review found evidence from one trial that infection screening and treatment programs for pregnant women before 20 weeks gestation reduce rates of preterm birth and preterm low birthweight.²⁶

Preterm birth is usual in multiple pregnancies. Around 60% of twin pregnancies result in spontaneous birth before 37 weeks and around 75% of triplet pregnancies result in spontaneous birth before 35 weeks (triplets are often delivered by Caesarean section^{27,28}).²⁹ A 2017 Cochrane review found that, in women with a multiple pregnancy, the administration of prenatal progestogens did not appear to reduce the risk of preterm birth or improve neonatal outcomes.³⁰ Older women are more likely to become pregnant with twins (in the US from 2007 to 2013, the probability of twin pregnancy increased from 1.3% in women 15–17 years old to 5.0% in women 35–39 years old and 6.9% in women >40 years old).³¹ Assisted reproductive technology (ART) was a major contributor to multiple births in the past but in Australia and New Zealand single embryo transfer is now usual (85.7% in 2015) and multiple delivery rates following ART have fallen from 6.9% in 2011 to 4.4% in 2015.³²

Best practice in the care of women about to give birth preterm

The World Health Organization has made the following recommendations, largely based on Cochrane reviews:

Antenatal corticosteroids (to increase the maturity of the baby's lungs) should be given to women at risk of preterm birth from 24 to 34 weeks gestation, provided: gestational age has been accurately assessed; preterm birth is considered to be imminent; there is no evidence of maternal infection; there are facilities to provide adequate childbirth care and care for the premature newborn (including resuscitation, thermal care, feeding support, safe oxygen use, and infection treatment)

Magnesium sulfate should be given to women at risk of imminent preterm birth before 32 weeks, to reduce the risk of the child having cerebral palsy

Antibiotics should be given to women with preterm rupture of membranes but not routinely to women in preterm labour with intact membranes and no clinical signs of infection

Tocolytic agents (which inhibit uterine contractions) should not be routinely given to women at imminent risk of preterm birth for the purpose of improving newborn outcomes, but their use can be considered in women at risk of imminent preterm birth whose pregnancy is otherwise uncomplicated, to provide time for the administration of antenatal corticosteroids and/or transfer to a hospital with appropriate neonatal care capabilities, although there is no direct evidence that this improves neonatal outcomes

Routine caesarean section should not be performed to improve newborn outcomes regardless of whether presentation is cephalic (head first) or breech.

Best practice in the care of premature newborns

The World Health Organisation recommends:

- Kangaroo mother care (where the baby is carried in skin-to-skin contact with its mother's chest) should be part of routine care for newborns weighing < 2000g at birth as soon as newborns are clinically stable
- A baby that is too unwell for Kangaroo care should be kept in a thermoneutral environment under either radiant warmers or in an incubator
- Continuous positive airway pressure therapy for infants with respiratory distress syndrome
- Surfactant replacement therapy for infants with respiratory distress syndrome
- When ventilating preterm babies born at or before 32 weeks, therapy should begin with 30% oxygen rather than 100% oxygen, and the use of progressively higher oxygen concentrations should be considered only if the baby's heart rate is < 60 beats per minute after 30 seconds of adequate ventilation with 30% oxygen.

Ministry of Health publications and websites

- Ministry of Health. 2016. **New Zealand Maternity Clinical Indicators 2015**. Wellington: Ministry of Health. <https://www.health.govt.nz/publication/new-zealand-maternity-clinical-indicators-2015>

Other New Zealand publications and websites

- **Newborn Clinical Network**. <https://www.starship.org.nz/for-health-professionals/new-zealand-child-and-youth-clinical-networks/newborn-clinical-network/> (this site has a number of guidelines, practice recommendations and consensus statements.)

New Zealand Guidelines

- Women's Health Service, Christchurch Women's Hospital. **Preterm Labour/Birth. Maternity guideline. 2017**. Canterbury District Health Board. <https://www.cdhb.health.nz/Hospitals-Services/Health-Professionals/maternity-care-guidelines/Documents/GLM0027-Preterm-Labour-Birth.pdf>

International guidelines

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IV. UNDER-FIVE MORTALITY

The mortality rate for children aged under five years is an indicator of both the level of child health, and the development and wellbeing of a population.¹ Relative poverty is the most important social determinant for child deaths in high-income countries, with a persistent inverse association between socioeconomic status and child mortality.² Continuing disparities in child mortality between and within countries emphasise the importance of engaging with the deep social inequalities inherent in society, and seeking to understand the complex pathways that ultimately lead to poor outcomes for children.³ Effective interventions to reduce infant and child deaths need to be solution-focused and to tackle underlying causes.³

Infant mortality, the rate at which babies and children of less than one year of age die, reflects the effect of economic and social conditions on the health of mothers and newborns, including the social environment, individual lifestyles as well as the characteristics and effectiveness of health systems.⁴ It serves as an indicator of national commitment to universal maternal and child health, particularly for poor and marginalised families.⁵ In all high income countries, infant mortality rates have reduced to fewer than 10 infant deaths per 1,000 livebirths. Infant mortality in New Zealand is higher than the OECD average; in 2013 New Zealand ranked sixth highest among the 35 OECD countries with data available.⁶

This section reviews all under-five mortality: infant mortality including sudden unexpected death in infancy (SUDI), and deaths of 1–4 year olds using information from the National Mortality Collection and the Birth Registration Dataset.

Data sources and methods

Indicator

1. Under-five mortality rate
2. Infant mortality
3. Child mortality (1–4 years)

Definition and data sources

Under-five mortality rate

Numerator: Number of deaths of children aged under five years

Source: National Mortality Collection (MORT)

Denominator: Total number of children aged under five years

Source: StatsNZ estimated resident population (ERP; with linear extrapolation between Census years)

Infant mortality

Numerator: Number of deaths of a live born infant before the first year of life is completed (prior to 365 days of life)

Source: National Mortality Collection (MORT)

Denominator: Total number of live born babies

Source: Birth Registration Dataset (BDM; livebirths only)

Infant mortality is further divided into

Neonatal mortality: Death of a live-born infant before 28 completed days after birth

Post neonatal mortality: Death of a live-born infant between 28 completed days and before the first year of life is completed

Sudden Unexpected Death in Infancy (SUDI)

Death of an infant 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

Child mortality (1–4 years)

Numerator: Number of deaths of children aged between one and four years

Source: National Mortality Collection (MORT)

Denominator: Total number of children aged between one and four years

Source: StatsNZ estimated resident population (ERP; with linear extrapolation between Census years)

Additional information

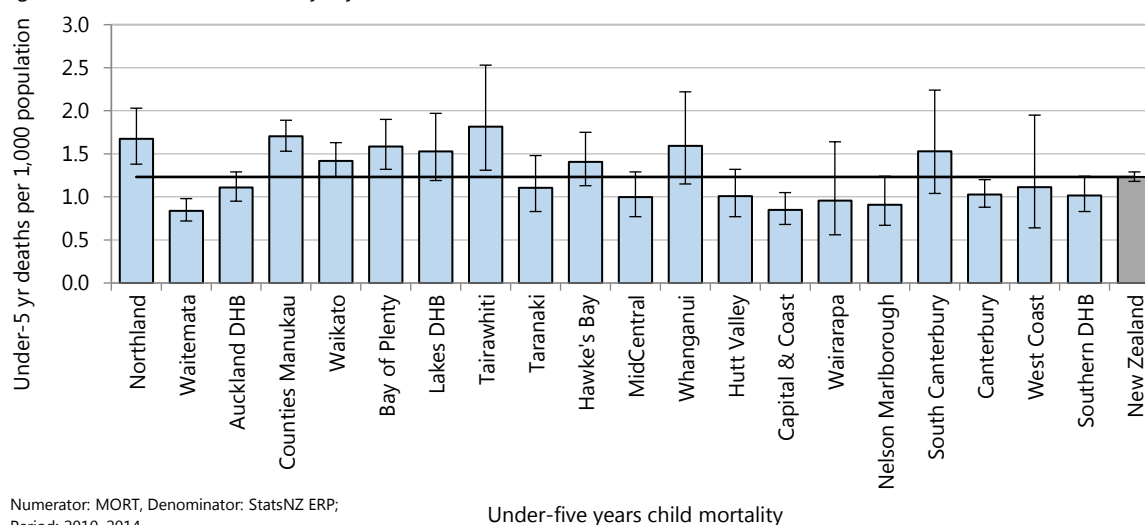
An overview of the National Mortality Collection (MORT) is provided in the appendices.

Cause of death was the main underlying cause of death. Refer to **Appendix 5** for the corresponding codes.

Two additional codes were added to the SUDI indicator in 2013 (Inhalation of gastric contents; and Inhalation and ingestion of food causing obstruction of the respiratory tract) to ensure consistency with the NZ 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.

Figure IV-1 and Table IV-1 present the mortality rate for children aged under five years during 2010–2014. The DHBs with under-five mortality rates significantly higher than the national rate were Northland, Counties Manukau, Bay of Plenty and Tairāwhiti, while under-five mortality rates were significantly lower than the national rate for Waitemata, Capital & Coast, and Canterbury DHBs.

Figure IV-1 Under five mortality, by district health board, 2010–2014



Numerator: MORT, Denominator: StatsNZ ERP, Period: 2010–2014

Under-five years child mortality

Table IV-1 Under five mortality, by district health board, 2010–2014

DHB	2010–2014 (n)	Annual average	Rate per 1,000 population	Rate ratio	95% CI
Under-five mortality					
Northland	100	20	1.67	1.36	1.11–1.66
Waitemata	163	33	0.84	0.68	0.58–0.80
Auckland	165	33	1.11	0.90	0.77–1.05
Counties Manukau	348	70	1.70	1.38	1.23–1.55
Waikato	197	39	1.42	1.15	0.99–1.33
Bay of Plenty	117	23	1.58	1.29	1.07–1.55
Lakes	60	12	1.53	1.24	0.96–1.60
Tairāwhiti	35	7	1.82	1.48	1.06–2.06
Taranaki	45	9	1.11	0.90	0.67–1.21
Hawke's Bay	81	16	1.41	1.14	0.92–1.43
MidCentral	57	11	1.00	0.81	0.62–1.06
Whanganui	35	7	1.59	1.29	0.93–1.81
Hutt Valley	52	10	1.01	0.82	0.62–1.08
Capital & Coast	81	16	0.85	0.69	0.55–0.86
Wairarapa	13	3	0.96	0.78	0.45–1.34
Nelson Marlborough	39	8	0.91	0.74	0.54–1.01
South Canterbury	26	5	1.53	1.24	0.84–1.83
Canterbury	164	33	1.03	0.83	0.71–0.98
West Coast	12	2	1.11	0.90	0.51–1.60
Southern	96	19	1.02	0.83	0.67–1.01
New Zealand	1,898	380	1.23	1.00	

Numerator: MORT, Denominator: StatsNZ ERP; Rate ratios are unadjusted

Under-five mortality

Infant mortality

The infant mortality rate for New Zealand was 5.23 per 1,000 livebirths for 2010–2014. The DHBs with infant mortality rates significantly higher than the national rate were Northland, Counties Manukau, Waikato, Bay of Plenty, and Tairāwhiti (although marginal), while Waitemata and Capital & Coast DHBs had significantly lower infant mortality rates (Table IV-2; Figure IV-2).

Nationally, infant mortality rates have declined from 1990–91 to 2006–07. The most pronounced fall occurred before 2000. Since 2006–07 there has been a statistically significant increase in neonatal death rates and this has been reflected in overall infant mortality rates (Figure IV-3).

Figure IV-2. Infant mortality, by district health board, 2010–2014

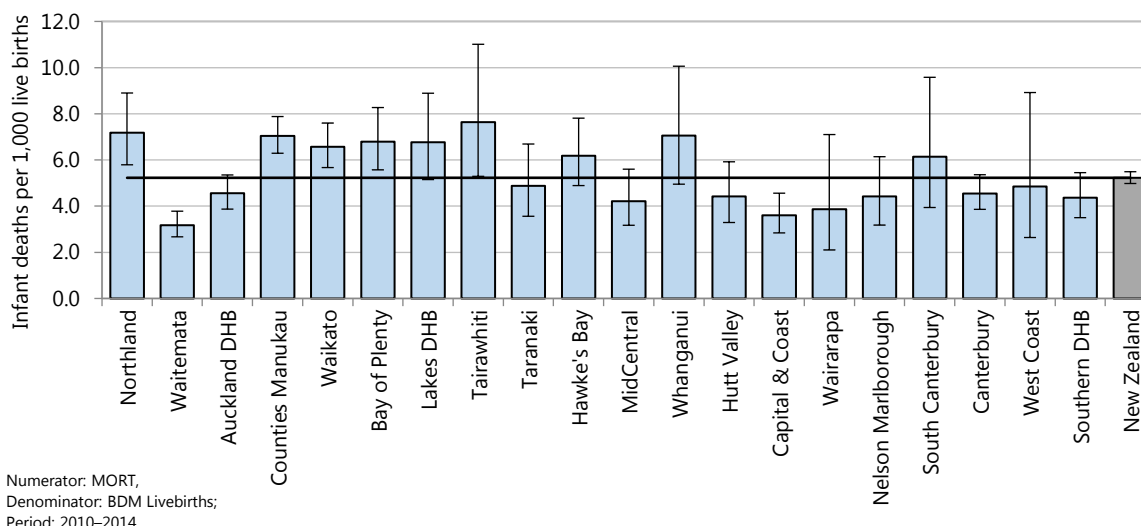
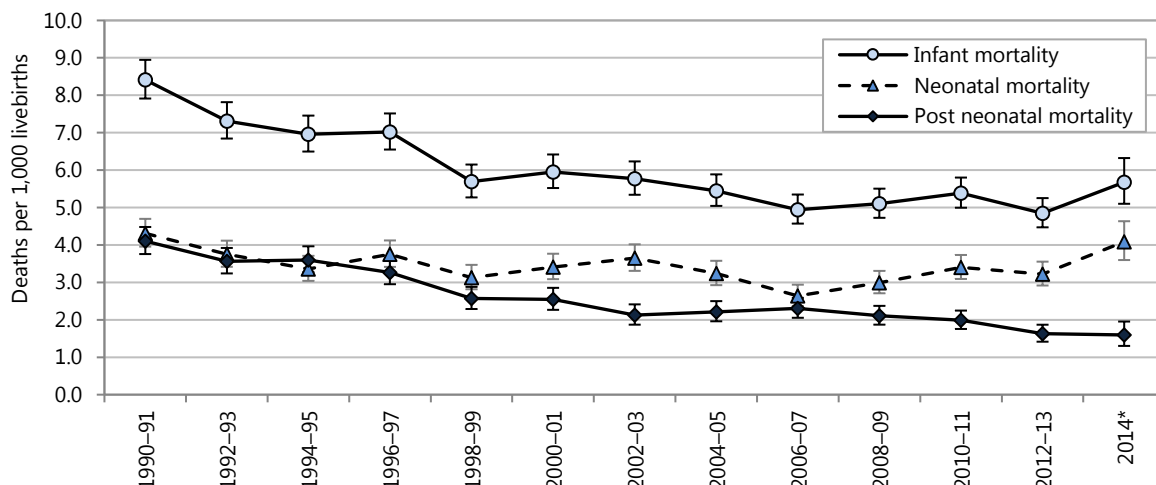


Table IV-2. Livebirths and infant mortality, by district health board, New Zealand 2010–2014

DHB	Livebirths	Infant mortality				
		2010–2014 (n)	Annual average	Rate per 1,000 livebirths	Rate ratio	95% CI
Northland	11,427	82	16	7.18	1.37	1.10–1.71
Waitemata	39,354	125	25	3.18	0.61	0.51–0.73
Auckland	32,069	146	29	4.55	0.87	0.74–1.03
Counties Manukau	42,629	300	60	7.04	1.35	1.19–1.52
Waikato	27,105	178	36	6.57	1.26	1.08–1.47
Bay of Plenty	14,435	98	20	6.79	1.30	1.06–1.59
Lakes	7,537	51	10	6.77	1.29	0.98–1.71
Tairāwhiti	3,669	28	6	7.63	1.46	1.01–2.12
Taranaki	7,783	38	8	4.88	0.93	0.68–1.29
Hawke's Bay	11,166	69	14	6.18	1.18	0.93–1.50
MidCentral	11,157	47	9	4.21	0.81	0.60–1.08
Whanganui	4,251	30	6	7.06	1.35	0.94–1.94
Hutt Valley	9,961	44	9	4.42	0.85	0.63–1.14
Capital & Coast	18,910	68	14	3.60	0.69	0.54–0.88
Wairarapa	2,586	10	2	3.87	0.74	0.40–1.38
Nelson Marlborough	7,918	35	7	4.42	0.85	0.61–1.18
South Canterbury	3,092	19	4	6.14	1.18	0.75–1.85
Canterbury	30,788	140	28	4.55	0.87	0.73–1.03
West Coast	2,059	10	2	4.86	0.93	0.50–1.73
Southern	17,849	78	16	4.37	0.84	0.67–1.05
New Zealand	306,894	1,604	321	5.23	1.00	

Numerator: MORT, Denominator: BDM Livebirths; Rate ratios are unadjusted

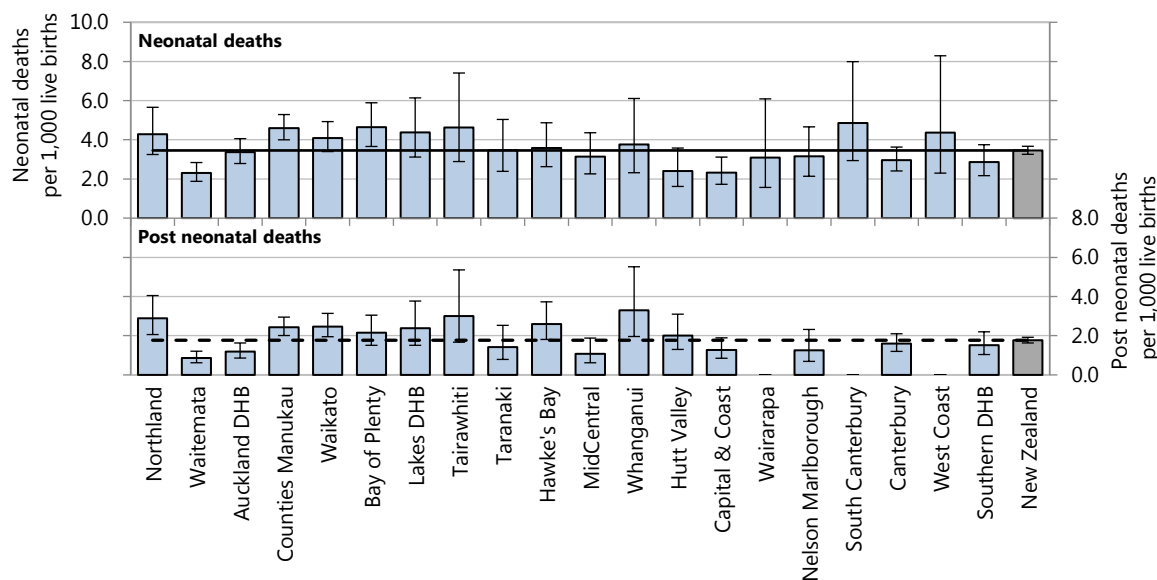
Figure IV-3. Infant deaths, by type, New Zealand 1990–2014



Numerator: MORT, Denominator: BDM Livebirths;
*2014 is a single year of data

In recent years, the majority of infant deaths occurred during the neonatal period (during the first 27 days of life; Figure IV-4 and Table IV-3) rather than in the post-neonatal period (28 days to 1 year; Figure IV-4 and Table IV-4). The neonatal death rate in Bay of Plenty DHB was slightly but significantly higher than the national rate; in Waitemata and Capital & Coast DHBs the rates were significantly lower than the national rate and other DHBs were not significantly different to the national rate. The DHBs with post-neonatal mortality rates significantly higher than the national rate were Northland, Counties Manukau, Waikato, Hawke’s Bay, and Whanganui, with significantly lower rates in Waitemata and Auckland DHBs. It must be remembered that the New Zealand rate is high by international standards and effective strategies to reduce these deaths is universally important.

Figure IV-4. Infant mortality, by type and district health board, 2010–2014



Numerator: MORT,
Denominator: BDM Livebirths;
Period: 2010–2014

Table IV-3. Neonatal mortality, by district health board, New Zealand 2010–2014

DHB	2010–2014 (n)	Annual average	Rate per 1,000 livebirths	Rate ratio	95% CI
Neonatal mortality					
Northland	49	10	4.29	1.24	0.93–1.65
Waitemata	91	18	2.31	0.67	0.54–0.83
Auckland	108	22	3.37	0.97	0.80–1.19
Counties Manukau	196	39	4.60	1.33	1.14–1.55
Waikato	111	22	4.10	1.18	0.97–1.44
Bay of Plenty	67	13	4.64	1.34	1.05–1.72
Lakes	33	7	4.38	1.27	0.90–1.79
Tairāwhiti	17	3	4.63	1.34	0.83–2.16
Taranaki	27	5	3.47	1.00	0.69–1.47
Hawke's Bay	40	8	3.58	1.04	0.76–1.42
MidCentral	35	7	3.14	0.91	0.65–1.27
Whanganui	16	3	3.76	1.09	0.67–1.78
Hutt Valley	24	5	2.41	0.70	0.47–1.04
Capital & Coast	44	9	2.33	0.67	0.50–0.91
Wairarapa	8	2	3.09	0.89	0.45–1.79
Nelson Marlborough	25	5	3.16	0.91	0.61–1.36
South Canterbury	15	3	4.85	1.40	0.84–2.33
Canterbury	91	18	2.96	0.85	0.69–1.06
West Coast	9	2	4.37	1.26	0.66–2.43
Southern	51	10	2.86	0.83	0.62–1.09
New Zealand	1,061	212	3.46	1.00	

Numerator: MORT, Denominator: BDM Livebirths; Rate ratios are unadjusted

Table IV-4. Post neonatal mortality, by district health board, New Zealand 2010–2014

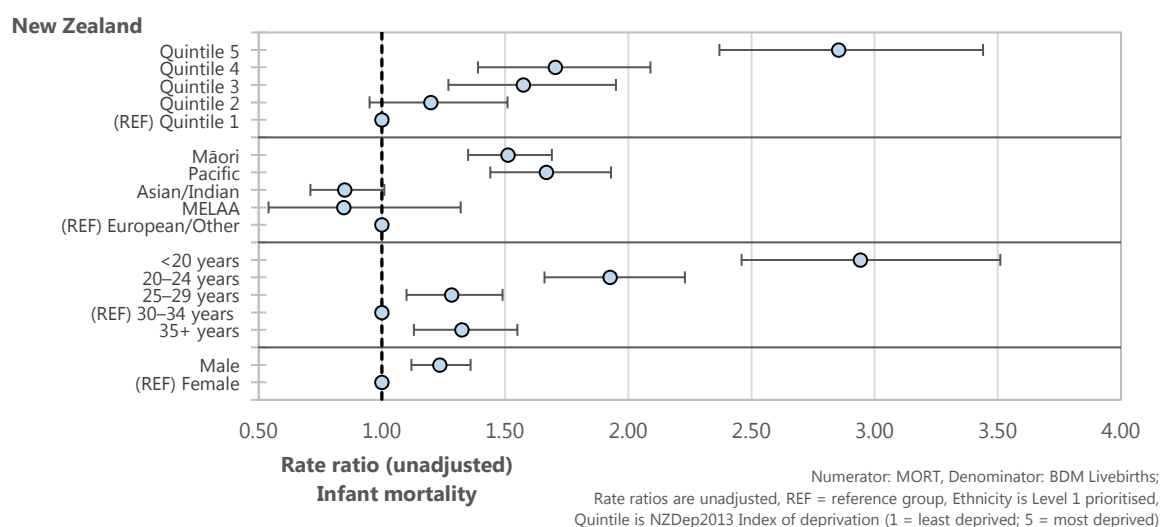
DHB	2010–2014 (n)	Annual average	Rate per 1,000 livebirths	Rate ratio	95% CI
Post neonatal mortality					
Northland	33	7	2.89	1.63	1.15–2.32
Waitemata	34	7	0.86	0.49	0.35–0.69
Auckland	38	8	1.18	0.67	0.48–0.93
Counties Manukau	104	21	2.44	1.38	1.12–1.70
Waikato	67	13	2.47	1.40	1.08–1.80
Bay of Plenty	31	6	2.15	1.21	0.85–1.74
Lakes	18	4	2.39	1.35	0.84–2.16
Tairāwhiti	11	2	3.00	1.69	0.93–3.08
Taranaki	11	2	1.41	0.80	0.44–1.45
Hawke's Bay	29	6	2.60	1.47	1.01–2.13
MidCentral	12	2	1.08	0.61	0.34–1.08
Whanganui	14	3	3.29	1.86	1.10–3.16
Hutt Valley	20	4	2.01	1.13	0.73–1.77
Capital & Coast	24	5	1.27	0.72	0.48–1.08
Wairarapa	<5	s	s	s	s
Nelson Marlborough	10	2	1.26	0.71	0.38–1.33
South Canterbury	<5	s	s	s	s
Canterbury	49	10	1.59	0.90	0.67–1.20
West Coast	<5	s	s	s	s
Southern	27	5	1.51	0.85	0.58–1.26
New Zealand	543	109	1.77	1.00	

Numerator: MORT, Denominator: BDM Livebirths; Rate ratios are unadjusted

Figure IV-5 presents the infant mortality rates by residential deprivation score (NZDep2013 index), maternal age, ethnicity, and gender. The unadjusted rate ratio presents the gap, if any, between the groups and the reference group. The following associations were observed, bearing in mind that this univariate analysis does not quantify the independent effect of each factor:

- The infant mortality rate for those residing in areas with the highest scores on the NZDep2013 index of deprivation (quintile 5; deciles 9–10) was almost three times higher than the mortality rate for infants residing in areas with the lowest NZDep2013 scores (quintile 1; deciles 1–2). Similarly, those residing in areas with moderate-to high NZDep2013 scores (quintiles 3–4; deciles 5–8) had significantly higher infant mortality rates compared to the quintile with the lowest NZDep2013 scores
- The mortality rates for Māori and Pacific infants were more than 1.5 times higher than mortality rates of European/Other infants
- The mortality rate for infants born to mothers aged less than 20 years was nearly 3 times higher than the mortality rate of infants born to mothers aged 30–34 years, while mortality rates were also significantly higher for mothers aged 20–29 years and 35 years and over
- The mortality rate was significantly higher for male infants when compared to female infants.

Figure IV-5. Infant mortality, comparison by demographic factors, New Zealand 2010–2014



The main conditions contributing to infant deaths were congenital anomalies, extreme prematurity and intrauterine hypoxia or birth asphyxia (Table IV-5). Sudden unexpected death in infancy (SUDI) is presented in more detail in the subsequent section.

Table IV-5. Infant mortality, by main underlying cause of death, New Zealand 2010–2014

Cause of death	2010–2014 (n)	Annual average	Rate per 1,000 livebirths	%
Infant mortality				
New Zealand				
Congenital anomalies	370	74	1.21	23.1
Extreme prematurity	312	62	1.02	19.5
Intrauterine hypoxia or birth asphyxia	12	2	0.04	0.7
Other perinatal conditions	464	93	1.51	28.9
SUDI: suffocation or strangulation in bed	119	24	0.39	7.4
SUDI: SIDS	100	20	0.33	6.2
SUDI: all other types	18	4	0.06	1.1
Injury or poisoning	38	8	0.12	2.4
Other causes	171	34	0.56	10.7
Total	1,604	321	5.23	100.0

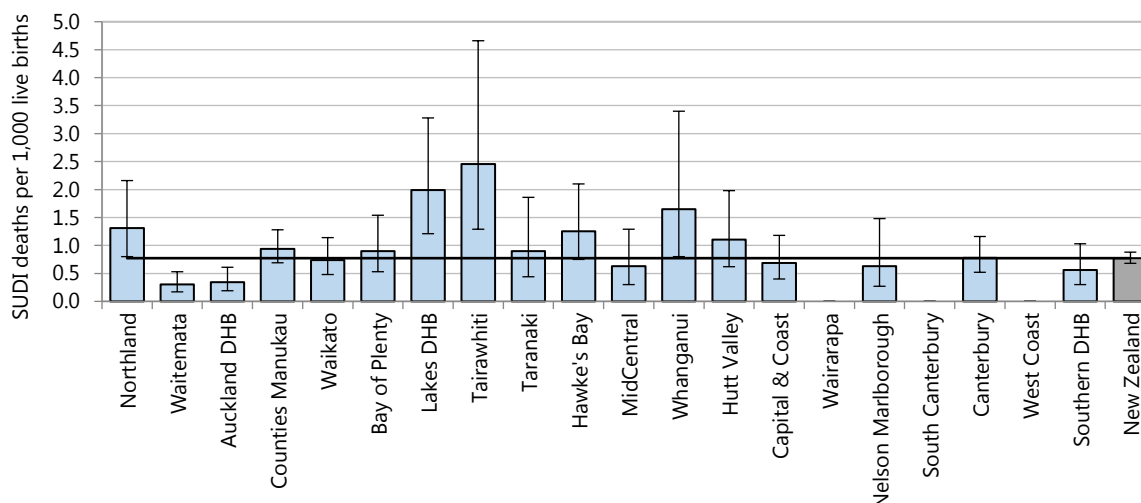
Numerator: MORT, Denominator: BDM Livebirths; SUDI = Sudden Unexpected Death in Infancy; SIDS = Sudden Infant Death Syndrome

Sudden unexpected death in infancy

Sudden unexpected death in infancy (SUDI) is the leading cause of death for New Zealand infants aged 28–364 days. Such deaths occur suddenly and unexpectedly in the first year of life, usually in otherwise healthy infants, and often during sleep.^{6,7}

Figure IV-6 and Table IV-6 present the SUDI rates by district health board during 2010 to 2014. Compared with the national rate, rates of SUDI were significantly lower in Waitemata and Auckland DHBs and significantly higher in Lakes, Tairāwhiti, and Whanganui DHBs. The rate of SUDI in New Zealand has declined significantly from the 1996–97 SUDI rate (Figure IV-7).

Figure IV-6. Sudden unexpected death in infancy (SUDI), by district health board, New Zealand 2010–2014



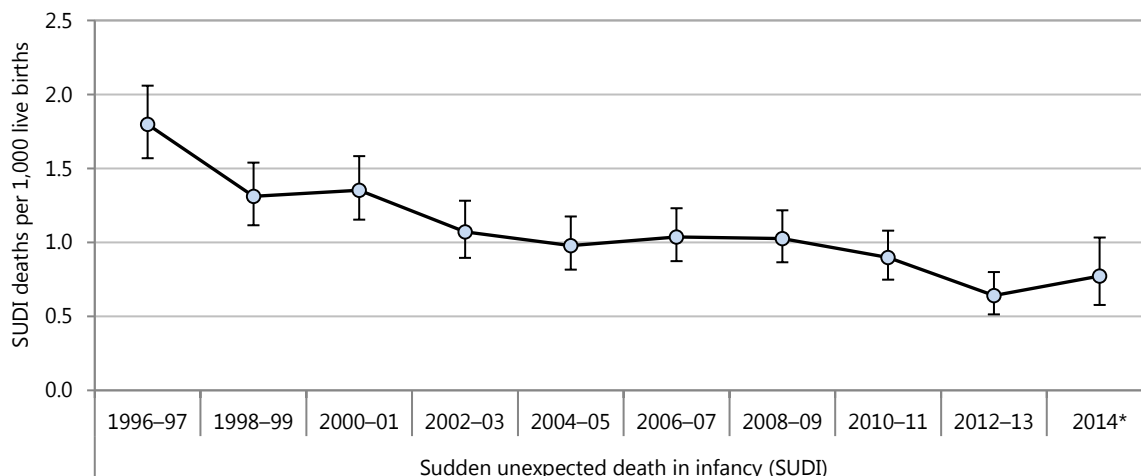
Numerator: MORT, Denominator: BDM Livebirths;
 Period: 2010–2014. Rates suppressed due to small numbers for Wairarapa, South Canterbury, and West Coast DHBs

Table IV-6. Sudden unexpected death in infancy (SUDI), by district health board, 2010–2014

DHB	2010–2014 (n)	Annual average	Rate per 1,000 livebirths	Rate ratio	95% CI
Sudden unexpected death in infancy (SUDI)					
Northland	15	3	1.31	1.70	1.01–2.86
Waitemata	12	2	0.30	0.39	0.22–0.71
Auckland	11	2	0.34	0.44	0.24–0.81
Counties Manukau	40	8	0.94	1.22	0.87–1.70
Waikato	20	4	0.74	0.96	0.61–1.51
Bay of Plenty	13	3	0.90	1.17	0.67–2.04
Lakes	15	3	1.99	2.58	1.53–4.34
Tairāwhiti	9	2	2.45	3.18	1.63–6.18
Taranaki	7	1	0.90	1.16	0.55–2.47
Hawke's Bay	14	3	1.25	1.62	0.95–2.78
MidCentral	7	1	0.63	0.81	0.38–1.72
Whanganui	7	1	1.65	2.13	1.01–4.52
Hutt Valley	11	2	1.10	1.43	0.78–2.62
Capital & Coast	13	3	0.69	0.89	0.51–1.56
Wairarapa	<5	s	s	s	s
Nelson Marlborough	5	1	0.63	0.82	0.34–1.98
South Canterbury	<5	s	s	s	s
Canterbury	24	5	0.78	1.01	0.66–1.54
West Coast	<5	s	s	s	s
Southern	10	2	0.56	0.73	0.39–1.37
New Zealand	237	47	0.77	1.00	

Numerator: MORT, Denominator: BDM Livebirths; Rate ratios are unadjusted

Figure IV-7. Trends in sudden unexpected death in infancy (SUDI), New Zealand 1996–2014

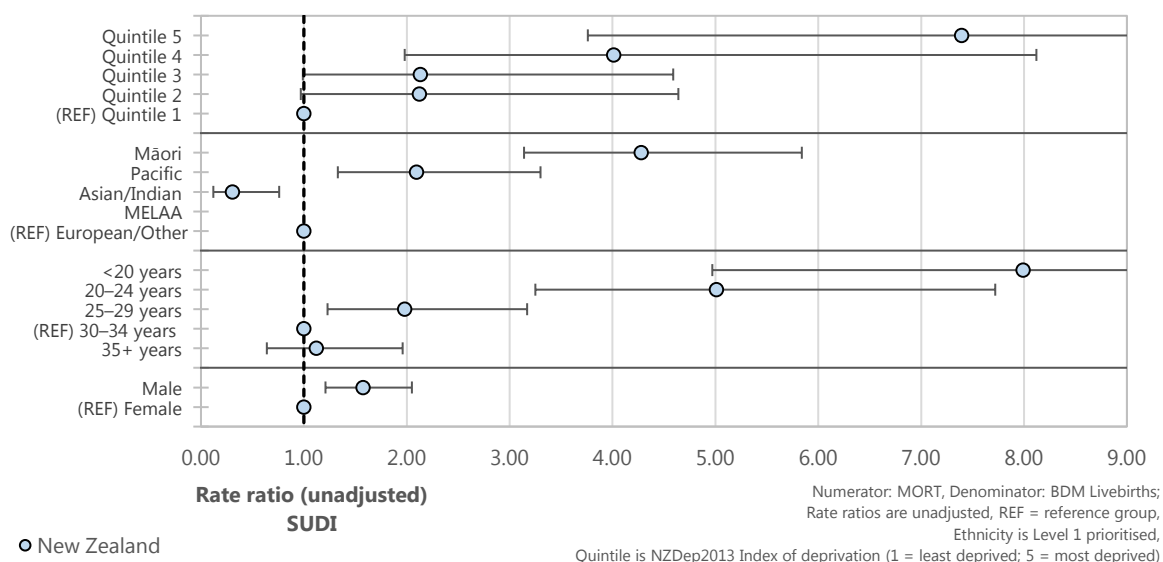


Numerator: MORT, Denominator: BDM Livebirths;
 *2014 is a single year of data

There were disparities in SUDI rates by score of infant domicile on the NZDep2013 index of deprivation, maternal age, (prioritised) ethnicity, and gender (Figure IV-8). The following associations were observed, bearing in mind that this univariate analysis does not quantify the independent effect of each factor:

- Infants residing in areas with higher NZDep2013 scores (quintile 4–5; deciles 8–10) had a SUDI rate over seven times higher compared with the SUDI rate for those residing in areas with lower deprivation scores (quintile 1; deciles 1–2)
- The SUDI rate for Māori infants was over four times higher than the SUDI rate for European/Other infants, and the rate for Pacific infants was twice the rate for European/Other infants
- Infants born to mothers aged under 20 years had SUDI rates almost eight times the rate for infants born to mothers aged 30 years or older, and the SUDI rate for infants born to mothers aged 20–24 years was more than five times higher than for infants born to mothers aged 30 years or older
- The SUDI rate for male infants was significantly higher than the SUDI rate for female infants.

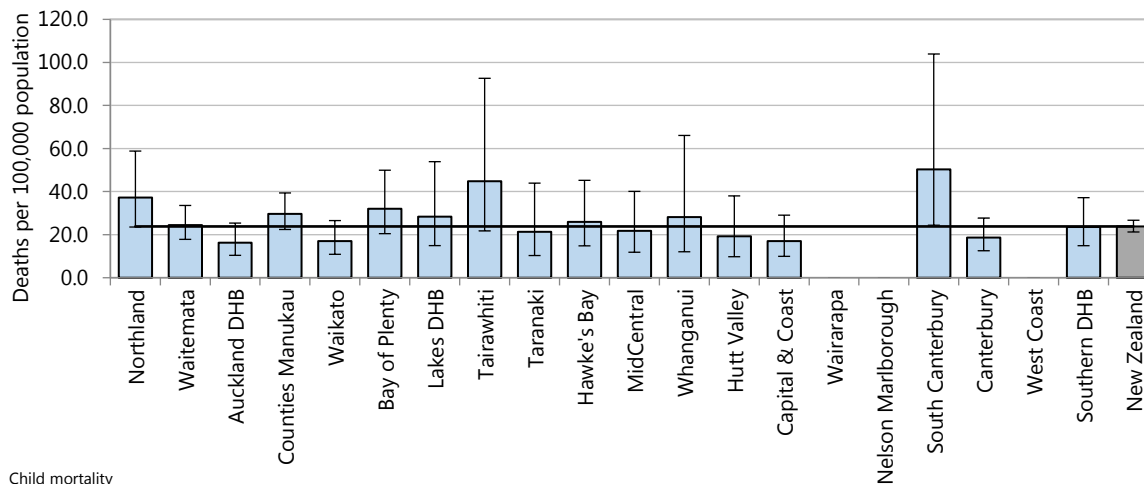
Figure IV-8. Sudden unexpected death in infancy (SUDI), comparison by demographic factors, New Zealand 2010–2014



Child mortality

Figure IV-9 and Table IV-7 present the mortality rate for children aged 1–4 years in each district health board during 2010–2014. There was no significant difference between the child mortality rates for the DHBs and compared with the national rate.

Figure IV-9 Child mortality, by district health board, 2010–2014



Child mortality
 Numerator: MORT, Denominator: StatsNZ ERP;
 Rates suppressed for Wairarapa, Nelson Marlborough, West Coast. Period: 2010–2014

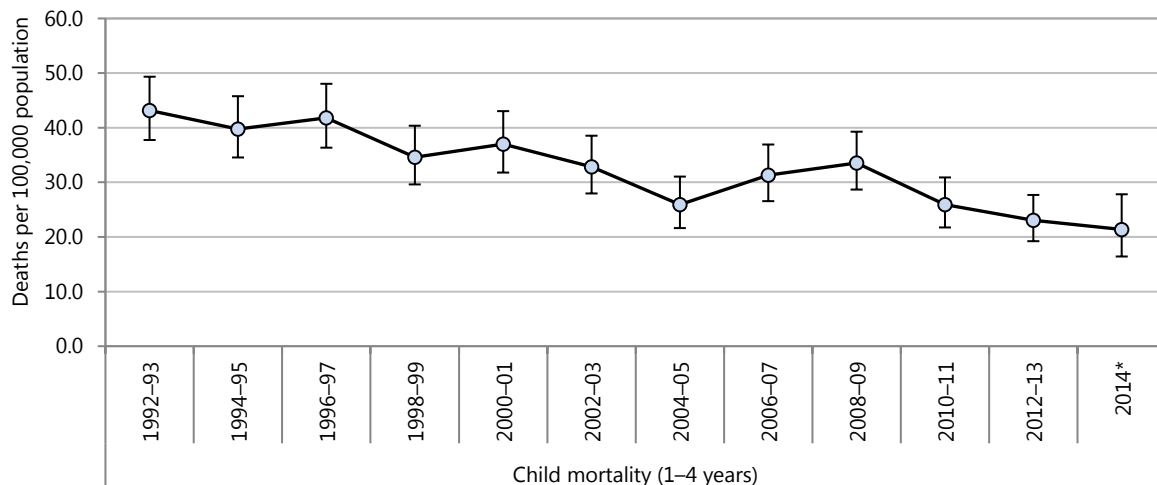
Table IV-7 Child mortality, by district health board, New Zealand 2010–2014

DHB	2010–2014 (n)	Annual average	Rate per 100,000 population	Rate ratio	95% CI
Child mortality					
Northland	18	4	37.2	1.56	0.97–2.51
Waitemata	38	8	24.5	1.03	0.73–1.44
Auckland	19	4	16.3	0.68	0.43–1.09
Counties Manukau	48	10	29.7	1.25	0.92–1.69
Waikato	19	4	17.0	0.71	0.45–1.13
Bay of Plenty	19	4	32.0	1.34	0.84–2.13
Lakes	9	2	28.4	1.19	0.61–2.31
Tairāwhiti	7	1	44.9	1.88	0.89–3.99
Taranaki	7	1	21.3	0.89	0.42–1.89
Hawke's Bay	12	2	25.9	1.09	0.61–1.94
MidCentral	10	2	21.8	0.91	0.49–1.72
Whanganui	5	1	28.2	1.19	0.49–2.87
Hutt Valley	8	2	19.3	0.81	0.40–1.63
Capital & Coast	13	3	17.0	0.71	0.41–1.24
Wairarapa	<5	s	s	s	s
Nelson Marlborough	<5	s	s	s	s
South Canterbury	7	1	50.4	2.11	1.00–4.47
Canterbury	24	5	18.6	0.78	0.52–1.19
West Coast	<5	s	s	s	s
Southern	18	4	23.5	0.99	0.61–1.59
New Zealand	294	59	23.8	1.00	

Numerator: MORT, Denominator: StatsNZ ERP; Rate ratios are unadjusted

Child mortality rates have gradually declined since the early 1990s; the most recent years have had the lowest child mortality rates in the past two decades (Figure IV-10).

Figure IV-10 Trends in child mortality, New Zealand 1992–2014

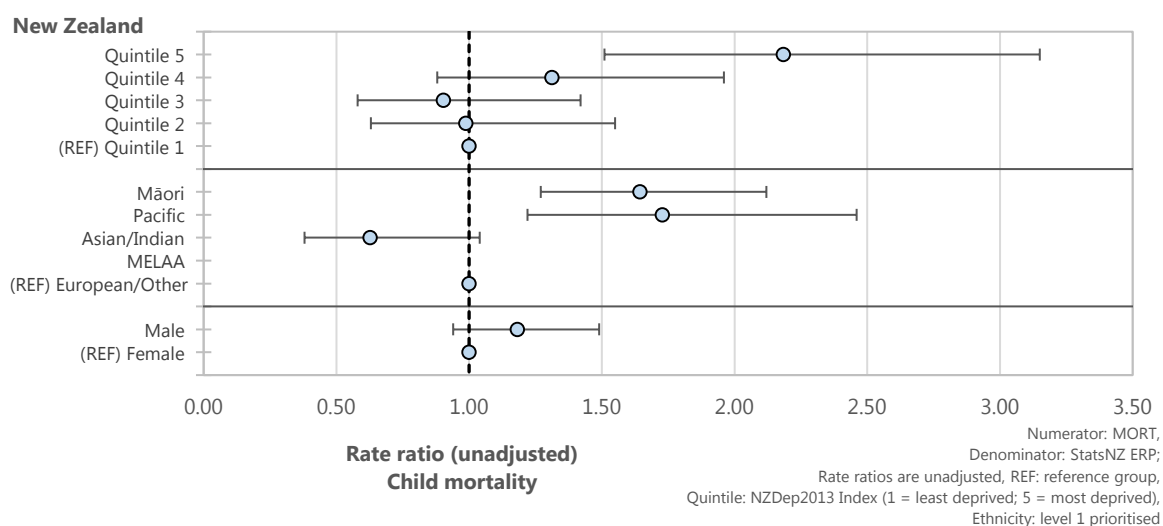


Numerator: MORT,
Denominator: StatsNZ ERP;
*2014 is a single year of data

Figure IV-11 presents child mortality rates by demographic factors. The unadjusted rate ratio presents the gap, if any, between the groups and the reference group. The following associations were observed, bearing in mind that this univariate analysis does not quantify the independent effect of each factor:

- The child mortality rate for those residing in areas with the highest scores on the NZDep2013 index of deprivation (quintile 5; deciles 9–10) was more than twice the mortality rate for 1–4 year olds residing in areas with the lowest NZDep2013 scores (quintile 1; deciles 1–2)
- The mortality rates for Māori and Pacific 1–4 year olds were more than 1.5 times higher than mortality rates of European/Other 1–4 year olds

Figure IV-11 Child mortality, comparison by demographic factors, New Zealand 2010–2014



Numerator: MORT,
Denominator: StatsNZ ERP;
Rate ratios are unadjusted, REF: reference group,
Quintile: NZDep2013 Index (1 = least deprived; 5 = most deprived),
Ethnicity: level 1 prioritised

Table IV-8 presents the leading causes of child deaths. Injury and poisoning was the leading cause of death of children aged 1–4 years, followed by cancer and congenital anomalies. These three causes accounted for half of all deaths for this age group in 2010–2014.

Table IV-8 Child mortality, by cause of death, New Zealand 2010–2014

Cause of death	2010–2014 (n)	Annual average	Rate per 100,000 population	%
Child mortality (aged 1–4 years)				
New Zealand				
Injury and poisoning	98	20	7.94	33.3
<i>Road traffic injuries</i>	16	3	1.30	5.4
Cancer	38	8	3.08	12.9
Congenital anomalies	33	7	2.67	11.2
Infectious and parasitic diseases	27	5	2.19	9.2
Nervous system disorders	26	5	2.11	8.8
Respiratory conditions	25	5	2.03	8.5
All other causes	47	9	3.81	16.0
Total	294	59	23.82	100.0

Numerator: MORT, Denominator: StatsNZ ERP;

Evidence for good practice

The evidence already provided for good antenatal care will contribute to a reduction in infant mortality, particularly in the neonatal period. The information below relates to sudden unexpected death in infancy (SUDI) and childhood injury, which are the main causes of death for 0–4 year olds.

Equity

The fall in sudden unexpected death in infancy (SUDI) rates in New Zealand since the 1980s has not been sufficient to achieve equity across ethnic groups, with rates for Māori and Pacific infants consistently higher than non-Māori non-Pacific rates.⁸ The population groups that experience the highest risk of SUDI frequently do not receive information to help keep infants safe, or they do not receive it in a form that leads to understanding and adoption of safe practice.⁹ Review of well child contacts has shown that Māori parents are less likely to receive SUDI prevention information than parents in other ethnic groups.¹⁰ Māori health providers have taken the lead in developing a culturally appropriate programme aimed to promote ‘safe sleep for every baby, every sleep’.⁹

Around the world, indigenous children experience higher risk of injury compared with their non-indigenous peers.¹¹ There have been very few evaluated interventions to specifically address injury rates among indigenous populations. Findings that are available suggest that culturally appropriate interventions and involvement of indigenous communities in the design and delivery of interventions are common themes in effective interventions. Inclusion of indigenous communities in shaping interventions and policy is important in terms of intervention effectiveness, and also underpins the key human rights principles of indigenous rights to self-determination and cultural preservation.¹¹

Prevention

The Child and Youth Mortality Review Committee has articulated the need for health services to better serve Māori whānau and communities, as well those living in areas with high NZDep2013 scores.⁸ The wahakura has developed as a strong aid to communication with whānau about safe sleeping spaces for infants.^{9,12} This can be described as an example of a health intervention where health researchers and practitioners worked in partnership to develop evidenced-based interventions that address Māori health inequities.¹³

The prevention of child injury is complex, with many local contextual factors affecting the occurrence of injury. However strategies that offer proven or promising strategies to reduce unintentional child injuries include environmental modification (e.g. reducing the height of playground equipment, or introducing traffic calming measures), product modification such as child resistant caps for medication or poisonous substances, legislation, regulation and enforcement, use of safety devices such as child passenger restraints, home visits to families of young children to provide age-appropriate information and to provide free or low-cost safety equipment, and community based interventions to change community values and behaviours.¹⁴ Parenting interventions, most commonly provided on a one-to-one basis in the home as part of multi-faceted interventions to improve a range of child outcomes during the first two years of a child's life, are effective in reducing self-reported or medically attended injury amongst young children.¹⁵

New Zealand guidelines

Observation of mother and baby in the immediate postnatal period: consensus statements guiding practice <http://www.health.govt.nz/system/files/documents/publications/observation-mother-baby-immediate-postnatal-period-consensus-statements.pdf>

Safekids Aotearoa. 2015. **Child unintentional deaths and injuries in New Zealand, and prevention strategies**. Auckland: Safekids Aotearoa. <http://www.safekids.nz/Resources/ProdID/134/CatID/5>

International guidelines

Mackay M & Vincenten J. 2014. **Action planning for child safety: 2014 update on the strategic and coordinated approach to reducing the number one cause of death for children in Europe - injury**. Birmingham: European Child Safety Alliance. <http://www.childsafetyeurope.org/tactics/info/final-report-csap.pdf>

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Abel S, et al. 2015. **The wahakura: A qualitative study of the flax bassinet as a sleep location for New Zealand Māori infants**. *N Z Med J*, 128(1413), 12-9

Shepherd M, et al. 2013. **Preventing child unintentional injury deaths: Prioritising the response to the New Zealand child and adolescent injury report card**. *Australian & New Zealand Journal of Public Health*, 37(5), 470-4.

Websites

Ministry of Health: Safe sleep <http://www.health.govt.nz/your-health/pregnancy-and-kids/first-year/helpful-advice-during-first-year/safe-sleep>

Safekids Aotearoa <http://www.safekids.nz/> includes child injury profiles for each DHB <http://www.safekids.nz/Resources/ProdID/121/CatID/20>

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V. BREASTFEEDING

The Ministry of Health recommends exclusive breastfeeding until babies are around six months of age,¹ which is similar to the World Health Organisation's recommendation of exclusive breastfeeding up to 6 months of age.² Most babies in New Zealand (over 90%) are receiving some breastmilk two weeks after birth, and around 80% are exclusively or fully breastfed at this time.³

Breastfeeding has health benefits for both mother and baby.⁴ Babies who are breastfed have lower rates of diarrhoea and vomiting, otitis media (ear infections), hospitalisation for respiratory infection, and sudden infant death syndrome.⁴⁻⁶ Breastfeeding for six months or more may reduce the risk of childhood leukaemia.⁷ Mothers who breastfeed have lower rates of post-partum haemorrhage, breast cancer and ovarian cancer, and are less likely to become pregnant soon after their baby's birth.⁴⁻⁶

Breastfeeding is a right of the child, however mothers should not be made to feel guilty by society or by health professionals if they are unable to or choose not to breastfeed. However the success rate among mothers who wish to breastfeed can be improved if there is active support from families, friends, communities, clinicians, health care leaders, employers and policymakers.⁴

The following section reviews breastfeeding rates at six weeks, three months and six months using the Well Child/Tamariki Ora (WCTO) dataset.

Data sources and methods

Indicator(s)

Infants exclusively or fully breastfed at two weeks (%)

Numerator: Number of Infants exclusively or fully breastfed at two weeks
Denominator: Number of Infants with recorded breastfeeding status at two weeks
Data source: WCTO NHI Dataset

Infants exclusively or fully breastfed at 6 weeks (%)

Numerator: Number of Infants exclusively or fully breastfed at 6 weeks
Denominator: Number of Infants with recorded breastfeeding status at 6 weeks
Data source: WCTO NHI Dataset

Infants exclusively or fully breastfed at 3 months (%)

Numerator: Number of Infants exclusively or fully breastfed at 3 months
Denominator: Number of Infants with recorded breastfeeding status at 3 months
Data source: WCTO NHI Dataset

Infants receiving breastmilk at six months (%)

Numerator: Number of Infants receiving breast milk at 6 months, whether exclusively, fully or partial.
Denominator: Number of Infants with recorded breastfeeding status at 6 months
Data source: WCTO NHI Dataset

Additional information

The analysis was done by year of birth of baby.

To get breastfeeding information for the highest possible percentage of Infants, all the records for each baby within each breastfeeding age band were searched for breastfeeding information. The record with the highest level breastfeeding information (at the earliest date if there was >1 such record) was chosen as the record indicating the breastfeeding status of that baby in that period. The DHB and deprivation score in that record was used in the analysis by DHB and NZDep2013.

So if a baby had, for example, exclusive recorded at one visit and partial recorded at another, then the baby's breastfeeding status for that time period (age band) was considered to be exclusive.

This process was done on the entire 2013–2016 set to get one record per breastfeeding age band for each baby, for use in the trend analysis, the DHB rate ratio analysis, and the demographic rate ratio analysis.

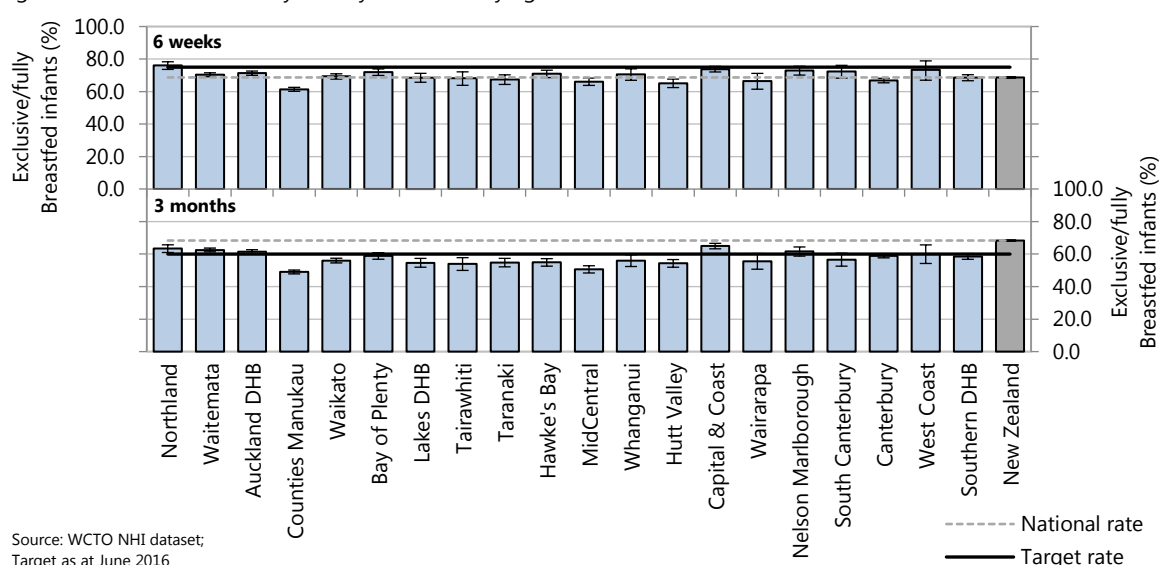
Breastfed at six weeks and three months

Figure V-1 and Table V-1 to Table V-2 present the proportion of infants that were exclusively or fully breastfed for each district health board during 2015.

The Ministry of Health has set a target of 75% of infants aged six weeks to be exclusively or fully breastfed, and a target of 60% for infants aged three months. Compared against these targets, only Northland DHB reached the six weeks breastfed target of 75%, while Northland, Capital & Coast, and Nelson Marlborough DHBs reached the three month 60% breastfed target (Figure V-1). The six weeks breastfeeding rate ranged from 61% in Counties Manukau to 76% in Northland and the three months rate ranged from 49% in Counties Manukau to 65% in Capital & Coast.

The rate of exclusively/fully breastfed infants aged six weeks was significantly higher than the national rate, by a small margin, in Northland, Auckland, Capital & Coast, and Nelson Marlborough DHBs, while the rates were slightly but significantly lower in Counties Manukau and Hutt Valley DHBs (Table V-1). A similar pattern was seen for infants aged three months (Figure V-1, Table V-2).

Figure V-1 Infants exclusively or fully breastfed, by age and district health board, 2015



Source: WCTO NHI dataset;
Target as at June 2016

Table V-1 Exclusively or fully breastfed infants at 6 weeks, by district health board, 2015

DHB	Documented status	2015 (n)	%	Rate ratio	95% CI
Infants exclusively or fully breastfed at milestone age					
6 weeks					
Northland	1,265	962	76.05	1.11	1.07–1.14
Waitemata	5,614	3,950	70.36	1.02	1.01–1.04
Auckland	4,638	3,308	71.32	1.04	1.02–1.06
Counties Manukau	6,049	3,712	61.37	0.89	0.87–0.91
Waikato	3,185	2,208	69.32	1.01	0.99–1.03
Bay of Plenty	1,926	1,386	71.96	1.05	1.02–1.08
Lakes	1,096	751	68.52	1.00	0.96–1.04
Tairāwhiti	483	329	68.12	0.99	0.93–1.05
Taranaki	963	649	67.39	0.98	0.94–1.03
Hawke's Bay	1,529	1,084	70.90	1.03	1.00–1.07
MidCentral	1,694	1,119	66.06	0.96	0.93–1.00
Whanganui	639	451	70.58	1.03	0.98–1.08
Hutt Valley	1,275	830	65.10	0.95	0.91–0.99
Capital & Coast	2,515	1,856	73.80	1.07	1.05–1.10
Wairarapa	358	238	66.48	0.97	0.90–1.04
Nelson Marlborough	1,027	749	72.93	1.06	1.02–1.10
South Canterbury	492	356	72.36	1.05	1.00–1.11
Canterbury	4,427	2,956	66.77	0.97	0.95–0.99
West Coast	210	154	73.33	1.07	0.98–1.16
Southern	2,412	1,653	68.53	1.00	0.97–1.03
New Zealand	41,848	28,739	68.67	1.00	

Source: WCTO NHI dataset; Rate ratios are unadjusted

Table V-2 Exclusively or fully breastfed infants at 3 months, by district health board, 2015

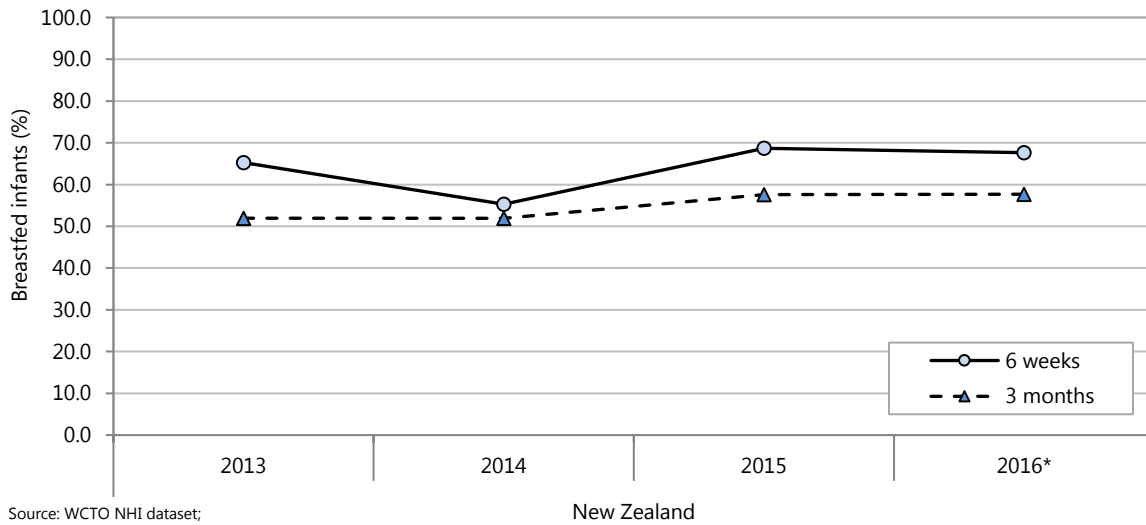
DHB	Documented status	2015 (n)	%	Rate ratio	95% CI
Infants exclusively or fully breastfed at milestone age					
3 months					
Northland	1,586	1,005	63.37	1.10	1.06–1.14
Waitemata	6,600	4,128	62.55	1.09	1.06–1.11
Auckland	5,171	3,174	61.38	1.07	1.04–1.09
Counties Manukau	6,705	3,285	48.99	0.85	0.83–0.87
Waikato	4,484	2,511	56.00	0.97	0.95–1.00
Bay of Plenty	2,311	1,360	58.85	1.02	0.99–1.06
Lakes	1,290	705	54.65	0.95	0.90–1.00
Tairāwhiti	616	332	53.90	0.94	0.87–1.01
Taranaki	1,384	758	54.77	0.95	0.91–1.00
Hawke's Bay	1,787	981	54.90	0.95	0.91–0.99
MidCentral	1,929	976	50.60	0.88	0.84–0.92
Whanganui	727	407	55.98	0.97	0.91–1.04
Hutt Valley	1,706	926	54.28	0.94	0.90–0.98
Capital & Coast	3,064	1,990	64.95	1.13	1.10–1.16
Wairarapa	405	225	55.56	0.96	0.88–1.05
Nelson Marlborough	1,138	701	61.60	1.07	1.02–1.12
South Canterbury	592	335	56.59	0.98	0.91–1.05
Canterbury	5,338	3,149	58.99	1.02	1.00–1.05
West Coast	278	167	60.07	1.04	0.95–1.15
Southern	3,004	1,759	58.56	1.02	0.99–1.05
New Zealand	50,208	28,927	57.61	1.00	

Source: WCTO NHI dataset; Rate ratios are unadjusted

The national proportion of exclusively/fully breastfed infants at six weeks remained fairly stable, although well below the target, over the period 2013–2016. The dip seen in 2014 is unlikely to reflect a genuine decline in

breastfeeding rates at six weeks and probably reflects a change in how data collectors defined breastfeeding that year. Nationally, there was a modest increase in rates of breastfeeding at three months over the same time period (Figure V-2).

Figure V-2 Breastfeeding status of infants, by age, New Zealand Jan 2013–Jun 2016

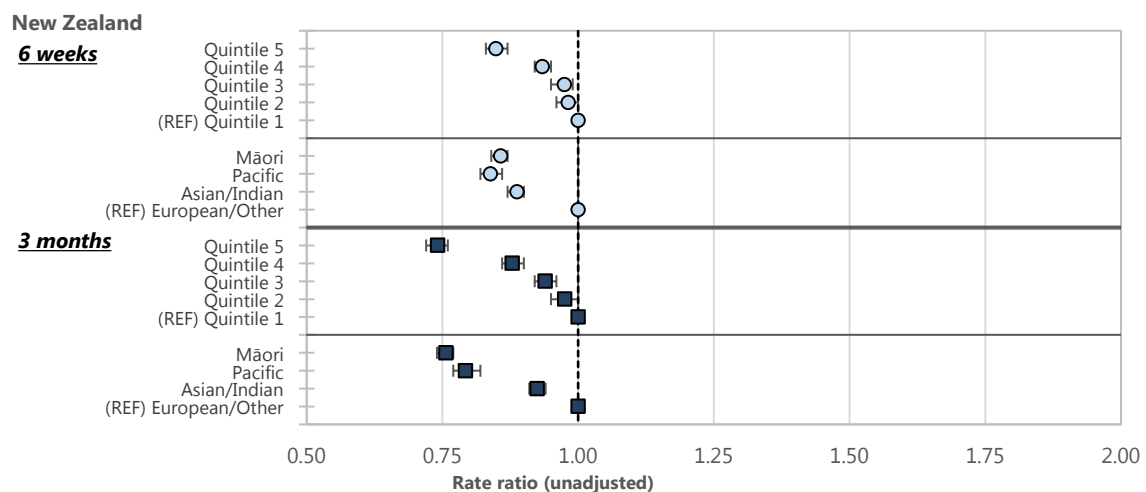


Source: WCTO NHI dataset;
 *Data for Jan–June only
 Exclusive/fully breastfed at 6 weeks or at 3 months

Figure V-3 presents the breastfeeding rates at six weeks and three months by the residential deprivation score (NZDep2013 index of deprivation score) and by ethnicity. The unadjusted rate ratio presents the gap, if any, between the groups and the reference group. The following associations were observed, bearing in mind that this univariate analysis does not quantify the independent effect of each factor:

- Rates of exclusively/fully breastfed infants at six weeks were significantly lower for those residing in areas with higher NZDep2013 scores (quintiles 4–5; deciles 7–10) compared with quintile 1 (deciles 1–2). Similarly, the breastfeeding rate at three months was significantly lower for quintiles 4–5 (highest NZDep2013 scores)
- European/Other infants had significantly higher rates of being exclusively or fully breastfed at six weeks or at three months compared with infants of the other ethnic groups.

Figure V-3 Exclusive/fully breastfed at milestone age, by demographic factor, New Zealand 2015



Source: WCTO NHI dataset;
 Rate ratios are unadjusted, REF = reference group,
 Quintile is NZDep2013 Index of deprivation (1 = least deprived; 5 = most deprived)

Received breastmilk at six months

Figure V-4 and Table V-3 present the proportion of infants that were receiving breastmilk (exclusively, fully or partially) at six months for New Zealand and each district health board during 2015.

The rates of any breastfeeding at six months were significantly higher in Northland, Waitemata, Auckland, Capital & Coast, and Nelson Marlborough DHBs compared to the national rate. These five DHBs were also above the Ministry of Health's target of 65% for the percentage of infants aged six months that should be receiving breastmilk. The rates in MidCentral and Whanganui were significantly lower than the national rate, and marginally lower than the 65% target (Figure V-4, Table V-3).

Figure V-4 Infants receiving breastmilk at 6 months, by district health board, 2015

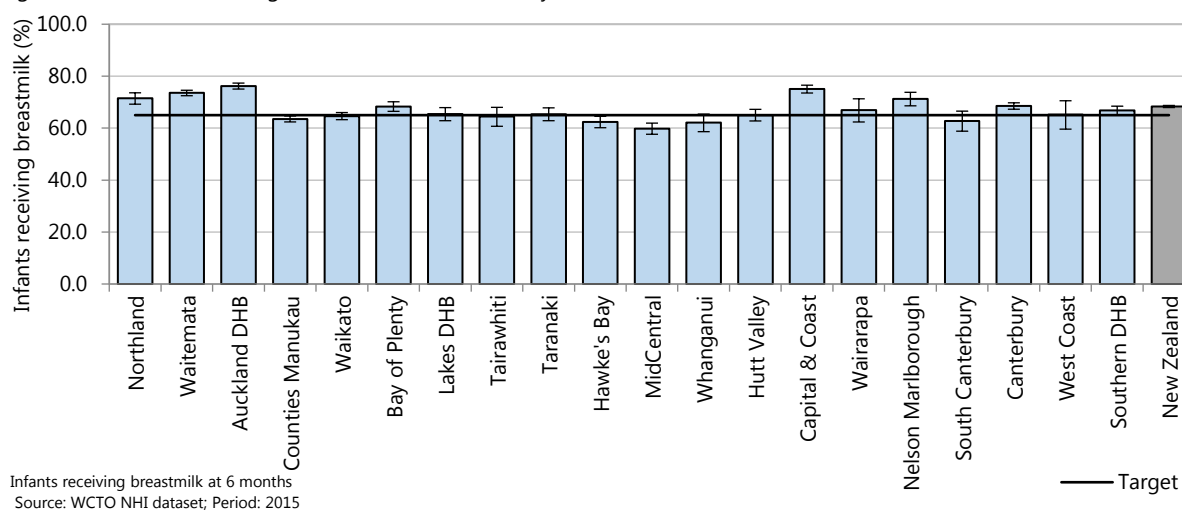


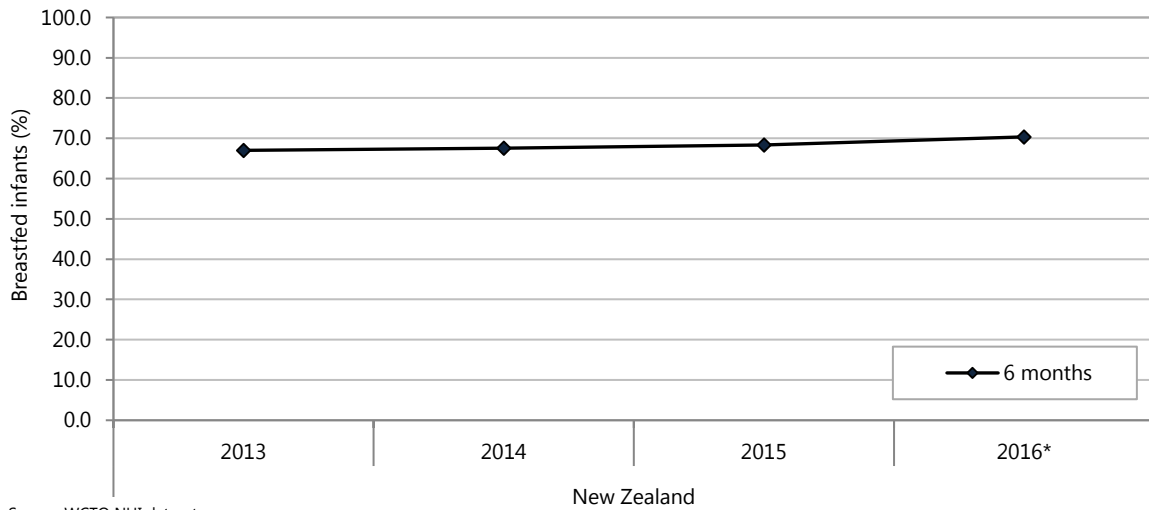
Table V-3 Infants receiving breastmilk at 6 months, by district health board, 2015

DHB	Documented status	2015 (n)	%	Rate ratio	95% CI
Infants receiving breastmilk at 6 months					
Northland	1,633	1,167	71.46	1.05	1.01–1.08
Waitemata	6,780	4,986	73.54	1.08	1.06–1.09
Auckland	5,288	4,030	76.21	1.12	1.10–1.13
Counties Manukau	6,881	4,372	63.54	0.93	0.91–0.95
Waikato	4,686	3,029	64.64	0.95	0.93–0.97
Bay of Plenty	2,441	1,668	68.33	1.00	0.97–1.03
Lakes	1,365	893	65.42	0.96	0.92–1.00
Tairāwhiti	658	424	64.44	0.94	0.89–1.00
Taranaki	1,418	927	65.37	0.96	0.92–0.99
Hawke's Bay	1,879	1,172	62.37	0.91	0.88–0.95
MidCentral	2,005	1,199	59.80	0.88	0.84–0.91
Whanganui	786	488	62.09	0.91	0.86–0.96
Hutt Valley	1,750	1,138	65.03	0.95	0.92–0.99
Capital & Coast	3,155	2,368	75.06	1.10	1.08–1.12
Wairarapa	424	284	66.98	0.98	0.92–1.05
Nelson Marlborough	1,162	828	71.26	1.04	1.00–1.08
South Canterbury	599	376	62.77	0.92	0.86–0.98
Canterbury	5,443	3,730	68.53	1.00	0.98–1.02
West Coast	288	188	65.28	0.96	0.88–1.04
Southern	3,102	2,073	66.83	0.98	0.95–1.00
New Zealand	52,075	35,585	68.33	1.00	

Source: WCTO NHI dataset; Rate ratios are unadjusted

The national breastfeeding rate at six months changed little from 2013 to 2016; although the rate has marginally increased over the four year period (Figure V-5).

Figure V-5 Infants receiving breastmilk at 6 months, New Zealand Jan 2013–Jun 2016

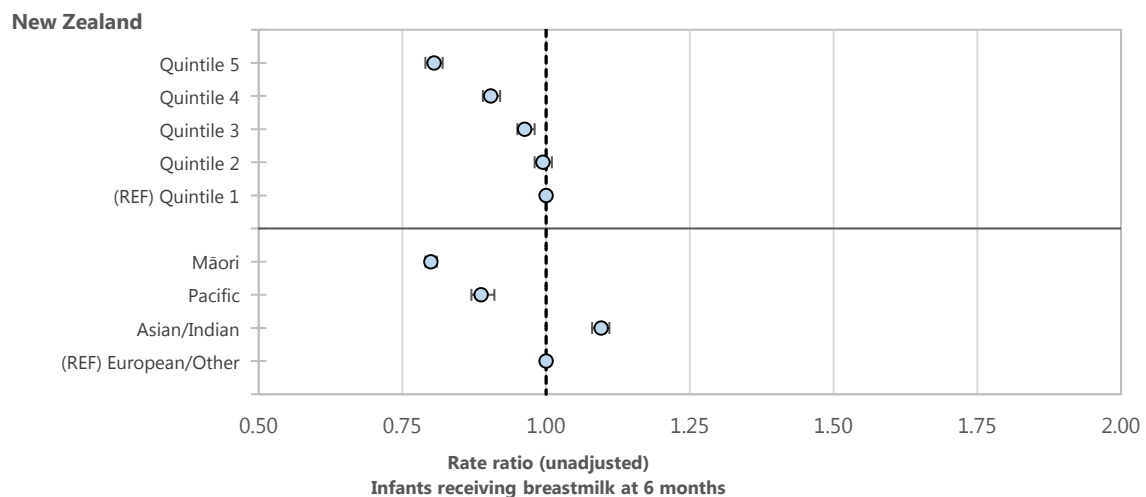


Source: WCTO NHI dataset;
 *Data for Jan–June only
 Infant receiving breastmilk at 6 months

Figure V-6 presents the rates of six month old infants receiving breastmilk by the residential deprivation score (NZDep2013 index of deprivation score) and by ethnicity. The unadjusted rate ratio presents the gap, if any, between the groups and the reference group. The following associations were observed, bearing in mind that this univariate analysis does not quantify the independent effect of each factor:

- Infants residing in areas with the highest (quintiles 4–5; deciles 7–10) NZDep2013 scores had significantly lower rate of receiving breastmilk compared with those residing in quintile 1 (deciles 1–2; lowest deprivation) areas
- Rates of receiving breastmilk at six months were significantly lower for Pacific and Māori infants compared to European/Other infants, while the rate was higher for Asian/Indian infants.

Figure V-6 Infants receiving breastmilk at 6 months, by demographic factor, New Zealand 2015



Source: WCTO NHI dataset;
 Rate ratios are unadjusted, REF = reference group,
 Quintile is NZDep2013 Index of deprivation (1 = least deprived; 5 = most deprived)

Evidence for good practice

Breastfeeding support increases both the duration and exclusivity of breastfeeding.^{8,9} Characteristics of effective support for breastfeeding identified in a 2017 Cochrane review¹⁰ include: that it is routinely offered by trained personnel during antenatal or postnatal care, that it includes on-going scheduled visits so that women can predict when support will be available, and that it is tailored to the setting and needs of the population. Support is likely to be more effective when initiation rates are high.¹⁰ It may be delivered by professional or lay/peer supporters, or a combination of both.¹⁰ Face to face support strategies are more likely to increase exclusive breastfeeding rates.¹⁰ There is a lack of good evidence regarding breastfeeding education and training for healthcare staff.¹¹ There is also a lack of conclusive evidence that antenatal breastfeeding education improves initiation, duration or exclusivity of breastfeeding.¹²

Concerns have been raised that promoting breastfeeding as “natural” may be problematic because it may align with a worldview that “natural” is always healthier and this may undermine other public health goals, particularly vaccination.¹³ It may also be viewed as endorsing traditional beliefs and values regarding gender roles and family life and it has been argued that promoting such values and beliefs is not the role of public agencies.¹⁴

Understanding why women stop breastfeeding is essential if women are to be better supported to continue breastfeeding. A 2016 review by Debevec and Evanson¹⁵ looked at the literature reporting on women’s perspectives and emotional experiences of breastfeeding. Common themes identified in the 21 included studies included feeling pressure to be a perfect mother, which could lead women to hide any difficulties they were having, unrealistic expectations that breastfeeding would come naturally, be easy, and be pleasurable rather than painful, feeling judged as bad mothers if they could not meet their breastfeeding goals, and the need for support from others, both friends and family and healthcare providers. Studies of women’s emotional experiences largely focussed on the negative emotions of failure and guilt stemming from the “breast is best” message and isolation due to the time commitment required for breastfeeding.

The review authors stated that healthcare providers need to provide women with honest and realistic information about breastfeeding, presenting it as a learned skill that requires time and experience to master and may be difficult initially. They also need to foster women’s personal qualities of determination, flexibility, optimism and perseverance as well as acknowledging the mixed feelings many women have about breastfeeding.

The most common problems faced by breastfeeding mothers are nipple pain and perceived low milk supply.¹⁶ The most common cause of nipple pain and nipple damage is poor attachment of the infant to the breast. Health practitioners can help mothers to get their baby in the best position to get well attached with the nipple and areola deep inside the mouth. Low milk supply may be a mother’s perception rather than reality. Mothers’ perceptions of low milk supply may be the result of lack of confidence or lack of awareness that it is normal for breasts to become softer and feeds to become shorter as breastfeeding becomes established and that some babies may feed up to ten times a day.¹⁶ Monitoring a baby’s weight gain is the best way to assess the adequacy of breastmilk supply.¹⁶ Support for new mothers is vital to enable them to increase their milk supply through better breast drainage.¹⁶

There is some controversy about the extent to which tongue tie (ankyloglossia) is a cause of breastfeeding difficulties and there is a lack of good quality evidence that surgical treatment (frenotomy) improves duration of breastfeeding.¹⁷⁻¹⁹ Frenotomy probably reduces mothers’ nipple pain in the short term but the placebo effect and intensive breastfeeding support following the procedure may be partly responsible for this.¹⁷⁻¹⁹

Pacifier (dummy) use has been found to be associated with premature cessation of exclusive breastfeeding in many observational studies²⁰ and WHO recommends against using pacifiers²¹. However, pacifier use has been found in case control studies to significantly decrease the risk of sudden infant death syndrome (SIDS), especially when babies are placed to sleep^{22,23}, so some professional bodies, such as the American Academy of Pediatrics²⁴, recommend parents consider offering their babies a pacifier when put down for sleep. A 2016 Cochrane review²⁵ compared the effect of restricted versus unrestricted pacifier use on breastfeeding duration in healthy full term infants whose mothers had initiated breastfeeding and intended to exclusively breastfeed. It included data from two RCTs in its analysis (1,302 babies) and found moderate quality evidence that pacifier use had no significant effect on the proportion of infants exclusively breastfed at three months or at four months, nor on the proportions of infants partially breastfed at the same ages.

When fathers have a positive attitude to breastfeeding and are encouraging and supportive, mothers are more likely to breastfeed and to breastfeed for longer.²⁶ For women who return to paid work, supportive employers

who provide lactation spaces and breastfeeding breaks can make it possible for women to continue breastfeeding.²⁷ In New Zealand, employers are legally required to give mothers unpaid breaks to breastfeed their babies or express milk, and must provide facilities for them to do this.²⁸

New Zealand guidelines

- Ministry of Health. 2016. **Breastfeeding**. <https://www.health.govt.nz/our-work/life-stages/breastfeeding>
All the breastfeeding information on the Ministry of Health's website can be accessed from this webpage.
- Ministry of Health. 2015. **For Health Practitioners**. <https://www.health.govt.nz/our-work/life-stages/breastfeeding/health-practitioners> Information on mastitis and breast abscesses; candida infections; sore, tender and cracked nipples; breast engorgement and breast oedema; medications and breastfeeding; Work and income assistance for breast pumps; and domperidone for treating low milk supply.
- Ministry of Health. 2015. **Infant Feeding in an Emergency**. <http://www.health.govt.nz/publication/infant-feeding-emergency>
- Medsafe. 2015. **Medicine use in Lactation**. <http://www.medsafe.govt.nz/Profs/PUarticles/June2015/June2015Lactation.htm>
- Ministry of Health. 2008. **Food and Nutrition Guidelines for Healthy infants and Toddlers (Aged 0–2): A background paper - Partially revised December 2012**. Wellington: Ministry of Health. <https://www.health.govt.nz/publication/food-and-nutrition-guidelines-healthy-infants-and-toddlers-aged-0-2-background-paper-partially>

International guidelines

- Centers for Disease Control and Prevention. 2017. **Breastfeeding Guidelines and Recommendations**. <https://www.cdc.gov/breastfeeding/recommendations/index.htm>
- World Health Organization. 2017. **Protecting, promoting and supporting breastfeeding in facilities providing maternity and newborn services**. <http://www.who.int/nutrition/publications/guidelines/breastfeeding-facilities-maternity-newborn/en/>
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- National Institute for Health and Care Excellence. 2006 (last updated February 2015). **Postnatal care up to 8 weeks after birth**. <https://www.nice.org.uk/guidance/cg37/chapter/1-Recommendations#infant-feeding> (full guideline and supporting evidence at: <https://www.nice.org.uk/Guidance/CG37/Evidence> Chapter 6 deals with infant feeding)
- Centers for Disease Control and Prevention. 2013, **The CDC Guide to Strategies to Support Breastfeeding Mothers and Babies**. Atlanta, GA: Centers for Disease Control and Prevention. <https://www.cdc.gov/breastfeeding/resources/guide.htm>
- U.S. Department of Health and Human Services. 2011. **The Surgeon General's Call to Action to Support Breastfeeding**. Washington, DC: Office of the Surgeon General. <https://www.ncbi.nlm.nih.gov/books/NBK52682/>

Evidence-based reviews

- The Cochrane Library. 2017. **Special collection of systematic reviews on breastfeeding**. <http://www.cochranelibrary.com/app/content/special-collections/article/?doi=10.1002%2F14651858.10100214651858>
- Victora CG, Bahl R, Barros AJD, et al. 2016. **Breastfeeding in the 21st century: Epidemiology, mechanisms, and lifelong effect**. The Lancet, 387(10017), 475-90. [http://dx.doi.org/10.1016/S0140-6736\(15\)01024-7](http://dx.doi.org/10.1016/S0140-6736(15)01024-7)

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Other relevant publications

- Hargest-Slade AC, Gribble KD. 2015. Shaken but not broken: **Supporting breastfeeding women after the 2011 Christchurch New Zealand earthquake.** *Breastfeeding Review*, 23(3), 7-13.
- Health Nexus Sante. 2013. **Breastfeeding matters: an important guide to breastfeeding for women and their families.** Ontario: Best Start Resource Centre. https://www.beststart.org/resources/breastfeeding/pdf/BreastfeedingMatters_2013_low_rez_reference.pdf
- Amir LH. 2014. **Managing common breastfeeding problems in the community.** *BMJ (Online)*, 348. <http://dx.doi.org/10.1136/bmj.g2954>

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- La Leche League of New Zealand. 2008. **Breastfeeding peer counsellor programme.** <http://www.pcp.org.nz/>
- Breastfeeding New Zealand. **The Joy Series videos** and the **Breastfeeding Naturally videos** <https://www.youtube.com/user/breastfeedingnz>
- New Zealand College of Midwives (Inc). 2017. **Position statement: Tongue-tie (Ankyloglossia)** <https://www.midwife.org.nz/pdf/Consensus%20Statements/Tongue%20tie%20Position%20Statement%20Ratified%20August%202017.pdf>

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6. Victora CG, Bahl R, Barros AJD, et al. 2016. Breastfeeding in the 21st century: Epidemiology, mechanisms, and lifelong effect. *The Lancet*, 387(10017) 475-90. [http://dx.doi.org/10.1016/S0140-6736\(15\)01024-7](http://dx.doi.org/10.1016/S0140-6736(15)01024-7)
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VI. IMMUNISATION

Immunisation is the process whereby a person is made immune or resistant to an infectious disease, typically by the administration of a vaccine.¹ Vaccination is a cost-efficient means of reducing inequities in health.^{2,3} Vaccine-preventable diseases, including diphtheria, pertussis, measles, *Haemophilus influenzae* type b disease, hepatitis B and pneumococcal disease, pose a significant risk to the health of children. Vaccines against these diseases, and others, are included in the National Immunisation Schedule for all New Zealand children.⁴ High immunisation coverage is vital to protect the population as a whole, protecting not only vaccinated individuals but also reducing the spread of disease to those who are too young or too sick to be vaccinated.⁴ The National Immunisation Schedule is reviewed regularly; in 2014 rotavirus vaccine was introduced and in 2017, vaccination against chickenpox (varicella).⁴ Some vaccines in addition to those in the routine schedule are available to children in special groups, for example influenza and other specified vaccines for children with cystic fibrosis.⁴

Increasing immunisation coverage and timeliness is one of the Ministry of Health's targets.⁵ Immunisation uptake has been lower in populations living in areas with higher NZDep2013 index of deprivation scores and there has also been inequity in immunisation rates between Māori and Pacific children compared with their non-Māori non-Pacific peers.⁶ The 2017 immunisation-specific health target is that 95 percent of eight-month-olds will have completed their primary course of immunisation (six weeks, three months and five months immunisation events) on time.⁵ This target supports early enrolment of infants in general practice and on-going engagement with primary care and well child services.⁵

Data sources and methods

Indicator(s)

1. Proportion of children fully immunised at each milestone age

Numerator: Number of children who had completed their age appropriate immunisations by the time they turned that milestone age

Denominator: Number of children who turned the milestone age during the reporting period

Data source: National Immunisation Register (NIR)

2. Hospitalisation for vaccine-preventable diseases

Numerator: Number of 0–4 year olds discharged from hospital with a primary diagnosis of a vaccine-preventable disease

Data source: National Minimum Dataset (NMDS)

Denominator: StatsNZ Estimated Resident Population (ERP; with linear extrapolation between Census years)

Additional information

Milestone ages for vaccination are: 6 months, 8 months, 12 months (1 year) 18 months, 24 months (2 years), and 5 year. Fully immunised NIR values were suppressed where there were less than 10 children in the group. Parents are able to 'opt off' having their child's immunisation information stored in the NIR. For information on the NIR see <http://www.health.govt.nz/our-work/preventative-health-wellness/immunisation/national-immunisation-register/questions-and-answers-national-immunisation-register>.

Vaccine-preventable (targeted) diseases comprise: Diphtheria, *Haemophilus influenzae* type B (Hib), Hepatitis B, Measles, Mumps, Pertussis (whooping cough), Polio (poliomyelitis), Rotavirus, Rubella, Pneumococcal disease, Tetanus. Additional vaccine-targeted diseases for high-risk groups (or available through purchase) include Hepatitis A, Meningococcal C and A, C, Y, W135, Varicella (chickenpox), Influenza, and Tuberculosis (TB). For the codes used to identify these listed diseases, refer to **Appendix 5**.

Immunisation coverage

Nationally the majority of infants and children were fully immunised at each milestone age (Table VI-1). At each milestone age, less than one percent of parents chose to opt-off having their child's immunisation information documented in the National Immunisation Register (NIR) and less than five percent declined any of the scheduled vaccinations. Note that children of parents who opted off inclusion of information in the NIR may or may not have been immunised.

Table VI-1 National immunisation coverage, year ending June 2017

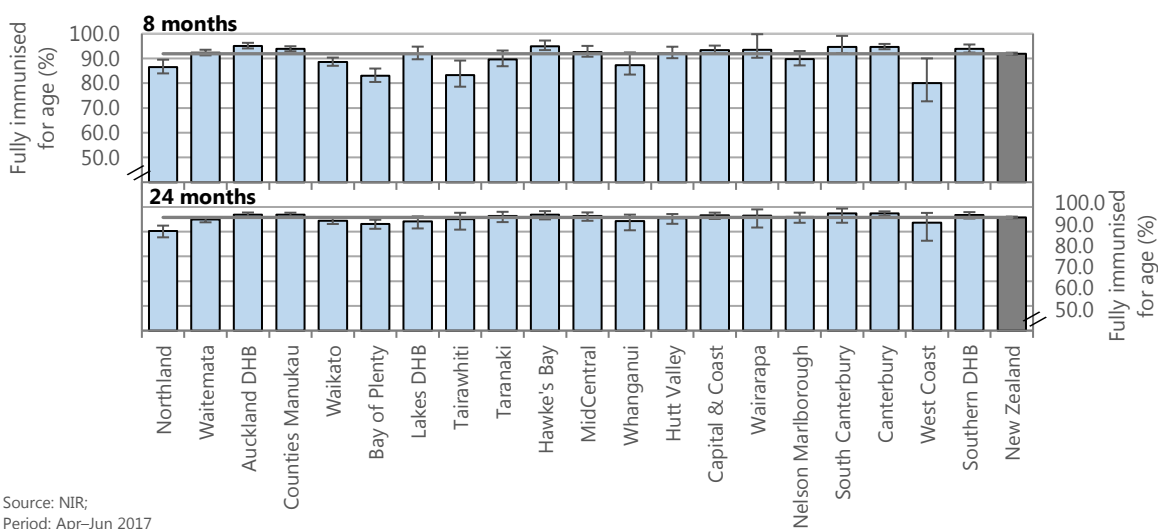
Milestone age	Eligible (n)	Fully immunised for age		Opt-offs		Declines	
		n	%	n	%	n	%
1 July 2016–30 June 2017							
6 month	60,160	48,068	80.0	360	0.6	2,390	4.0
8 month	60,132	55,422	92.0	368	0.6	2,370	3.9
12 month (1 year)	60,030	56,353	94.0	358	0.6	2,284	3.8
18 month	60,127	51,284	85.0	359	0.6	2,517	4.2
24 month (2 years)	60,875	56,469	93.0	351	0.6	2,545	4.2
5 year	64,413	56,937	88.0	433	0.7	3,163	4.9

Source: Ministry of Health

Figure VI-1 and Table VI-2 to Table VI-3 present the proportion of infants fully immunised at 8-months or at two years for New Zealand and each district health board during April to June 2017. The proportion of fully immunised 8-month-olds ranged from 80% on the West Coast to around 95% in Auckland and Hawke’s Bay DHBs. The proportion of fully immunised 8-month-olds was significantly lower than the national rate in Northland, Bay of Plenty, Tairāwhiti, and West Coast DHBs, and significantly higher for Auckland, Counties Manukau, Hawke’s Bay, and Canterbury DHBs. The rates of immunisation for remaining DHBs were comparatively similar to the national rate.

The proportion of fully immunised 24-month-olds (two year olds) were similar to the national rate in most DHBs, with the exception of Northland DHB, where the rate was significantly lower than the national rate. The proportion of fully immunised 24-month-year-olds ranged from 86.5% in Northland to over 95% in Nelson Marlborough and South Canterbury.

Figure VI-1 Children fully immunised, by milestone age and district health board, Apr–Jun 2017



Source: NIR;
Period: Apr–Jun 2017

Table VI-2 Proportion fully immunised at 8-months, New Zealand April–June 2017

DHB	Eligible 8 month olds (n)	8 months	
		n	%
Fully immunised at milestone age: April–June 2017			
Northland	586	507	86.5
Waitemata	2,126	1,963	92.3
Auckland	1,404	1,335	95.1
Counties Manukau	2,134	2,003	93.9
Waikato	1,405	1,245	88.6
Bay of Plenty	732	608	83.1
Lakes	444	408	91.9
Tairāwhiti	191	159	83.2
Taranaki	357	320	89.6
Hawke's Bay	499	474	95.0
MidCentral	556	515	92.6
Whanganui	213	186	87.3
Hutt Valley	522	481	92.1
Capital & Coast	877	819	93.4
Wairarapa	109	102	93.6
Nelson Marlborough	420	377	89.8
South Canterbury	170	161	94.7
Canterbury	1,646	1,559	94.7
West Coast	80	64	80.0
Southern	845	793	93.8
New Zealand	15,316	14,079	91.9

Source: NIR

Table VI-3 Proportion fully immunised at 24-months, New Zealand April–June 2017

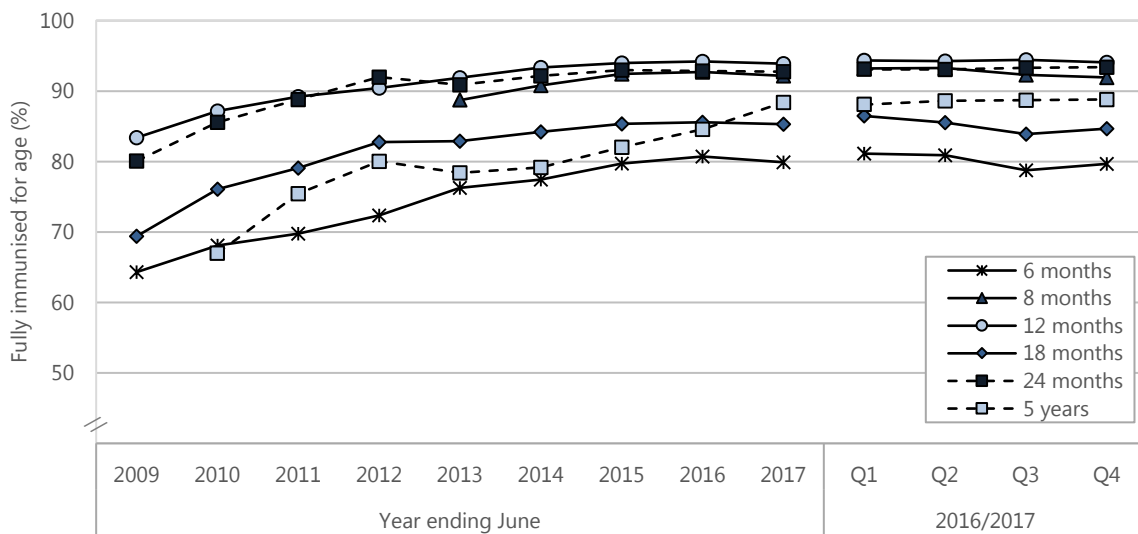
DHB	Eligible 24 month olds (n)	24 months	
		n	%
Fully immunised at milestone age: April–June 2017			
Northland	570	496	87.0
Waitemata	1,864	1,722	92.4
Auckland	1,444	1,367	94.7
Counties Manukau	2,056	1,948	94.7
Waikato	1,365	1,254	91.9
Bay of Plenty	747	675	90.4
Lakes	375	343	91.5
Tairāwhiti	174	161	92.5
Taranaki	371	349	94.1
Hawke's Bay	514	487	94.7
MidCentral	558	525	94.1
Whanganui	218	200	91.7
Hutt Valley	474	441	93.0
Capital & Coast	919	867	94.3
Wairarapa	122	115	94.3
Nelson Marlborough	410	384	93.7
South Canterbury	168	160	95.2
Canterbury	1,625	1,549	95.3
West Coast	77	70	90.9
Southern	867	820	94.6
New Zealand	14,918	13,933	93.4

Source: NIR

Figure VI-2 presents the immunisation trends for New Zealand from 2009 to 2017 and for each reporting quarter in the 2016/2017 year. The immunisation rates have gradually increased for all age groups since 2008/2009. More recently, rates have generally stabilised for each age group, with the exception of the rate for 5 year olds. For the 2016/2017 reporting year, the immunisation rates for most milestone ages have been stable over the four

quarters, with the exception of the 6-month and 18-month age groups, which have marginally decreased since the first quarter.

Figure VI-2 Trends in immunisation coverage, by milestone age, New Zealand, years ended 30 June 2009–2017



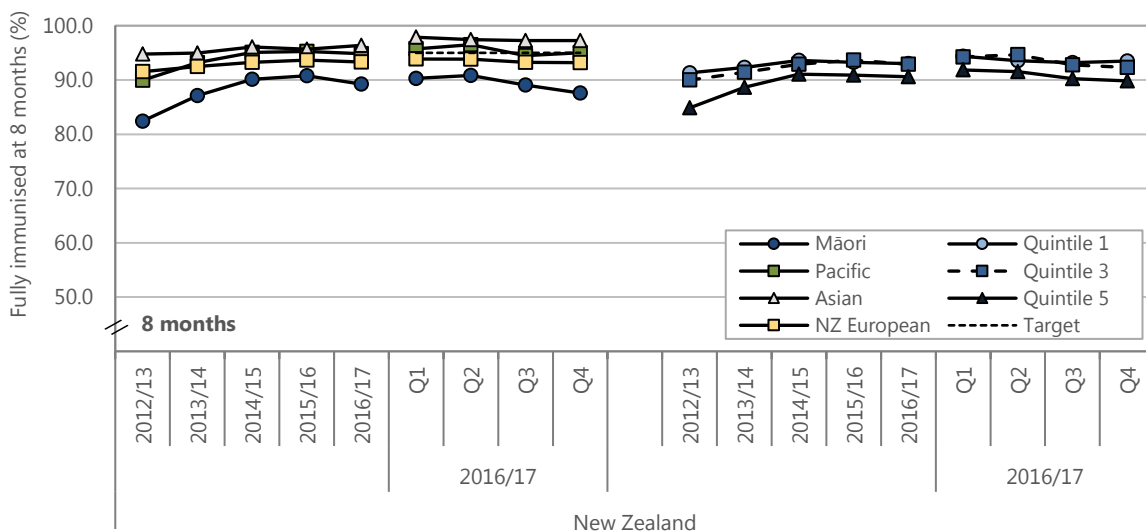
Source: NIR;

Figure VI-3 presents the proportion of fully immunised eight month olds by ethnicity and NZDep2013 score.

Nationally, the immunisation rate among Māori 8-month-olds has generally been lower compared to the other ethnic groups, and generally higher for the Asian 8-month-olds. The immunisation rate for Māori infants has been gradually increasing annually since 2012/2013 with an apparent decline in coverage in the 3rd and 4th quarters of 2016/2017.

The immunisation rate for 8-month-olds residing in areas with high deprivation scores on NZDep2013 (quintile 5) have consistently been lower than the rates for 8-month-olds in areas with lower deprivation scores (quintiles 1 and 3) (Figure VI-3). In the year ending 2017, the national immunisation rate for 8-month-olds was above 90% in all deprivation quintiles.

Figure VI-3 Immunisation coverage at eight months of age, by ethnicity and NZ Deprivation Index quintile, New Zealand, years ended 30 June 2013–2017



Source: NIR; Financial year: 1 July–30 June

Hospitalisations for vaccine-preventable diseases

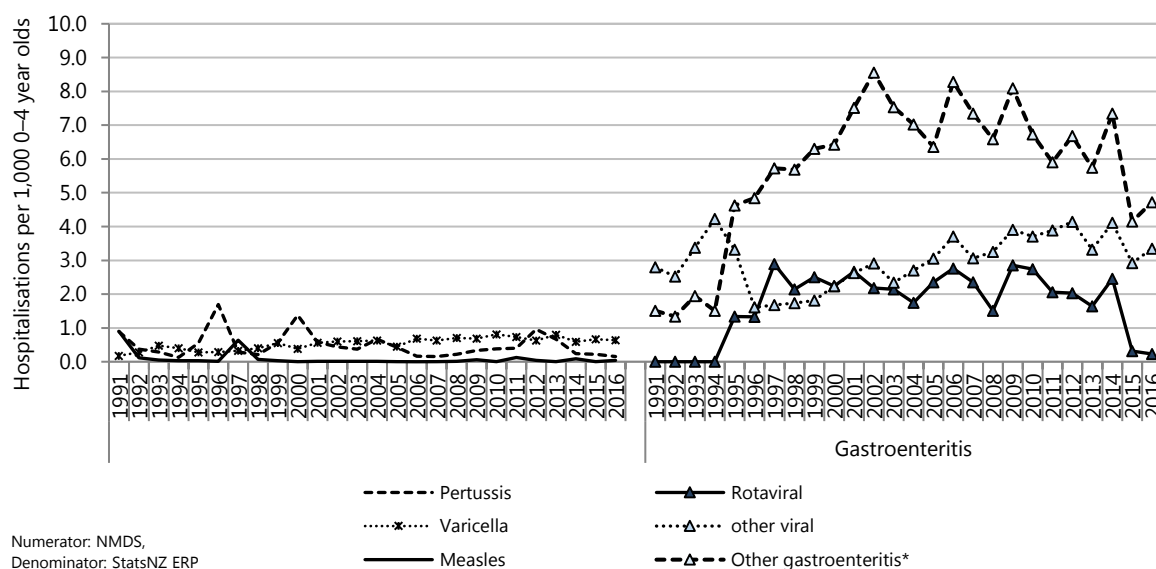
The national rates of 0–4 year olds hospitalised with vaccine-preventable diseases between 2012 and 2016 are presented in Table VI-4. Hospitalisations of this age group were predominantly for gastroenteritis, varicella (chickenpox) and pertussis (Table VI-4). Since the introduction of the rotavirus vaccine in 2014, the hospitalisation rate of under 5-year-olds for gastroenteritis has decreased noticeably (Figure VI-4).

Table VI-4 Hospitalisations for vaccine-targeted diseases in 0–4 year olds, by primary diagnosis, New Zealand 2012–2016

Primary diagnosis	2012–2016 (n)	Rate	95% CI
Vaccine-targeted diseases			
New Zealand			
Diphtheria	0	..	..
Tetanus	0	..	..
Pertussis	700	0.44	0.41–0.48
Polio (poliomyelitis)	0	..	..
(Acute) Hepatitis B	<5	s	s
<i>Haemophilus influenzae</i>	0	..	..
Pneumococcal disease	131	0.08	0.07–0.10
Measles	56	0.04	0.03–0.05
Mumps	8	0.01	0.00–0.01
Rubella	<5	s	s
Gastroenteritis: Rotaviral	2,088	1.32	1.27–1.38
Gastroenteritis: other viral	5,624	3.56	3.47–3.66
Gastroenteritis: non-viral	600	0.38	0.35–0.41
Gastroenteritis: Other or NOS	8,419	5.33	5.22–5.45
Meningitis: bacterial	240	0.15	0.13–0.17
Meningitis: viral, other, NOS	585	0.37	0.34–0.40
Meningococcal disease	170	0.11	0.09–0.13
Tuberculosis	25	0.02	0.01–0.02
Varicella	1,045	0.66	0.62–0.70

Numerator: NMDS, Denominator: StatsNZ ERP; Rate per 1,000 0–4 year olds

Figure VI-4 Trends in hospitalisations for select vaccine-preventable diseases in 0–4 year olds, by primary diagnosis, New Zealand 1991–2016



Numerator: NMDS,
Denominator: StatsNZ ERP

Evidence for good practice

Vaccine coverage is influenced by a complex mix of social, behavioural, demographic and structural factors, but it requires that parents have access to, and acceptance of, vaccination for their children. A review by Thomson et al.⁷ identified 23 possible determinants of sub-optimal vaccination coverage, and organised these into five dimensions, the 5As:

- **Access** The ability of individuals to be reached by, or to reach, recommended vaccines
- **Affordability** The ability of individuals to afford vaccination, both in terms of financial and non-financial costs (e.g., time)
- **Awareness** The degree to which individuals have knowledge of the need for, and availability of, recommended vaccines and their objective benefits and risks
- **Acceptance** The degree to which individuals accept, question or refuse vaccination
- **Activation** The degree to which individuals are nudged towards vaccination uptake.

Access can be improved by ensuring that all babies are registered on the National Immunisation Register and enrolled with a general practice as soon as possible after birth,⁸ and by making it easy for parents to get their child to immunisation appointments, for example, by offering appointments at times that suit parents, and offering help with transport or with care for other children. There is strong evidence that home visiting programmes, in which home visitors assess clients' vaccination status, discuss the importance of recommended vaccinations, and either provide vaccinations to clients in their homes or refer them to available immunisation services, are effective in increasing vaccination rates. Such programmes, however are resource-intensive and expensive compared to other options for increasing vaccination rates.⁹

Childhood vaccinations are free in New Zealand, so affordability is probably mostly related to the time cost for parents who may, for example, need time off work to take their baby to their GP for vaccination, and to care for their baby afterwards if they are too upset to return to childcare.

There is little evidence from higher income countries regarding how best to educate parents about the benefits of vaccination.^{10,11} A 2017 Cochrane review¹² assessed qualitative studies that explored: parents' and informal caregivers' views and experiences regarding communication about childhood vaccinations and the manner in which information is communicated; and the influence that vaccination communication has on parents' and informal caregivers' decisions regarding vaccination. The review included 38 studies, mostly from high-income countries (a purposive sample from the 79 studies meeting the review's inclusion criteria).

It found that, in general, parents wanted more information than they were getting and that, for some parents, lack of information led to worry and regret about vaccination. Parents wanted balanced information about the benefits and harms of vaccination that was clearly and simply presented, and tailored to their situation. They wanted information to be available at a wider variety of locations, including outside health services, and they wanted it in good time before each vaccination visit (rather than at the visit when they were distracted and worried about their child). Parents considered health workers as an important source of information. Sometimes poor communication and negative relationships with health workers affected parents' vaccination decisions. Parents generally found it hard to know which information sources to trust and to find information they felt was unbiased and balanced. It seemed that parents who were more hesitant about vaccination wanted more information.

Parents who intend to get their child vaccinated can be nudged towards getting it done by prompts such as letters and phone calls.^{13,14} There is emerging evidence that text messages may also be effective.¹⁵⁻¹⁷

Computer-based clinical decision support systems and electronic health records that give healthcare providers reminders that a patient they are seeing is due for vaccination may be effective in improving vaccination rates.¹⁸⁻²¹ National immunisation registries, such as New Zealand's, allow any authorised health professional in the country to access a child's immunisation records, even if they are not the child's usual healthcare provider.^{22,23} They allow health authorities to identify gaps in immunisation coverage and target resources at groups with low immunisation coverage, and to monitor vaccine safety and effectiveness.²²⁻²⁴

A small percentage of parents are hesitant about vaccinating their children and their hesitancy may have results ranging from delay in accepting one or more offered vaccines to complete refusal of all vaccines. Vaccine-hesitant parents are a diverse group and the factors associated with vaccine hesitancy are complex and context-specific, varying with time, place and vaccine.²⁵ According to the World Health Organization's Strategic Advisory Group of Experts (SAGE) Vaccine Hesitancy working group, vaccine hesitancy is influenced by

complacency, convenience and confidence. Complacency occurs when the perceived risk of contracting a vaccine preventable disease is low or the perceived severity of a vaccine preventable disease is low.²⁶ Lack of confidence in a vaccine's safety and fears about the reliability and competence of the health system are major causes of vaccine hesitancy.²⁶ Convenience is related to practical difficulties of getting a child vaccinated, such as how far a parent has to travel.²⁶

It has been suggested that the trend for people to become more involved in their own healthcare and seek out their own information on vaccination has contributed to vaccine hesitancy.²⁷ There is a wealth of inaccurate information on the internet and elsewhere that can influence parents not to vaccinate their children.²⁸ Health care professionals need to be aware of the prevailing misinformation so that they can be ready to respond to parents' concerns.²⁹

If they are parents themselves, as many are, health professionals can share their experiences and decision-making regarding vaccinating their own children.³⁰ Parents who are willing to share their reasons for vaccinating their children can be powerful ambassadors for vaccination in their communities.²⁹ Such parents may benefit from using the C.A.S.E. method: Corroborate hesitant parents' fears (find an area that you can agree on, thus building rapport), offer personal information about yourself and your vaccination experiences (About me), provide information on the Science, and give advice based on the science (Explain/advise).³¹

Personal stories, such as those of parents whose child has suffered from a vaccine preventable disease, can be more powerful than scientific information in convincing parents of the benefits of vaccination, and can provide a stronger defence against anti-vaccine messages, which tend to rely almost exclusively on personal narratives.³⁰ Therefore, it is worth considering adding personal stories to evidence-based information about vaccination provided to parents.³⁰

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VII. CHILD WEIGHT

This indicator is important to provide a picture of the patterns of weight of four year olds within the population served by each DHB. The B4 School Check is the final core contact of the Well Child/Tamariki Ora programme and is intended to be available to all children within the eligible age bracket. B4 School Checks are to be initiated and completed with children between their fourth birthday (48 months old) and prior to five years of age (60 months old). Children who missed this time period may, as an exception, undertake a B4 School Check prior to reaching six years of age. The B4 School Check may be comprised of: assessing child and family health (such as immunisation status, and family violence and smoking); hearing, vision, and oral health screening; development and behavioural screening; growth and weight monitoring; and support, referral, and intervention services where appropriate. At an individual child level, inclusion of weight within the B4 School Check (B4SC) allows for the identification of four year olds who are thin, overweight or obese.

Obesity is a condition of excess body fat in relation to lean body mass to the extent that it may have a negative effect on health.¹ Obesity rates have increased in all ages, genders and ethnic groups over the last 30 years, with those born more recently becoming obese at a younger age.² Obesity is particularly concerning in children as it is associated with a wide range of health conditions and increased risk of premature onset of illness. It can also affect a child's immediate health, educational attainment and quality of life.² Body mass index (BMI) is the measure commonly used to classify body weight, with sex and age-specific BMI cut-off points used to define thinness, overweight and obesity in children.³

Factors associated with an increased risk of developing childhood obesity include maternal over-nutrition, pre-term birth and infants being small or large for gestational age.^{4,5} Children with developmental disabilities and autism also have higher prevalence of obesity than other children.^{6,7} Obesity in childhood is associated with a wide range of health conditions and increased risk of premature onset of illness, and can also affect a child's immediate health, educational attainment and quality of life.² However there is currently a lack of scientific evidence on the relationship between specific BMI thresholds and any potential short- and long-term health risks for the child.¹

The 'Raising healthy kids' health target is one of the initiatives in the childhood obesity plan.^{2,8} This target required that by December 2017, 95% of obese children identified in the B4SC programme would be offered a referral to a health professional for clinical assessment and family-based nutrition, activity and lifestyle interventions. This will mean that any medical complications in four year olds who are identified as obese are managed appropriately and that the children and their families are offered any services they may find helpful to support healthy eating and activity.² The package brings together initiatives across government agencies, the private sector, communities, schools, families and whānau.²

The following section presents data about the weight of four year olds at the time of the B4SC. The section concludes with guidelines and brief overviews of evidence for good practice including obesity-related review chapters published in NZCYES 2013 reports.

Data sources and methods

Indicator

Children with a B4 School Check (B4SC) BMI-for-age value in the obese range

Data sources and definitions

Data source: B4 School Check Information System (B4SC IS)

Children with BMI-for-age value in the obese range

Numerator: Number of children in the overweight or obese range as at the B4SC

Denominator: Total number of children with anthropomorphic information recorded at B4SC

BMI-for-age can be classified into:^{3,9}

Underweight: below the 2nd centile

Healthy weight: between 5th and 84th percentile (inclusive)

Overweight: above 91st centile

Obese: above 98th centile.

Additional information

The BMI-for-age percentiles were calculated based on the anthropomorphic information measured at the B4 School Check.¹⁰ Only children with caregiver consent for B4 School Check were included in the analyses.

Health target, implemented 1 July 2016: 'By December 2017, 95% of obese children identified in the B4 School Check (B4SC) programme will be offered a referral to a health professional for clinical assessment and family based nutrition, activity and lifestyle interventions.' Each district health board (DHB) agrees to a target number of checks which it expects to deliver in a year. Refer to <http://www.health.govt.nz/new-zealand-health-system/health-targets/about-health-targets/health-targets-raising-healthy-kids>

National coverage of B4 School Check

Table VII-1 presents the number of children four years of age who were offered a B4SC k from 2013 to 2016. The number of four year olds offered a B4SC has been around 57,000–59,000 each year. This table also presents the way that the percentage of four-year-olds offered a B4SC varies with the use of different, valid, denominator populations from year to year. When comparing statistics it is important, therefore, to determine what population is being used to calculate coverage.

Table VII-1 Children offered a B4 School Check, New Zealand 2016

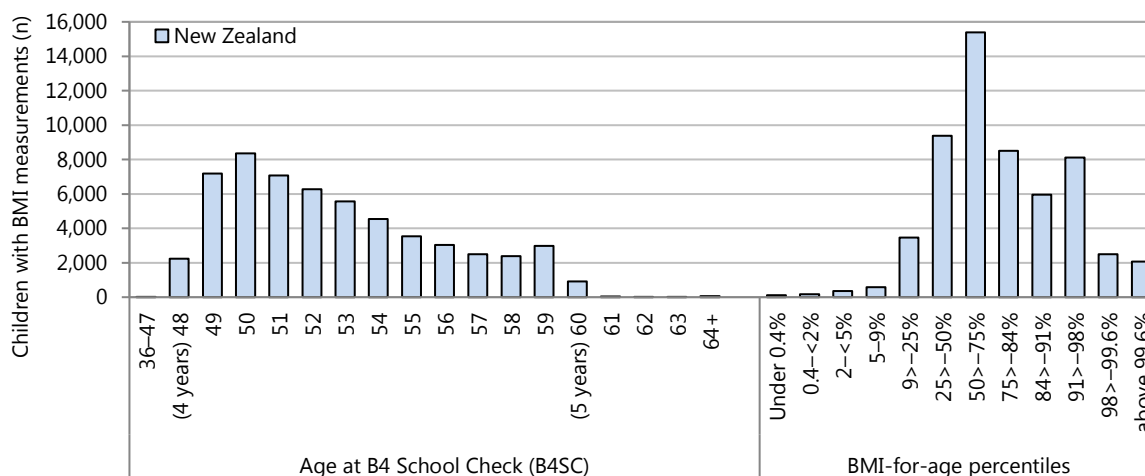
Year	4-year-olds offered a B4SC (n)	Percent of population				
		Eligible 4-year-olds*	Enrolled with Primary Health Organisation (PHO)**	Livebirth cohort§	Estimated resident population||	Projected population‡
4-year-olds offered a B4SC †						
New Zealand						
2013	53,960	83.13	82.76	85.27	85.00	
2014	59,100	90.46	91.95	91.35	91.51	
2015	57,785	90.67	89.22	92.94	87.98	91.76
2016	57,258	91.20	94.66	92.30	85.74	90.98

Source: Numerator: B4SC IS, Denominators: *B4SC performance reports, **PHO Enrolment Collection, †Access to Primary Care, §BDM livebirths; ||StatsNZ ERP, Age: 4 years (48–59 months), †Offered = any child documented in B4SC IS (includes declined checks)

Children with anthropomorphic measurements

Figure VII-1 presents the age of the child for whom a B4SC had been completed, and the BMI-for-age percentile groupings for children aged between 48–71 months who completed the B4SC. Most children had a BMI-for-age within the normal range (5th–85th percentile).

Figure VII-1 Age (in months) of child and BMI-for-age percentiles at the B4SC, New Zealand 2016



Source: B4SC IS; Consented B4 School checks completed in: 2016. *Age is in months, **BMI distribution for children aged between 48 and 71 months (inclusive)

The following analyses are limited to children aged four or five for whom a B4SC has been completed, including the documentation of anthropomorphic measurements.

The children with completed B4SC and documented anthropomorphic measurements are presented in Table VII-2 according to the percentile groupings. The majority of children in New Zealand had measurements within the normal/healthy weight percentiles. Around 14% of children were considered overweight and around 8% were considered obese. A very small percentage of children were considered underweight. The 'other' category consists of children with BMI-for-age percentile outside the existing ranges (i.e. percentiles 2–<5; 84–>91).

Table VII-2 B4SC BMI-for-age centile groupings, New Zealand 2016

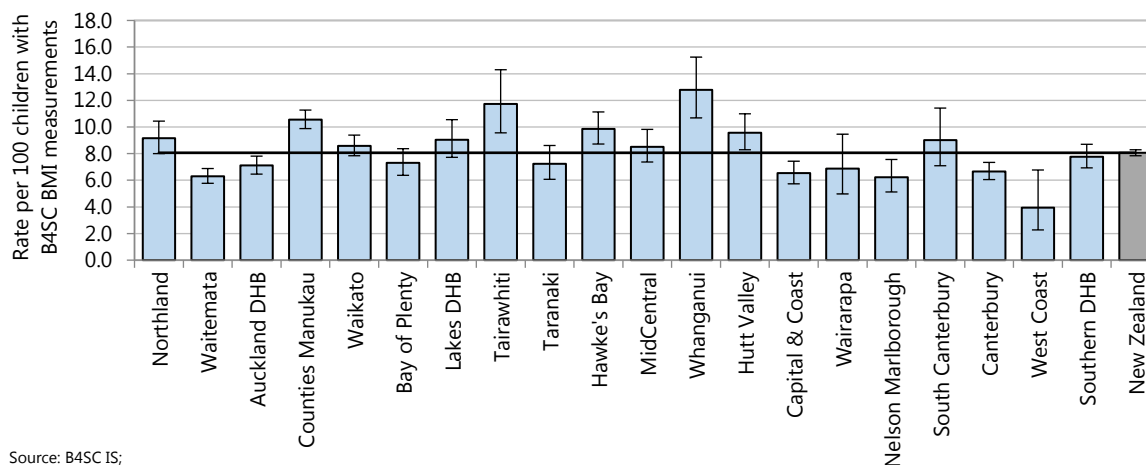
BMI-for-age centile groups	2016 (n)	Rate
Children who had BMI-for-age measured at a B4 School Check in 2016		
New Zealand		
Possible undernutrition/underweight (<2%)	292	0.52
Normal/healthy weight (5–<85%)	37,321	65.91
Overweight (91–>98%)	8,119	14.34
Obese (>98%)	4,566	8.06
Other	6,327	11.17
Total	56,625	100.00

Source: B4SC IS; Consented B4 School checks completed in: 2016. Rates are per 100 children with BMI-for-age measurements. The 'other' category consists of children with BMI-for-age percentile outside the existing ranges (i.e. percentiles 2–<5; 84–>91).

Children within the obese range

Figure VII-2 and Table VII-3 present the proportion of children aged four or five years who completed a B4SC during 2016 and had anthropomorphic measurements within the obese range (above 98th percentile). For these children, the rates of obesity were significantly higher than the national rate in Counties Manukau, Tairāwhiti, Hawke's Bay, Whanganui, and Hutt Valley DHBs. Child obesity rates were significantly lower than the national rate in Waitemata, Auckland, Capital & Coast, Nelson Marlborough, Canterbury, and West Coast DHBs.

Figure VII-2 Children in the obese percentile range at B4 School Check, by district health board, 2016



Source: B4SC IS; Consented B4 School checks completed in: 2016. Rates are per 100 children with BMI-for-age measurements. Grouped BMI-for-age percentiles

Obese (above 98th centile)

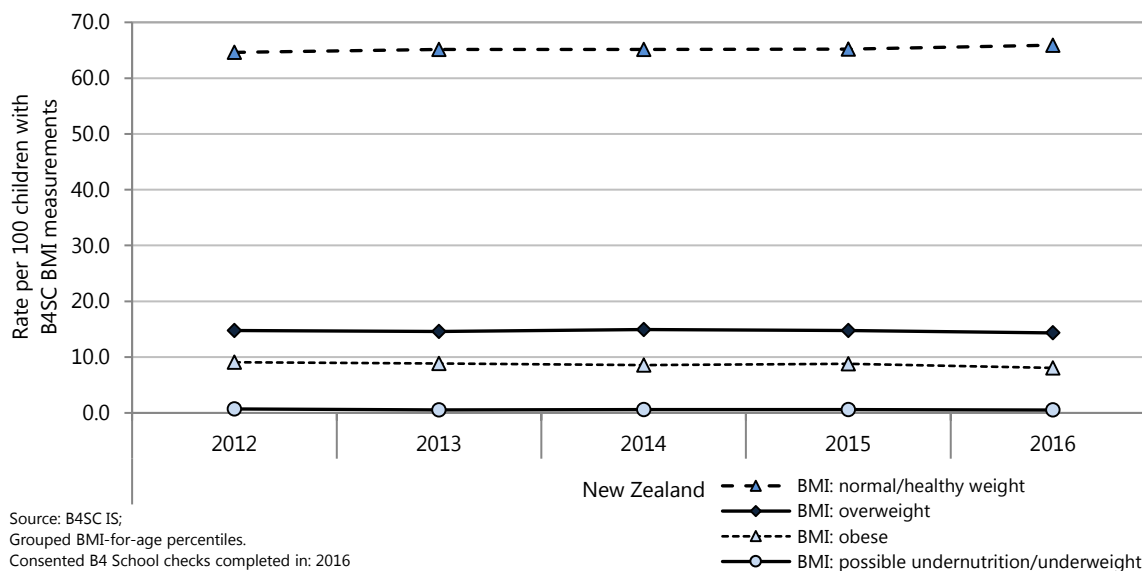
Table VII-3 Children measured as obese at B4 School Check, by district health board 2016

DHB	2016 (n)	Rate*	Rate ratio	95% CI
Children who had BMI-for-age measured at a B4 School Check in 2016				
Obese (above 98th centile)				
Northland	197	9.2	1.13	0.99–1.30
Waitemata	462	6.3	0.78	0.71–0.86
Auckland	398	7.1	0.88	0.80–0.97
Counties Manukau	793	10.6	1.31	1.22–1.41
Waikato	431	8.6	1.06	0.97–1.17
Bay of Plenty	192	7.3	0.91	0.79–1.04
Lakes	143	9.0	1.12	0.96–1.31
Tairāwhiti	83	11.7	1.45	1.19–1.78
Taranaki	116	7.2	0.90	0.75–1.07
Hawke's Bay	232	9.9	1.22	1.08–1.39
MidCentral	171	8.5	1.06	0.91–1.22
Whanganui	105	12.8	1.59	1.32–1.90
Hutt Valley	175	9.6	1.19	1.03–1.37
Capital & Coast	212	6.5	0.81	0.71–0.93
Wairarapa	34	6.9	0.85	0.62–1.18
Nelson Marlborough	94	6.2	0.77	0.63–0.94
South Canterbury	61	9.0	1.12	0.88–1.42
Canterbury	383	6.7	0.83	0.75–0.91
West Coast	12	3.9	0.49	0.28–0.85
Southern	272	7.8	0.96	0.86–1.08
New Zealand	4,566	8.1	1.00	

Source: B4SC IS; Rates are per 100 children with B4SC BMI-for-age measurements. B4 School checks completed in: 2016. Rate ratios are unadjusted

Figure VII-3 presents the trends in BMI-for-age percentile groupings for children aged four or five who completed a B4SC in New Zealand. The proportion of children within each weight range have been relatively steady from 2012–2016.

Figure VII-3 Trends in child BMI at B4 School Check, by BMI-for-age grouping, New Zealand 2012–2016



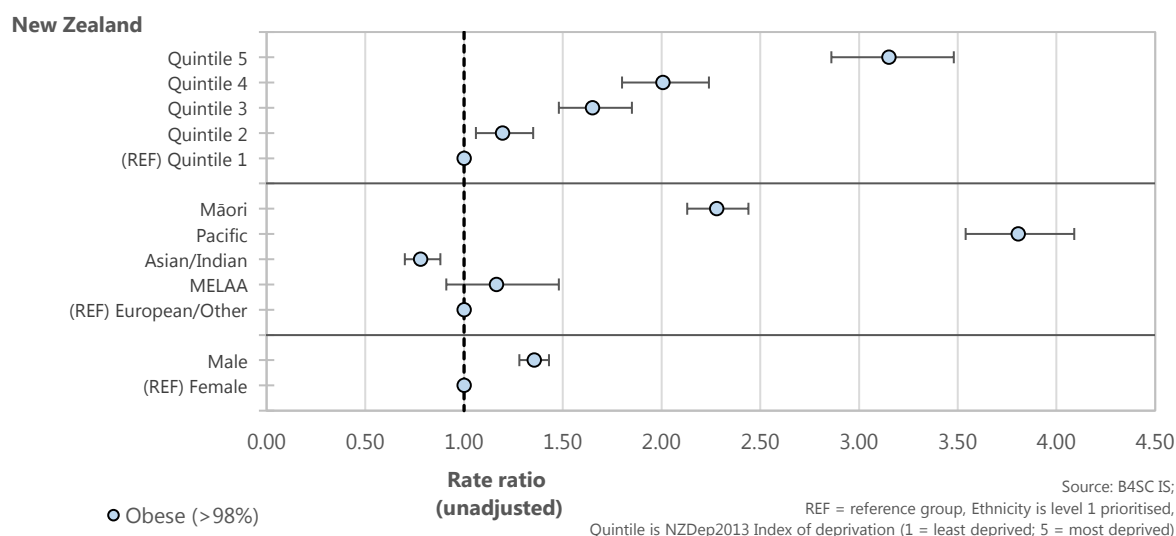
Source: B4SC IS; Grouped BMI-for-age percentiles. Consented B4 School checks completed in: 2016

Figure VII-4 presents the proportion of 4 or 5 year old children with a BMI-for-age within the obese range (above 98th percentile) by the residential deprivation score (NZDep2013 index of deprivation score), ethnicity, and gender. The unadjusted rate ratio presents the difference, if any, between the groups and the reference group. The following associations were observed, bearing in mind that this univariate analysis does not quantify the independent effect of each demographic factor:

- The obesity rate was significantly higher for those residing in areas with higher (quintiles 2–5; deciles 3–10) NZDep2013 scores compared with quintile 1

- Pacific and Māori children had significantly higher rates of obesity compared with European/Other children
- Boys had significantly higher rates of obesity compared with girls.

Figure VII-4 Children with B4SC obese BMI-for-age measurements, by demographic factor, New Zealand 2016



Referral at B4 School Checks

The Ministry of Health’s *Raising Healthy Kids* target is that 95% of children identified as obese at B4SC should be referred to a health professional for further assessment and support.

Table VII-4 presents the referral status of children four years of age documented as obese at B4SC in 2016. The referral rate for children documented as obese at the check was 64.5%, which is short of the Ministry’s 95% target. Nearly 28% of those referred were recorded as declined, which includes referral declines by a child’s parent(s) or caregiver or declines from the service provider to which the child was referred. The rate of non-referral with advice for children documented as obese was almost 18%.

Table VII-4 Referral status of children documented as obese at B4 School Check, New Zealand 2016

	2016 (n)	Rate per 100 obese children
Children documented as obese at a B4 School Check in 2016		
Referral status		
Declined	40	0.87
Under care	185	4.01
No referral required	596	12.91
No referral required and advice given	817	17.70
Referral required	2,979	64.5
<i>Referred</i>	2,151	46.6
<i>Referral declined</i>	828	17.9
Total	4,617	

Source: B4SC IS; Rates are per 100 obese children as documented in B4SC records. B4 School checks completed in 2016. Rate ratios are unadjusted

Evidence for good practice

Equity

There are social and ethnic inequalities in the prevalence of childhood obesity in New Zealand. The New Zealand Health Survey 2016/17 found that children living in the most deprived areas were two and a half times more likely to be obese than those living in the least deprived areas (after adjustment for age, sex, and ethnic group), and that 18% of Māori children and 29% of Pacific children were obese, compared to 9% of European children and 5.4% of Asian children.¹¹ A higher prevalence of obesity in children from lower socio-economic groups is common in high-income countries.¹²

There is evidence that children in socioeconomically disadvantaged families have greater exposure to factors predictive of early childhood obesity, including unhealthy feeding practices (early introduction of solids, infant formula feeding, and being put to bed with a bottle), unhealthy maternal diet and more hours of television viewing.¹³⁻¹⁵ Findings from the UK Millennium Cohort study suggest that maternal pre-pregnancy overweight and maternal smoking during pregnancy explain a considerable amount of the social inequalities in childhood overweight.^{16,17}

A 2014 systematic review by Laws et al.¹⁸ assessed the impact of interventions to prevent obesity or improve obesity-related behaviours in young children (0–5 years) from socioeconomically disadvantaged and/or indigenous families. The reviewers identified 32 studies altogether, but only two low quality studies involving indigenous groups (in the US). The interventions included intensive home visiting programs (typically for infants), and interventions in primary health care, preschool and community settings. Mean differences between intervention and control groups ranged from -0.29 kg/m² to -0.54 kg/m² for body mass index (BMI = weight in kg ÷ (height in metres)²) and -2.9 to -25.6% for the prevalence of overweight/obesity. The interventions initiated in infancy (< 2 years) improved obesity-related behaviours (e.g. diet quality) but few of these studies measured longer-term effects on healthy weight gain. Studies involving pre-schoolers had mixed results, with the more successful interventions characterised by high levels of parental engagement, the use of behaviour change techniques, and a focus on skill building (e.g. cooking skills, media literacy, communication, problem solving, conflict resolution and parenting skills), and links to community resources. Common features of the successful interventions for pre-schoolers were a dual focus on obesity prevention and school readiness, weight screening and referral, an educational component for parents, and a focus on household routines.

An intervention study with infants in New Zealand found promising effects on child weight at ages 3.5 years and 5 years from a brief sleep intervention antenatally and at age 3 weeks.¹⁹ The authors recommended further research to investigate whether more intensive or extended sleep interventions would have larger or more long-lasting effects.

A 2015 review commissioned by the UK Department of Health²⁰ aimed to assess how effective interventions are at reducing socioeconomic inequalities in obesity among children and adults. The child section of this review examined interventions at the individual, community and societal level for children aged 0–18 years (including prenatal). It included only studies that had a primary outcome that is a proxy for body fat, 76 in total (42 experimental and 34 observational), mostly of moderate or low quality. There were no studies on prenatal interventions and 19 on interventions for pre-schoolers. This review did not report on studies by age groups, but by level of intervention. Overall, it found that interventions do not increase inequalities and that there was most evidence for effectiveness for targeted primary school based environmental interventions, such as not selling unhealthy food and drink in school cafeterias and vending machines, and primary school delivered empowerment interventions, such as nutrition and physical activity education combined with exercise sessions. The review authors noted that the international evidence suggests that interventions are universally much more effective among school-aged children than among preschool children.

The same authors also wrote a narrative synthesis of the “best available” evidence for each intervention type, based on only the highest quality studies for each intervention type (23 studies in total, most from the US and of 6–12 year old children).²¹ This review found limited evidence that some individual and community based interventions may be effective in reducing socio-economic inequalities in obesity-related outcomes amongst children.

Prevention

Children who are overweight or obese are more likely to grow up to be overweight or obese as adults than children of normal weight, and overweight and obesity in adulthood is associated with increased risks of type 2 diabetes and cardiovascular disease, so addressing childhood obesity could potentially prevent health problems in later life.²²

It can be easier for an overweight or obese child than an adult to attain normal weight status.²³ In a child weight loss is not always needed to attain normal weight status: all that may be necessary is to reduce weight gain so that, as the child becomes taller, their weight becomes appropriate for their height.

The increase in obesity worldwide over the past few decades suggests a key role for environmental determinants as opposed to changes in human’s basic genetic code.⁵ The World Health Organization has stated that obesity prevention and treatment requires a whole-of-government approach in which policies in all sectors systematically take health into account, and avoid harmful health impacts, thereby improving population health and health equity.²⁴

Actions at government level recommended by the World Health Organization include²⁴:

- Developing and disseminating simple and accessible nutrition information aimed at both adults and children
- Providing children, parents, teachers and health professionals with guidance on healthy body size, sleep behaviours, physical activity and appropriate use of screen-based entertainment
- Taxing sugar-sweetened drinks
- Taking steps to reduce children's exposure to marketing of unhealthy foods
- Requiring simple front-of-pack food and drink labelling so that consumers can easily assess a product's nutritional value
- Requiring schools and childcare facilities to create healthy food environments
- Increasing access to healthy foods in disadvantaged communities
- Ensuring that schools and communities have adequate facilities for children's physical activity during recreational time
- Incorporating obesity-prevention measures into antenatal care
- Collecting data on children's BMI-for-age to monitor trends in childhood obesity

In the UK, as part of its childhood obesity reduction plan²⁵, the government challenged the food and drinks industry to reduce overall sugar in the products that contribute most to children's sugar intakes by 20%. The UK National Diet and Nutrition Survey indicated that the foods that contribute most to children's sugar intake are biscuits; breakfast cereals; cakes; chocolate confectionery; ice cream, lollies and sorbets; bakery products such as pastries, buns and waffles; puddings (including pies and tarts); sweet confectionery; sweet spreads and sauces; and yogurt and fromage frais.^{26,27}

There are three modifiable risk factors for child obesity in the prenatal period: maternal smoking, excessive weight gain during pregnancy, and gestational diabetes.²⁸ While there has been research on interventions to prevent maternal smoking and excessive gestational weight gain, there is currently little evidence that such interventions reduce child obesity because studies have not looked at this outcome.²⁹⁻³¹ Some studies have reported on infant birth weight, but a 2014 review³¹ found no statistically significant effect of interventions in pregnancy care on infant birth weight (9 studies, 1381 participants, fixed-effects analysis). Healthcare providers should ensure that counselling on nutrition, physical activity and smoking cessation is a standard component of antenatal care.²⁹

Many preschool children spend much of their day in childcare.³² In a national survey conducted in Ireland, parents cited "other people minding their children" as one of the main barriers to providing a healthy diet for their child.³³ A 2016 systematic review³⁴ of 15 studies of the association between childcare and the risk of overweight and obesity in children aged five years and under found that informal care (e.g. relatives, friends or neighbours) was consistently associated with higher BMI. The review authors suggested that grandparents who are less capable of physical activity and tend to "spoil" children by giving them palatable and high-calorie foods may be a reason for this. Centre-based care was associated with higher odds of overweight or obesity compared to parental care in some studies but other studies found no association or a protective effect.

Although a number of RCTs and quasi-RCTs have identified interventions for childcare services that have increased child physical activity and fundamental movement skill proficiency, improved child diet quality and prevented excessive weight gain, and evidence-based guidelines on healthy eating and physical activity for childcare centres have been produced, research suggests that implementation of obesity prevention policies and practices in childcare centres is often poor.³⁵ A 2016 Cochrane review found little evidence for the effectiveness of strategies for improving child care centres' implementation of policies and practices to promote healthy eating, physical activity and/or obesity prevention, improving staff knowledge or attitudes, or improving children's diet, physical activity or weight status.

Short sleep duration is associated with obesity in children and adolescents.³⁶ A recent systematic review³⁷ of obesity prevention interventions that aimed to improve sleep duration (and reported on BMI, BMI percentile, dietary intake, or physical activity) found that when child sleep duration improved, there were improvements in child BMI, nutrition and physical activity. Most interventions, however, were not successful in changing children's sleep duration. The prevention of overweight in infancy (POI) study in New Zealand found that a brief sleep intervention in early infancy had promising outcomes for child weight through to age five years.¹⁹

It is important that interventions to prevent obesity do not inadvertently increase weight stigmatisation or encourage disordered eating (and so increase the risk of a child developing an eating disorder later in life), but instead promote the benefits of healthy eating and physical activity for everyone.³⁸

Treatment

Parents of overweight and obese children often do not perceive that their child has a problem.³⁹ The Growing Up in New Zealand study found that that majority, 73%, of overweight and obese children's mothers thought that they were of normal weight.³² Health professionals have an important role in sensitively helping parents of overweight children to recognise the problem and the need for action, and providing advice on healthy living.⁴⁰

The Clinical guidelines for weight management in New Zealand children and young people³ recommend that clinicians regularly measure children's height and weight (ideally every 12 months) and, for children under five years, plot weight and height for age to determine weight and height centiles, and use these with the weight-height BMI conversion chart to determine BMI centile.⁴¹ A BMI above the 91st centile indicates that a child is overweight and a BMI above the 98th centile that a child is obese.⁴² The Ministry of Health's Raising Healthy Kids health target is that, from December 2017, 95% of obese children identified in the B4SC programme will be offered a referral to a health professional for clinical assessment and family-based nutrition, activity and lifestyle interventions.⁴³

Child obesity interventions should aim to decrease the rate at which a child gains weight so that the child grows into their weight.³ There is limited evidence regarding interventions for overweight or obese preschool children⁴⁴, so strategies need to draw on the evidence relating to older children. This evidence, which is generally not of high quality, indicates that multicomponent interventions that include diet, physical activity and behaviour-changing strategies may help achieve small, short to medium term reductions in BMI, BMI z score and weight.⁴⁵⁻⁴⁸ Examples of behavioural strategies are: not offering food as a reward or to soothe distress, having a regular schedule for meal times, allowing children to stop eating rather than encouraging them to finish their food, having meals at the table rather than in front of the television, parental modelling of healthy eating habits, and not having unhealthy food in the house.⁴⁹

Effective interventions tend to be those with a family component, such as education for parents, or encouragement for obese parents to lose weight.⁴⁵ Expert consensus is that a child is more likely to achieve a healthy weight if the whole family adopts a healthy lifestyle.⁵⁰

There is insufficient evidence to determine whether one type of eating pattern (e.g. low-fat, low-carbohydrate, low-glycaemic, or increased protein diets) is more effective for weight management than any other.⁵¹⁻⁵³ There is consistent evidence that exercise produces modest reductions in BMI z score in obese children and adolescents⁵⁴ so increasing physical activity should be part of weight management plans. Interventions to reduce sedentary behaviour in children are possibly effective in reducing BMI, but there is little evidence that they produce clinically significant reductions for obese children.⁵⁵⁻⁵⁷

New Zealand guidelines

Ministry of Health. 2016:

- **Health targets: Raising healthy kids.** <http://www.health.govt.nz/new-zealand-health-system/health-targets/about-health-targets/health-targets-raising-healthy-kids>
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Evidence-based reviews

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VIII. AMBULATORY CARE-SENSITIVE CONDITIONS

Ambulatory care-sensitive hospitalisations (ACSH) are a range of conditions for which hospitalisation could have potentially been avoided through preventive care and early intervention.^{1,2} At a community level, high ACSH 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 ACSH 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 ACSH. Not all these hospitalisations would be avoidable even in a perfect health system; for example, children who are found to have relatively minor ACSH conditions may have come in to hospital for investigations to exclude more serious illness such as meningococcal disease.³

There are currently two different ACSH algorithms in use in New Zealand, with both including and excluding Emergency Department cases. The NZCYES uses paediatric ACSH codes developed by Anderson et al⁴ with hospitalisations restricted to children aged 28 days to 4 years and a StatsNZ population estimate denominator. The Health Quality and Safety Commission (HQSC) use a similar but not identical list in 29 days to 14 year olds with a StatsNZ population projection denominator.⁵ Prior to 1 July 2015 HQSC had used a Primary Health Organisation enrolled population denominator.³

In New Zealand children, ACSH accounts for approximately 30% of all acute and arranged medical and surgical discharges.^{3,6} Pathways to prevent ACSH will vary by condition. For asthma it may be the use of preventive medicine, whilst for gastroenteritis it may be about access to early oral rehydration fluids.⁷ 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.⁷

This indicator serves as a proxy for access to and quality of primary health care, and enables identification of conditions for which early intervention is known to prevent or reduce severity and associated complications.^{1,2} It also highlights variation between different population groups thereby informing service planning to reduce disparities. This indicator also serves as a performance monitor for district health boards.⁸

Data sources and methods

Indicator

Ambulatory care-sensitive hospitalisations of children aged 28 days to 4 year olds

Data sources

Numerator: National Minimum Dataset (NMDS)

Denominator: StatsNZ Estimated Resident Population (ERP; with linear extrapolation between Census years)

Definition

Hospitalisations: Acute and arranged hospitalisations for ambulatory care-sensitive conditions (refer to **Appendix 5**) in 28 day–4 year olds, excluding neonates; waiting list admissions were excluded, apart from dental hospitalisations which were all included.

Additional information

An acute hospitalisation is an unplanned hospitalisation occurring on the day of presentation, while an arranged hospitalisation (referred to elsewhere as semi-acute) is a non-acute hospitalisation with an admission date less than seven days after the date that the decision that hospitalisation was necessary was made. A waiting list hospitalisation is a planned hospitalisation, where the admission date is seven or more days after the date that the decision was made that the hospitalisation was necessary.

Age filters

The 28 day–4 year age group has been selected for this analysis as it aligns with the Ministry of Health’s previous paediatric ACSH 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.

Emergency Department filters

Due to inconsistent uploading of Emergency Department (ED) cases to NMDS, the Ministry of Health has traditionally applied a number of filters.^{9,10} These filters exclude Accident and Emergency cases which meet the following criteria: same admission and discharge dates, patient was not discharged dead and a health specialty code of M05–M08.

While NZCYES does not recommend the use of such filters in the paediatric population, in order to allow DHBs to assess the impact that ED cases have on their ACSH rates, analyses in this section present ED cases included and excluded. NZCYES includes or excludes all ED cases and 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).

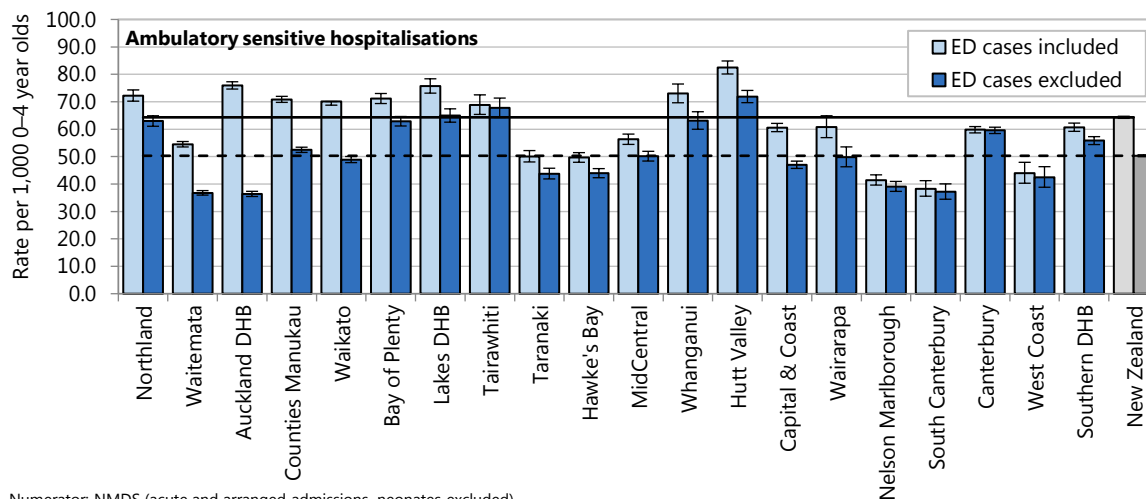
For those DHBs without a dedicated paediatric emergency department, who assess the majority of their cases in a Paediatric Assessment Unit or on the Paediatric Ward, the ED included and excluded analyses may be identical. Local variations in the way health specialty codes are assigned to such cases may profoundly influence the differences seen between the ED included and excluded rates.

Figure VIII-1 presents the hospitalisation rates, both including and excluding ED cases, of children aged 28 days–4 years with ambulatory care-sensitive conditions for New Zealand and each district health board during 2012 to 2016. For the same period and age group, Table V-2 describes the hospitalisation rates for ambulatory care-sensitive conditions inclusive of ED cases, while Table VIII-2 describes the rates exclusive of ED cases.

The ED inclusive hospitalisation rate ranged from 38 per 1,000 children in South Canterbury to 82 per 1,000 children in Hutt Valley. The rates in Northland, Auckland, Counties Manukau, Bay of Plenty, Whanganui, Hutt Valley DHBs were significantly higher than the national rate (Figure VIII-1, Table VIII-1). ED exclusive hospitalisation rates were much higher than the national rate in Northland, Bay of Plenty, Lakes, Tairāwhiti, Whanganui, Hutt Valley, and Canterbury DHBs (Figure VIII-1, Table VIII-1, Table VIII-2).

There was a greater significant difference between the ED inclusive and ED exclusive rates in Waitemata, Auckland, Counties Manukau, and Waikato DHBs (Figure VIII-1, Table VIII-1, Table VIII-2).

Figure VIII-1 Ambulatory care-sensitive hospitalisations of 0–4 year olds, by district health board compared to New Zealand, 2012–2016



Numerator: NMDS (acute and arranged admissions, neonates excluded),
Denominator: StatsNZ ERP

Table VIII-1 Ambulatory care-sensitive hospitalisations in 0–4 year olds, New Zealand 2012–2016

DHB	2012–2016 (n)	Annual average	Rate per 1,000 0–4 year olds	Rate ratio	95% CI
Ambulatory care-sensitive hospitalisations in 0–4 year olds					
Emergency Department cases included					
Northland	4,489	898	72.39	1.12	1.09–1.16
Waitemata	11,035	2,207	54.60	0.85	0.83–0.86
Auckland	11,605	2,321	76.09	1.18	1.16–1.20
Counties Manukau	14,843	2,969	70.99	1.10	1.08–1.12
Waikato	10,084	2,017	70.36	1.09	1.07–1.11
Bay of Plenty	5,406	1,081	71.37	1.11	1.08–1.14
Lakes	2,986	597	75.91	1.18	1.14–1.22
Tairāwhiti	1,339	268	68.89	1.07	1.01–1.13
Taranaki	2,134	427	50.29	0.78	0.75–0.81
Hawke's Bay	2,919	584	49.75	0.77	0.74–0.80
MidCentral	3,267	653	56.38	0.87	0.85–0.90
Whanganui	1,628	326	73.19	1.14	1.08–1.19
Hutt Valley	4,253	851	82.57	1.28	1.24–1.32
Capital & Coast	5,870	1,174	60.67	0.94	0.92–0.97
Wairarapa	844	169	61.06	0.95	0.89–1.01
Nelson Marlborough	1,824	365	41.60	0.65	0.62–0.68
South Canterbury	678	136	38.51	0.60	0.55–0.64
Canterbury	9,695	1,939	59.87	0.93	0.91–0.95
West Coast	490	98	44.03	0.68	0.63–0.74
Southern	5,914	1,183	60.95	0.95	0.92–0.97
New Zealand	101,748	20,350	64.47	1.00	

Numerator: NMDS (acute and arranged admissions, neonates excluded), Denominator: StatsNZ ERP; Rate ratios are unadjusted

Table VIII-2 Ambulatory care-sensitive hospitalisations in 0–4 year olds, New Zealand 2012–2016

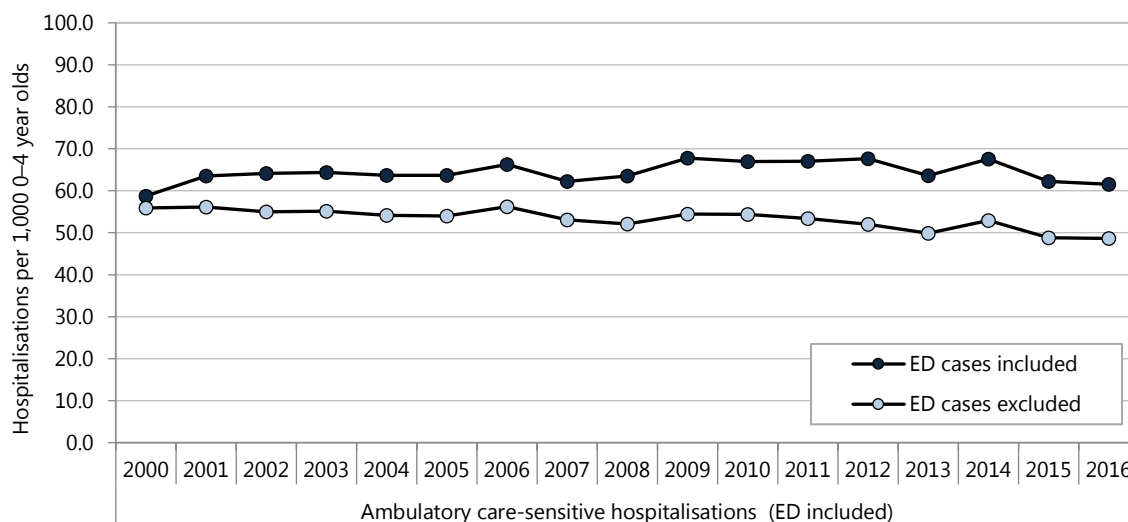
DHB	2012–2016 (n)	Annual average	Rate per 1,000 0–4 year olds	Rate ratio	95% CI
Ambulatory care-sensitive hospitalisations in 0–4 year olds					
Emergency Department cases excluded					
Northland	3,912	782	63.08	1.25	1.21–1.29
Waitemata	7,448	1,490	36.85	0.73	0.71–0.75
Auckland	5,565	1,113	36.49	0.72	0.70–0.74
Counties Manukau	10,996	2,199	52.59	1.04	1.02–1.06
Waikato	7,042	1,408	49.14	0.97	0.95–1.00
Bay of Plenty	4,778	956	63.08	1.25	1.22–1.29
Lakes	2,562	512	65.13	1.29	1.24–1.34
Tairāwhiti	1,317	263	67.76	1.34	1.27–1.42
Taranaki	1,865	373	43.95	0.87	0.83–0.91
Hawke's Bay	2,583	517	44.02	0.87	0.84–0.91
MidCentral	2,909	582	50.20	1.00	0.96–1.03
Whanganui	1,408	282	63.30	1.26	1.19–1.32
Hutt Valley	3,707	741	71.97	1.43	1.38–1.47
Capital & Coast	4,555	911	47.08	0.93	0.91–0.96
Wairarapa	692	138	50.07	0.99	0.92–1.07
Nelson Marlborough	1,720	344	39.22	0.78	0.74–0.82
South Canterbury	658	132	37.37	0.74	0.69–0.80
Canterbury	9,658	1,932	59.64	1.18	1.16–1.21
West Coast	473	95	42.50	0.84	0.77–0.92
Southern	5,440	1,088	56.06	1.11	1.08–1.14
New Zealand	17,949	3,590	54.13	1.07	

Numerator: NMDS (acute and arranged admissions, neonates excluded), Denominator: StatsNZ ERP; Rate ratios are unadjusted

Figure VIII-2 show a divergent trend between the rates of ambulatory care-sensitive hospitalisations when ED cases were included and when excluded for New Zealand.

While the rates of ED exclusive ambulatory care-sensitive hospitalisations have gradually declined since 2000, ED inclusive rates have remained relatively stable. There was a marginal separation between the trends of ED included and excluded rates (Figure VIII-2).

Figure VIII-2 Trends in hospitalisation of 0–4 year olds for ambulatory care-sensitive conditions, New Zealand 2000–2016

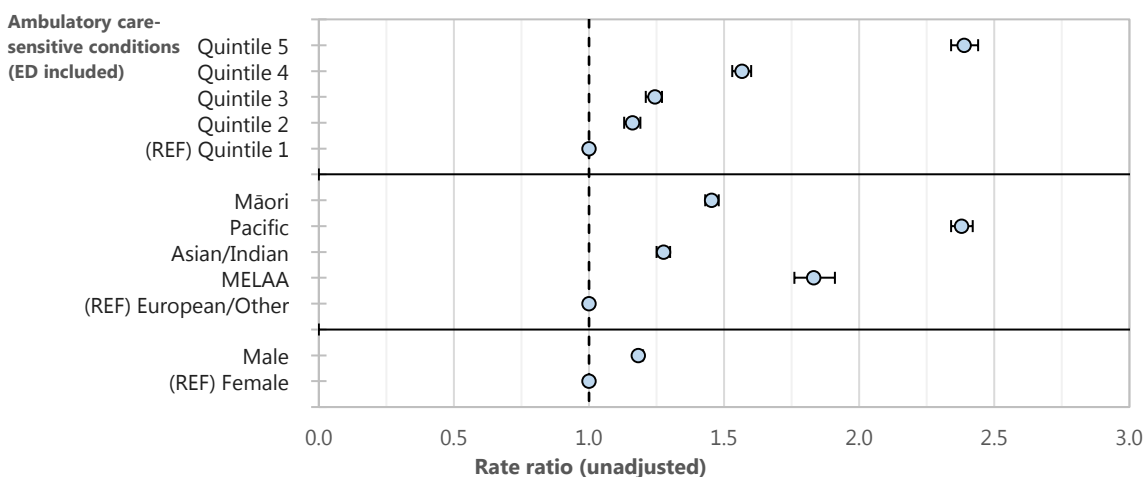


Numerator: NMDS (acute and arranged admissions, neonates excluded),
Denominator: StatsNZ ERP

Figure VIII-3 presents the ambulatory care-sensitive hospitalisations (ACSH; including ED cases) of children aged 28 days–4 years for differing demographic groups, specifically the residential deprivation score (NZDep2013 index of deprivation score), ethnicity, and sex. The unadjusted rate ratio presents the gap, if any, between the groups and the reference group. The following associations were observed, bearing in mind that this univariate analysis does not quantify the independent effect of each factor:

- ACSH rates were significantly higher for those residing in areas with the higher (quintiles 2–5; deciles 3–10) NZDep2013 scores compared with quintile 1 (deciles 1–2)
- The ACSH rate for European/Other children was significantly lower than the rate for children of the other ethnic groups
- Males had significantly higher ACSH rates compared with females.

Figure VIII-3 Ambulatory care-sensitive hospitalisations of 0–4 year olds, by demographic variable, New Zealand 2012–2016



Numerator: NMDS (acute and arranged admissions, neonates excluded), Denominator: StatsNZ ERP;
REF = reference group, Ethnicity is level 1 prioritised, Quintile is NZDep2013 (1 = least deprived; 5 = most deprived) ○ ED cases included

Table VIII-3 presents a summary of primary diagnosis of 28 day–4 year olds hospitalised with ambulatory care-sensitive conditions during 2012–2016. The conditions most frequently diagnosed in ED inclusive hospitalisations in New Zealand were (in order) asthma and wheeze, gastroenteritis/dehydration, acute upper respiratory tract infections, dental conditions, pneumonia or skin infections. Conditions most frequently diagnosed in ED exclusive hospitalisations were asthma and wheeze, dental conditions, and gastroenteritis/dehydration.

Table VIII-3 Ambulatory care-sensitive hospitalisations in 0–4 year olds, by ED status and primary diagnosis, New Zealand 2012–2016

Primary diagnosis	2012–2016 (n)	Annual average	Rate per 1,000 0–4 year olds	%
hospitalisations for ambulatory care-sensitive conditions in 0–4 year olds				
Emergency Department cases included				
Asthma and wheeze	21,864	4,372.8	13.85	21.5
Gastroenteritis/dehydration	19,498	3,899.6	12.35	19.2
Respiratory infections - Acute upper†	19,312	3,862.4	12.24	19.0
Dental conditions*	15,038	3,007.6	9.53	14.8
Respiratory infections - Pneumonia‡	9,144	1,828.8	5.79	9.0
Skin infections	7,742	1,548.4	4.91	7.6
Dermatitis and eczema	2,757	551.4	1.75	2.7
Otitis media	2,348	469.6	1.49	2.3
Constipation	2,071	414.2	1.31	2.0
Gastro-oesophageal reflux (GORD)	1,165	233.0	0.74	1.1
Bronchiectasis	370	74.0	0.23	0.4
Nutritional deficiency and anaemia	278	55.6	0.18	0.3
VPD ≥ 6 months: DTP, Polio, HepB	127	25.4	0.08	0.1
VPD ≥ 15 months: MMR	24	4.8	0.02	0.0
Rheumatic fever or rheumatic heart disease	10	2.0	0.01	0.0
Total	101,748	20,349.6	64.47	100.0
Emergency Department cases excluded				
Asthma and wheeze	16,121	3,224.2	10.21	20.3
Dental conditions*	15,000	3,000.0	9.50	18.8
Respiratory infections - Acute upper†	13,458	2,691.6	8.53	16.9
Gastroenteritis/dehydration	12,774	2,554.8	8.09	16.0
Respiratory infections - Pneumonia‡	7,611	1,522.2	4.82	9.6
Skin infections	7,246	1,449.2	4.59	9.1
Dermatitis and eczema	2,505	501.0	1.59	3.1
Otitis media	1,577	315.4	1.00	2.0
Constipation	1,516	303.2	0.96	1.9
Gastro-oesophageal reflux (GORD)	1,022	204.4	0.65	1.3
Bronchiectasis	365	73.0	0.23	0.5
Nutritional deficiency and anaemia	264	52.8	0.17	0.3
VPD ≥ 6 months: DTP, Polio, HepB	113	22.6	0.07	0.1
VPD ≥ 15 months: MMR	16	3.2	0.01	0.0
Rheumatic fever or rheumatic heart disease	10	2.0	0.01	0.0
Total	79,598	15,919.6	50.43	100.0

Numerator: NMDS (acute and arranged admissions, neonates excluded), Denominator: StatsNZ ERP; *Dental conditions includes waiting list admissions; †Acute upper respiratory tract infections excludes croup; ‡Pneumonia comprises bacterial, and non-viral pneumonia; VPD = Vaccine preventable diseases; DTP = diphtheria, tetanus, pertussis; HepB = hepatitis B; MMR = measles, mumps, rubella

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IX. MAKING HEALTH EASIER: REDUCING INEQUALITIES IN CHILD HEALTH THROUGH ADDRESSING LOW HEALTH LITERACY

Author: Dr Judith Adams

Introduction

Keeping their children healthy and safe is one of the most important responsibilities parents and caregivers have. It requires knowledge and skills that are acquired in a number of ways: from families and friends, through cultural heritage, at school, from health professionals, through reading, and through audio-visual media, such as television, radio and the internet.

The knowledge and skills people need to meet the complex demands of health and healthcare systems in a modern society have been conceptualised as health literacy.¹ Being health literate means having the knowledge, skills, motivation and confidence to accurately assess the health of yourself, your family and your community, to understand the factors that influence health at each of these levels, to take responsibility for health, and to act appropriately.¹ It means being able to make well-informed decisions on personal health matters like nutrition, choice of healthcare providers, preventive interventions such as immunisation and screening, and treatment options for health problems.¹ It also means being able to form informed opinions on public health issues, such as air pollution, the safety of the water supply, workplace health and safety, the quality of food offered in school canteens, the location of liquor outlets, and the social and economic determinants of health, and being able to use political processes to affect government policy relating to such matters.¹⁻³

When faced with a personal health problem, a health literate person can recognise symptoms that warrant medical attention, seek and obtain help from the health system, make an informed choice if they are offered treatment options, and understand and follow the advice and treatment plan they are given. They can, for example, use the information on the label to determine the correct dose of liquid medicine to give their child⁴, or understand informed consent documents.⁵ They can carry out health-related tasks requiring numeracy skills, such as understanding food labels⁶, measuring blood sugar⁷, and comparing the risks of different treatment options⁸. They can make a phone call to make an appointment with a healthcare provider, arrange time off work to attend the appointment, get themselves to the health service, and interact confidently with health professionals by answering questions, providing a history, and asking questions about things they do not understand.⁹

According to the World Health Organisation, health literacy is one of the three key elements of health promotion, together with healthy cities and good governance.¹⁰ As will be explained further, many people have poor health literacy and this is a major contributor to poor health outcomes and to health inequities between different population groups. In their 2015 discussion paper *Health literacy: A necessary element for achieving health equity*¹¹, Logan et al. made the following three key points about health literacy and health disparities:

- Health literacy is intrinsically linked to both an individual's and a community's socioeconomic context, and is a powerful mediator of the social determinants of health
- Health literacy interventions are viable options among other evidence-based strategies to address social adversity and environmental health determinants and should be considered when assessing meaningful actions to address health disparities
- Health literacy interventions and practices contribute to reducing health disparities, which fosters health equity and social justice.

This article discusses the research on health literacy and its relation to health outcomes, the research on interventions to improve health outcomes for people with low health literacy, and how the health system can reduce the health literacy demands it places on patients and better serve patients with low health literacy.

Levels of health literacy in New Zealand's population

More than half of all New Zealanders have poor health literacy.¹² The data on New Zealanders' health literacy comes from the 2006 Adult Literacy and Life Skills Survey which tested the literacy, numeracy, and problem-solving skills of a nationally representative sample comprising 7000 people aged 16–65 years.¹² The survey included 191 questions that related to health matters across four domains: prose and document literacy, numeracy, and problem solving. The questions were related to five types of activities: health promotion (60 items), health protection (64 items), disease prevention (18 items), health care maintenance (16 items) and system navigation (32 items). Health literacy scores were assigned to five levels with levels 1 and 2 (scores of below 276 out of 500) indicating poor health literacy.

The report *Kōrero Marama: Health literacy and Māori* compared the health literacy scores of Māori and non-Māori.¹² The key finding of this report was that the average health literacy scores for both Māori and non-Māori males and females were below 276, which is the minimum threshold score for level 3 that indicates an adequate level of skills for coping with the demands of everyday life and work in an advanced society. The level 3 threshold is roughly equivalent to the skill level required to successfully complete high school and enter tertiary education. Māori males and females had significantly lower health literacy scores than non-Māori: while just over half non-Māori males and females had poor health literacy, four out of five Māori males and three out of five Māori females had poor health literacy. Mean health literacy scores increased with increasing level of education and with increasing level of income, but average scores were below 290 (in the lower range of level 3) for both Māori and non-Māori, even in the highest income and education categories.

New Zealand's results are not unusual among developed countries: The European Health Literacy Survey (HLS-EU) conducted in 2011 in Austria, Bulgaria, Germany, Greece, Ireland, the Netherlands, Poland and Spain found that, across all eight countries, 48% of the population lacked sufficient general health literacy.¹³ The proportion who had insufficient health literacy varied between countries: from 29% in the Netherlands to 62% in Bulgaria. Multivariate linear regression indicated that financial deprivation was the strongest predictor of low health literacy, followed by low social status and low education.

The healthcare experiences of patients with low literacy

Having low literacy is often source of shame. A study that interviewed patients presenting for acute care at a large public hospital in Atlanta, Georgia found that 43% had inadequate or marginal health literacy.¹⁴ Of these patients, only 67% admitted to having trouble reading and understanding what they had read. Two-thirds of these patients had never told their spouses, over half had never told their children, and 19% had never told anyone about their difficulties with reading. Due to embarrassment and shame, patients with low literacy rarely ask for help with reading, and often use strategies to mask the fact that they cannot read or do not understand what they have read.¹⁵ For example, they will walk out of a healthcare facility if presented with a complicated form to fill in at reception, say they have forgotten their reading glasses, sign consent forms they can't read or understand, or say "no" when asked whether they have any questions about written material they have been given.

Another study, carried out in emergency departments and clinics at two large urban public hospitals in California, used focus groups and individual interviews to explore the difficulties that patients with poor literacy experience in interacting with the health system.¹⁶ This study also found that patients with low literacy harbour a deep sense of shame, which can be reinforced if hospital staff become impatient or angry when someone cannot complete a form or read instructions. Shame made patients reluctant to disclose their literacy problems to healthcare providers. Patients reported that seeking medical care was intimidating, that finding their way around the hospital was difficult, that they had made serious medication errors due to being unable to read labels, and that healthcare providers did not explain medical problems and treatments in an understandable way. They said they coped with their difficulties by relying heavily on oral explanations, visual cues and demonstration of tasks, and the help of family and friends.

Health literacy and health outcomes

Given the difficulties that people with low literacy experience when interacting with the health system, it is predictable that they would experience worse health outcomes than other people. The early research in the area of health literacy focused on the relationship between reading ability and a variety of health outcomes. In 2003 the Agency for Healthcare Research and Quality (AHRQ) commissioned a systematic review and analysis from

the RTI International-University of North Carolina Evidence-based Practice Center on the evidence for a causal relationship between literacy and health outcomes and the effectiveness of interventions purposed to mitigate the impact of low literacy.¹⁷ This review examined the following key questions:

- Are literacy skills related to the use of health care services?
- Are literacy skills related to health outcomes?
- Are literacy skills related to the costs of health care?
- Are literacy skills related to disparities in health outcomes according to race, ethnicity, culture, or age?

To be included in the review, studies had to have used a valid instrument to measure literacy skills, such as the Rapid Estimate of Adult Literacy in Medicine (REALM)¹⁸ or the Test of Functional Health Literacy in Adults (TOFHLA).¹⁹

In general, there was a positive and significant relationship between reading ability and knowledge of health outcomes or health services (16 studies). Patients with lower literacy (after controlling for age, gender, race, education, and income) were more likely to have never had a cervical smear, to have not had a mammogram in the last two years, and to have not had influenza and pneumococcal immunisations (one good quality cross-sectional study).²⁰ Two good quality studies found that a lower literacy level was associated with increased risk of hospitalisation.

There were many studies that examined the relationship between reading ability and a variety of health outcomes. One of the two studies measuring adherence to antiretroviral therapy for HIV found that lower literacy was associated with increased odds of poor adherence, after adjustment for race, income, social support and education.²¹ Some diabetes outcomes, including glycaemic control, were correlated with the reading ability of the patient or, in the case of child patients, the patient's parents (three studies). Two studies found no relation between reading ability and hypertension and single studies found no association with functional status in rheumatoid arthritis or with migraine headaches in children. Three out of the four studies that evaluated the relationship between reading ability and a global health status measure found an association between poorer reading status and poorer health. One U.S. study examined the relationship between reading ability and the costs of healthcare (Medicaid charges) and found that, among the 74 non-pregnant patients, the 18 who were reading at or below third grade level had costs that were, on average, three times higher when compared to the 56 patients who read above third grade level.²²

Overall, the review found that reading ability is related to knowledge about health and healthcare, hospitalisation rates, some chronic diseases, and global measures of health status. The review authors noted that analysis of confounding factors is very important in attempting to understand how literacy affects health as many of the factors associated with poor literacy, such as lack of health insurance and poverty, are themselves determinants of health.

A subsequent review of English language studies for the AHRQ considered later health literacy related studies (reported in 98 articles from 2003 to February 2011) and studies assessing the relationship between numeracy and health (reported in 22 articles from 1996 to February 2011).²³ The review authors did not identify any studies dealing with oral health literacy (speaking and listening skills) and health. This review found that low health literacy was consistently associated with higher hospitalisation rates; greater use of emergency care; lower receipt of mammography screening and influenza vaccine; poorer ability to demonstrate taking medications appropriately; poorer ability to interpret labels and health messages; and, among elderly people, poorer overall health status and higher mortality rates. There was some evidence that lower health literacy contributed to racial disparities in health outcomes. The evidence regarding the relationship between low numeracy and health outcomes was very new and inconclusive.

Most of the studies in the later review used multivariate analysis to control for potential confounding variables but some did not do this in an appropriate manner. For example, many studies controlled for educational attainment (which is highly correlated with health literacy) and some controlled for variables likely to be in the casual pathway or to mediate the relationship between health literacy and health outcomes, for example they adjusted for health status when assessing the relationship between health literacy and depression. Such "overadjustment" may hide the existence of a relationship between health literacy and an outcome of interest.²⁴

Health literacy and child health

When parents have low health literacy there can be consequences for their children's health as well as their own. In their 2009 systematic review, De Walt and Hink looked at the evidence regarding the relationship between

parent and child health literacy and child health outcomes.²⁵ They noted that all the research to date (2008) involved evaluations of relationships between literacy, as indicated by reading ability, and health.

All but one of the eight studies that examined parental literacy as the exposure of interest found that parents with lower literacy had less knowledge about health outcomes, health behaviours and health services.

The results of studies assessing the relationship between literacy and use of healthcare services had mixed results. One study found that asthmatic children with parents with low literacy had higher rates of emergency department visits and hospitalisation, even after controlling for potentially confounding variables.²⁶ Another study assessed the health literacy of caregivers of children who presented to an inner city emergency department in the US, and then retrospectively reviewed the children's previous use of healthcare services (four types of visits: preventive care, urgent care, emergency care, and hospital care). The study found that caregiver health literacy (in English or Spanish, as preferred) was not associated with disparities in use of child health services.²⁷ There were, however, some caregiver characteristics that were associated with greater use of child health services: being born outside the US, being a mother aged under 24 years at her child's birth, and having limited proficiency in English.

Children's literacy did not affect child health outcomes in the two studies that investigated this: one on migraine headaches²⁸ and one on glycaemic control in diabetic children.²⁹

Four studies examined the relationship between parental literacy and child health. The previously mentioned study on diabetic children found that maternal literacy affected the child's glycaemic control. Another study found that maternal depression was associated with depressive/withdrawn symptoms in children only when there was low maternal literacy. A study of children with asthma who attended a university paediatric clinic found that children of parents with low literacy had more emergency department visits, hospitalisations, and days missed from school, and were more likely to have moderate or severe persistent asthma and greater use of rescue medications.²⁶

A study that assessed the validity of the a newly developed Test of Functional Health Literacy in Dentistry (TOFHLiD), found that dental health literacy was not associated with parents' perceptions of either their own dental health or their children's oral health. The study authors stated that they did not know as to whether these findings meant that there was no association between dental health literacy and perceptions of oral health or that TOFHLiD was not a valid and reliable measure of dental health literacy.³⁰

Studies published since the 2009 review by De Walt and Hink have found that lower caregiver health literacy is associated with poorer oral health behaviours, such as nighttime bottle use and lack of daily toothbrushing,³¹ as well as with more severe oral health treatment needs³² and worse oral health status.^{33,34}

A 2017 systematic review of the evidence regarding an association between oral health literacy and oral health conditions³⁵ identified three studies that had found that low parental oral health literacy was associated with dental caries in children^{33,34,36}. The review authors considered the evidence regarding the association between oral health literacy and dental caries in primary teeth weak and so advised that it should be interpreted with caution. They noted that the studies had used convenience samples and were relatively small (415 participants at most).

Measuring the health literacy of children and young people

There have been relatively few studies that have attempted to measure child or adolescent health literacy. A 2013 review³⁷, which aimed to compile, analyse and describe the methodology and measurement of childhood/adolescent health literacy, identified 16 English language studies that reported on health literacy measurement in people under the age of 18, of which were published between 1980 and April 2011. Thirteen of the studies developed a new measurement tool specifically for their study and the other three used or adapted existing adult health literacy measurement tools.

The studies had a variety of reasons for wanting to measure health literacy, including: to validate a health literacy measurement tool; to measure the association of health literacy with another variable, such as behaviour, health status, social status or BMI; to measure students' perceptions of health and health literacy; and to assess the effectiveness of an intervention in improving an aspect of health literacy, for example the ability to recognise mental health problems.

The review authors concluded that the current literature did not provide a definitive description of what exactly health literacy involved for children (in or out of school settings), a definition which is required to determine what should be measured when assessing the health literacy of a child. The authors identified a lack of definition

pertaining not only to health-related knowledge, but also in terms of Nutbeam's three levels of health literacy (basic/functional literacy, communicative/interactive literacy, and critical literacy).²

It follows from this that there is almost no evidence relating specifically to children and young people on associations between health literacy and health-related outcomes, the efficacy of interventions to improve health literacy, or ways to improve health outcomes for those who have low health literacy.

The relationship between health literacy and health disparities

Many of the social factors associated with poor health literacy, such as low education, low income, and belonging to an ethnic minority population, are also associated with poor health status, both in New Zealand^{12,38,39} and in other countries.¹³ The exact nature of the relationship between social disparities and health literacy is still being investigated and so the pathways by which health literacy contributes to social disparities in health outcomes are still unclear.⁴⁰

Mantwill et al.⁴⁰ conducted a systematic review to better understand how well the relationships between health literacy and health disparities have been systematically studied and the potential relationships and pathways identified in the literature. They included studies meeting the following three criteria: they used a valid measure of health literacy; they explicitly conceived a health disparity as being related to a social disparity, such as education or race/ethnicity; and they presented their results by comparing two or more groups affected by a social disparity and explored how health literacy affected associations between social disparity and health outcomes.

Thirty-six studies were included. Most investigated racial/ethnic disparities and a few investigated educational disparities. One study investigated the contribution of health literacy to potential gender differences in health. All but five studies had been conducted in the US, and the others in Canada, China, the Netherlands and the UK. The health-related outcomes used in the studies were: self-reported health status; cancer-related outcomes; medication adherence/management; disease control; preventive care, and end-of-life decisions. Most of the data sets that were used in the studies had been originally collected to investigate relationships other than those between health literacy and health disparities.

The reviewers found some limited evidence that health literacy mediates educational and racial/ethnic disparities in self-reported health status. For example, a study of older U.S. adults who participated in the 2003 National Assessment of Adult Literacy found that health-related print literacy significantly mediated racial/ethnic (black vs. white) disparities in self-rated health status and receiving an influenza vaccination.⁴¹ There was also some evidence that health literacy mediated the relationship between racial/ethnic disparities and medication adherence/management and health knowledge. A study investigating predictors of misunderstanding instructions for paediatric liquid medications in the U.S. found that, in an adjusted analysis that excluded literacy, African Americans were more likely to misunderstand instructions when compared to Caucasians; however, when literacy was included in the analysis, the effect of race on misunderstanding became insignificant.⁴

The reviewers noted that only a few studies tested hypotheses concerning pathways and systematically scrutinised the relationship between health literacy and health disparities. They suggested that longitudinal studies would shed more light on the potential causal pathways that link health literacy and other mediating variables to health disparities.

It is possible that one pathway by which low health literacy leads to lower health status is in cases where a health system provides a lower quality of service to people with lower health literacy. A recent U.S. study⁴² of caregiver health literacy done in a paediatric emergency department found that both low caregiver health literacy and minority race were associated with less radiologic testing (fewer x rays). However, it also found that, in analysis stratified by caregiver health literacy, minority race was associated with less radiologic testing only when caregivers had low health literacy and there was no difference among those with adequate health literacy. This study used bivariate and multivariate analyses adjusting for ED triage level, child insurance, and chronic illness. It measured caregiver health literacy using the Newest Vital Sign test.⁴³

In their discussion the study authors noted that caregivers with low health literacy are less likely to provide an adequate history (describe their problem well) and tend to lack the skills to participate in shared medical decision making. They stated that their study did not support the presumption that health providers would do more testing if they had a lack of information (e.g. due to a caregiver giving a poor history) and stated that it is concerning that a disparity in healthcare resource use exists when there is no biologic basis for differential testing.

Health literacy interventions

Policy makers, researchers and healthcare practitioners have focused on health literacy because it is something that is both amenable to intervention and a means through which health disparities can be reduced.^{11,44-46} It may be that they feel that low health literacy is easier to address, more within the sphere of influence of the health system, and less of a political issue than other social determinants of poor health, such as poverty, lack of education, or racism. However, without action on these wider determinants of health, addressing health literacy may yield only modest population health benefits.

Interventions to address health literacy can be implemented at various levels: the individual, the population or the health system. They can aim to improve people's health literacy, or to reduce the health literacy demands of obtaining healthcare, or both. The following sections review individual-level, population-level and health system level health literacy interventions. There is a focus on interventions that can be delivered by the health system, because this article is written primarily for a health system readership. It should not be forgotten, however, that addressing health literacy requires a whole-of-society approach involving national and local government, the health sector, the education sector, workplaces and businesses, and community organisations such as libraries, the media, cultural and religious organisations, immigrant and refugee settlement services, unions, and senior citizens' groups.^{47,48}

Health literacy Interventions for individuals

Health literacy research in this area addresses the question: How can we improve health outcomes (or health-related outcomes) for people with low health literacy? To be considered health literacy research, a piece of research examining the effectiveness of an intervention must have established that all or some study participants had low health literacy, through use of a recognised health literacy measurement tool, and measured outcomes for low literacy participants.

A number of systematic reviews,^{17,25,49-54} and reviews of reviews,^{55,56} have examined interventions to improve the health literacy of individuals and to mitigate the effects of low literacy on individuals' health outcomes.

The 2011 review by Berkman et al. for the U.S. Agency for Healthcare Research and Quality (AHRQ)⁴⁹ looked at the effectiveness of interventions to mitigate the effects of low health literacy on: use of health services; health outcomes; costs of healthcare; and health disparities.

The interventions were tested in populations with varying proportions of people with low health literacy or low numeracy. Twenty-one studies examined the effects of interventions specifically within low literacy subgroups, although many were underpowered (too small to be able to measure statistically significant differences) for these analyses and/or didn't adequately control for confounding. The other studies examined the effects of interventions in populations, including individuals with both high and low health literacy or numeracy, and so provided only supportive evidence about the effect of interventions to mitigate the effects of low literacy.

The strategies used in the single strategy interventions included alternative document design (2 studies), alternative presentation of numerical information (3 studies), additive or alternative pictorial representations (8 studies), alternative media, such as video or slideshow (4 studies), and a combination of simplification of readability and document redesign (7 studies). There was also one study examining the effects of notifying physicians of patients' literacy status on health outcomes. The mixed intervention studies included a combination of the strategies already mentioned and other strategies intended to improve patients' knowledge, disease, self-efficacy, behaviour, adherence, quality of life, and use of healthcare services.

Overall, the strength of the evidence regarding the effect of specific intervention design features for low health literacy populations was low, primarily because of differences in the interventions, and subsequent results. The review authors did note several design features that had improved understanding in low health literacy populations, in one or a few studies. These included: presenting essential information by itself; presenting essential information first; presenting information so that the higher number (rather than the lower number) indicates better quality; using the same denominator to present baseline risk and treatment benefit information; adding icon arrays to numerical presentation of treatment benefit; and adding video to verbal narratives. They also noted that their previous (2004) review for the AHRQ¹⁷ had identified potential benefit from using reduced reading level and illustrated narratives. There were some design features that seemed to worsen comprehension: using coloured traffic light symbols to denote hospital quality (one study), and adding symbols to non-essential quality information such as patient satisfaction (one study).

Icon arrays (also known as pictographs) are a way of illustrating proportions, for example the proportion of patients with a disease who will benefit from a particular treatment, using a series of dots, human figures, or faces, a proportion of which are shaded to represent the proportion of individuals affected.

As well as reviewing studies in groups by intervention type, the review authors looked at studies of mixed interventions (those employing a variety of strategies) in groups according to outcomes. They found moderate evidence that the studied interventions change healthcare service use; specifically, they found that intensive self-management and adherence interventions (for chronic conditions such as asthma or congestive heart failure) appear to be effective in reducing emergency room visits and hospitalisations.

Educational interventions and/or cues for screening increase colorectal cancer and prostate cancer screening. (The review authors noted that it is questionable whether prostate cancer screening is beneficial.)

There was moderate evidence that some interventions change health outcomes: intensive self-management interventions appear to improve disease control in chronic conditions such as diabetes and asthma. They also increase self-management behaviour but, in the only study that did analysis stratified by health literacy level, a self-management intervention had a greater effect in the high health literacy subgroup than in the low health literacy subgroup. There was insufficient evidence regarding the effects of other mixed strategy interventions on other health-related outcomes, including knowledge, self-efficacy, adherence, health-related skills, quality of life, and cost. This was because the studies addressing these outcomes had mixed results. There was also insufficient evidence regarding the effects of health literacy interventions on behavioural intent or disparities, because too few studies had addressed these outcomes.

Common features of nearly all of the interventions that improved distal outcomes (such as self-management, hospitalisations or mortality) were: high intensity; a theory basis; and an emphasis on skill building, pilot testing before implementation; and delivery by a health professional, such as a diabetes educator or a pharmacist. Studies that examined multiple outcomes reported that, in addition to changing distal outcomes, interventions also changed intermediate outcomes, such as knowledge, self-efficacy and behaviour. Although none of the studies undertook formal mediation analysis (assessing how one variable affects another variable), the review authors suggested that changing knowledge and behaviour, and increasing self-efficacy, may be important aims in mitigating the effects of low health literacy.

The 2011 review by Sheridan et al.⁵⁰ covered 38 studies that reported results stratified by literacy level and the review, therefore, provides direct evidence about the effectiveness of interventions for people with low literacy. Of the 38 studies, 26 were included in the 2011 AHRQ review⁴⁹, plus seven from the 2004 AHRQ review¹⁷ and five studies identified in a February 2011 search update. As well as identifying the same effective intervention design features as the 2011 AHRQ review, this review noted one study that suggested that presenting numerical information in tables or pictographs, rather than text, improved study participants' understanding of the risks and benefits of research participation.⁵⁷ It also noted that several interventions had used simplified text and teach-back methodologies that have been shown to be effective in the educational and psycholinguistic literatures.⁵⁸

A rapid review commissioned by the European Centre for Disease Prevention and Control (ECDC), entitled *Interventions for Improving Population Health Literacy: Insights From a Rapid Review of the Evidence*⁵⁹, summarised the findings from five reviews published from 2005 to 2009^{25,52,53,60,61}, including a part of the 2004 AHRQ review⁶⁰, and the child-specific review by De Walt and Hink²⁵ (which will be discussed in more detail later). Three of the reviews reported the quality criteria used to assess studies, and they reported that included studies were of variable quality. Almost of the studies were conducted in North America, most in the US.

Most of the interventions were directed at patients in clinical settings (or child patients' parents or caregivers, in four studies) and many were educational condition management interventions for patients with specific health conditions, such as asthma, diabetes, cancer or HIV. Most studies assessed the effects of written health information, and/or alternative formats for information presentation, such as audiotapes or videos. No studies were reported to have assessed interventions specifically for people with low literacy or for disadvantaged, minority or hard-to-reach groups. The ECDC review authors stated that, although some studies indicated that the target group involved in their intervention had defining characteristics, such as "African-American" or "Latino-speaking", there was no indication that these groups had been chosen because they were perceived to be disadvantaged.

Like the 2011 AHRQ review⁴⁹, the ECDC review found that there was considerable variation between studies in both interventions and in outcome measures, and this made it difficult to draw firm conclusions. The ECDC review authors stated that there seemed to be some confusion among researchers about whether health literacy

should be considered as an outcome measure or as a component of the intervention process. While all five included reviews identified some interventions that improved some outcomes, these outcomes were sometimes health knowledge or health behaviours (such as taking medication correctly), rather than health outcomes. They noted that two of the reviews' authors, Clement et al.⁶¹ and Pignone et al.,⁶⁰ argued that, although health knowledge and health behaviours are important, improvements in these areas do not always translate into improvements in health, health services utilisation, or disease prevalence.

Not all of the reviews noted whether study results were stratified by literacy level, but, from the reviews that did, it was apparent that few studies provided this analysis. When studies do not analyse their results according to participants' literacy levels, it is impossible to measure the impacts of interventions on people with varying levels of health literacy. The ECDPC review authors stated that it is difficult to effectively target interventions to reduce health disparities and inequalities without this knowledge.

In summary, the ECDPC review, despite its title, did not identify any evidence regarding population-level interventions to improve health literacy, but did identify some interventions that may improve the health literacy skills of individual patients, for example in regard to management of their particular disease.

Health literacy interventions for child health

The 2009 review by De Walt and Hink²⁵ addressed the effectiveness of interventions purposed to improve health outcomes for children who have parents with low literacy, or who have low literacy themselves. It included five studies: two^{62,63} were included in the 2004 AHRQ review,¹⁷ two^{64,65} were included in the 2011 AHRQ review,⁴⁹ and one⁶⁶ was excluded from the 2011 AHRQ review,⁴⁹ because it did not measure literacy or health literacy (although it was carried out in a multi-ethnic low socioeconomic area).

Four studies measured knowledge as one of their outcomes.^{62-64,66} Two studies showed that well-designed written materials can improve comprehension for parents of all reading abilities, but had no effect on the disparity in comprehension between good and poor readers.^{62,63} One study⁶⁴ evaluated four different strategies for delivering information for informed consent: (1) original consent form; (2) enhanced easy-to-read consent form; (3) computer-based presentation; and (4) video. Of the four methods, for the whole study population, enhanced written materials were as effective as video and computer-based materials. For the sub-group of parents who read below 9th-grade level, enhanced written materials were generally superior to all other methods. One study⁶⁶ tested a combination of a pictogram-based medication instruction sheet and brief counselling and teach-back sessions. Compared to parents in the usual-care control group, parents in the intervention group had greater knowledge about the medication dose and frequency.

This study⁶⁶ was the only one to measure a health behaviour outcome. It found that parents in the intervention group were more likely to use the correct medication dose and had greater self-reported adherence to the prescribed medication regimen.

One quasi-experimental study assessed an intervention for 110 minority children with moderate or severe persistent asthma in South Los Angeles.⁶⁵ The intervention consisted of Saturday school programme providing each child with two hours of reading instruction and 30 minutes of asthma education, plus a five day Asthma Reading Advocacy camp, held on a university campus. The minimum intervention period for each child was six months but 60% of participants enrolled for a year or more. Following the intervention there was a statistically significant decrease in both hospitalisations (from 37% to 22%, $p < 0.001$) and emergency department visits (from 63% to 33%, $p < 0.010$), when comparing the six months prior to the intervention with the six months during the intervention. In addition, all children showed significant improvement in their reading level and self-efficacy.

Information technology health literacy interventions

Information technology based interventions, often referred to as eHealth interventions, have great potential to increase health literacy through: providing information in a variety of formats (text, pictures, audio and video) and in multiple languages; supporting and enabling behaviour change; enabling communication with healthcare providers and with communities with common health interests (such as expectant parents or people with diabetes); and facilitating health and disease management.^{54,67}

In 2015, almost three quarters of all New Zealanders had access to a smartphone (70%) and/or a laptop or notebook (72%).⁶⁸ Smart phones are fast becoming the most popular mobile communication device with a 48% increase in ownership/access between 2013 and 2015. Among 18–34 year olds, 91% owned or had access to a smartphone and 85% to a laptop. Forty-eight percent of all smart phone users reported using their phone more frequently than they had done in the previous year. A large majority (86%) of this group reported that they were

specifically using their phone more frequently to connect to the internet with the top three reasons being looking for reference information, accessing social networking sites and online banking.

The 2015 World Internet Project New Zealand (WIPNZ) survey indicated that 91% of survey respondents were active internet users.⁶⁹ Older age and low income were the most important factors associated with not using the internet, although younger people aged 16 to 29 years were high users whatever their income. Pasifika respondents had notably lower internet usage scores than respondents of other ethnicities, particularly in the 40 plus age group. As more people become able to access the internet, the social disadvantage will increase for the minority who remain on the wrong side of the digital divide.

A recently published U.S. study sought to determine whether health literacy was associated with patients' uses of four kinds of health information technology (HIT) tools: nutrition and fitness apps, activity trackers, and patient portals.⁷⁰ Health literacy was measured using the Newest Vital Sign.⁴³ Compared to participants with low health literacy, those with adequate health literacy were significantly more likely to use all four forms of HIT. After controlling for demographic variables, greater health literacy was also associated with greater perceived ease of use and greater perceived usefulness of all the HIT tools. People with lower health literacy were more likely to perceive their information on HIT tools as private. The study authors stated that there is a pressing need to better understand how health literacy is related to HIT adoption and usage, to ensure that all users receive maximum health benefits from HIT advances, are engaged with organisations and providers they trust, and have their health and personal information kept private.

The 2016 review by Jacobs et al.⁵⁴ aimed to answer the question: What are the current eHealth interventions to improve health literacy? It identified 12 relevant studies. The interventions addressed a variety of issues related to health risks, lifestyles and disease management, and had a variety of theoretical foundations. The eHealth platforms included personal computers, tablets, netbooks, touchscreen computers, and personal digital assistants (PDAs) with web-based applications that included multimedia applications, such as videos and interactive self-help tools (PDAs have since been superseded by smartphones).

Due to differences between these studies in methods and rigor, quality criteria, study population, and illness or condition addressed, there were wide variations in their results and conclusions regarding computer-based applications for improving health literacy. For this reason, the review authors chose to provide only general descriptions of the major types of eHealth interventions currently being used or tested. Compared to control interventions, eHealth interventions were reportedly associated with some significantly better outcomes, or showed promise for future positive outcomes, regarding health literacy, for diverse groups of people, in a variety of settings, with a variety of diseases. The review authors concluded that: "Before eHealth interventions can be hailed as a behavior change intervention of the future, the effective components and mechanisms need to be identified, rigorously tested, and its cost effectiveness established in different contexts".

Having access to the internet does not guarantee that a person will be able to use the internet to enhance their health literacy. While there is a vast amount of health information online, the quality and accuracy of much of it is questionable.

A 2015 review by Divani et al.⁷¹ aimed to review the evidence regarding the association of low health literacy and (1) people's ability to evaluate online health information, (2) perceived quality of online health information, (3) trust in online health information, and (4) the use of evaluation criteria for online information. The review included 38 articles but only four investigated the specific role of low health literacy in the evaluation of online health information. The others examined the association between educational level or other proxy measures of health literacy, such as general literacy, and one or more of the specified outcomes.

The review authors stated that, overall, the studies' results indicated a positive association between health literacy (or one of its proxies) and people's ability to evaluate online health information and trust in the internet as an information source. There was, however, inconsistent evidence regarding a relationship between health literacy and either perceived quality of online information or people's use of evaluation criteria for online health information.

Two reviews^{72,73} have assessed the effects of interventions to enhance consumer's online health literacy (teaching people skills to search for, evaluate and use online health information). The 2011 Cochrane review⁷³ identified only two relevant studies, both of adult education classes teaching information and communication technology (ICT) skills. The review authors concluded that the evidence suggested consumer ICT skills interventions may have a positive effect on consumers' attitudes and behaviours regarding use of the internet for health information but it was too weak to permit drawing any conclusions regarding the content or the delivery of consumer internet skills interventions.

The other review, by Lee et al.,⁷² had less restrictive inclusion criteria and reported on seven studies (one of which was a RCT included in the Cochrane review), as well as two papers from the grey literature. The reviewers provided only a descriptive critique of each study because of limitations in the design characteristics and analysis, and perceived overall quality of the studies. Most interventions involved teaching consumers how to use the internet and/or find credible websites. Outcome measures were mostly self-assessed by study participants and included knowledge and skills pertaining to internet use and searching for reliable health information. The review authors stated that there is potential for further research to explore other ways to help consumers find reliable online health information and to assess outcomes via objective measures.

Interventions for populations

According to the World Health Organization, health literacy is one of the three key elements of health promotion, along with healthy cities and good governance for health (when all government departments factor health into all their decision making and prioritise policies that prevent people becoming ill and protect them from injuries).¹⁰ From a public health perspective, enhancing a population's health literacy through effective communication of health information is a key strategy for promoting health, preventing disease, and getting the best from the healthcare system. There is, however, a lack of discussion in the literature about what a health literate population looks like, or how best to assess health literacy at the population level.⁷⁴

If a study is going to attempt to measure whether or not an intervention leads to improved health literacy, or an improvement in health or health-related outcomes for individuals or populations with low health literacy, then it needs to measure health literacy in some way. The existing health literacy research, most of which has been conducted with patients in clinical settings in North America, has used mostly used health literacy measurement tools such as the Rapid Estimate of Adult Literacy in Medicine (REALM)¹⁸ or the Test of Functional Health Literacy in Adults (TOFHLA).¹⁹ These tools have been criticised on a number of grounds: they do not actually measure health literacy; they give only a rough indication of reading skills⁷⁵; and they are incapable of assessing other important aspects of health literacy, such as understanding, motivation, and ability to access and use information about health and healthcare.⁷⁶

The 2015 review by Guzys et al.⁷⁴ looked at whether commonly used health literacy assessment tools could be appropriate for assessing critical health literacy at the population level. Critical health literacy involves having an understanding of the social determinants of health and the ability to take action to address them to promote the health of yourself, your family and your community by political and other means^{2,3}.

The tools reviewed included, among others, the Demographic Assessment for Health Literacy (DAHL)⁷⁷, the Health Literacy Questionnaire⁷⁸, the All Aspects of Health Literacy Scale (AAHLS)⁷⁹, and the European Health Literacy Survey Questionnaire (HLS-EU-Q)⁸⁰. The review authors stated that, although developments in measuring health literacy at the population level indicate an increasing acknowledgement of the complexity of health literacy as a concept, the focus was still on the health literacy of individuals or the collation of individual data. They concluded that the current tools are unsuited for assessing critical health literacy at the societal level. They stated that collaboration with members of the general public, who have a range of literacy and health literacy levels, is required to develop an appropriate framework that could assess the critical health literacy of communities and that this framework need to integrate health promotion theories, the views of community members, a focus on the critical domain of health literacy, and a public health approach.

The lack of consensus about what population health literacy is and how to measure it is a likely reason for the lack of published quantitative studies of interventions to improve population health literacy.

Population-level interventions intended to improve a whole population's health literacy, such as health promotion or disease prevention campaigns, may be of the greatest benefit to people with higher levels of education and health literacy, and so result in increased disparity between the most and least disadvantaged groups in society.⁸¹ A 2012 King's Fund study used data from the Health Survey for England to examine how four lifestyle risk factors – smoking, excessive alcohol use, poor diet, and low levels of physical activity – co-occurred in the population and how their distribution had changed over time.⁸² This study found that, while the overall proportion of the population engaging in three or four of these unhealthy behaviours had fallen significantly, from around 33% in 2003 to around 25% in 2008, the reductions had occurred mainly among those in higher educational and socioeconomic groups. People with no qualifications were more than five times as likely as those with higher education to engage in all four unhealthy behaviours in 2008, compared to only three times as likely in 2003.

While the field of population health literacy research is in its infancy, there is a vast literature devoted to the closely related fields of health promotion and health education. It is suggested that readers view this literature

with the needs of people with low health literacy in mind, and, if they are considering implementing a health education or health promotion intervention, ask themselves the question: Is this intervention likely to improve health outcomes for people with low health literacy?

Health literacy from a health system perspective

Many definitions of health literacy promote the idea that health literacy is determined by the knowledge and capabilities of individuals.⁸³ Defining health literacy as an attribute of individuals suggests that improving the population's health literacy could be best achieved by improving people's literacy, numeracy, health knowledge, and communication and problem-solving skills and that this should be primarily the responsibility of the education system with the health system having a only secondary role, for example in health promotion and patient education.⁸⁴

An alternative view is that poor health literacy results from a mismatch between the knowledge and capabilities of individuals and the demands of the health system.⁸⁴ In this view, it is the responsibility of the health system to become more user-friendly, for example by using less medical jargon in both oral and written communication, and by ensuring that written materials are not too difficult for most people to read and understand, and avoid assuming patients' familiarity with mathematical and scientific concepts. Locating health literacy in the interaction between individuals and the health system makes it possible to appreciate that a person's health literacy may vary with their situation and the barriers within their situation. For example, a person may have good health literacy in their native country but poor health literacy in a country where they do not understand how the local health system works and do not understand the local language. Anyone, no matter how good their general health literacy is, can experience low health literacy with regard to a particular decision and situation and so, for example, may find it more difficult to take in information when they are in pain, are not feeling well, or are in times of emotional stress, such as when their child is seriously ill.

New Zealand's Ministry of Health has recognised the need for healthcare organisations to reduce the health literacy demands they place on consumers and has encouraged them to carry out health literacy reviews.⁹ The Ministry's 2015 publication *Health Literacy Review: A guide*⁹, offers advice on how to do this. It defines a health literate organisation as follows:

A health-literate organisation:

- Makes health literacy everyone's business – leaders, managers, and clinical and non-clinical staff
- Designs systems, processes and services that allow consumers to access services easily
- Supports operational staff to use health literacy approaches and strategies
- Eliminates confusing communication that could prevent consumers from accessing treatment easily
- Actively builds health literacy of consumers to help them to manage their health
- Makes sure operational staff understand that, no matter how high a consumer's level of health literacy is, stress and anxiety affect their ability to understand and remember new information.

There is a wealth of available information that can help healthcare organisations address health literacy barriers within their services and support their staff to build patients' health literacy. Links to some resources that may be useful are provided in the reading list at the end of this chapter. This information draws on the evidence that is discussed in the section on interventions for individuals, and on the evidence relating to healthcare consumer empowerment and communication strategies, but there is little direct evidence for the effectiveness or cost effectiveness of many of the recommended actions. This is largely because the field of health literacy is still evolving, and health literacy interventions tend to be complex and may not produce measureable changes in health outcomes for many years, and are therefore unsuited to evaluation through randomised controlled trials.⁴⁸

The following sections discuss a few of the strategies that healthcare organisations and healthcare professionals can use to reduce health literacy barriers.

Screening for low health literacy: Is it a good idea?

It can be difficult for health professionals to identify patients or caregivers with low health literacy, especially if they have good oral communication skills, and health professionals generally overestimate the health literacy of their patients.^{85,86} Over the last twenty years, many different tools to measure health literacy in various contexts have been developed.^{87,88} Some are sufficiently quick to administer that they are suitable as screening tools to identify patients with low health literacy.

Some people have advocated that all patients should receive health literacy screening when they enter a healthcare facility so that patients with low health literacy can be given extra help.^{89,90} Such an approach, however, may be embarrassing and stigmatising for patients⁹¹ and it has been argued that there is no evidence that additional training or support for patients with low health literacy is beneficial.⁹² Using screening to alert healthcare professionals to patients with limited health literacy may not improve outcomes for those patients. A trial in a U.S. public hospital examined the effect of notifying physicians in cases where their diabetes patient had limited health literacy and found that, although the notified intervention physicians were more likely (when compared to control physicians) to use management strategies recommended for patients with low health literacy, both intervention and control patients had similar post-visit self-efficacy scores and similar changes in follow-up glycosylated hemoglobin values (HbA1c, a measure of diabetes control).⁹³

A UK study interviewed people who sought help from an Adult Learning Centre about their experiences with health and health services and asked participants to suggest ways that health services could better support people with low literacy.⁹⁴ Most participants strongly preferred to avoid disclosing their literacy difficulties and they reported experiencing fear of their difficulties becoming apparent, which had led them to have guarded relationships with healthcare staff and avoid querying words they did not understand. Some suggested that healthcare staff needed education about dyslexia and literacy problems. Many advocated the simplification of written information, including signage, appointment information, instructions for taking medicine, and healthcare leaflets. They also suggested that their understanding of clinical information would be much better if health professionals explained things using lay terminology rather than medical terminology and jargon.

The alternative: Universal precautions

To work around cases in which patients with low health literacy avoid self-disclosure and are difficult to identify, healthcare professionals can take a universal precautions approach. This means that the professional assumes that all patients, regardless of their health literacy level, may have difficulty understanding and using health information⁹⁵, just as health practitioners who are exposed to patients' blood or other body fluids assume that any patient may have a blood-borne disease and wear gloves with all patients. Health literacy universal precautions aim to:

- Simplify communication with all patients, and confirm that they have understood what has been communicated to them to minimise the risk of miscommunication
- Make the healthcare system and the office environment easier to navigate
- Support patients' efforts to improve their health.

The universal precautions approach is recommended by the U.S. Agency for Healthcare Research and Quality (AHRQ)⁹⁵, the U.S. Department of Health and Human Services⁴⁵, the New Zealand Medical Association⁹⁶, Health Quality & Safety Commission New Zealand⁹⁷, and the Australian Commission on Safety and Quality in Health Care⁹⁸.

Addressing health literacy in healthcare services by reviewing the patient experience

An approach that may be helpful for healthcare organisations that conduct health literacy reviews involves focusing on the key tasks undertaken by patients and visitors who enter a healthcare facility and identifying the health literacy demands associated with these tasks.

The U.S. publication *The Health Literacy Environment of Hospitals and Health Centers*⁹⁹ contains the *Health Literacy Environment Review*, a series of detailed checklists that can be used to rate a hospital or health centre in the areas of Navigation, Print Communication, Oral Exchange, Technology, and Policies and Protocols. Checklist items include items relating to the phone system, signage (including graphics and maps), the information desk, whether staff offer assistance with paperwork, whether print materials have features that improve comprehension for people with limited literacy (such as a summary of main points, simple everyday words and short sentences, an uncluttered layout, and visuals to reinforce key messages), whether staff use good oral communication practices (such as checking for understanding and avoiding unnecessary medical jargon), and whether there is health literacy training for staff.

A hospital walkthrough, in which observers take a patient's appointment letter and use it to get themselves to the appointment, is one way of finding out how easy it is for patients to navigate a hospital.^{99,100} In Dundee, Scotland, a group of people, including adult learners, students and health workers, walked through Ninewells Hospital and found that the information in the appointment letter was different to the signs at the hospital. The letter used different terms to refer to the same place, for example the letter read "Children's Outpatient Department" while the sign read "Tayside Children's Hospital".¹⁰¹ The group also found that, although volunteers at the hospital were helpful, the directions they offered were too complex.

Further insight into the patient experience can be obtained by shadowing a patient for a day, observing their experiences, listening to what they have to say, and mapping the flow of care.^{98,102} It is usually preferable to choose a shadower who is not familiar with the care experience being shadowed because they are likely to be more open-minded and have fewer preconceptions.¹⁰².

The use of mystery shoppers is another way to gain a better understanding of the consumer experience of health and social care services and identify areas for improvement.^{98,103} A study conducted for the Department of Health in England¹⁰⁴ used mystery shoppers to explore how patients, service users and carers found out about locally available services and about how to access them.

The mystery shoppers carried out enquiries into a region other than the one they lived in by phone and by acting out scenarios, for example: "I am considering moving to [area], and I am trying to find out about local services in advance". The scenarios were developed in discussions with three distinct focus groups consisting of ethnic minority older people, people affected by long term physical conditions (multiple sclerosis and diabetes), and parents of children or young people with autism. The specific types of services sought depended on the condition the shopper was affected by. This study highlighted a number of problems: when messages were left on service provider's answerphones, it was common to not receive a call back; it was common to be passed around within the organisation or between different organisations and general enquiry lines without being referred to individuals and information sources more relevant and potentially helpful to the enquiry; and there were cases where organisations refused to provide information to people who had not been formally referred to the service.

Other key findings included the following.

- Organisations contacted were usually friendly but sometimes unhelpful. Health professionals, who are often responsible for the first diagnosis or are the first port of call for patients seeking help in managing their condition, did not systematically or proactively provide their patients with information about accessing local services.
- There was a lack of coordination between information providers across boundaries: geographical, sectorial and organisational
- There was a lack of effective signposting. While there is plenty of information available, service users often have to dig it out for themselves, and they may not know what it is they need to know.

The authors of this study pointed out that their research participants all had experience of living with long-term health conditions, and were mostly highly motivated, articulate and assertive, and therefore represented the more capable end of the ability range for information-seekers. They stated that people who were new to needing to get service information, or who did not have the same personal skills and qualities, were likely to struggle even more.

The mystery shopper strategy was used in New Zealand in 2001 in the evaluation of the clinical safety of a pilot 24 hour telephone triage service.¹⁰³ Academic GPs developed four scripted clinical scenarios, designed to necessitate a referral to a GP for further investigation, that were used by simulated patients to make telephone calls to the triage service.

Patient navigators

Patient navigators are people trained to help patients overcome individual-level barriers to obtaining healthcare and navigating the healthcare system, especially patients disadvantaged by low health literacy, poverty, belonging to an ethnic or cultural minority, poor English language skills, or lack of social support.¹⁰⁵ The concept originated in the early 1990s in Harlem, New York where patient navigators were introduced as advocates for poor black women with abnormal cancer screening findings.^{106,107} The navigators dealt with barriers to timely care commonly experienced barriers by women, including: financial barriers, such as not having health insurance; communication and information barriers; medical system barriers, such as lost or missed appointments; and fear, distrust and emotional barriers. Navigation increased the proportion of women who had a recommended breast biopsy, and the women who got a biopsy did so more quickly when they had a navigator.

Patient navigators may be community health workers, lay health educators, peer health promoters, cancer survivors, social workers or nurses. The literature on patient navigators is largely related to navigators for cancer patients in the US^{108,109} but there are some studies reporting on patient navigators for other kinds of patients, for example postpartum women¹¹⁰, smokers hoping to quit¹¹¹, patients with chronic kidney disease¹¹², and homeless people with serious mental illness.¹¹³

In their 2008 review, Wells et al.¹⁰⁸ provide a qualitative synthesis of the literature on cancer patient navigation published prior to October 2007. They identified 45 articles, 16 of which provided data on the efficacy of patient navigators in increasing participation in cancer screening and adherence to diagnostic follow-up care after detection of an abnormality. In comparison with control patients, the reported increases in screening ranged from 11% to 17%, and the reported increases in adherence to diagnostic follow-up care from 21% to 29%. There was less evidence that patient navigation was efficacious in reducing either late-stage cancer diagnosis or delays in starting cancer treatment, or improving outcomes during cancer survivorship. Most studies had methodological limitations, such as lack of control groups, small sample sizes, and combining navigation with other intervention components, such as counselling. This review found no evidence regarding the cost-effectiveness of patient navigation.

The 2011 review by Paskett et al.¹⁰⁹ updated the 2008 review by Wells et al.¹⁰⁸. It identified 33 studies published from November 2009 through July 2010, almost all conducted in either the U.S. or Canada. Consistent with the earlier review, this review found some evidence for the efficacy of patient navigation in increasing cancer screening rates. However, there was less recent evidence regarding the benefits of patient navigation in relation to diagnostic follow-up or in the treatment setting. There was still little research focussing on patient navigation during cancer survivorship. Many studies had methodological limitations including small sample sizes and lack of control groups.

One of the key strengths of patient navigators is that they understand the culture and beliefs of the patients they serve.¹¹⁴ In many ways, the Native Patient Navigators for American Indians¹¹⁴ perform similar roles to New Zealand services such as Dunedin Hospital's Māori Health Liaison Service¹¹⁵ or Whānau Ora navigators.¹¹⁶

Patient navigators in New Zealand

The use of patient navigators for cancer patients has been explored in New Zealand. The Ministry of Health funded three pilot projects, which ran from the end of 2008 to June 2010, that were contracted to deliver both patient navigation for cancer patients and community health promotion.^{117,118} The projects aimed to reduce barriers to cancer service access and care for Māori (in Rotorua and Tāmaki, Auckland) and for people living in rural areas (on the West Coast).

The projects' evaluation, based on consultation with more than 2300 stakeholders, reported that the activities of the cancer support services included smoothing patients' transitions through primary/community and secondary health and social services, and facilitating patient and whānau links with healthcare specialists, social service providers, NGOs, PHO based programmes, and community based support services.

Many service users were deeply grateful for the help they received. Service users showed their satisfaction in a number of ways, and some of these contributed to service sustainability, for example volunteering to work with the cancer support team and promoting the service to friends and whānau.

The evaluation compared the project clients who were Māori and/or had high NZDep scores with the proportion who were Māori and/or had high NZDep scores among patients first admitted to hospital with cancer during the pilot project. It was found that relatively more of the project clients were Māori or had high NZDep scores, indicating that the project was fulfilling its aim of reaching the groups most affected by disparities in cancer outcomes. For example, although only 6% of patients first admitted to hospital in the Auckland region in 2008–2010 were Māori, over 62% of the Tāmaki's project's 133 service users were Māori.

Although existing service providers initially exhibited some patch protection behaviours in response to the new service, over time these issues abated and health and social service providers noted benefits including streamlining engagement between services and service users, and time savings because patients' social and emotional needs were being addressed by the cancer support team and because patients were better prepared for appointments.

The evaluation reported that the pilot project did not have a sufficiently rigorous design to permit a direct assessment of whether it contributed to improving overall cancer outcomes for service users or the wider community.

After the end of three year pilot, the West Coast Primary Health organisation decided to continue the patient navigator service and expand it cover other patient groups including patients living with social complexity and other long term conditions such as cardiovascular disease, diabetes and chronic obstructive pulmonary disease.¹¹⁹ This service used lay navigators whose functions were to:

- Provide additional support for patients with long term conditions and family/whānau with complex social needs

- Improve access to healthcare
- Support primary healthcare
- Improve access to social support services
- Enhance health literacy and ability to self-care
- Improve health outcomes and reduce health disparities
- Decrease unplanned emergency department visits and hospital admissions.

The service chose as navigators people with experience working in primary healthcare or the community, or as caregivers, with knowledge of the local community and established networks.

After two years, an evaluation was undertaken with a focus on two key questions: was the target audience being reached; and were general practices and rural clinics feeling supported by the service? The results indicated that most of those referred to the service, 59%, lived in areas of high socioeconomic deprivation. Eleven percent were Māori, 53% were male, and 59% were aged 65 years or more. They generally had three or more chronic conditions, most commonly heart disease, cancer, respiratory disease and diabetes. The leading reasons for referral were transport, access to support services, complex social situations and financial assistance. The survey results indicated that the two main reasons health and social care professionals referred clients to the service were to improve access to services, and for support. Overall, the professionals were highly satisfied with the service, but four of the 13 who responded to the statement “the health navigator keeps me informed of the progress my patient is making” did not agree with the statement. To deal with this issue, a direct emailing system was established to provide referrers with standardised feedback on the allocated navigator and their patient’s progress.

Patient navigators for children

Patient navigation could be of benefit for children, especially those with long-term health conditions. The 2013 review by Raphael et al.¹²⁰ aimed to systematically assess the effectiveness of lay health worker interventions in improving healthcare utilisation, symptom management, and family psychosocial outcomes for children with chronic conditions. The review authors included the term “patient navigator” among their search terms.

The review authors identified 17 studies meeting their criteria. All addressed one of the following four specific conditions: asthma (11 studies), type 1 diabetes (4 studies), obesity (1 study), or failure to thrive (1 study). Most studies targeted minority populations of low socio-economic status. Due to the heterogeneity of the interventions and outcome measures, meta-analysis was not feasible. Several of the interventions were multi-faceted, including both on-on-one and group interactions. The nature of the services provided by the lay health workers varied but all included educational components. Two of the diabetes interventions involved clinic-based ambassadors who tried to improve clinic attendance and follow-up visits to the clinic through phone calls and letters. The most commonly reported positive effects of the interventions were reduced use of urgent care, decreases in symptoms, fewer missed school and work days, and improved parental quality of life. One study showed that lay health worker interventions were cost effective.

The review authors concluded that lay health worker interventions for children with chronic conditions may lead to modest improvements in urgent care use, symptoms, and parental wellbeing, and may also be cost-effective. In their discussion, the authors stated that, overall, the evidence suggested that the use of lay health workers may be an important strategy for improving care, and warrants further study. They noted that although patient navigation, as provided to adults with cancer, includes components grounded in self-efficacy and social support theories similar to lay health worker interventions, it also incorporates practical assistance to improve desired outcomes. A patient navigator might, for example, organise child care for a parent’s other children and transport to the clinic. They suggested that patient navigation may represent a new model for lay health worker intervention for children in the future.

A 2010 Cochrane review assessed the evidence on the effects of lay health worker (LHW) interventions in primary and community care on maternal and child health and the management of infectious diseases. In many of the studies, LHWs worked among low-income or minority populations in high-income countries, or in low-income countries. Meta-analyses were undertaken for four groups of broadly similar studies. In regard to maternal and child health outcomes, these indicated that there was moderate quality evidence for the effectiveness of LHWs in promoting childhood immunisation uptake and breastfeeding (initiation of, any and exclusive), in comparison to usual care. There was also low quality evidence that, compared to usual care, LHWs may reduce child morbidity, and child and neonatal mortality, and increase the likelihood of seeking care for childhood illness. For other maternal and child health issues, the evidence was insufficient to draw

conclusions about the effectiveness of LHWs, or to make it possible to identify specific LHW training or intervention strategies likely to be most effective.

The Ophelia approach: Addressing health literacy and health inequity through partnering with consumers

Working in partnership with communities and healthcare consumers to develop services and information resources can help to both build people's health literacy and reduce the health literacy demands of obtaining healthcare.¹²¹

The Ophelia (OPTimising HEalth LIterAcY) Victoria project is a collaboration between higher education researchers at Deakin and Monash Universities, the Victorian Department of Health, and nine health service sites across Victoria.^{121,122} The overall aim of the project was to develop and test a structured approach that organisations can use to enhance equitable engagement of consumers in health and healthcare. The guiding principles were: Outcomes focused, Equity driven, Needs diagnosis, Co-design, Driven by local wisdom, Sustainable, Responsive and Systematically applied.

The Ophelia approach includes three key phases. Phase 1 involves conducting a health literacy assessment on a representative cross section of people associated with a service or sector. The results of this assessment are then presented to stakeholders to stimulate discussion and idea generation for strengthening services and practises. In Phase 2, local stakeholders decide on priorities for action and plan and develop interventions that have potential to respond to local health literacy needs or improve information or service access. In Phase 3, continuous Plan-Do-Study-Act quality improvement cycles are used to implement, refine and evaluate the interventions.

A new health literacy measurement tool, the Health Literacy Questionnaire (HLQ), was developed for the project.⁷⁸ The HLQ is designed to capture and measure all aspects of the concept of health literacy. It comprises nine separate scales, each describing a different aspect of health literacy. People's scores on each scale reflect both their personal level of health literacy and their experiences attempting to engage with health information and health services. The nine scales are: 1) Feeling understood and supported by healthcare providers; 2) Having sufficient information to manage my health; 3) Actively managing my health; 4) Social support for health; 5) Appraisal of health information; 6) Ability to actively engage with healthcare providers; 7) Navigating the healthcare system; 8) Ability to find good health information; and 9) Understanding health information well enough to know what to do.

Eight organisations (one of which operated on two sites) were recruited into the project after expressions of interest were sought from service organisations providing Home and Community Care (HACC) services, Hospital Admission Risk Programs (HARP) or community nursing and other chronic disease services.¹²² Each site was required to establish their own project team to lead activities and liaise with the academic research team. Most organisations developed interventions that targeted older clients with chronic conditions. They focussed on improving clients' health through mechanisms such as enhancing the ability of clients or community members to self-manage their health, understand health information, or engage more effectively with healthcare providers.

The researchers identified four distinct intervention pathways across the study sites:

- Providing clinicians with skills training and resources to support them to respond to a range of health literacy strengths and limitations when working to build clients' capacity to self-manage their long term conditions (3 sites)
- Using community volunteers to act as mentors thus building community members' capacity to achieve better health outcomes (2 sites)
- Providing clients with resources or targeted training to improve their health literacy (3 sites)
- Redesigning existing service procedures to improve access to services for people with different health literacy strengths and limitations.

Organisations undertook a variety of evaluation activities including pre-post HLQ scales, interviews and focus groups. All used a quasi-experimental (pre-post) design with five of the nine sites using a mixed methods approach. Across the nine sites, 228 clients (range 5–70 at each site) and 22 volunteers (range 8–14) participated in evaluation activities (813 clients completed an initial HLQ). Forty-two staff (range 4–10) involved in intervention delivery were also interviewed. Qualitative data indicated small, but positive, impacts for clients, volunteers and clinicians. Seven sites also undertook quantitative analysis. Effect sizes for individual HLQ scales were nil/minimal in two sites, moderate in two sites, and moderate to large in one site, although none

were statistically significant due to small numbers of participants. The study authors noted that their study is one of very few studies that have shown improvement in any standardised health literacy measure.

The Ophelia project demonstrates a process that can be applied by a wide range of stakeholders and organisations to develop fit-for-purpose health literacy interventions that improve outcomes at a number of levels: organisational processes, staff knowledge and skills, community engagement and client outcomes and equity.

Conclusions

In a modern society, the level of health literacy required to take optimal care of their own and their children's health is beyond the capabilities of many people. People with low health literacy tend to be people who are disadvantaged in other ways: by lack of education, poverty, and membership of ethnic minority groups. Nevertheless, anyone can experience low health literacy, especially under the stress resulting from illness in themselves or a family member.

Everyone working in the health system needs to be aware of this and strive to make it easier for people to manage their own health and to navigate the health system. Making it easier requires action at multiple levels: at the health system level, at the health services level, and at the health professional level. It requires improvements in health information, communication, informed decision making, and access to health services. Partnering with healthcare consumers is essential for understanding the patient perspective and making health services more user friendly.

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X. FACTORS THAT INFLUENCE EQUITY OF ORAL HEALTH IN NEW ZEALAND AND WHAT WE CAN WE DO ABOUT THEM

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Oral health, quality of life, and social determinants of health

Dental caries and quality of life

Dental caries has been identified by the New Zealand (NZ) Ministry of Health (MoH) as the country's most prevalent chronic disease.¹ Dental diseases of the oral cavity include, but are not limited to, dental caries, developmental defects of enamel and/or dentine, dental erosion and periodontal disease.² Dental caries and periodontal disease are largely preventable and are currently considered significant global health burdens.^{2,3}

Dental caries involves the pathological destruction of tooth tissue by acids produced by cariogenic bacteria, and the progression of this disease can lead to pain, difficulty with eating, sleeping, and concentrating.² Dental caries is multifactorial, with contributing factors including not only the presence and number of cariogenic pathogens or dental anomalies, but also modifiable factors such as diet, poor oral hygiene, and drug and alcohol abuse. Periodontal diseases affect the gingival tissues (gums) and surrounding tooth-supporting structures, and are a major cause of tooth loss. Periodontal pathogens are primarily responsible for the presence of this disease, with a number of modifiable factors shown to contribute to its severity and progression.^{2,4} Many of the modifiable risk factors for both dental caries and periodontal disease are also implicated in other chronic diseases such as diabetes, heart disease, and obesity, and they are also inextricably linked to socio-economic deprivation.⁵⁻⁷

Children are born without the bacteria that cause tooth decay; these are likely to be acquired from direct transfer via the saliva of their primary caregiver. If a primary caregiver has high amounts of untreated dental caries, then there is a much greater risk of cariogenic bacteria being passed to their child's oral cavity, therefore placing them at greater risk of developing dental caries from an earlier age.^{8,9} Horizontal transmission of cariogenic bacteria between kindergarten children has also been demonstrated, and although the transmission rates are low, measures to disrupt this chain of infection from child to child are needed.¹⁰

Poor oral health impacts directly on many aspects of life, including nutrition, education, mental and physical well-being, and it has been directly linked to poor general health.^{2,3,11,12} Untreated dental caries can result in pain, acute and chronic infection. The appearance of untreated dental caries or lost teeth due to caries can be unsightly, resulting in stigmatisation, embarrassment, and low self-esteem. Both dental caries and periodontal disease cause halitosis (bad breath), impacting negatively on social and personal interactions, and potentially hindering employment opportunities.²

In 2016, the FDI World Dental Federation re-defined oral health as...

"... multi-faceted and includes the ability to speak, smile, smell, taste, touch, chew, swallow and convey a range of emotions through facial expressions with confidence and without pain, discomfort and disease of the craniofacial complex. Further attributes include that it is a fundamental component of health and physical and mental wellbeing. It exists along a continuum influenced by the values and attitudes of individuals and communities; [it] reflects the physiologic, social, and psychological attributes that are essential to quality of life; [it] is influenced by the individual's changing experiences, perceptions, expectations and ability to adapt to circumstances".⁷

This new definition was designed to reflect a move away from the traditional bio-medical model of oral health towards embracing a broader bio-psychosocial model that considers both the impact of oral health on quality of life, and wider social determinants of health.⁷

Social determinants of health

Social determinants of health are the conditions that individuals have been born into, and are known to impact on their health and wellbeing. They include social class, income, educational opportunities, and the political environment.¹³⁻¹⁶ Socio-economic gradients in oral health are evident from a young age, and these gradients have been shown to widen in adulthood.^{14,17,18} To improve oral health inequities, it is necessary to address these social determinants of health in order to create a society where every child has an equal opportunity for good health, quality of life, success and wellbeing, regardless of what background they were born into.⁷

Deprivation and oral health

In New Zealand, government-funded dental care for adults (i.e. beyond the age of 18 years) is limited to emergency care only.¹⁹⁻²¹ For low- to middle-income adults, the costs of accessing necessary treatment is the most-reported barrier for not seeking dental care, with many reporting a sense of inevitability towards poor oral health.¹ The reality for many low socio-economic families is that dental treatment will no longer be free when their children turn 18 years of age, hence attending a dental clinic is likely to be unaffordable. There are often low oral health expectations within families, with generations having lost their teeth at a young age. Many such families accept this as 'the norm', with the possibility of retaining their teeth often considered an unattainable goal.²²

Dental caries in early childhood has been found to be a predictor of poor long-term oral health.^{23,24} The need for ongoing dental treatment as a child can lead to anxiety, fear, and avoidance of dental care as an adult.⁶ Many young children with high restorative needs may require treatment under general anaesthesia, and long waiting lists can result in an increase in hospital presentations for emergency interim care.²⁵

Ethnicity and oral health

In many countries, indigenous groups have experienced colonisation, discrimination, and marginalisation, resulting in poorer health outcomes, including mental and oral health.¹⁷

Discrimination towards ethnic minority groups is associated with poor mental health, including anxiety, depression, substance abuse, psychological distress and a poorer perception of their own health.^{17,26} There can also be a lack of confidence in an individual's ability to maintain general health, as well as good oral health, with a subsequent avoidance of many health care services.²⁶

A recent study by Jamieson et.al (2016) found that indigenous people across Australia, New Zealand and Canada were more likely to have untreated dental caries or extractions, and less likely to have had restorative treatment. This study highlighted that not only do indigenous populations have a disproportionately greater burden of oral disease, but also were less likely to have received appropriate treatment.¹⁷

In New Zealand, a disproportionate number of Māori experience poor oral and general health; however, this has not always been the case.^{13,26,27} In 1924, the Department of Health reported that European children had, on average, twice as many filled teeth as Māori children; but by the mid 1930s, this gap had closed, and the oral health status of Māori was declining.¹³ It is thought that one contributing factor of this change in oral health status, was that European colonisation resulted in the gradual change from a traditional to a more westernised diet.¹³

Health services in New Zealand were originally developed by non-Māori, and implemented a bio-medical model of health service delivery, with a primary focus on treatment of disease rather than maintaining the overall wellbeing of the person or their extended family.²⁶ Many traditions and practices that were valued by Māori were not considered under this system. Māori have a strong sense of whānau (family group), and the support of family members is considered as important as the treatment of the patient. This lack of consultation or consideration of the customs of Māori has led to a general distrust of health care services.¹⁷ As a result, many Māori avoided accessing services where they felt they may not be treated with the proper respect.¹⁷ The avoidance of health and oral health services resulted in a view that Māori did not care for their children or were irresponsible, and thus were often treated as such.¹³

For many Māori, poor oral health, pain, and subsequent tooth loss is considered inevitable.²⁶ While there is currently free dental care for children in New Zealand, many feel that once children attain the age of 18, treatment will be unaffordable; therefore, a belief exists that treatment only delays the inevitable. Having teeth removed if required can sometimes be considered kinder than going through treatment, and prevents the need for treatment later in life. There is also a perception by many that baby teeth are not important because they are going to fall out anyway.^{26,28}

Mental health and oral health

Anxiety, depression and addictions are all mental health disorders that can result from stressful experiences.²⁹ The symptoms of these conditions include reduced capacity to function, loss of motivation and low self-worth.^{13,15} People who are socially-disadvantaged, and from ethnic minority backgrounds, are more likely to suffer from poor mental health due to a greater exposure to unfavourable circumstances, and having less support mechanisms in place.^{29,30} Low security employment, and employment with low rewards have been shown to significantly affect a person's sense of worth and subsequent mental health.²⁹ The mental health of parents has been found to be a predictor of health outcomes for children, resulting in an inter-generational transfer of inequities. The risk, however, can be reduced by having good social and emotional support available to families who are struggling.²⁹ The Global Burden of Disease project has found that major depression is a leading cause of years lived with disability world-wide, with anxiety ranked 6th for women, and 11th for men.²⁹

Addiction and substance abuse can deprive families of their ability to function normally and provide the basic necessities of life, such as food, healthcare and a supportive family environment.³⁰ Good mental health is essential for health and wellbeing, and this includes oral health.²⁹

The 2016, the NZ Drug Harm Index reported approximately 388,000 illicit drug users in NZ, with 29,900 being recorded as dependent on these drugs.³⁰ Harm to the community included an increase in crime to fund drug habits, increase in unpredictable and sometimes violent behaviour, and increased suffering of friends and family of someone with a drug addiction. In 2014, the total cost to the community of illicit drug use in NZ was estimated at \$892.7 million, with \$437 million being attributed to harm to family and friends.³⁰

When children are born into homes with a member suffering mental health issues including anxiety, depression and addictions, there are multiple issues the family need to manage. Oral health can be a low priority as they struggle with the daily routine of functioning in society.²⁹

New Zealand oral health inequalities

The World Health Organization (WHO) defines health inequities as:

“...avoidable inequalities in health between groups of people within countries and between countries. These inequities arise from inequalities within and between societies. Social and economic conditions and their effects on people's lives determine their risk of illness and the actions taken to prevent them becoming ill or treat illness when it occurs”.³

Inequalities in oral health status within NZ are well-documented, with children and adults in areas of high deprivation and within ethnic minority groups are known to carry a significantly greater burden of disease.^{1,19,21}

The 2015/2016 New Zealand Health Survey identified that, after adjusting for age, sex and ethnic differences, adults living in the most socioeconomically-deprived areas were nearly twice as likely to only visit a dental clinic if they were experiencing dental problems when compared to adults in the least-deprived areas. Māori and Pasifika adults and adults living in the most-deprived neighbourhoods had poorer access to oral health services, and this was represented by poorer oral health outcomes, with 8% having had teeth removed in the past 12 months, compared with 6% of Māori and Pasifika adults in the least-deprived areas.³¹ This outcome was similar for children living in the most-deprived areas.³¹

Child and adolescent oral health in New Zealand

Data collection

NZ caries statistics are collected by Community Oral Health Service (COHS) dental therapists, after each child's first completed course of treatment at 5 years-of-age, and at the end of their last completed treatment in Year 8 (approximately 12-13 years of age). In NZ, it is usual for children to start school at the age of five, therefore this was an age where the majority of children could be accounted for. Year 8 is the last year that children are funded under the School Dental Service (SDS)/COHS agreement, as they are transferred to the Adolescent Oral Health Service scheme in year 9.

Year 8 data document the number of permanent teeth affected by dental decay in the mouth prior to children commencing secondary school. This is the age where many children can expect their deciduous teeth to exfoliate and permanent teeth to erupt; so, with the exception of the first permanent molars which erupt at six years of age, the permanent dentition is often newly erupted or not yet present.³² The caries-specific information collected is the number of 'decayed, missing or filled primary teeth (dmft) or permanent teeth (DMFT).³³

Oral health data

In 2013, the Ministry of Health (MoH) reported the mean dmft for 5-year-old children in NZ was 1.9. The District Health Board (DHB) with the highest mean dmft was Northland at 3.6, with only 34.2% of children having caries-free primary dentition. The lowest mean dmft was seen in the Southern DHB at 1.3; this area encompasses Otago and Southland, with 63% of children exhibiting caries-free primary dentition. For Year 8 data, the average DMFT for NZ was 1.1. The DHB reporting the highest mean DMFT was again Northland at 1.8, with only 45% of 12-13-year-old children being caries-free in the permanent dentition. Capital and Coast DHB had the lowest mean DMFT at 0.7, with 65.7% of children showing caries-free permanent dentition. Boys have been reported as having worse oral health outcomes than girls in both the primary and permanent dentition.^{1,34,35}

According to the 2009 New Zealand Oral Health Survey (NZOHS), approximately 50% of children aged between 2 and 17 years had experienced dental caries, and yet one in five had not visited a dental professional in the previous 12 months.¹ These statistics were similar to the key findings of the subsequent 2012/2013 NZ health survey, which also reported that one in four children (21%) in the 1-14 year age group had not seen a dental health professional in the previous 12 months.³⁴ Seven percent of children and adolescents had experienced toothache in the previous 12 months.¹, and, according to the NZ health survey, 30,000 New Zealand children (4%) had teeth removed due to dental caries, oral infection or gum disease in the previous 12 months.³⁴

In 2010, MoH dmft/DMFT data showed the percentage of Year 8 children who were caries-free was 53.3%, with a mean DMFT of 1.23. However, Māori children had worse oral health overall with only 40.9% having a caries-free mouth, and a mean DMFT of 1.89. These figures were similar for Pacific children with 42.9 % being caries-free and a mean DMFT of 1.67. By 2015, whilst the percentage of caries-free children had increased for all groups, the ethnic and socio-economic disparities remained.

Māori and Pacific children and adolescents have been identified as less likely to have visited a dental professional in the last 12 months than non-Māori and non-Pacific children and adolescents. Māori and Pacific children also had a significantly lower mean number of sound primary teeth than non-Māori, and were over twice as likely to have untreated dental caries in both their primary and permanent dentitions.¹ Children living in the most-deprived areas were almost six times as likely have had one or more primary tooth extractions due to caries than those children living in more privileged neighbourhoods.¹ Pacific children and adolescents were the least likely to have a caries-free dentition in their permanent teeth, and this was statistically significant.¹ Pacific children were also over twice as likely to have experienced pain in their teeth in the previous 12 months than non-Pacific children, and have higher rates of hospital admissions for dental issues compared with other ethnic groups.^{1,36}

Social disadvantage

Adolescents who live in areas of high deprivation are less likely to be able to access dental care, more likely to live crowded homes, less likely to have breakfast, and more likely to be concerned about not having enough money for food.³⁵ According to the 2012 Youth '12 survey investigating the health and wellbeing of NZ secondary school children, over one third of Pacific youth reported someone sleeping in a garage or a living room.³⁷ In the year prior to completing the survey, 15% could not access dental care when required.³⁷

Māori are more likely to be socially and economically disadvantaged than non-Māori, with one in four reporting income levels in the lowest quintile, and living in areas of high socioeconomic deprivation.²⁸ Children born into low income families are more likely to leave school without formal qualifications, and subsequently are more likely to have low-income jobs, or be unemployed. Since 2009, Māori unemployment has risen to 14% compared to the total population which has only risen to 6.6%.²⁸ In June 2010, Māori adolescents aged between 15 and 24 years of age had unemployment rates of 30%.²⁸ This is particularly significant, as free dental care is no longer available after the age of 18.

Many Pacific peoples are generally more socially-disadvantaged with regard to education, income and housing, and this results in poorer general health and oral health outcomes.^{38,39} When looking at severe hardship, 27% of Pacific People living in NZ meet the criteria compared to 8% of the total population, with Pacific unemployment rates nearly twice the national unemployment rate.³⁹ Pacific people are more likely to live in overcrowded homes, and reside in neighbourhoods of high deprivation.^{37,39} Positive improvements and progress have been made in recent years, however, with an increased desire to achieve in education, and positive changes in sexual behaviours, substance abuse, and driving habits.³⁷ Pacific youth have reported improved life satisfaction, and while they felt they were less likely to get enough time with parents compared to their European counterparts, their families were more likely to have more quality time together.³⁷

Diet and nutrition

According to the New Zealand Health Survey 2015/2016, after adjusting for age and sex differences, Māori and Pacific children were less likely to eat breakfast at home each day than non-Māori and non-Pacific children.³¹ Seventy percent of children living in the most socioeconomically-deprived areas were less likely to eat breakfast compared to 90% of the children living in the least deprived areas. Seventeen percent of all children had consumed at least three fizzy (soft) drinks in the past week compared to 23% of Māori children and 31% of Pacific children. Children living in the most socioeconomically-deprived areas were 3.5 times more likely to have consumed at least three fizzy drinks in the past week than children living in the least deprived areas. Overall, 8% of children had eaten fast food at least three times in the last week, compared to 14% of children living in the most deprived areas, 17% Pacific children and 12% for Māori children.³¹ Pacific youth stated their parents worry about not having enough food, and their nutrition was recorded as unhealthy with high rates of obesity.³⁷

Tooth-brushing

It is recommended that children and adults brush their teeth twice a day with a toothpaste fluoridated at 1000 ppm.⁴⁰ According to the 2009 National Oral Health Survey, 63.5% of NZ children and adolescents brush their teeth at least twice a day; however, only 43% used a fluoride toothpaste of 1000 ppm or greater.¹ This may be due to the availability of 500-ppm toothpastes, and these being marketed as suitable for pre-school children, or due to a personal preference for toothpaste without fluoride. Boys were less likely than girls to brush their teeth twice a day, and Māori were less likely to brush at least twice a day compared to non-Māori. Children and adolescents living in the most deprived neighbourhoods were only about two-thirds as likely as those living in the least deprived neighbourhoods to brush their teeth at least twice a day.¹

Fluoride

Historically, children who live in fluoridated areas have been shown to have better oral health outcomes than those who do not, although inequalities still existed for Pacific and Māori children. According to the latest MoH 2016 data, dmft and caries-free status for all children residing in fluoridated areas compared to non-fluoridated areas were similar at age five, with a mean dmft of 1.8 for both groups, and the percentage of caries-free children at 59.8 and 59.6 respectively.⁴¹ Fluoride data is unable to be adjusted for socio-economic status thereby limiting its use. When adjusting for ethnicity, however, a difference between fluoridated and non-fluoridated areas is apparent. Māori children residing in fluoridated areas had a lower mean dmft than those in non-fluoridated areas at 2.53 (44.1% caries-free) and 3.68 (38.6% caries-free) respectively. A similar difference was observed for Pacific children residing in fluoridated compared with non-fluoridated areas, with a mean dmft of 3.41 (34.6% caries-free) and 3.68 (32.6% caries-free).⁴¹

Year 8 MOH 2016 data showed that NZ children living in a fluoridated area had a mean DMFT of 0.8 (64.3% caries-free), compared with children residing in non-fluoridated areas who had an overall mean DMFT of 0.97 (60.6% caries-free). Māori children residing in a fluoridated areas had mean DMFT of 1.11 (55.5% caries-free). In non-fluoridated areas, 48.7% of Māori children were caries-free with a mean DMFT of 1.6. For Pacific children/adolescents living in fluoridated areas, 50.9% were caries-free with a mean DMFT of 1.25 ; in non-fluoridated 45.3% were caries-free with a mean DMFT 1.6 (same as for the Māori children) Again there was a greater negative impact on Pacific and Māori children.⁴¹ For Pacific and Māori children living in non-fluoridated areas, the percentage who were caries-free was less for than for the total number of children; however, only 601 Pacific children lived in non-fluoridated areas and this may have skewed the result.

Self-rated oral health

Just over 60% of NZ adolescents rated their oral health as excellent or very good, and over 70% of children aged 2 between 14 years felt their wellbeing was not affected by their oral health status.³⁵ Māori children were 1.4 times as likely to have reported fair or poor oral health for their self-rated oral health compared to non-Māori.³⁵

Emergency care and general anaesthesia

Many children in NZ are routinely treated successfully for dental caries by dental and oral health therapists in the COHS with or without the use of local anaesthesia (LA). There are, however, children who are unable to cope with dental treatment. This may be due to the child being very young, having high treatment requirements or severe oral infection, or suffering from dental anxiety. These children are often referred to hospital dental departments which are able to provide restorative treatment under general anaesthesia (GA).²⁵

In 2008, Lingard and colleagues prepared a report for the NZ Society of Hospital and Community Dentistry (NZSHCD) on the provision of dental care for children under GA.²⁵ This report disclosed that, once referrals were received, waiting lists for assessment were up to 8 months depending on the region in which the child

resided, with the wait for treatment taking up to 12 months. This delay in receiving much-needed dental treatment contributed to an advanced progression of disease with ongoing intermittent pain and suffering for the child, and the requirement for more complex treatment or extractions. An initiative by the MoH in the late 2000s aimed to address waiting times for GA, and this has resulted in a reduction of waiting times.²⁵ Lingard further reported that in NZ, approximately 5,000 children were treated under GA for dental caries annually. The MoH now estimates this to be over 7,700 for the 0 to 14 year age group in 2016. Treatment under GA is not without its health risks and comes at a significant cost to the public healthcare system.²⁵

In 2014, Whyman et al. reported that in the 20-year period between 1990-2009, the national rate of preventable dental hospital admissions in NZ had increased nearly four-fold from 0.76 per 1000 to 3 per 1000.⁴² The rate of admission was highest in children aged 3-4 years, those living in areas of high deprivation, and Māori and Pacific people. The majority of those presenting with dental disease had complications arising from dental caries.⁴²

In 2016 nine in every 100 New Zealand 5–14-year-olds were hospitalised for dental conditions. Hospitalisation was usually only required when a child needed dental treatment under general anaesthesia, commonly but not always for tooth extraction.⁴³ Early childhood tooth decay is known as one of the most sensitive markers of economic stress on households.⁴³

Emotional wellbeing of adolescents

Overall, 92% of students reported feeling okay, satisfied or very happy with their life (94% of males and 90% of females).³⁵ This contradicts the finding deliberate self-harm was fairly common, with 29% of female and 18% of male students reporting deliberately self-harming themselves in the last 12 months. Six percent of the females and 2% male students had made a suicide attempt in last 12 months with 29% females and 10% males having serious thought about suicide.³⁵

Fifty-seven percent of students reported trying alcohol, and of these, 8% reported drinking alcohol weekly or more, and 23% had engaged in binge-drinking in the last four weeks. Current student drinkers described experiencing negative consequences such as unsafe sex, unwanted sex and injuries, and 11% had been advised by friends and family to reduce their drinking. Eleven percent of students questioned were smoking and, of these, 5 percent reported smoking weekly or more.³⁵

New Zealand oral health services for children and adolescents

New Zealand children and adolescents are able to access government funded free dental care until the age of 18, with the exception of orthodontic treatment which is not subsidised.

Community Oral Health Service (COHS)

Until recently, preschool, primary and intermediate-aged children in New Zealand accessed free dental care through the School Dental Service (SDS). This was a school-based service, with dental clinics in many public schools throughout NZ.⁴⁴ Dental therapists who worked in these school-based clinics provided dental education, prevention and treatment for a range of oral health conditions.

In 2006, the New Zealand Ministry of Health released its strategic vision for oral health in NZ ‘Good Oral Health for All for Life’.⁴⁵ It had become apparent that the outdated buildings and equipment used within the SDS were no longer meeting the requirements of modern dentistry. Increased caseloads, the changing expectations of parents, and more complex treatment options had resulted in growing arrearsⁱ and increased pressure on dental therapists employed within the service. Nationally, the decline in caries prevalence appeared to have come to an end, with growing inequalities for Māori and Pacific children and those living in areas of high deprivation.^{18,24,45} A nationwide change in service delivery and an upgrade of facilities was subsequently undertaken, with school-based clinics being progressively decommissioned and replaced with a new community-based hub-and-spoke system that was renamed the Community Oral Health Service (COHS).⁴⁵ While publicly-funded services have played an important role in improving dental health for children in NZ, the indirect costs and psychological barriers associated with accessing care for many families still exist.^{12,45,46} With the COHS, high demand for publicly-funded services in some areas of New Zealand often results in recall delays for many high-risk children. This is apparent in areas of greatest deprivation, where multiple treatment needs place a heavy burden on services.²⁵

ⁱ Arrears are defined as the percentage of enrolled children overdue for their scheduled examinations with the Community Oral Health Service

Combined Dental Agreement (CDA)

Adolescents from Year 9 (13-14 years of age) until their 18th birthday can enrol with a contracted private dentist and receive free dental care under the Adolescent Oral Health Service (AOHS) Combined Dental Agreement. Whilst the Community Oral Health Service provides enrolment information at the end of Year 8, adolescents can enrol directly with a contracted dentist.

Continuity of care for adolescents is problematic, as once children leave the COHS system, many do not seek enrolment with a contracting dentist. An investigation into the barriers of uptake of free adolescent dental care was undertaken by Nelson Marlborough District Health Board (NMDHB) in 2007/2008. Although no single factor was found to explain an adolescent's non-use of the dental service, a number of factors impacted to varying degrees, including the level of parent/caregiver education, gender, living situation (partnership or single) and ethnicity. Between 2007 and 2017, the percentage of adolescents using DHB-funded regular dental services increased from 59% to 71.4% (196,129 adolescents used these services in the year to December 2017).

Accident Compensation Corporation (ACC)

Dental treatment needed due to injury or accident is funded for all people in New Zealand and managed through the ACC. Dental practitioners may part charge for dental services provided under this contract.

Privately-funded dental care

Parents of children and adolescents can elect to have private dental treatment from a registered dental profession or dental specialist.

'Health promotion' and assumptions

Historically, oral health professionals have had a bio-medical focus on disease prevention, with health education often focusing on personal responsibility for health, and the need to maintain a healthy lifestyle that promotes good health and wellbeing. These oral health messages included information such as 'brush twice a day with a fluoridated toothpaste, avoid foods with sugar, have healthy snacks, floss, attend regular dental check-ups, and, if treatment is required, turn up to appointments'. These messages come from scientifically-sound sources, and those individuals who are able to embrace and make the necessary lifestyle changes often see positive results, with a measurable increase in good health and wellbeing. However, when patients continue to ignore professional advice, and present with increasingly worse oral health burden, many oral health professionals become increasingly frustrated. This can lead to patients being labelled as unintelligent, irresponsible or even negligent.¹³ This perspective however, overlooks the underlying complexities of a person's life, the reasons why they cannot make the changes that seem on the surface (to those of privilege) to be the easy, sensible and responsible choices.^{15,18}

Eat less sugar!

Currently in NZ, there is more awareness of the need for a healthy diet and to reduce sugar intake. This is because sugar has been found to be a key cause of dental caries, obesity, and obesity-related illnesses.^{47,48} For those living in areas of high deprivation however, this is not always possible. Healthy foods, such as dairy products, fruit, vegetables, and meat, are increasingly unaffordable to many low-income NZ families.^{37,48} Whilst dairy products have been shown to be beneficial for oral health, for many children, cheese and yoghurt remain a luxury, and not a staple part of their diets. Conversely, foods that have a lower nutritional value, such as carbonated drinks, sweets, crisps, and fish and chips appear affordable and are easily accessible. As a result, many individuals, including children from low income families are becoming obese, with diet-related illnesses and consequently poor oral health.^{47,48}

In 2005, a study by Wilson et al. investigated the marketing of fat and sugar to children on NZ television. They found that the majority of foods advertised on mainstream television channels were high in fat and/or sugar, with 70% of food-related advertisements being classified as "counter to improved nutrition".⁴⁷

For many families, being able to treat their children with nice things is a way to show love. For those in a more secure financial situation, this can be through buying branded clothing, dining at expensive restaurants, or going away on family holidays. Those with less money, however, are often not in a position to be able to reward, or show love to their children in this way. Lollies and sweet drinks are cheap, enjoyed by most children, and often a convenient way to reward their children.

Many schools offer canteens, with cheap foods low in nutrition and high in sugar or fat available on hand for children to purchase. Common food for sale includes pies, biscuits, sweets and soft drinks, which are popular choices for children who have become accustomed to, and enjoy, these food options.⁴⁹ For many families, it is an easier and cheaper alternative to going to the supermarket and purchasing healthy foods that are often expensive, and which may be wasted if not eaten. Unhealthy food choices are often considered 'nicer' by many children and there is peer pressure to be seen consuming these foods. This can result in the acquisition of unhealthy foods and drinks being seen as a status symbol by peer groups, with water and sandwiches being seen as not socially acceptable.^{49,50}

The availability of cheap, low-nutrition foods and drinks high in sugar and/or fat has been associated with a significant increase in the consumption of these foods. Children who use such canteens are less likely to consume the recommended servings of fruit and vegetables per day, and more likely to make unhealthy choices where healthy foods are available.^{49,51} In 2012, the Youth '12 survey of the health and wellbeing of NZ secondary school children identified that only 54% of NZ students in the study reported regularly having breakfast, and 39% of students usually purchased their lunch from shops or cafeterias.³⁵

Unfortunately, for schools in the most deprived areas, if families are struggling to afford foods high in nutrition, or if they do not have the skills or resources to prepare healthy lunches, then some children have no lunch at all if they do not receive support from school. Recently, a news item on the difference in school lunches between a Decile 1 vs a Decile 10 school in Auckland reported that in an unidentified Decile 10 school, all 19 children had eaten breakfast that morning, all had a nutritious lunch, and only four did not have fruit. Conversely, in an unidentified Decile 1 school, over half of the 26 children in the class had no lunch at all, and of those that did, many had only a biscuit or packet of chips. Only four out of 26 had a nutritious lunch, and only two had fruit.⁵²

Brush twice a day!

An assumption is often made that basic oral health messages, such as 'brush twice a day', 'use a fluoridated toothpaste' and 'use dental floss', are simple and that there is no excuse why this cannot be done. The availability of homecare preventive products is determined by income, and for those on a low income, paying the bills and/or feeding the family may be regarded as a higher priority than ensuring everyone in the household has a toothbrush or other homecare preventive products.¹⁴ There are many children in NZ who do not have a toothbrush, or toothpaste, and recent data from the NZ Ministry of Health identified that many children are sharing toothbrushes.⁴³

It's quite simple... just turn up to appointments!

The School Dental Service (SDS) was re-orientated in 2009 and evolved to become the Community Oral Health Service.⁴⁵ The introduction of modern, upgraded community-based clinics and mobile dental units replaced the older school-based clinics. This has resulted in both positive and negative outcomes for children.⁵³ Under the SDS, many children could access their dental treatment from their school-based clinical services. Parents were not required to attend their child's appointment unless they wished to. On the other hand, parents are now required to attend their child's dental appointments at COHS hubs or mobile clinics. This enables them to be more involved in their children's oral health care, allowing for treatment plans to be fully explained and oral health education to be provided.^{45,53} However, for many parents, it may be difficult to take time off work for to attend such appointments, and because it is often those on lower incomes who have a greater burden of disease, the number of appointments they need to attend with their children is often greater than those children from middle- to high-income families.^{19,21}

Transport has also been identified as a barrier. Many families may not have a personal vehicle, therefore to attend a clinic, they may need to walk or use public transport to get to appointments, and when there are multiple appointments, this can be time-consuming and inconvenient.¹³ If children are not complaining of pain, it may be seen as a burden to attend multiple appointments. In addition, if children are not coping with treatment, attending appointment can be distressing for both parent and child, and many may choose to avoid appointments.

Many of those who are most deprived, thus bearing the greatest burden of disease, are often transient, making it difficult for health workers to contact them to ensure that they are receiving the care that they need.²¹

Dental decay has modifiable risk factors, and parents may feel they are being blamed for their children's oral health.¹³ This can result in avoidance of the clinic, particularly if they have been reprimanded by the oral health professional in the past. Being advised that they give their children too many lollies, that they should not give them sweet drinks, or need to turn up to appointments, are common messages given to parents, and often lead to

a feeling of shame and subsequent avoidance of the clinic. If parents themselves had high treatment needs as children, they may be fearful of the dental environment, and would choose not to put their children through the same ordeal.

When dental treatment has been avoided, by the time the child is in pain (and thereby parents have no option but to seek help), the child may already have extensive dental treatment needs that are more complicated. If the children are unable to cope with treatment in the clinic, a referral can be made for treatment under general anaesthesia. The waiting list for this care ranges from 6 months to 2 years depending on where they reside in NZ.²⁵

Prevention

Water fluoridation

Fluoride works both systemically and topically to prevent and repair early carious lesions. The MoH promotes the addition of fluoride to drinking water and recommends that the fluoride content should be maintained in the range of 0.7 to 1.0mg/L for oral health reasons. The Code of Practice for Fluoridation of Drinking-water Supplies in New Zealand (2014) specifies the optimum fluoride levels, design standards and fluoridation monitoring requirements.⁵⁴

The Health (Fluoridation of Drinking Water) Amendment Bill has progressed to its second reading. A change recommended by this bill is to give DHBs the power to direct which water supplies should be fluoridated. DHB's mandated to "improve, promote and protect the health of people and communities and to reduce health outcome disparities between various population groups".⁵⁵ The rationale to remove the decision to fluoridate or not fluoridate water supplies from local authorities, was because although responsible for providing local infrastructure and water supplies, they are not experts in health.⁵⁵

Health promotion initiatives

The WHO Ottawa Charter for health promotion has developed five action areas that are necessary for reducing inequalities.⁵⁶ These action areas include implementing healthy public policy, creating supportive environments, strengthening community action, developing personal skills and reorienting health services towards prevention of illness and promotion of health. There have been many interventions initiated by government agencies, private businesses, and charitable groups within New Zealand, aimed at improving health and reducing inequities.

Nutrition labels on foods

Nutrition labels on foods have enabled consumers to assess the nutritional value of the food that they are purchasing. While this has helped many to make educated decisions regarding food choices, a study by Signal et al. (2008) found that Māori, Pacific and low-income New Zealanders rarely used these nutrition labels to assist them with their choices. One reason cited was the difficulty in interpreting the information on the labels, and the time needed to try and understand the information, and another was the number of low-cost foods that did not have nutrition labels. This has led the authors to conclude that the current labels are not meeting the needs of those at risk in our society.⁵⁷

Heart Foundation Tick

In 1991, the New Zealand Heart Foundation produced national recommendations for the consumption of sugar and fat, to promote good health.⁵⁸ A Heart Foundation 'Tick' was placed on many food and drink items that contained less than 10 grams of fat and/or sugar. To be included in this scheme, companies were required to pay a fee to have their products assessed for suitability.⁵⁸ This led to some concerns that companies were able to 'buy' their 'Tick' status, potentially creating a conflict of interest when considering foods to recommend. Despite this, the system was easy for all to understand, and the programme has been credited with encouraging food production companies to lower their fat, salt and sugar content, and make consumers more aware of what they are purchasing. The Heart Foundation has advised that they are no longer accepting new foods into this programme, and that the programme will be discontinued in December 2018.⁵⁹

Adolescent oral health service enrolment

Utilisation of adolescent oral health services data is available from the MoH website, although attendance, caries-free status and DMFT data is not. In 2011, the average utilisation of adolescent oral health services across DHBs was 71.6%, with figures ranging from 59.4% in Northland to 91.4% in South Canterbury.⁶⁰ In 2007-

2008, the Nelson Marlborough DHB conducted a study to identify parental barriers to uptake of free adolescent dental care for Year 11 students in the Nelson/Tasman region. Parental education, gender and ethnicity was found to be a determinant of adolescent dental attendance.⁶¹ The Nelson Marlborough DHB established an enrolment initiative aimed at improving the enrolment and attendance of young people at free adolescent oral health services, and developing environments that are supportive of good oral health. This programme involved liaison with enrolled adolescent dental providers, and distribution of enrolment packs to all Year 8 students through various means, such as secondary schools, youth agencies and Work and Income NZ (WINZ), following up with all parents who did not complete and return enrolment forms. A Freephone telephone number was promoted, and health promotions were developed collaboratively with secondary school health co-ordinators.⁶¹ Similar programmes have been developed in other DHBs and are adapted to suit the services available in their areas.⁶¹ Recent data to determine the success of these interventions are not currently available on the MoH website, although according to 2011 data, DHBs were reporting an increase in adolescent oral health service utilisation.⁶⁰

Health-promoting schools

The purpose of Health-Promoting Schools (HPS) is to "...improve equity, whānau wellbeing, and educational outcomes through evidence-informed practice".⁶² This approach is different to health promotion (HP) in schools, as HPS is a community led development, while HP in schools is driven by a health provider.⁶³ In the 1980s, the World Health Organization recognised the capacity of schools to provide a healthy environment for children, and subsequently developed the health promoting schools initiative. This initiative adopted the principles of the Ottawa charter for health promotion and considered the greater determinants of health, including physical, mental, emotional, social and spiritual wellbeing.⁶⁴ In 1997, this approach was trialled in Auckland and Northland schools, and subsequently expanded nationwide. By 2009, 67% of New Zealand schools had chosen to be included in this programme, which is linked to 'Healthy Families', and supported by contractors of the Ministry of Health, such as DHBs and public health units. A 2015 Cochrane collaboration systemic review and meta-analysis on HPSs found positive average intervention effects when looking at body mass index (BMI), physical activity, physical fitness, fruit and vegetable intake, tobacco use, and being bullied.⁶⁵

HPS cover many areas of health, including food and nutrition, physical activity, whānau engagement and agency, student achievement, student engagement and agency, mental health, body care and physical safety, physical health, student attendance, student wellbeing, positive behaviours for learning, puberty and community engagement.⁶³ A 2016 evaluation of HPS identified that 61% of school community respondents felt there had been an increase in knowledge and awareness, 36% reported new practices that had an impact, and 33% felt there had been a shift in attitudes. Investigators now recommend focusing on long term shifts in behaviour and practice.⁶³ In 2015, there were fifty 'Equity' workshops nationwide for school communities. These workshops were found to be very effective, with 73% of attendees identifying an action area to address inequities within their school community. However, these workshops needed to be promoted more effectively to increase awareness, as only 4 out of 10 schools were aware of them.⁶³ Seventy-one percent of respondents reported recommending HPS to others, and having an active HPS facilitator that works closely with the school was identified as an important key to continued motivation and commitment to implementing and improving the health and wellbeing of their school.⁶³

Tooth-brushing and topical fluoride interventions

Many DHBs have been implementing tooth-brushing, behaviour intervention, and topical fluoride programmes in schools to try and prevent and/or remineralise carious lesions. Due to a previous lack of evaluation in New Zealand HP projects, it is unclear how effective these preventive programmes have been.

A 2003 Cochrane collaboration systematic review on the effect of primary school-based behaviour interventions identified 1518 possible studies worldwide; however, only four were sufficiently relevant and of significant quality to be included in the review. One study reported a reduction in dental caries for children who received a behaviour intervention, and three studies reported improved dental plaque control. The authors of the review concluded that more high-quality research was needed to confirm these findings.⁶⁶

In 2016, another Cochrane collaboration systematic review investigated the use of fluoride mouth rinses for preventing dental caries in children and adolescents.⁶⁷ Thirty-seven trials were included, and all had provided a supervised fluoride-containing mouth rinse intervention in a school setting. This review found a significant reduction in dental caries increment for the permanent dentition.⁶⁷

A review on maternal fluoride supplementation during pregnancy showed no evidence that fluoride supplements were effective in preventing dental caries in their children.⁶⁸

The “Fruit in Schools” programme

The “Fruit in Schools” programme is funded by the NZ Ministry of Health, and managed by the fresh produce company ‘United Fresh’. The initiative was in response to the 2002 Child Nutrition Survey, where it was reported that only 43% of NZ school children consumed the recommended two pieces of fruit per day.⁶⁹ Decile 1 and Decile 2 primary and intermediate schools in NZ are eligible for this programme, which provides a piece of fresh produce every day for each child in the school. As of 2008, approximately 470 schools across NZ were involved.⁷⁰ An evaluation of this programme in 2015 found that, for many of these low-decile schools, principals had reported that children coming to school hungry or with little (if any lunch) had been a significant issue for them. As a result of the ‘Fruit in Schools’ initiative, 85% of principals felt their school had fewer hungry children, and 80% reported that children were more willing to ask for food if they were hungry.⁷¹ Increased concentration by children during classes was reported by 74% of principals and that this was contributing to improved learning, reduced behavioural problems, and improved attendance.⁷¹ All principals who had participated in the programme felt that the ‘Fruit in Schools’ programme had increased awareness among staff and students of the importance of healthy eating, resulting in a positive attitude towards eating fruit and vegetables for pupils.⁷¹

Milk in schools

‘Milk in schools’ is an initiative aimed at increasing nutrition and dairy products for children. From 1937 until 1967, milk was supplied to the majority of NZ primary school children. However, due to the lack of adequate refrigeration, this initiative was received with mixed acceptance by school children, especially those who did not like drinking warm milk.⁷² This scheme was revived by Fonterra in 2013 following a successful trial in Northland in 2012. Currently, 70% of NZ primary schools are participating in this programme, with approximately 10,500 farmers contributing to the Fonterra milk for schools annually.⁷³ Calcium and phosphate has been identified as beneficial for both bone and tooth health, and a study by Massey University recently reported significantly improved bone health when comparing children who attended a school who participated in the milk in schools programme, compared to those who did not.⁷⁴ While milk naturally contains lactose, a sugar that is moderately cariogenic, milk also contains factors which are anti-cariogenic, such as calcium and phosphate; therefore, milk without added sugars is effectively non-cariogenic.⁷⁵ The calcium and phosphate content of dairy products is protective, and dental preventive products have been developed that contain casein phosphor peptide-amorphous calcium phosphate (CPP-ACP), e.g. ‘Tooth Mousse’.^{76,77}

KickStart Breakfast Club

In 2009, Fonterra partnered with Sanitarium to provide Weet-bix™ and milk to all NZ schools regardless of decile rating. The aim of this intervention was to ensure every NZ school child had access to a nutritious breakfast. The programme initially provided breakfast for two days per week; however, in 2013 the NZ government provided funding to the programme which enabled breakfast to be provided to the school children every day. There are currently over 900 schools that offer the KickStart Breakfast Club, with participating schools reporting that children have more energy, are consuming less junk food at morning teatime, and are better able to concentrate during lessons.⁷⁸

Kids Can

Kids Can is a charitable trust that was set up in 2005 to help reduce inequities in learning for disadvantaged NZ children, ensuring equal opportunity for health and education, with the aim of breaking the cycle of poverty.⁷⁹ The Trust identified that many children did not have suitable wet weather clothing or shoes, resulting in problems with attendance, and many were going to school hungry. Two programmes were introduced in 2006, ‘Raincoats for Kids’, and ‘Food for Kids’. A third programme, ‘Shoes for Kids’, was implemented in 2007.⁷⁹ The Kids Can Trust currently supports children from 700 low-decile schools across NZ, and are careful to ensure that products are distributed in a way that does not cause stigmatisation for the recipients. An independent review by Massey University in 2010 found that schools varied in how the food was made available to children, with some providing children with complete meals, and others only topping up school lunches.⁷⁹ Most schools indicated that they were following up with families of children who frequently required food, and making referrals to support services where appropriate.⁷⁹

Recommendations

Water Fluoridation

Regulate fluoride levels in NZ water supplies according to MoH recommendations of between 0.7 and 1.00mg/L.

Learn from other successful interventions

One health behaviour that has been successfully modified through adopting the recommendations of the Ottawa Charter is smoking. The Smokefree Environment Act of 1990 was devised to regulate smoke-free areas, marketing and advertising of tobacco products.⁸⁰ According to the 2012/2013 Tobacco Use Health Survey, in 1996/1997, 25% of the adult population reported being current smokers, and by 2012/2013 this rate had dropped to 18%, equating to a reduction of around 600,000 people.⁸¹ Much can be learned from anti-smoking initiatives, with particular acknowledgment of the need for change at a policy level.^{80,82} There has also been an increase in taxation on tobacco-based products, and a commitment by the NZ Government to have a smoke free NZ by 2025.

Create healthy public policy and supportive environments

To encourage the creation of supportive environments, an upstream approach that looks at building a healthy public policy is imperative. Legislation that makes the healthy choice the easy, affordable and natural choice is needed to reduce inequities not only in oral health, but also many other health conditions with modifiable risk factors, such as heart disease, obesity and mental health.⁸³

There is a need for a nationwide change in public policy that aims to make healthy foods affordable for all New Zealanders, regardless of socio-economic status. Instigating a tax on unhealthy foods, and using the revenue to subsidise healthy foods would help make the healthy choice the affordable choice. The World Health Organization has recommended taxation on sugar sweetened beverages to reduce consumption and reduce dental caries.ⁱⁱ

Many DHBs are now leading by example, and creating healthy policies that limit the sale of soft drinks in hospitals, with Nelson Marlborough being the first DHB to also extend this to include artificially-sweetened beverages, smoothies and juices.⁸⁴

Many facilities that provide care for children, such as schools, child-care centres and holiday programmes, are also introducing general healthy food policies that promote a healthy environment for the children in their care. Policies that restrict what can be sold in school canteens can encourage healthy choices by having healthy alternatives that are appealing and affordable.⁴⁹

Many schools have healthy food policies that restrict what is allowed in school lunches, and promote that drink bottles should contain only water. The aim being to establish an environment whereby eating healthy foods become the norm, where no one is allowed to eat junk food at school, and therefore the healthy choice becomes the only choice.⁴⁹ At present, however, the creation of, and adherence to, such policies by these facilities is voluntary. For those facilities who do not promote and create healthy food policies in schools, it usually takes public pressure from within the communities or a 'champion of the cause' to effect change.⁸⁵ An upstream approach from the NZ Government would ensure consistency in practice, ensuring that regardless of what school or care facility a child attends, they will have equal access to an environment that promotes health and wellbeing.

Empower through positive health education and promotion

Reassess the delivery of one-on-one health education in a clinical setting, to encourage positive reinforcement, and create a welcoming and non-judgemental environment. Focus on finding areas that families are doing well, and deliver information in a way that educates, but does not blame or dictate. Provide additional training to staff on positive communication and effective delivery of health information.

Aim to provide education to groups, as messages can be received by large numbers of people at once, and are less likely to be taken personally. Participate in local and national events such as 'World Oral Health Day', and the 'International Science Festival'.

ⁱⁱ World Health Organization. 2017. Sugars and dental caries. Geneva: World Health Organization. http://www.who.int/oral_health/publications/sugars-dental-caries-keyfacts/en/

Create innovative approaches to delivering information. Include fun activities, encourage participation, and create a new and exciting profile for oral health. The University of Otago, Faculty of Dentistry currently has two interactive and fun programmes for children; the “Dental Detectives” programme, and the ‘Otago Participatory Science Platform’ initiative “Sugar in your diet Kino Te Pai”.⁸⁶ Both programmes provide interactive activities for children, including (but not limited to) pH testing, placing fissure sealants on plastic tooth models, taking impressions and making animal tooth models, working with mirrors, and tooth identification. The science preparatory platform initiative is currently being evaluated with results due in 2018.⁸⁶

The modifiable risk factors and social determinants of health that affect oral health, are often the same or similar for many other areas of health. Consider ‘joining forces’ with other health professionals when formulating health promotion activities, sharing resources and staff time. Work with HPS to ensure that oral health is seen and considered as part of overall health.

There is a need to increase the profile of oral health and create positive health messages that highlight the benefits of good oral health in relation to general health and quality of life. Increase fun and informative advertising on healthy choices that benefit the public in a wide range of health conditions that include oral health. Television advertising could be considered as a joint initiative that includes various health professions, thereby limiting costs to an individual discipline.

Treat the whole family

It is important to address the oral health of the whole family rather than just individual members. However, this is not routinely funded in NZ. It is well-known that poor oral health status of the mother, and poor self-rated oral health, is associated with the subsequent oral health status of the child.¹⁸ While the COHS has helped minimise equity disparities, these inequalities are seen to widen again once dental care is no longer free.⁸⁷ Therefore, there is a need to not only look after the child, but also the whole family.

Māori recommend embracing a ‘Whānau Ora’ approach, which advocates an oral health service that provides and cares for all members of the family, regardless of age. The reorientation of the SDS to the COHS in 2009 was seen by Māori as a missed opportunity to incorporate such a system.⁵³

Māori identified the need for a health system that has a high focus on disease prevention across many integrated health professions and sectors, caring for all family members, not just those who are under 18.⁸⁸ The health and wellbeing of extended whānau is considered vital to ensure the health and well-being of the child. Many areas of NZ now have Māori Oral Health services that are interlinked with mainstream health services. These services are designed to meet the needs of Māori and embrace a Whānau Ora approach, with Māori beliefs and values being the primary focus.^{13,26,88} The system focuses on services being accessible to all, including those living in rural areas.⁸⁸ These services receive additional funding to provide oral health care to parents and caregivers.⁸⁸ Whilst much of the literature on Māori oral health research focuses predominantly on the negative effects of poor oral health, and how this affects Māori, there is also a need for research that examines the positive effects of improved oral health, for example, investigating and publishing the benefits of the Whānau Ora approach (Taskforce on Whānau-centred Initiatives 2010).

Identify healthy food choices

There is a window of opportunity for a new Ministry of Health-led system that enables all people to easily identify healthy food choices to be formulated and initiated prior to the end of the ‘Heart Foundation Tick’ programme. Ultimately, a collaborative multi-disciplinary working party that can create nationwide guidelines that consider many modifiable diseases impacted by poor diet would be helpful, and result in an overarching trustworthy guideline for the public. An easily-recognisable image, analogous to the Heart Foundation’s ‘Tick’, would be an easy way for the whole population to identify which foods are healthier. This could also be a way of identifying which foods should be subsidised, and which ones are not conducive to health (i.e. those possibly targeted for taxation). This same multi-disciplinary working party could also look at other initiatives, such as warning labels for foods that contain more than the recommended amount of sugar and fat, and pictures that depict poor health, such as the ones used on packaging of tobacco products.

Work collaboratively

Since 2013, DHBs have been required to detail and record their health promotion interactions with schools. The purpose of this is to (i) enable these interactions to be documented, (ii) assess how well the HPS service is being delivered, and (iii) identify areas for improvement.⁶³ However, oral health has not been included in this

requirement, and this omission will lead to the segregation and isolation of oral health from general health. Oral health reflects general health - it is the window for body health.

Children who experience the greatest oral health burdens are often represented disproportionately in other areas of health as well. It is important to identify these families, as they will often be known to different support services. At a DHB level, multi-disciplinary teams, including oral health workers, school principals, public health nurses, social workers, Pasifika and Māori community leaders could help to identify and work with those most in need. Plans can then be put in place to support those who are not coping, and identify how to best ensure that these children and their families receive the support that they need.

DHB's could consider conducting verifiable Continued Professional Development (CPD) sessions than involves Inter-professional Education (IPE), with professionals from various areas of health all sharing information on the health and wellbeing of children.⁸⁹ Increased knowledge can result in increased confidence to then provide health information that is not directly in a health professional's field of expertise. In Otago and Southland, some general practice nurses are already offering oral health advice to families, and many indicated that, if appropriate training and resources were available, they would be happy to provide this.⁹⁰

Support community initiatives

There is a need to support communities who wish to build a sense of community and promote health and wellbeing. These include many projects such as community gardens, events, and focused community groups. Many initiatives need to be community-led for them to be effective. Finding a champion within the community that is passionate about the cause is a way that change can come from within. Work with communities, to help them to achieve their goals and feel empowered to make their own changes. Provide information as required, but allow communities to formulate initiatives that they feel will work best for their people.

Evaluate existing public health initiatives

Data is collected for many existing health promotion programmes, however there is a need for this data to be analysed and results subsequently published, to enable effective evaluation of various interventions in NZ. Publishing results can provide quality evidence to inform the direction for future health promotion programmes.

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XI. ORAL HEALTH

Dental disease is a major public health issue and dental caries is the most widespread non-communicable disease worldwide.¹ Poor oral health affects a child's growth, development, performance at school, and quality of life.^{2,3} Concerted effort is required to achieve 'Good oral health for all, for life' and this needs to start in the early years.⁴

This section presents data on oral health of five-year olds in New Zealand from the Community Oral Health Service and National Minimum Dataset (NMDS). Good oral health is indicated by a higher prevalence of being caries-free, and by a lower mean number of decayed, filled, or missing teeth. Hospitalisation rates for dental services is an indicator of the need for and access to treatment for severe cases of dental caries.

Data sources and methods

Indicator(s)

Proportion of 5-year-olds who were caries-free

Numerator: Number of 5-year-olds whose deciduous teeth were caries-free on completion of treatment with an oral health service

Denominator: Total number of 5-year-olds examined in the year

Data source: Community Oral Health Service (COHS) published by the Ministry of Health

Mean number of decayed, missing or filled teeth (dmft) at age 5 years

Numerator: Number of 5-year-olds with deciduous teeth that are decayed, missing (due to caries) or filled on completion of treatment

Denominator: Total number of 5-year-olds examined in the year

Data source: Community Oral Health Service (COHS) published by the Ministry of Health

Hospitalisations for dental caries in 1–4 year olds

Numerator: Hospitalisations of 1–4 year olds with a primary diagnosis of dental caries

Numerator source: National Minimum Dataset (NMDS)

Denominator: Number of usually resident children aged 0–4 years

Denominator source: StatsNZ estimated resident population (ERP; with linear extrapolation between Census years)

Additional information

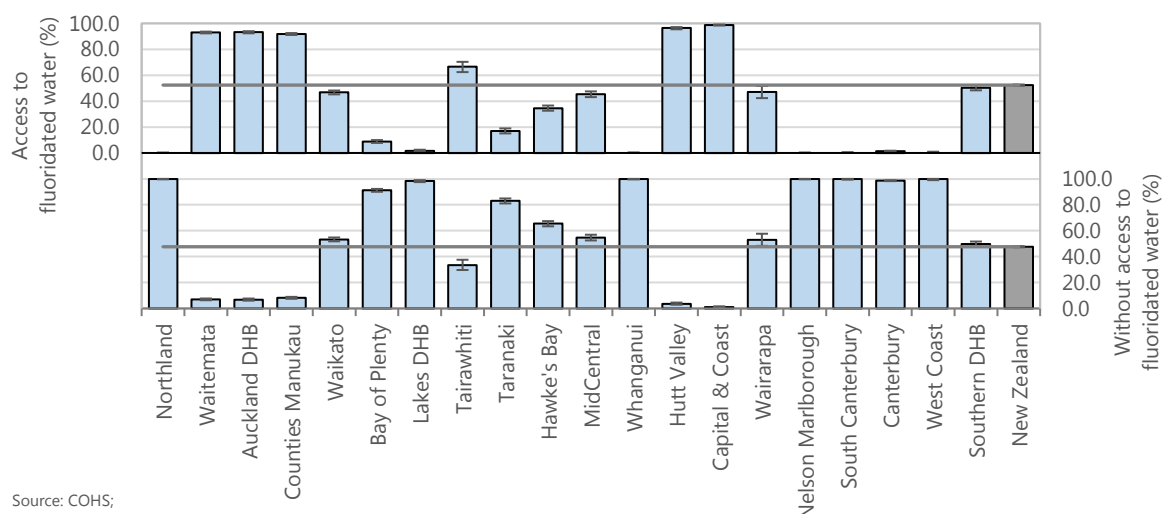
Community Oral Health Service (COHS): Fluoridation status is classified by the fluoridation status of the water at the school the child attends, or in the case of home schooling the child's residential address.⁵

Community oral health status

Fluoridation status refers to the attended school's water supply, rather than the residential area in which the children live.⁵ Figure XI-1 and Table XI-1 present the proportion of the five-year-olds examined during 2015 by community oral health services (COHS) and whether or not they had access to fluoridated water.

In New Zealand, around 52.3% of examined five-year-olds had access to fluoridated water. The proportion of children with access to fluoridated water was highest in Waitemata, Auckland, Counties Manukau, Tairāwhiti, Hutt Valley, and Capital & Coast DHBs. The proportion of children without access to fluoridated water was highest in Northland, Bay of Plenty, Lakes, Taranaki, Hawke's Bay, Whanganui, Nelson Marlborough, South Canterbury, Canterbury, and West Coast DHBs.

Figure XI-1 Proportion of five-year-olds with access to fluoridated water, by district health board 2015



Source: COHS;
5-year-olds examined with or without access to fluoridated water in 2015

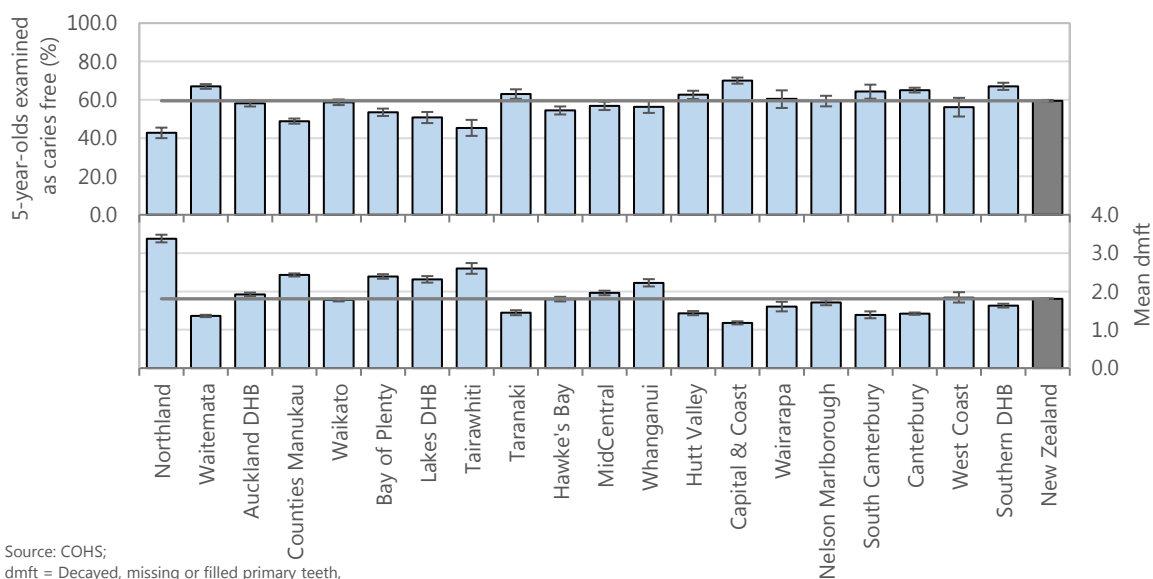
Table XI-1 Proportion of 5-year-olds examined with or without access to fluoridated water, by DHB, 2015

DHB	Access to fluoridated water (%)	Without access to fluoridated water (%)
5-year-olds examined by oral health services in 2015		
Northland	0.00	100.00
Waitemata	93.01	6.99
Auckland	93.20	6.80
Counties Manukau	91.82	8.18
Waikato	46.71	53.29
Bay of Plenty	8.78	91.22
Lakes	1.58	98.42
Tairāwhiti	66.48	33.52
Taranaki	16.94	83.06
Hawke's Bay	34.57	65.43
MidCentral	45.30	54.70
Whanganui	0.00	100.00
Hutt Valley	96.38	3.62
Capital & Coast	98.82	1.18
Wairarapa	46.99	53.01
Nelson Marlborough	0.00	100.00
South Canterbury	0.00	100.00
Canterbury	1.39	98.61
West Coast	0.00	100.00
Southern	50.33	49.67
New Zealand	52.38	47.62

Source: COHS

Figure XI-2 and Table XI-2 present the proportion caries-free or mean dmft (decayed, missing, or filled primary teeth) among five-year-olds examined in 2015 for New Zealand and each district health board. Nationally, the proportion of five-year-olds who were examined as caries-free was 59.5%, while the mean number of those examined as having decayed, missing, or filled teeth was 1.81. The proportion of five-year olds who were caries-free was significantly higher than the national proportion in Waitemata, Taranaki, Capital & Coast, South Canterbury, Canterbury, and Southern DHB, while these DHBs also had lower mean dmft for five-year-olds when compared to the national mean. The proportion of five-year olds who were caries-free was significantly lower than the national proportion in the Northland, Counties Manukau, Bay of Plenty, Lakes, Tairāwhiti, and Hawkes Bay DHBs.

Figure XI-2 Proportion caries-free or mean dmft among 5-year-olds, by district health board, 2015



Source: COHS;
 dmft = Decayed, missing or filled primary teeth,
 5-year-olds examined by community oral health services with access to fluoridated water in 2015

Table XI-2 Proportion caries-free or mean dmft (decayed, missing or filled teeth) among five-year-olds, by district health board 2015

DHB	5-year-olds examined (n)	Caries-free		Mean dmft
		n	%	
5-year-olds examined by oral health services				
Northland	1,248	533	42.7	3.38
Waitemata	5,623	3,764	66.9	1.36
Auckland	3,748	2,177	58.1	1.92
Counties Manukau	5,345	2,612	48.9	2.43
Waikato	4,318	2,535	58.7	1.78
Bay of Plenty	2,562	1,370	53.5	2.39
Lakes	1,139	578	50.7	2.31
Tairāwhiti	543	246	45.3	2.60
Taranaki	1,452	915	63.0	1.44
Hawke's Bay	2,175	1,184	54.4	1.80
MidCentral	1,956	1,112	56.9	1.96
Whanganui	992	558	56.3	2.22
Hutt Valley	1,932	1,209	62.6	1.43
Capital & Coast	3,129	2,191	70.0	1.18
Wairarapa	432	261	60.4	1.60
Nelson Marlborough	1,213	720	59.4	1.71
South Canterbury	653	420	64.3	1.39
Canterbury	5,669	3,688	65.1	1.42
West Coast	395	222	56.2	1.84
Southern	2,424	1,625	67.0	1.63
New Zealand	46,948	27,920	59.5	1.81

Source: COHS

The proportion of caries-free or mean dmft for five-year-olds with access and without access to fluoridated water are presented in Table XI-3 and Table XI-4. Nationally, the caries-free rate was similar between children with and without access to fluoridated water; 59.9% of the five-year-olds with access to fluoridated water were caries-free, while 59% of children without access to fluoridated water were caries-free. Capital & Coast and Southern DHBs had the highest proportion of five-year olds with access to fluoridated water who were caries-free (Table XI-3). Waitemata and Capital & Coast DHBs had the lowest mean dmft in five-year olds without access to fluoridated water (Table XI-4).

Table XI-3 Proportion caries-free or mean dmft (decayed, missing or filled teeth) among 5-year-olds with fluoridated water, by district health board 2015

DHB	5-year-olds examined (n)	Caries-free		Mean dmft
		n	%	
5-year-olds with access to fluoridated water				
Northland	0	0	0.0	0.00
Waitemata	5,230	3,490	66.7	1.36
Auckland	3,493	2,045	58.5	1.92
Counties Manukau	4,908	2,333	47.5	2.51
Waikato	2,017	1,104	54.7	1.97
Bay of Plenty	225	120	53.3	2.24
Lakes	18	7	38.9	2.33
Tairāwhiti	361	175	48.5	2.22
Taranaki	246	138	56.1	1.67
Hawke's Bay	752	434	57.7	1.74
MidCentral	886	531	59.9	1.52
Whanganui	0	0	0.0	0.00
Hutt Valley	1,862	1,164	62.5	1.44
Capital & Coast	3,092	2,166	70.1	1.18
Wairarapa	203	120	59.1	1.74
Nelson Marlborough	0	0	0.0	0.00
South Canterbury	0	0	0.0	0.00
Canterbury	79	41	51.9	1.56
West Coast	0	0	0.0	0.00
Southern	1,220	861	70.6	1.55
New Zealand	24,592	14,729	59.9	1.76

Source: COHS

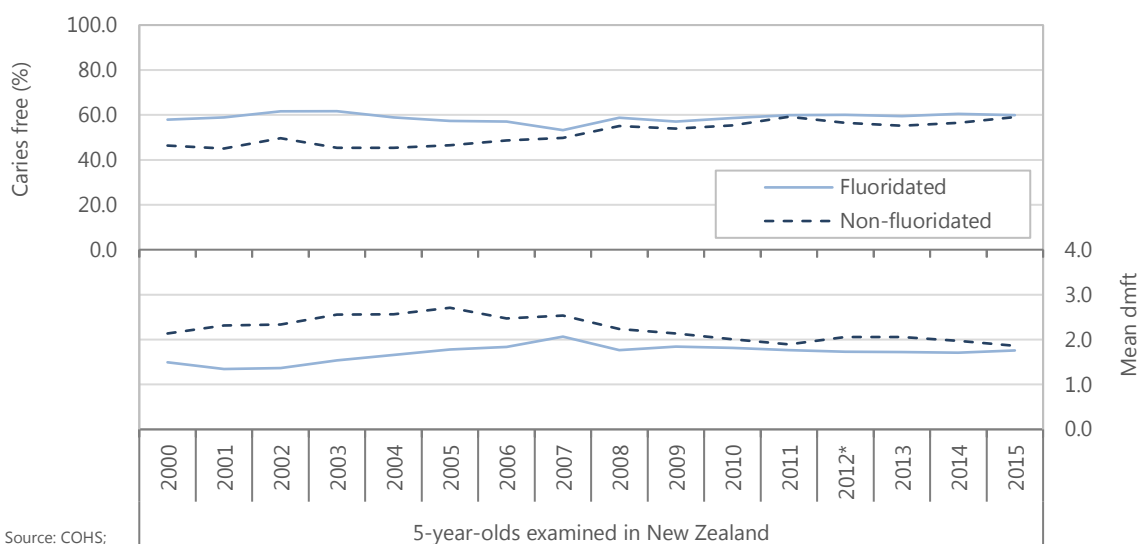
Table XI-4 Proportion caries-free or mean dmft (decayed, missing or filled teeth) among 5-year-olds without fluoridated water, by district health board 2015

DHB	5-year-olds examined (n)	Caries-free		Mean dmft
		n	%	
5-year-olds without access to fluoridated water				
Northland	1,248	533	42.7	3.38
Waitemata	393	274	69.7	1.31
Auckland	255	132	51.8	2.01
Counties Manukau	437	279	63.8	1.54
Waikato	2,301	1,431	62.2	1.62
Bay of Plenty	2,337	1,250	53.5	2.40
Lakes	1,121	571	50.9	2.31
Tairāwhiti	182	71	39.0	3.34
Taranaki	1,206	777	64.4	1.40
Hawke's Bay	1,423	750	52.7	1.83
MidCentral	1,070	581	54.3	2.32
Whanganui	992	558	56.3	2.22
Hutt Valley	70	45	64.3	1.14
Capital & Coast	37	25	67.6	1.16
Wairarapa	229	141	61.6	1.48
Nelson Marlborough	1,213	720	59.4	1.71
South Canterbury	653	420	64.3	1.39
Canterbury	5,590	3,647	65.2	1.42
West Coast	395	222	56.2	1.84
Southern	1,204	764	63.5	1.72
New Zealand	22,356	13,191	59.0	1.86

Source: COHS

Figure XI-3 presents the trends for five-year-olds, with and without access to fluoridated water, by the proportion caries-free and mean dmft. Since 2000, the proportion of caries-free five-year-olds has increased marginally for five-year-olds without fluoridated water access, while the proportion for five-year-olds with access has remained relatively stable. The mean dmft has marginally decreased for children with and without access to fluoridated water since 2007. In recent years, there has been little difference in the proportion of caries-free five-year-olds by status of fluoridated water access. Similarly, there has been little difference in the mean dmft by status of fluoridated water access (Figure XI-3).

Figure XI-3 Proportion of caries-free five-year-olds and mean dmft of five-year-olds with and without access to fluoridated water, New Zealand 2000–2015



Source: COHS;
*2012 - excludes Southern DHB

The proportions of five-year-olds examined as caries-free are presented for each ethnic group in Figure XI-4 and Table XI-5. A higher proportion of five-year-olds in the Other ethnic group were caries-free in New Zealand, compared with Māori or Pacific ethnic groups. When compared to the Pacific group, a higher proportion of five-year-olds in the Māori ethnic group were caries-free, although by a small margin.

At present, the Community Oral Health Service does not report information on deprivation.

Figure XI-4 Proportion of five-year-olds caries-free, by ethnicity, New Zealand 2015



Source: COHS;
Ethnicity is prioritised ethnicity,
*Other (includes Pacific children in the other DHBs that are not the seven 'official' Pacific DHBs)

Table XI-5 Proportion caries-free or mean dmft (decayed, missing or filled teeth) among five-year-olds, by ethnicity, New Zealand 2015

DHB	5-year-olds examined (n)	Caries-free	Proportion caries-free (%)	Mean dmft
5-year-olds examined by oral health services in 2015				
Māori	10,211	4,008	39.3	2.92
Pacific	4,007	1,309	32.7	3.55
Other*	32,730	22,603	69.1	1.25

Source: COHS; Ethnicity is prioritised ethnicity. *Other (includes Pacific children in the other DHBs that are not the seven 'official' Pacific DHBs)

Dental hospitalisations

The New Zealand Health Survey 2014/2015 found that 1.0% (95% CI: 0.5–1.7) of 1–4 year olds had had teeth removed due to decay, an abscess, infection or gum disease in the preceding 12 months. This proportion was consistent with the two preceding health surveys.⁶

Table XI-6 presents the hospitalisation rate of 1–4 year olds in 2011–2015 where the primary diagnosis was a dental condition. Nationally, dental caries was the leading reason for oral-health-related hospitalisations of 1–4 year olds.

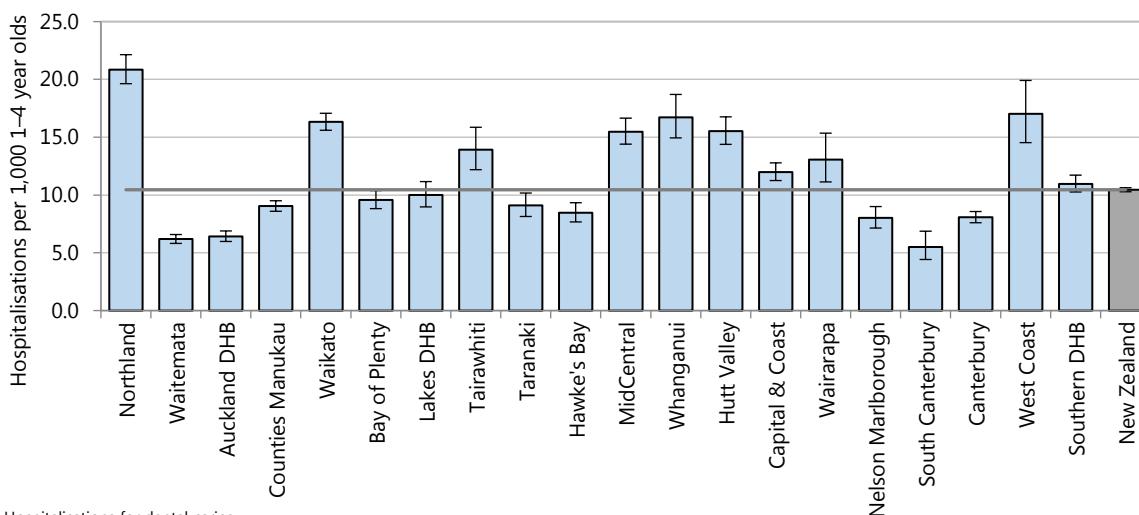
Table XI-6 Hospitalisations of 1–4 year olds for dental conditions, by primary diagnosis, New Zealand 2011–2015

Primary diagnosis	2011–2015 (n)	Annual average	Rate	%
Hospitalisations for dental conditions in 1–4 year olds				
New Zealand				
Dental caries	13,122	2,624.4	10.45	86.0
Diseases of the pulp/periapical tissue	1,631	326.2	1.30	10.7
Disorders of tooth development/eruption	220	44.0	0.18	1.4
Other disorders of the teeth or supporting structures	136	27.2	0.11	0.9
Gingivitis/periodontal diseases	71	14.2	0.06	0.5
Dentofacial anomalies/malocclusion	43	8.6	0.03	0.3
Other diseases of the teeth hard tissue	26	5.2	0.02	0.2
Other disorders of the gingiva/edentulous alveolar ridge	11	2.2	0.01	0.1
Embedded/impacted teeth	5	1.0	0.00	0.0
Total	15,265	3,053.0	12.16	100.0

Numerator: NMDS, Denominator: StatsNZ ERP; Rates are per 1,000 1–4 year olds, Suppressed applied for small numbers

In Lakes and Southern DHBs, the rates of hospitalisation for dental caries among 1–4 year olds were similar to the national rate. The lowest dental caries hospitalisation rates were in Waitemata, Auckland, and South Canterbury DHBs, while Northland DHB had the highest dental caries hospitalisation rate (Figure XI-5, Table XI-7).

Figure XI-5 Hospitalisations of 1–4 year olds for dental caries, by district health board vs New Zealand 2011–2015



Hospitalisations for dental caries
 Numerator: NMDS,
 Denominator: StatsNZ ERP

Table XI-7 Hospitalisations of 1–4 year olds for dental caries, by district health board, New Zealand 2011–2015

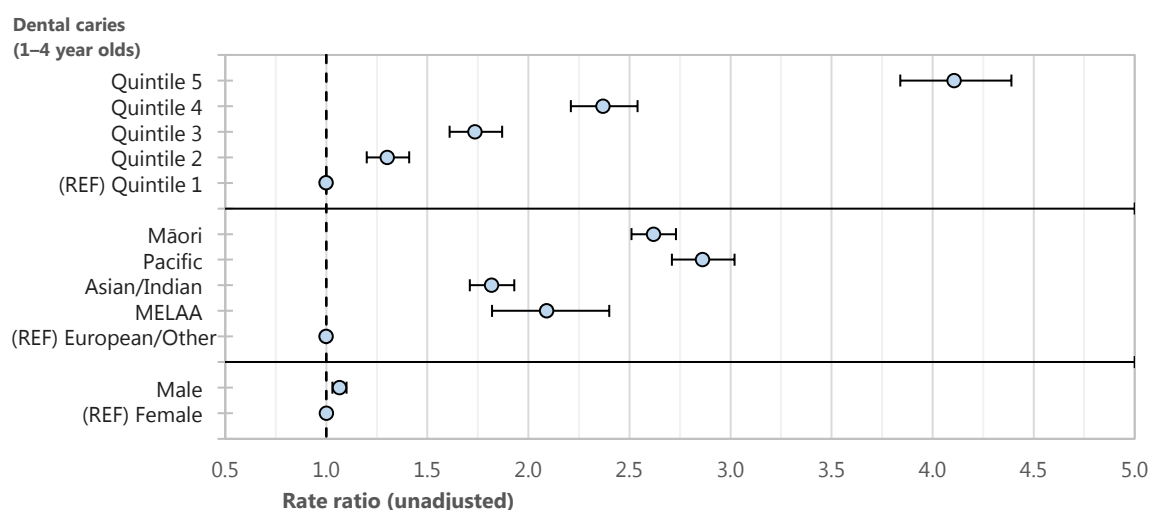
DHB	2011–2015 (n)	Annual average	Rate per 1,000 1–4 year olds	Rate ratio	95% CI
Hospitalisations of 1–4 year olds for dental caries					
Northland	1,035	207	20.85	1.99	1.87–2.12
Waitemata	984	197	6.19	0.59	0.55–0.63
Auckland	765	153	6.42	0.61	0.57–0.66
Counties Manukau	1,484	297	9.03	0.86	0.82–0.91
Waikato	1,860	372	16.32	1.56	1.49–1.64
Bay of Plenty	578	116	9.57	0.92	0.84–0.99
Lakes	318	64	10.00	0.96	0.86–1.07
Tairāwhiti	219	44	13.91	1.33	1.17–1.52
Taranaki	307	61	9.10	0.87	0.78–0.97
Hawke's Bay	398	80	8.46	0.81	0.73–0.89
MidCentral	720	144	15.48	1.48	1.38–1.60
Whanganui	299	60	16.72	1.60	1.43–1.79
Hutt Valley	646	129	15.53	1.49	1.37–1.61
Capital & Coast	930	186	11.99	1.15	1.07–1.23
Wairarapa	146	29	13.07	1.25	1.06–1.47
Nelson Marlborough	286	57	8.02	0.77	0.68–0.86
South Canterbury	78	16	5.51	0.53	0.42–0.66
Canterbury	1,051	210	8.07	0.77	0.73–0.82
West Coast	152	30	17.01	1.63	1.39–1.91
Southern	855	171	10.96	1.05	0.98–1.12
New Zealand	13,122	2,624	10.45	1.00	

Numerator: NMDS, Denominator: StatsNZ ERP

Figure XI-6 presents the hospitalisation rate of 1–4 year olds for dental caries by the residential deprivation score (NZDep2013 index of deprivation score), ethnicity, and sex. The unadjusted rate ratio presents the gap, if any, between the groups and the reference group. The following associations were observed bearing in mind that this univariate analysis does not quantify the independent effect of each demographic factor:

- Nationally, the hospitalisation rates for dental caries was significantly higher for those residing in areas with higher (quintiles 2–5; deciles 9–10) NZDep2013 scores compared with quintile 1
- While European/Other children had significantly lower rates of hospitalisation for dental caries than the other ethnic groups, the hospitalisation rates for Māori and Pacific children were around 2.7 times higher
- Boys hospitalised for dental caries was significantly higher, although marginal, than the hospitalisation rate for girls.

Figure XI-6 Hospitalisations of 1–4 year olds for dental caries, by demographic factor, New Zealand 2011–2015



Numerator: NMDS, Denominator: StatsNZ ERP;

REF = reference group, Ethnicity is level 1 prioritised, Quintile is NZDep2013 (1 = least deprived; 5 = most deprived)

Evidence for good practice

In addition to the oral health review topic, a selection of New Zealand publications relevant to good practice in oral health is listed below:

On the horizon

The development of an electronic oral health record for DHB-provided oral health services is underway by the Ministry of Health. For more information - <http://www.health.govt.nz/our-work/preventative-health-wellness/oral-health/electronic-oral-health-record-eohr-programme>

New Zealand publications

- **Oral health** — <http://www.health.govt.nz/our-work/preventative-health-wellness/oral-health>
- **Fluoride and oral health** — <http://www.health.govt.nz/our-work/preventative-health-wellness/fluoride-and-oral-health>
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5. Ministry of Health. 2015. Community Oral Health Services for children and some adolescents. Tier two service specification. <https://nsfl.health.govt.nz/service-specifications/current-service-specifications/oral-health-service-specifications> accessed November 2017.
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XII. APPENDICES

APPENDIX 1: EVIDENCE FOR GOOD PRACTICE

For most indicators in this report there is a section devoted to evidence for good practice. These comprise evidence summaries, references and links that aim to provide readers with a starting point from which to consider the most effective interventions that are available to address particular child and youth health issues. Included are New Zealand policy documents such as Ministry of Health Strategies and Toolkits, New Zealand and international guidelines, and evidence-based reviews that are relevant to the prevention and management of child and youth health issues. The approach taken in these sections is intended to assist health professionals to use the principles of evidence-based medicine (EBM), that is, to solve problems by using the best available research evidence and combining this with clinical expertise and patient values.¹ Evidence-based reviews, the best known of which are those produced by the Cochrane Collaboration, collate all the available evidence (published and unpublished trials, observational studies etc.) relevant to a particular health intervention, evaluate it in a rigorous manner, and publish the resulting synthesis of the evidence in a format that allows readers to quickly evaluate the effectiveness of the intervention.

When preparing the evidence for good practice section for each indicator, the authors searched 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. They also conducted smart searches in Google Scholar for journal articles and Google for government documents.

Methodology used in preparing policy/evidence of good practice sections

New Zealand policy documents

Each review section provides a list of Ministry of Health (or where appropriate, other Government Agency) policy documents and strategies relevant to the area. Using Google.com a smart search was conducted of Ministry of Health and other government departments.

Example smart searches used:

("fetal alcohol syndrome" OR "fetal alcohol spectrum disorder" OR FAS OR FASD) site:.health.govt.nz

("fetal alcohol syndrome" OR "fetal alcohol spectrum disorder" OR FAS OR FASD) site:.govt.nz

Evidence for good practice

The databases listed below were searched for reviews assessing the effectiveness of population level interventions to prevent and/or manage each of the issues included in this report. These databases were chosen because of the high calibre of the institutions maintaining them. The search strategy concentrated on publications that attempted to synthesise all of the available evidence, thereby providing the broadest possible coverage of the relevant literature. In general, only literature from the last three years was searched, although earlier publications were included if there was a lack of more recent information. Individual trials and protocols were not specifically sought but if there was no other relevant information available, an attempt was made to locate individual research reports or recommendations. It is hoped that that, although the lists of references provided are not completely comprehensive, they will nevertheless 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) <http://www.york.ac.uk/inst/crd>

This is a department of the University of York and is part of the National Centre for Health Research (NCHR) 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. Due to cessation of funding, no new records have been added to the database since March 2015.

National Institute for Health and Clinical Excellence (NICE) <http://www.nice.org.uk>

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.

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>.

In addition to these databases the websites of the World Health Organization, and government health departments in Australia, the UK, the US, and Canada, often yielded relevant guidance, as did the sites of international clinical collaborations such as the European Cystic Fibrosis Society and the International Society for Pediatric and Adolescent Diabetes.

APPENDIX 2: STATISTICAL METHODS

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 $p < 0.05$; that is, when the probability of the observed differences occurring by chance is less than 5%.²

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 ten 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.¹ Where the observed counts are small and the denominator is large, then a Poisson distribution has been utilised for both rate and confidence interval calculations.³

The indicators in this report are mainly presented using crude (unadjusted) rates or by age group (age-specific rates).

Crude rates: Measures the number of people with the condition of interest in relation to the number of people in the population. It is calculated by dividing the number of people with the condition of interest in a specific time period by the total number of people in the population in the same time period.

Age-specific rates: Measures the occurrence of an event within a defined age group in relation to the number of people in that group. Age-specific rate is calculated by dividing the number of people with the condition of interest in a specific age group and time period by the total number of people in the population in the same age group and time period. All rates by age group in this report are age-specific unless stated otherwise.

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. 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 captures 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 or demographic factors, 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.⁴

APPENDIX 3: DATA SOURCES

This report contains information derived from several national administrative datasets and population surveys. These are described briefly below, and limitations to be aware of when interpreting results drawn from these sources are outlined.

National Minimum Dataset

The National Minimum Dataset (NMDS) is a 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.⁵

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 1999.⁵

National Mortality Collection

The National Mortality Collection (MORT) 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 MORT, with cases in this subset having additional information on factors such as birth weight and gestational age.⁶ 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 New Zealand Cancer Registry (NZCR), the Institute of Environmental Science and Research, and Water Safety NZ.⁷

Birth Registration Dataset

Since 1995 all New Zealand 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 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.⁸

National Maternity Collection

The National Maternity Collection (MAT) contains information on selected publicly funded maternity services from nine months before to three months after a birth. It integrates information from three data sources:^{9,10}

- Claims for payment for primary maternity services provided by Lead Maternity Carers (LMCs) under Section 88 of the NZ Public Health and Disability Act 2000;
- Provision of (last resort) primary maternity services by DHB primary maternity teams (includes DHB caseload midwives, DHB primary midwifery teams, and shared care arrangements); and
- inpatient and day-patient hospital events during pregnancy, birth and the postnatal period for women giving birth and their babies from the NMDS (includes public and private hospitals and birthing centres)

Information contained on the LMC claim forms includes details on all women registered with a LMC, antenatal and postnatal factors (such as parity, and breastfeeding status). Subsequent changes to the Section 88 Notice have enabled collection of additional information such as smoking status and maternal weight.¹¹

Well Child/Tamariki Ora

Well Child/Tamariki Ora (WCTO) is a national programme with a focus on service provision for children and family/whānau. WCTO services are offered for all children from birth to up to five years of age, including: assessment services, care and support and health education.¹²⁻¹⁴

The WCTO dataset is a national registry of all children enrolled in the WCTO programme.¹² The WCTO dataset contains information on:^{12,14}

- Child health status and needs assessment (including dental, vision, hearing, breastfeeding, immunisation status, etc), health service quality and accessibility, family violence, mental health in the family, smoking status in the family, and abuse and neglect;
- Demographic information by region, deprivation level and ethnicity.

The data is used by the Ministry of Health to monitor service coverage and quality. WCTO service providers submit six monthly reports, including NHI level direct reports to the Ministry of Health and DHB aggregated reports to the Ministry of Health. Reports direct to the Ministry of Health are managed by the Ministry and made publicly available through their website.¹²

B4 School Check

The B4 School Check (B4SC) is a universal programme offered to all families with children turning four, and is the final core contact under the Well Child/Tamariki Ora schedule. The Check is designed to promote the health and well-being of four year olds by identifying and addressing any concerns about their health, behaviour, social and/or development, thereby ensuring they are healthy and have the ability to thrive at school. It replaced the School New Entrant check. Families are able to decline or opt-off the B4SC.

The B4SC information system (B4SC IS) is a national dataset managed by the Ministry of Health. It contains the information as documented during completion of the B4School Check, including anthropometry, vision and hearing, oral health, development assessment (Parental Evaluation of Developmental Status; PEDS) and behaviour assessment (Strengths and Difficulties; SDQ) scores.

The Ministry of Health utilises the data to monitor and evaluate the programme for improving the health and wellbeing of children, particularly in relation to, coverage, referral to specialist services, follow-ups and/or retesting.¹⁵

Data 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 MORT 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.¹⁶ 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.⁷ 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,¹⁶ 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 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: DEMOGRAPHIC FACTORS

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.

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.^{17,18} Adjusters developed using national level data (as in Hauora IV) 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%.

Socioeconomic deprivation

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 social and material 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.¹⁹ 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, as shown in Box 1. 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.²⁰

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.¹⁹ Despite these limitations, the NZDep2013 has been shown to be predictive of mortality and morbidity from a number of diseases in New Zealand.

Box 1 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 poverty²⁰

APPENDIX 5: CLINICAL CODES

The following are the codes associated with the conditions presented in this report.

	ICD-10-AM
Fetal death	
Main fetal underlying cause of death	
Malnutrition or slow fetal growth	P05
Prematurity or low birthweight	P07.0, P07.2
Intrauterine hypoxia	P20.0
Congenital pneumonia	P23
Infections specific to perinatal period	P35–P39
Fetal blood loss	P50
Neonatal aspiration of meconium, amniotic fluid, or mucus	P240, P24.1
Polycythaemia neonatorum	P61.1
Hydrops fetalis (non-haemolytic disease)	P83.2
Congenital anomalies	Q00–Q99
Unspecified cause	P95, R99
Maternal cause of death (first, if present)	
Incompetent cervix/premature rupture of membranes	P01.0, P01.1
Oligohydramnios	P01.2
Multiple pregnancy	P01.5
Placenta praevia/placental separation and haemorrhage	P02.0, P02.1
Other abnormalities of placenta	P02.2
Compression of umbilical cord	P02.5
Chorioamnionitis	P02.7
Maternal Hypertensive Disorders	P00.0
Placental transfusion syndromes	P02.3
Infant mortality	
Extreme prematurity	P07.2
Intrauterine hypoxia or birth asphyxia	P20, P21
Other perinatal conditions	P00–P19; P22–P96
Congenital anomalies	Q00–Q99
SUDI: SIDS	R95
SUDI: unspecified	R96, R98, R99
SUDI: suffocation or strangulation in bed	W75
SUDI: inhalation of gastric contents or food	W78, W79
Inhalation of gastric contents	W78
Inhalation and ingestion of food causing obstruction of the respiratory tract	W79
Injury or poisoning	V01–Y36
Child mortality (1–4 year olds)	
Injury and poisoning	V00–Y09 V01–V06.x(1), V09.x(2, 3); V10–V18.x(4, 5, 9), V19.x(4, 5, 6, 9); V20–V28.x(4, 5, 9), V29.x(4, 5, 6, 9); V30–V38.x(5, 6, 7, 9), V39.x(4, 5, 6, 9); V40–V48.x(5, 6, 7, 9); V50–V58.x(5, 6, 7, 9); V60–V68.x(5, 6, 7, 9); V70–V78.x(5, 6, 7, 9); V82.x(1, 9), V83–V86.x(0, 1, 2, 3)
Road traffic injuries	
Cancer	C00–D48
Congenital anomalies	Q00–Q99
Infectious and parasitic diseases	A00–B99
Nervous system disorders	G00–G99
Respiratory conditions	J00–J99
All other causes	all other codes

Primary diagnosis	ICD-10-AM	ICD-9-CM
Vaccine-targeted diseases		
Diphtheria	A36	032
Tetanus	A33, A34, A35	037, 771.3
Pertussis	A37	033
Polio (poliomyelitis)	A80	045
(Acute) Hepatitis B	B16	070
Haemophilus influenzae	B96.3	041.5, 038.41
Pneumococcal disease	J13, A40.3, B95.3	481, 038.2
Measles	B05	055
Mumps	B26	072
Rubella	B06	056
Gastroenteritis: Rotaviral	A08.0	008.61
Gastroenteritis: other viral	A08	008.6, 008.8
Gastroenteritis: non-viral	A00–A07	001–008
Gastroenteritis: Other or NOS	A09	009
Meningitis: bacterial	G00, G01	320
Meningitis: viral, other, NOS	A87, G02, G03	321, 322, 047
Meningococcal disease	A39	036
Tuberculosis	A15–A19	010–018
Varicella	B01	052
Other vaccine preventable diseases	P35.0, M01.4	771.0
Ambulatory care-sensitive conditions*		
(Acute) Rheumatic fever or (chronic) rheumatic heart disease	I00–I02, I05–I09	390–392, 393–398
Asthma and wheeze	J45–J46, R06.2	493.00, 493.01
Bronchiectasis	J47	494
Constipation	K59.0	564.0
Dental conditions†	K02, K04, K05	521.0, 522, 523
Dermatitis and eczema	L20–L30	690–693, 698
Gastroenteritis	A02–A09, R11, K52.9	001–009, 787.0, 558.9
Gastro-oesophageal reflux (GORD)	K21	530.11, 530.81
Nutritional deficiency and anaemia	D50–D53, E40–E46, E50–E64	260–269, 280–281
Otitis media	H65–H67	381.0–381.4, 382
Respiratory infections - acute upper (excludes croup)	J00–J04, J06	460–463, 465, 464.0, 464.1, 464.2
Respiratory infections - pneumonia (bacterial or non-viral)	J13–J16, J18	481–483, 485, 486
Skin infections	H00.0, H01.0, J340, L00–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)
Vaccine preventable diseases (VPD):		
Neonatal or obstetric tetanus	A33, A34	771.3, 670.04
Pertussis (≥6 months)	A37	033
Diphtheria (≥6 months)	A36	032
Hepatitis B (≥6 months)	B16, B18.0, B18.1	070.2, 070.3
Polio (≥6 months)	A80	045
Tetanus (≥6 months)	A35	037
Measles, Mumps, Rubella (≥15 months)	B05, B06, B26, M01.4, P35.0	055, 056, 072, 056.71, 771.0
(Acute) Rheumatic fever or (chronic) rheumatic heart disease	I00–I02, I05–I09	390–392, 393–398
Asthma and wheeze	J45–J46, R06.2	493.00, 493.01
Dental conditions		
Dental caries	K02	
Disorders of tooth development/eruption	K00	
Embedded/ impacted teeth	K01	
Other diseases of the teeth hard tissue	K03	
Diseases of the pulp/periapical tissue	K04	
Gingivitis/periodontal diseases	K05	
Other disorders of the gingiva/edentulous alveolar ridge	K06	
Dentofacial anomalies/malocclusion	K07	
Other disorders of the teeth or supporting structures	K08	

*Includes all acute and arranged admissions that were admitted within 7 days. Waiting list admissions were excluded, except for dental hospitalisations. †includes waiting list admissions

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