

# ISSUES IN INFANCY





# BIRTHS AND PERINATAL DEATHS

## Introduction

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

### Data source and methods

#### Data sources

<i>Livebirths:</i>	Birth registration dataset
<i>Deaths:</i>	National Mortality Collection

#### Definitions

*Total births* are livebirths plus fetal deaths

*Fetal death* is when the infant is born deceased, weighing 400 grams or more, or is issued from its mother after the 20th week of pregnancy<sup>2</sup>

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

*Perinatal death* is fetal deaths and early neonatal deaths

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

*Neonatal death* is the death of a live-born infant before 28 completed days after birth, and comprises:

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

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

Early neonatal death rate = *number of early neonatal deaths per 1,000 livebirths*

Late neonatal death rate = *number of late neonatal deaths per 1,000 livebirths*

#### Notes on interpretation

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

## National trends and distribution

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

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

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

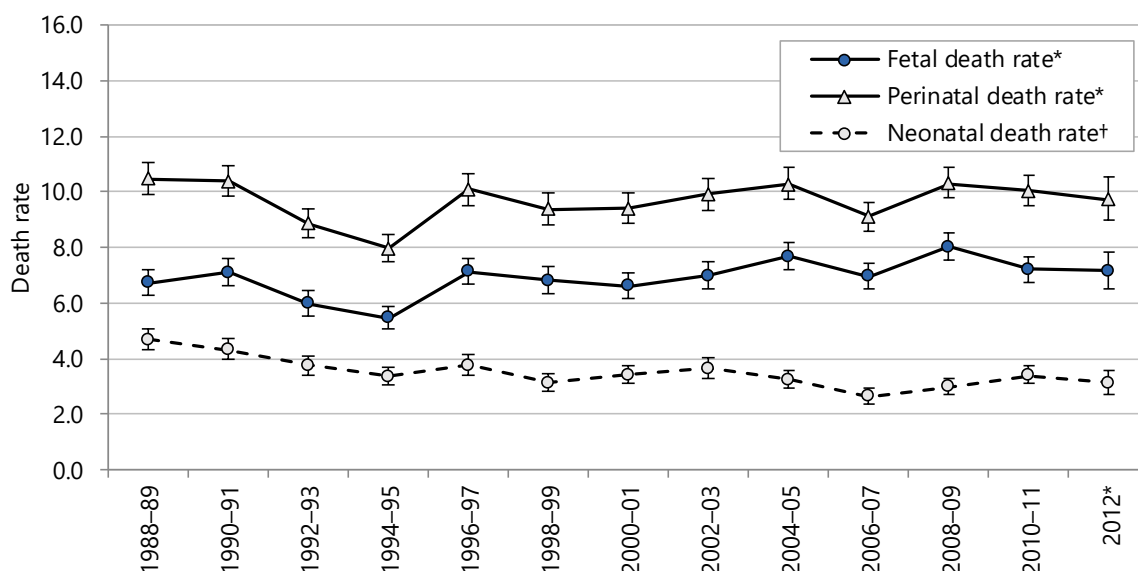
	Number: 2008–2012	Number: annual average	Rate per 1,000 births	95% CI
New Zealand				
Live births	317,526	63,505	..	..
Total births	319,934	63,987	..	..
Fetal deaths*	2,408	482	7.53	7.23–7.83
Perinatal deaths*	3,229	646	10.09	9.75–10.4
Neonatal deaths†	1,010	202	3.18	2.99–3.38
Early neonatal deaths†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

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

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

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

Figure 1. Fetal, perinatal and neonatal death rates, New Zealand 1988–2012



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

## South Island region distribution and trends

The number of births occurring between 2008 and 2012 ranged from 2,182 in the West Coast to 32,249 in Canterbury. The majority of births in each DHB were live births (99.3–99.5%). The fetal death rate ranged from 5.50 fetal deaths per 1,000 total births in the West Coast to 7.35 fetal deaths per 1,000 total births in Canterbury, while neonatal deaths ranged from 1.68 neonatal deaths per 1,000 live births in Nelson Marlborough to 4.78 neonatal deaths per 1,000 live births in South Canterbury (**Table 2**).

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

	Number: 2008–2012	Number: annual average	Rate per 1,000 births	95% CI
Nelson Marlborough				
Live births	8,329	1,666	..	..
Total births	8,378	1,676	..	..
Fetal deaths*	49	10	5.85	4.43–7.72
Perinatal deaths*	58	12	6.92	5.36–8.94
Neonatal deaths†	14	3	1.68	1.00–2.82
South Canterbury				
Live births	3,136	627	..	..
Total births	3,156	631	..	..
Fetal deaths*	20	4	6.34	4.11–9.77
Perinatal deaths*	32	6	10.14	7.19–14.28
Neonatal deaths†	15	3	4.78	2.91–7.87
Canterbury				
Live births	32,012	6,402	..	..
Total births	32,249	6,450	..	..
Fetal deaths*	237	47	7.35	6.47–8.34
Perinatal deaths*	322	64	9.98	8.96–11.13
Neonatal deaths†	98	20	3.06	2.52–3.73
West Coast				
Live births	2,170	434	..	..
Total births	2,182	436	..	..
Fetal deaths*	12	2	5.50	3.15–9.59
Perinatal deaths*	19	4	8.71	5.58–13.56
Neonatal deaths†	10	2	4.61	2.51–8.46
Southern DHB				
Live births	18,581	3,716	..	..
Total births	18,713	3,743	..	..
Fetal deaths*	132	26	7.05	5.95–8.36
Perinatal deaths*	165	33	8.82	7.58–10.26
Neonatal deaths†	41	8	2.21	1.63–2.99

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

# FETAL DEATHS

## Introduction

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

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

### Data sources and methods

#### Indicator

*Fetal deaths*

#### Data sources

Numerator: National Mortality Collection

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

#### Definition

*Fetal death* is when the infant is born deceased, weighing 400 grams or more, or is issued from its mother after the 20th week of pregnancy.<sup>2</sup>

Fetal deaths are further defined into:

*Intermediate:* Fetal deaths occurring between 20 and 27 weeks gestation.

*Late:* Fetal deaths occurring 28+ weeks gestation.

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

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

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

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

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

#### Notes on interpretation

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

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

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

## National trends and distribution

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

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

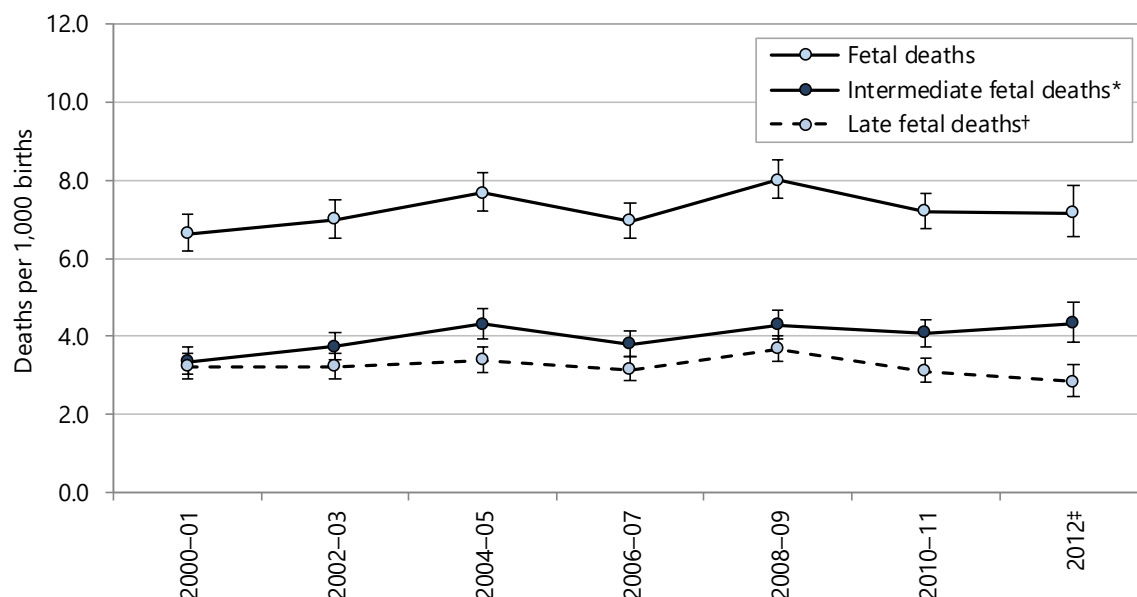
Main cause of fetal death	Number: 2008–2012	Number: annual average	Rate per 1,000 births	95% CI	Per cent
Intermediate fetal deaths*					
Prematurity or low birth weight	173	35	0.54	0.47–0.63	12.9
Congenital anomalies: chromosomal	152	30	0.48	0.41–0.56	11.3
Congenital anomalies: CNS	115	23	0.36	0.30–0.43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

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

The overall fetal death rate was stable from 2000 to 2012 with year-to-year fluctuations around an average of 7.24 deaths per 1000 births. Within this time period there was an overall decline in the rate of late fetal deaths from 3.23 to 2.83 deaths per 1000 births of 28 weeks gestation or more and an increase in the rate of intermediate fetal deaths from 3.35 to 4.32 deaths per 1000 births of 20 weeks gestation or more (**Figure 2**).

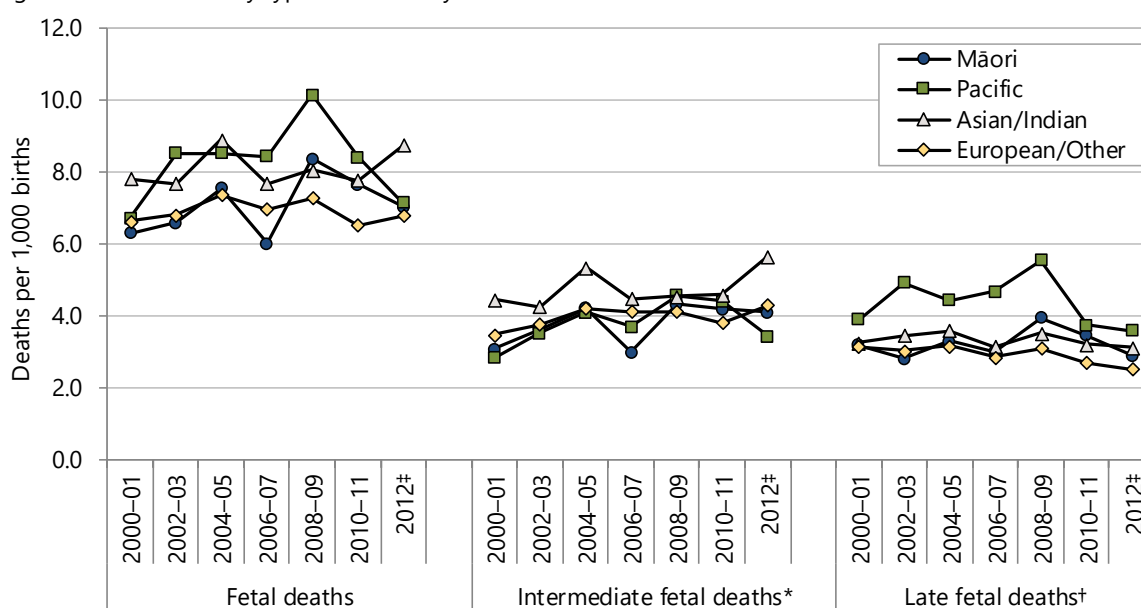
Similar patterns over time were observed for all ethnic groups. Intermediate fetal death rates were consistently highest for the Asian/Indian ethnic group and late fetal death rates were consistently highest for the Pacific ethnic group (**Figure 3**).

Figure 2. Fetal deaths, by type, New Zealand 2000–2012



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

Figure 3. Fetal deaths, by type and ethnicity, New Zealand 2000–2012



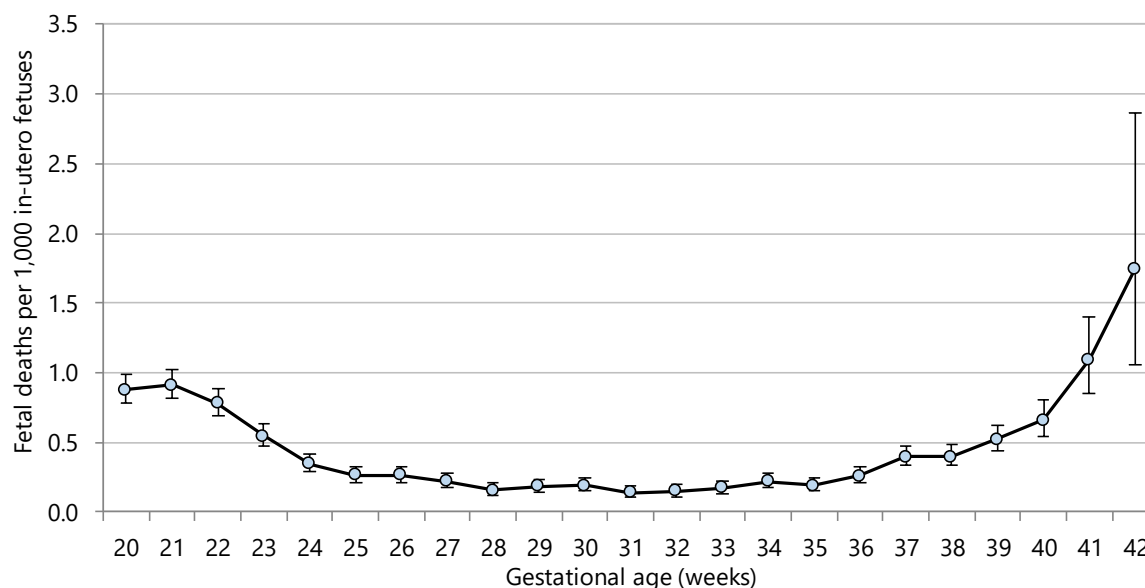
Numerator: National Mortality Collection; Denominator: Birth Registration Dataset and National Mortality Collection; \* Rate per 1,000 births (live births and fetal deaths of 20 weeks gestation or more); † Rate per 1,000 births (live births and fetal deaths of 28 weeks gestation or more); Ethnicity is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

## Distribution by gestational age

Between 2008 and 2012 fetal death rates were higher at gestational ages less than 25 weeks and more than 36 weeks, with the highest rates of all at over 40 weeks gestational age (**Figure 4**). In interpreting these figures, note that the denominator was those fetuses remaining in utero at the specified gestational age. This means that the denominator at and beyond term is smaller than earlier in pregnancy and although the absolute number of fetal deaths is lower at later gestational ages, the risk is higher as fewer pregnancies continue past these gestational ages.



Figure 4. Fetal deaths, by gestational age, New Zealand 2008–2012



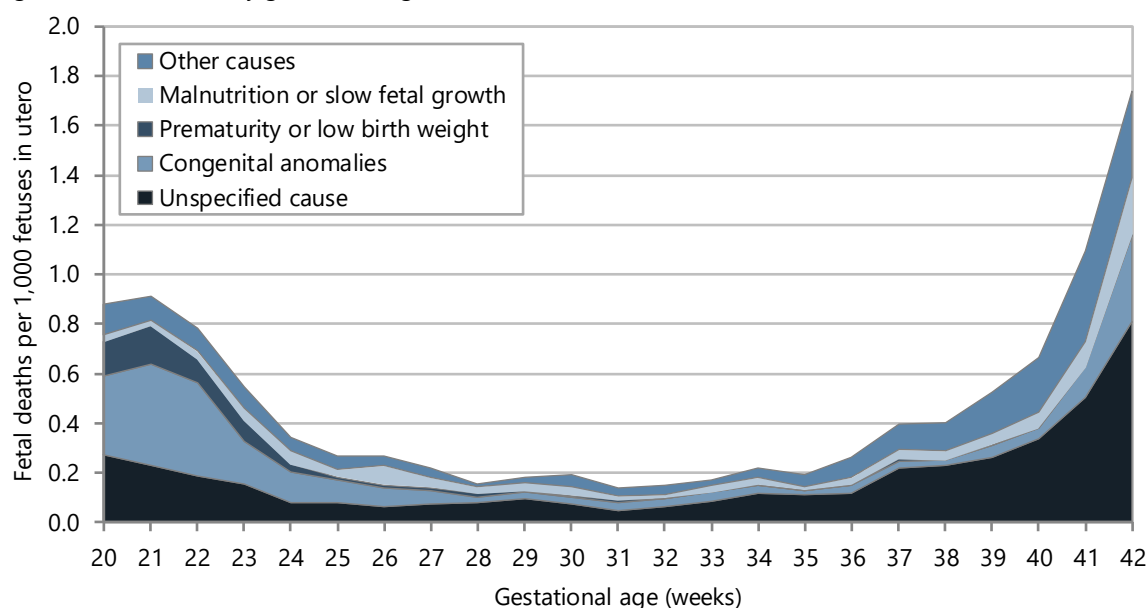
Numerator: National Mortality Collection; Denominator: Birth Registration Dataset and National Mortality Collection; Rate per 1,000 (live and stillborn) fetuses remaining in-utero at each gestational age

### Distribution by cause

Between 2008 and 2012 a fetal cause of death was unspecified for 27.2% of intermediate fetal deaths and 49.9% of late fetal deaths. Where specified, the most frequent causes of intermediate fetal death were congenital anomalies, prematurity or low birth weight, and malnutrition or slow fetal growth. The most frequent causes of late fetal death were congenital anomalies, malnutrition or slow fetal growth, and intrauterine hypoxia (**Figure 5**).

Fetal death rates from prematurity or low birth weight were highest at 20–22 weeks gestation. Fetal death rates arising from congenital anomalies were highest at 20–22 weeks gestation and at 42 weeks gestation. The data did not distinguish between spontaneous fetal deaths and terminations of pregnancy and the higher fetal mortality rates at less than 25 weeks gestation must be interpreted with this in mind. Fetal death rates from malnutrition or slow fetal growth were highest at 41–42 weeks gestation (**Figure 5**).

Figure 5. Fetal deaths, by gestational age and cause of death, New Zealand 2008–2012



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

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

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

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

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

## Distribution by demographic factors

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

These patterns differed when comparing intermediate and late fetal deaths. Rates of intermediate fetal death were *significantly higher* for the Asian/Indian ethnic group compared with European/Other and also *significantly higher* for mothers aged under 20 years and over 34 years compared with mothers aged 30–34 years. There were *no significant differences* in intermediate fetal death rates by NZDep2013 and *no significant difference* in rates between Māori, Pacific and European/Other ethnic groups. Rates of late fetal death were *significantly higher* in areas with the highest NZDep2013 scores (decile 9–10), *significantly higher* for Māori and Pacific ethnic groups compared with Asian/Indian and European/Other, and *significantly higher* for mothers aged 20–24 years as well as mothers aged under 20 years and over 34 years compared with mothers aged 25–34 years (**Table 6**).

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

Variable	Number: 2008–2012	Rate per 1,000 births	Rate ratio	95% CI
Fetal deaths				
NZDep2013 Index of deprivation quintile				
Deciles 1–2	315	6.83	1.00	
Deciles 3–4	366	7.17	1.05	0.90–1.22
Deciles 5–6	412	7.04	1.03	0.89–1.19
Deciles 7–8	513	7.33	1.07	0.93–1.24
Deciles 9–10	791	8.51	1.25	1.09–1.42
Prioritised ethnicity				
Māori	732	7.83	1.14	1.04–1.25
Pacific	319	8.86	1.29	1.14–1.46
Asian/Indian	301	8.09	1.18	1.03–1.34
European/Other	1,053	6.88	1.00	
Maternal age group				
<20 years	222	9.90	1.48	1.27–1.72
20–24 years	456	7.74	1.16	1.02–1.31
25–29 years	525	6.61	0.99	0.88–1.11
30–34 years	596	6.69	1.00	
35+ years	609	8.68	1.30	1.16–1.45
Gender				
Female	1,164	7.48	1.00	
Male	1,219	7.42	0.99	0.92–1.08

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

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

Variable	Number: 2008–2012	Rate per 1,000 births	Rate ratio	95% CI
Intermediate fetal deaths*				
NZDep2013 Index of deprivation quintile				
Deciles 1–2	186	4.03	1.00	
Deciles 3–4	232	4.54	1.13	0.93–1.37
Deciles 5–6	244	4.17	1.03	0.86–1.25
Deciles 7–8	293	4.19	1.04	0.86–1.25
Deciles 9–10	383	4.12	1.02	0.86–1.22
Prioritised ethnicity				
Māori	395	4.22	1.05	0.92–1.19
Pacific	154	4.28	1.06	0.89–1.27
Asian/Indian	179	4.81	1.20	1.01–1.41
European/Other	616	4.03	1.00	
Maternal age group				
<20 years	129	5.75	1.51	1.23–1.84
20–24 years	235	3.99	1.04	0.88–1.23
25–29 years	286	3.60	0.94	0.81–1.10
30–34 years	340	3.82	1.00	
35+ years	356	5.08	1.33	1.15–1.54
Gender				
Female	645	4.14	1.00	
Male	684	4.17	1.01	0.90–1.12
Late fetal deaths†				
NZDep2013 Index of deprivation quintile				
Deciles 1–2	127	2.76	1.00	
Deciles 3–4	133	2.62	0.95	0.74–1.21
Deciles 5–6	166	2.85	1.03	0.82–1.30
Deciles 7–8	217	3.12	1.13	0.91–1.40
Deciles 9–10	398	4.30	1.56	1.27–1.90
Prioritised ethnicity				
Māori	330	3.54	1.25	1.08–1.44
Pacific	159	4.43	1.56	1.30–1.88
Asian/Indian	122	3.30	1.16	0.95–1.42
European/Other	432	2.83	1.00	
Maternal age group				
<20 years	89	3.99	1.39	1.09–1.77
20–24 years	217	3.70	1.29	1.07–1.54
25–29 years	235	2.97	1.03	0.87–1.23
30–34 years	255	2.88	1.00	
35+ years	248	3.55	1.24	1.04–1.47
Gender				
Female	514	3.32	1.00	
Male	523	3.20	0.96	0.85–1.09

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

## Distribution by region

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

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

DHB	Number: 2008–2012	Number: annual average	Rate per 1,000 births	Rate ratio	95% CI
Fetal deaths					
Northland	91	18	7.71	1.02	0.98–1.07
Waitemata	299	60	7.50	1.00	0.96–1.04
Auckland	262	52	7.85	1.04	1.00–1.09
Counties Manukau	389	78	8.79	1.17	1.12–1.22
Waikato	211	42	7.49	0.99	0.95–1.04
Bay of Plenty	84	17	5.61	0.75	0.71–0.78
Lakes	68	14	8.32	1.11	1.06–1.16
Tairāwhiti	28	6	7.15	0.95	0.90–1.00
Taranaki	54	11	6.75	0.90	0.86–0.94
Hawke's Bay	82	16	6.96	0.92	0.89–0.97
MidCentral	98	20	8.39	1.11	1.07–1.16
Whanganui	42	8	9.33	1.24	1.18–1.30
Hutt Valley	89	18	8.25	1.10	1.05–1.15
Capital & Coast	131	26	6.56	0.87	0.84–0.91
Wairarapa	19	4	7.04	0.93	0.89–0.99
Nelson Marlborough	49	10	5.85	0.78	0.74–0.81
South Canterbury	20	4	6.34	0.84	0.80–0.89
Canterbury	237	47	7.35	0.98	0.94–1.02
West Coast	12	2	5.50	0.73	0.69–0.77
Southern	132	26	7.05	0.94	0.90–0.98
New Zealand	2,408	482	7.53	1.00	

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

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

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

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

DHB	Number: 2008–2012	Number: annual average	Rate per 1,000 births*	Rate ratio	95% CI
Intermediate fetal deaths					
Northland	40	8	3.39	0.81	0.76–0.85
Waitemata	179	36	4.49	1.07	1.01–1.13
Auckland	161	32	4.83	1.15	1.09–1.21
Counties Manukau	187	37	4.23	1.00	0.95–1.06
Waikato	115	23	4.08	0.97	0.92–1.02
Bay of Plenty	39	8	2.61	0.62	0.59–0.65
Lakes	38	8	4.65	1.11	1.04–1.17
Tairāwhiti	12	2	3.06	0.73	0.68–0.77
Taranaki	27	5	3.37	0.80	0.76–0.85
Hawke's Bay	52	10	4.41	1.05	0.99–1.11
MidCentral	58	12	4.97	1.18	1.12–1.25
Whanganui	22	4	4.89	1.16	1.09–1.23
Hutt Valley	52	10	4.82	1.15	1.08–1.21
Capital & Coast	81	16	4.06	0.96	0.91–1.02
Wairarapa	16	3	5.93	1.41	1.32–1.50
Nelson Marlborough	31	6	3.70	0.88	0.83–0.93
South Canterbury	9	2	2.85	0.68	0.64–0.72
Canterbury	137	27	4.25	1.01	0.96–1.07
West Coast	<5	s	s	s	s
Southern	78	16	4.17	0.99	0.94–1.05
New Zealand	1,346	269	4.21	1.00	

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

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

DHB	Number: 2008–2012	Number: annual average	Rate per 1,000 births†	Rate ratio	95% CI
Late fetal deaths					
Northland	48	10	4.08	1.25	1.17–1.33
Waitemata	119	24	3.00	0.91	0.86–0.97
Auckland	100	20	3.01	0.92	0.86–0.98
Counties Manukau	199	40	4.52	1.38	1.30–1.47
Waikato	95	19	3.38	1.03	0.97–1.10
Bay of Plenty	44	9	2.95	0.90	0.84–0.96
Lakes	30	6	3.69	1.13	1.06–1.20
Tairāwhiti	15	3	3.84	1.17	1.09–1.25
Taranaki	26	5	3.26	0.99	0.93–1.06
Hawke's Bay	30	6	2.56	0.78	0.73–0.83
MidCentral	39	8	3.36	1.02	0.96–1.09
Whanganui	20	4	4.46	1.36	1.27–1.46
Hutt Valley	35	7	3.26	1.00	0.93–1.06
Capital & Coast	49	10	2.47	0.75	0.71–0.80
Wairarapa	<5	s	s	s	s
Nelson Marlborough	18	4	2.16	0.66	0.62–0.70
South Canterbury	11	2	3.50	1.07	0.99–1.14
Canterbury	98	20	3.05	0.93	0.88–0.99
West Coast	8	2	3.67	1.12	1.04–1.21
Southern	54	11	2.90	0.88	0.83–0.94
New Zealand	1,044	209	3.28	1.00	

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

## South Island region distribution and trends

### Comparison with New Zealand

In the South Island DHBs between 2008 and 2012 the fetal death rates were *significantly lower* than the national rate in Nelson Marlborough, South Canterbury, West Coast and Southern DHBs with *no significant difference* in Canterbury DHB.

Intermediate fetal death rates were *significantly lower* than the national rate in Nelson Marlborough and South Canterbury DHBs with *no significant difference* in Canterbury and Southern DHBs, while rates were suppressed on the West Coast due to numbers less than five. Late fetal death rates were *significantly higher* on the West Coast, *significantly lower* in Nelson Marlborough, Canterbury and Southern DHBs, and *not significantly different* in South Canterbury DHB (**Table 10**).

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

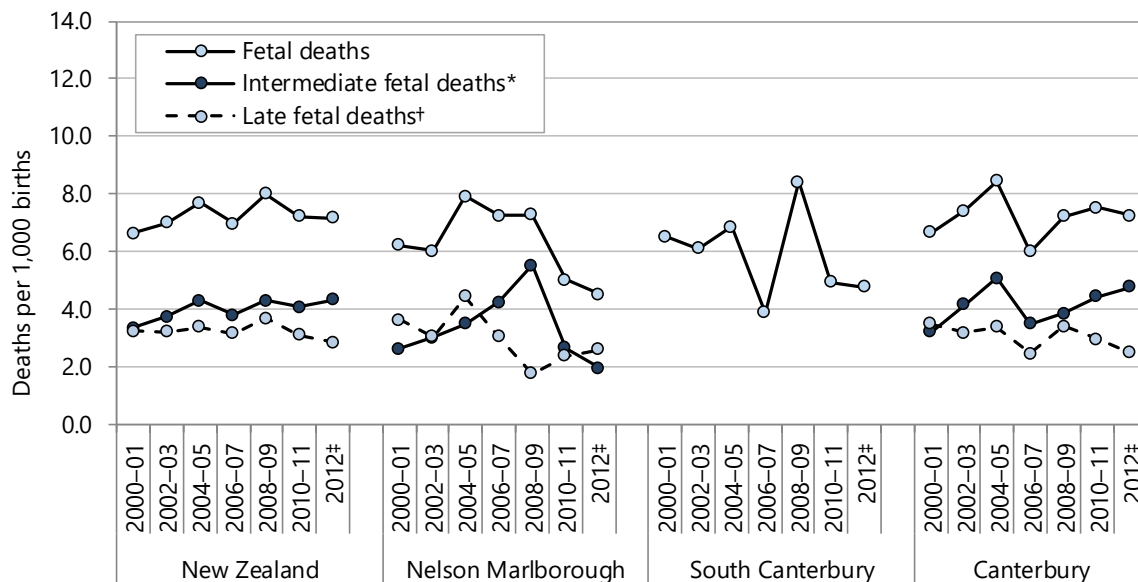
DHB	Number: 2008–2012	Number: annual average	Rate per 1,000 births	Rate ratio	95% CI
Fetal deaths					
Nelson Marlborough	49	10	5.85	0.78	0.74–0.81
South Canterbury	20	4	6.34	0.84	0.80–0.89
Canterbury	237	47	7.35	0.98	0.94–1.02
West Coast	12	2	5.50	0.73	0.69–0.77
Southern	132	26	7.05	0.94	0.90–0.98
New Zealand	1,346	269	4.21	1.00	
Intermediate fetal deaths*					
Nelson Marlborough	31	6	3.70	0.88	0.83–0.93
South Canterbury	9	2	2.85	0.68	0.64–0.72
Canterbury	137	27	4.25	1.01	0.96–1.07
West Coast	<5	s	s	s	s
Southern	78	16	4.17	0.99	0.94–1.05
New Zealand	1,346	269	4.21	1.00	
Late fetal deaths†					
Nelson Marlborough	18	4	2.16	0.66	0.62–0.70
South Canterbury	11	2	3.50	1.07	0.99–1.14
Canterbury	98	20	3.05	0.93	0.88–0.99
West Coast	8	2	3.67	1.12	1.04–1.21
Southern	54	11	2.90	0.88	0.83–0.94
New Zealand	1,044	209	3.28	1.00	

Numerator: National Mortality Collection; Denominators: Birth Registration Dataset and National Mortality Collection. \* Rate per 1000 births (live births and fetal deaths of 20 weeks gestation or more); † Rate per 1000 births (live births and fetal deaths of 28 weeks gestation or more)

## Regional trends

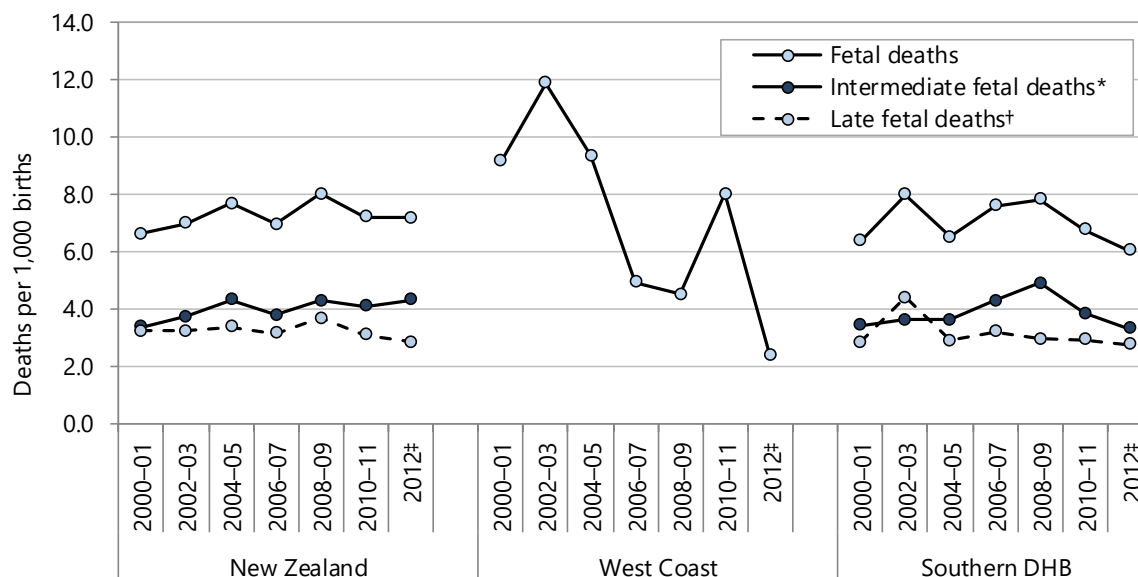
While fetal death rates in the South Island DHBs varied year to year between 2000 and 2012, rates generally decreased in the Nelson Marlborough, South Canterbury and West Coast DHBs and were more stable in Canterbury and Southern DHB (Figure 6, Figure 7).

Figure 6. Fetal deaths, by type, Nelson Marlborough, South Canterbury, and Canterbury DHBs vs New Zealand 2000–2012



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

Figure 7. Fetal deaths, by type, West Coast, and Southern DHBs vs New Zealand 2000–2012



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



## Regional distribution by cause

In the South Island region, congenital anomalies were the predominant causes of fetal deaths between 2008 and 2012 (**Table 11**). Of the fetal deaths with a maternal cause listed, abnormalities of the placenta were the predominant causes in Nelson Marlborough, Canterbury, Southern DHBs and compression of umbilical cord in South Canterbury DHB. Causes varied on the West Coast (**Table 12**).

Table 11. Fetal deaths, by cause of death, South Island DHBs 2008–2012

Main cause of fetal death	Number: 2008–2012	Number: annual average	Rate per 1,000 births	95% CI	Per cent
<b>Fetal deaths</b>					
<b>Nelson Marlborough</b>					
Congenital anomalies	15	3.0	1.79	1.09–2.95	30.6
Malnutrition or slow fetal growth	5	1.0	0.60	0.25–1.40	10.2
Prematurity or low birth weight	<5	s	s	s	s
Fetal blood loss	<5	s	s	s	s
Other causes	<5	s	s	s	s
Unspecified cause of fetal death	17	3.4	2.03	1.27–3.25	34.7
Nelson Marlborough total	49	9.8	5.85	4.43–7.72	100.0
<b>South Canterbury</b>					
Congenital anomalies	<5	s	s	s	s
Prematurity or low birth weight	<5	s	s	s	s
Other causes	<5	s	s	s	s
Unspecified cause of fetal death	9	1.8	2.85	1.50–5.41	45.0
South Canterbury total	20	4.0	6.34	4.11–9.77	100.0
<b>Canterbury</b>					
Congenital anomalies	65	13.0	2.02	1.58–2.57	27.4
Prematurity or low birth weight	33	6.6	1.02	0.73–1.44	13.9
Malnutrition or slow fetal growth	27	5.4	0.84	0.58–1.22	11.4
Intrauterine hypoxia	17	3.4	0.53	0.33–0.84	7.2
Fetal blood loss	11	2.2	0.34	0.19–0.61	4.6
Congenital pneumonia	9	1.8	0.28	0.15–0.53	3.8
Infections specific to perinatal period	7	1.4	0.22	0.11–0.45	3.0
Neonatal aspiration*	7	1.4	0.22	0.11–0.45	3.0
Other causes	20	4.0	0.62	0.40–0.96	8.4
Unspecified cause of fetal death	41	8.2	1.27	0.94–1.72	17.3
Canterbury total	237	47.4	7.35	6.47–8.34	100.0
<b>West Coast</b>					
Congenital anomalies	<5	s	s	s	s
Other causes	5	1.0	2.29	0.98–5.35	41.7
Unspecified cause of fetal death	5	1.0	2.29	0.98–5.35	41.7
West Coast total	12	2.4	5.50	3.15–9.59	100.0
<b>Southern DHB</b>					
Congenital anomalies	40	8.0	2.14	1.57–2.91	30.3
Malnutrition or slow fetal growth	11	2.2	0.59	0.33–1.05	8.3
Intrauterine hypoxia	11	2.2	0.59	0.33–1.05	8.3
Prematurity or low birth weight	6	1.2	0.32	0.15–0.70	4.5
Infections specific to perinatal period	<5	s	s	s	s
Hydrops fetalis (non-haemolytic disease)	<5	s	s	s	s
Other causes	7	1.4	0.37	0.18–0.77	5.3
Unspecified cause of fetal death	50	10.0	2.67	2.03–3.52	37.9
Southern DHB Total	132	26.4	7.05	5.95–8.36	100.0

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

Table 12. Fetal deaths, by maternal cause of fetal death, South Island DHBs 2008–2012

Main maternal cause of fetal death	Number: 2008–2012	Number: annual average	Rate per 1,000 births	95% CI	Per cent
Fetal deaths					
Nelson Marlborough					
Placenta praevia/placental separation and haemorrhage	<5	s	s	s	s
Other abnormalities of placenta	6	1.2	0.72	0.33–1.56	12.2
Compression of umbilical cord	5	1.0	0.60	0.25–1.40	10.2
Placental transfusion syndromes	<5	s	s	s	s
Other causes	13	2.6	1.55	0.91–2.65	26.5
No listed maternal cause	18	3.6	2.15	1.36–3.39	36.7
Nelson Marlborough total	49	9.8	5.85	4.43–7.72	100.0
South Canterbury					
Compression of umbilical cord	<5	s	s	s	s
Other causes	5	1.0	1.58	0.68–3.70	25.0
No listed maternal cause	12	2.4	3.80	2.18–6.63	60.0
South Canterbury total	20	4.0	6.34	4.11–9.77	100.0
Canterbury					
Placenta praevia/placental separation and haemorrhage	27	5.4	0.84	0.58–1.22	11.4
Other abnormalities of placenta	24	4.8	0.74	0.50–1.11	10.1
Chorioamnionitis	19	3.8	0.59	0.38–0.92	8.0
Compression of umbilical cord	15	3.0	0.47	0.28–0.77	6.3
Incompetent cervix/premature rupture of membranes	14	2.8	0.43	0.26–0.73	5.9
Multiple pregnancy	12	2.4	0.37	0.21–0.65	5.1
Maternal hypertensive disorders	8	1.6	0.25	0.13–0.49	3.4
Oligohydramnios	7	1.4	0.22	0.11–0.45	3.0
Placental transfusion syndromes	6	1.2	0.19	0.09–0.41	2.5
Other causes	39	7.8	1.21	0.88–1.65	16.5
No listed maternal cause	66	13.2	2.05	1.61–2.60	27.8
Canterbury total	237	47.4	7.35	6.47–8.34	100.0
West Coast					
Maternal hypertensive disorders	<5	s	s	s	s
Other causes	6	1.2	2.75	1.26–5.99	50.0
No listed maternal cause	<5	s	s	s	s
West Coast total	12	2.4	5.50	3.15–9.59	100.0
Southern DHB					
Placenta praevia/placental separation and haemorrhage	11	2.2	0.59	0.33–1.05	8.3
Chorioamnionitis	10	2.0	0.53	0.29–0.98	7.6
Compression of umbilical cord	8	1.6	0.43	0.22–0.84	6.1
Other abnormalities of placenta	6	1.2	0.32	0.15–0.70	4.5
Maternal hypertensive disorders	6	1.2	0.32	0.15–0.70	4.5
Multiple pregnancy	6	1.2	0.32	0.15–0.70	4.5
Incompetent cervix/premature rupture of membranes	<5	s	s	s	s
Placental transfusion syndromes	<5	s	s	s	s
Oligohydramnios	<5	s	s	s	s
Other causes	35	7.0	1.87	1.35–2.60	26.5
No listed maternal cause	43	8.6	2.30	1.71–3.09	32.6
Southern DHB Total	132	26.4	7.05	5.95–8.36	100.0

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

# Evidence for good practice for the prevention of fetal deaths

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

Leduc D, Biringer A, Lee L, et al. 2013. **Induction of labour.** J Obstet Gynaecol Can, 35(9), 840-60.  
<http://sogc.org/guidelines/induction-labour-replaces-107-aug-2001/>

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

National Guideline Clearinghouse. 2010 (revised 2014). **Guideline synthesis: induction of labour.** Rockville (MD): Agency for Healthcare Research and Quality (AHRQ).

<http://www.guideline.gov/syntheses/synthesis.aspx?id=47799&search=induction+of+labour>

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

### International guidelines relevant to the management of stillbirth

Queensland Maternity and Neonatal Clinical Guidelines Program. 2010. **Stillbirth Care.** Brisbane: Queensland Government. [http://www.health.qld.gov.au/qcg/documents/g\\_still5-0.pdf](http://www.health.qld.gov.au/qcg/documents/g_still5-0.pdf)

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

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

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

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

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

### Evidence-based medicine reviews

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

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

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

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

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

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

Peters M, Riitano D, Lisy K, et al. 2014. **Providing care for families who have experienced stillbirth: a comprehensive systematic review.** Adelaide: The Joanna Briggs Institute (for the Stillbirth Foundation of Australia).

<http://www.stillbirthfoundation.org.au/wp-content/uploads/2014/03/Stillbirth-systematic-review-report.pdf>

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

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

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

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

Nieuwenhuijsen MJ, Dadvand P, Grellier J, et al. 2013. **Environmental risk factors of pregnancy outcomes: a summary of recent meta-analyses of epidemiological studies.** Environ Health, 12, 6.

<http://www.ncbi.nlm.nih.gov/pmc/articles/PMC3582445/>

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

Koopmans L, Wilson T, Cacciatore J, et al. 2013. **Support for mothers, fathers and families after perinatal death.** Cochrane Database of Systematic Reviews (6).

<http://onlinelibrary.wiley.com/doi/10.1002/14651858.CD000452.pub3/abstract>

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



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

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

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

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

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

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

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

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

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

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

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

Mothers who have a stillbirth commonly report perceiving a reduction in, or absence of, their baby's movements in the days preceding their baby's death. For this reason, monitoring of babies' movements is often advised by caregivers, and used by mothers to assess their baby's wellbeing. This review aimed to determine the effectiveness of various management strategies for decreased fetal movements (DFM). The review authors did not identify any RCTs of management of DFM. They did identify 13 randomised trials of management strategies for women whose babies are at risk of poor outcomes for various reasons, including DFM, but data on DFM sub-groups was only able to be provided by the authors of one trial and the numbers of cases of DFM (28) was too small for meaningful analysis. They

concluded that there were insufficient data from RCTs to provide guidance on the management of DFM in clinical practice, but that, based on the findings from other systematic reviews, the following strategies show promise and should be prioritised for further research: Doppler ultrasound studies, computerised cardiotocography, and fetal arousal to facilitate cardiotocography.

Gulmezoglu MA, Crowther CA, Middleton P, et al. 2012. **Induction of labour for improving birth outcomes for women at or beyond term.** Cochrane Database of Systematic Reviews (6).

<http://onlinelibrary.wiley.com/doi/10.1002/14651858.CD004945.pub3/abstract>

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

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

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

<http://onlinelibrary.wiley.com/doi/10.1002/14651858.CD007113.pub3/abstract>

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

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

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

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

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

parents should be offered a thorough investigation including a high-quality autopsy and placental histopathology. Future research should focus on screening and interventions to reduce antepartum stillbirth as a result of placental dysfunction.

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

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

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

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

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

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

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

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

#### Other relevant publications

PMMRC. 2014. **Eighth Annual Report of the Perinatal and Maternal Mortality Review Committee: Reporting mortality 2012.** Wellington: Health Quality & Safety Commission.

<http://www.hqsc.govt.nz/assets/PMMRC/Publications/eighth-PMMRC-report-June-2014.pdf>

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

- There was a significant reduction in stillbirth rates from 2007 to 2012, which was independent of demographic changes. The rates (per 1000 total babies born at 20 weeks or beyond, or weighing at least 400g if gestation was unknown) were 5.6, 5.8, 6.1, 5.3, 5.3 and 5.1 in 2007–2012 respectively
- There was a significant reduction in unexplained antepartum stillbirth and hypoxic peripartum stillbirth, which contributed to the observed reduction

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

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

Redshaw M, Rowe R, Henderson J. 2014. **Listening to Parents after stillbirth or the death of their baby after birth.** Oxford, UK: National Perinatal Epidemiology Unit, University of Oxford.

<https://www.npeu.ox.ac.uk/downloads/files/listeningtoparents/report/Listening%20to%20Parents%20Report%20-%20March%202014%20-%20FINAL%20-%20PROTECTED.pdf>

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

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

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



<p>Spong CY, Mercer BM, D'Alton M, et al. <b>Timing of indicated late-preterm and early-term birth.</b> <i>Obstet Gynecol</i> 2011;118:326–7.</p>
<p>Moewaka Barnes H, Moewaka Barnes A, Baxter J, et al. 2013. <b>Hapū Ora: Wellbeing in the Early Stages of Life.</b> Auckland: Whāriki Research Group, Massey University. <a href="http://www.massey.ac.nz/massey/learning/departments/centres-research/shore/projects/hapu-ora.cfm">http://www.massey.ac.nz/massey/learning/departments/centres-research/shore/projects/hapu-ora.cfm</a></p> <p>This is the report of a project funded by the partnership programme of the Health Research Council of New Zealand and the Ministry of Health. The project aimed to identify Māori life course research priorities, with a specific focus on wellbeing at the early stage of life, hapū ora (the fetal/gestational and neonatal periods). While the report does not specifically consider the prevention of fetal death, it does contain much information relevant to those who are involved in providing maternity care for Māori, particularly in Chapter 4, which reviews literature on antenatal, labour and delivery care for Māori, and in Chapter 5, which outlines views from the health sector gathered from both individuals and groups.</p>
<p>Stacey T, Thompson JM, Mitchell EA, et al. 2012. <b>Antenatal care, identification of suboptimal fetal growth and risk of late stillbirth: findings from the Auckland Stillbirth Study.</b> <i>Australian &amp; New Zealand Journal of Obstetrics &amp; Gynaecology</i>, 52(3), 242–7. <a href="http://onlinelibrary.wiley.com/doi/10.1111/j.1479-828X.2011.01406.x/abstract">http://onlinelibrary.wiley.com/doi/10.1111/j.1479-828X.2011.01406.x/abstract</a></p> <p>This paper reports findings from the Auckland Stillbirth Study, a case control study which included 155 cases (out of 215 invited) cases and 310 controls (out of 429 invited). Increased risk of late stillbirth was found to be associated with accessing &lt;50% of recommended antenatal visits compared to accessing the recommended number of visits (adjusted odds ratio, aOR, 2.68; 95% CI, 1.04–6.90) and with having a small-for-gestational-age (SGA) baby that had not been identified as being SGA prior to birth (aOR, 9.46; 95% CI, 1.98–45.13), compared to having a SGA baby that was identified as such antenatally. There was no association found between the type or model of maternity care provider at booking and late stillbirth risk. The authors stated that their findings reinforced the importance of regular antenatal care attendance, which may identify babies that are SGA and thus reduce the chances of them being stillborn.</p>
<p>Peat AM, Stacey T, Cronin R, et al. 2012. <b>Maternal knowledge of fetal movements in late pregnancy.</b> <i>Australian &amp; New Zealand Journal of Obstetrics &amp; Gynaecology</i>, 52(5), 445–9</p> <p>This paper reports on a study which involved interviewing a convenience sample of 100 women attending two antenatal clinics in Auckland in November and December 2011 to determine what information women in their third trimester of pregnancy receive about fetal movements, both from their lead maternity carer and from other sources. The study results indicated that 97% of women reported that their lead maternity carer regularly asked about fetal movements. Sixty-two percent recalled receiving information from their LMC about what to expect regarding fetal movements in the last three months of pregnancy. Thirty-three percent reported that the information they received from their LMC was that their baby's movements should increase or stay the same, and 20% that their baby's movements may decrease in late pregnancy. Forty per cent were advised to contact their LMC if they had any concerns about their baby's movements, and one-quarter were told to seek advice if they had fewer than 10 movements in a day. The study authors concluded that their results suggested that some pregnant women in Auckland lack optimum information about fetal movements. They stated that strategies to enhance maternal knowledge, such as pamphlet provision, could be helpful.</p>
<p style="text-align: center;"><b>Websites</b></p>
<p>Ministry of Health. 2014. <b>Fetal and Infant Deaths 2011.</b> <a href="http://www.health.govt.nz/publication/fetal-and-infant-deaths-2011">http://www.health.govt.nz/publication/fetal-and-infant-deaths-2011</a></p> <p>This website presents key findings regarding fetal and infant deaths in 2011. It has downloadable tables which present a summary of fetal and infant deaths with a focus on deaths and stillbirths registered in 2011 with the Births, Deaths, Marriages and Citizenship Registry (BDM). The tables include information on demographic characteristics (such as ethnicity and sex), cause of death, gestation and birthweight, and also information on deaths classified as sudden infant death syndrome (SIDS) and sudden unexpected death in infancy (SUDI).</p>

# PRETERM BIRTH

## Introduction

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

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

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

### Data sources and methods

#### Indicator

*Proportion of live babies born prematurely*

#### Data sources

Birth registration dataset

Numerator: Live births between 20–36 weeks gestation  
Denominator: Live births

National Minimum Dataset

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

#### Definition

Preterm birth per 100 live births

#### Notes on interpretation

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

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

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

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

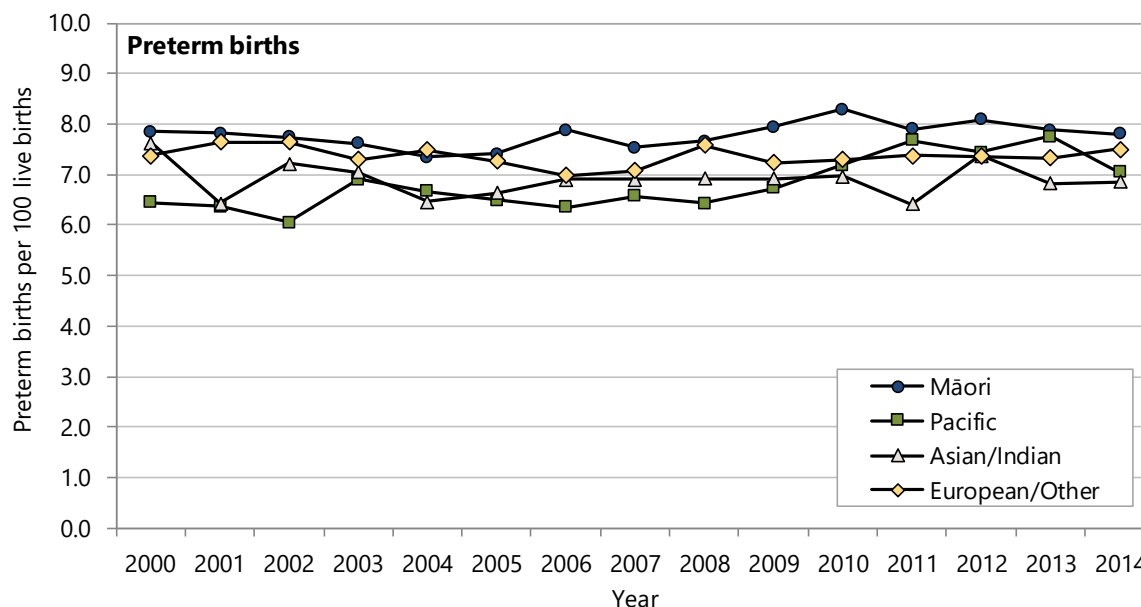
Note 5: An overview of the Birth Registration and National Minimum Datasets are provided in **Appendix 3**.

## National trends and distribution

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

This stable pattern over time was observed for all ethnic groups, with Māori pre-term birth rates generally higher than rates for other ethnic groups. Since 2010 the pre-term birth rates for Asian/Indian infants have been generally lower than for other ethnic groups (**Figure 8**).

Figure 8. Preterm live births, by ethnicity, New Zealand 2000–2014

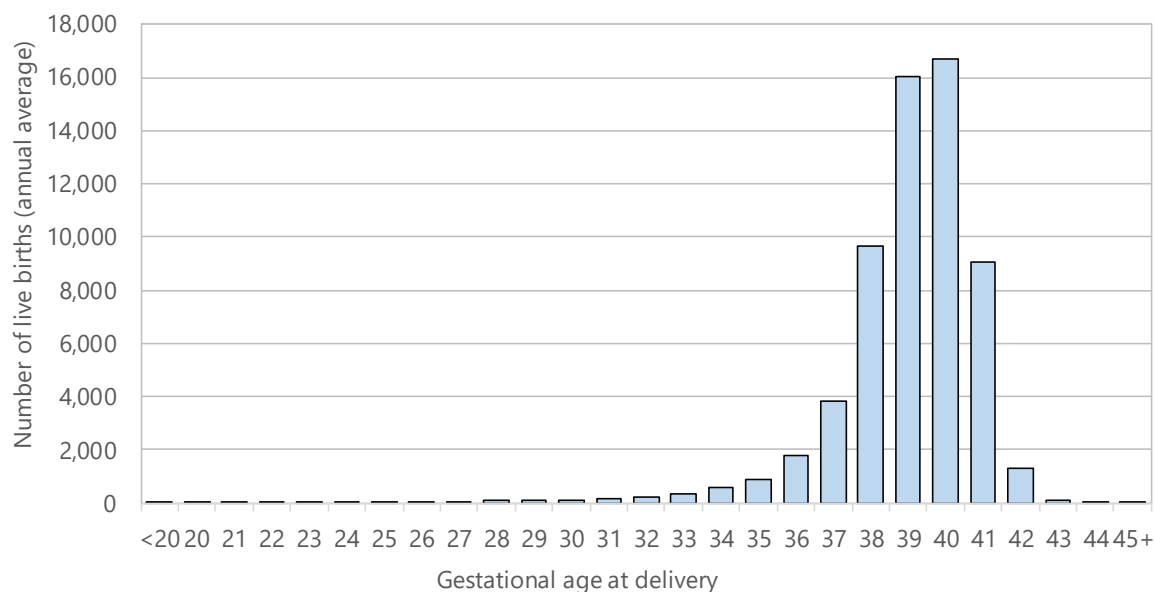


Birth Registration Dataset; Numerator: live births between 20–36 weeks gestation. Denominator: live births; Preterm live birth rate is per 100 live births; Ethnicity is level 1 prioritised

## Distribution by demographic factors

Between 2010 and 2014 there were *small but significant* disparities in pre-term birth rates by NZDep2013 score, ethnicity, maternal age, and infant sex. The greatest disparity was observed with plurality which is also discussed on **page 29**. Rates of pre-term birth were *significantly higher* for infants living in areas with higher scores on NZDep2013 (deciles 7–10) compared with deciles 1–6 and for Māori infants compared with Pacific, MELAA and European/Other infants. Pre-term birth rates were *significantly lower* for Asian/Indian infants than for other ethnic groups. There was an association with maternal age with *significantly higher* pre-term birth rates for infants born to mothers aged under 20 years and aged over 35 years, compared with mothers aged 25–34 years. Pre-term birth rates were *significantly higher* for male compared with female infants. There was a strong association between plurality and pre-term birth with *significantly higher* rates for multiple compared with singleton pregnancies. Pre-term birth was over nine times more likely for twins compared with singletons, and over 16 times more likely for other multiple births (**Table 13**). Between 2010 and 2014 most live births occurred after 36 weeks gestation with an average of 4,611 pre-term births each year (**Figure 9**).

Figure 9. Distribution of live births, by gestational age at delivery, New Zealand 2010–2014



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

Table 13. Preterm live births, by demographic factors, New Zealand 2010–2014

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

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

## Plurality and gestational age

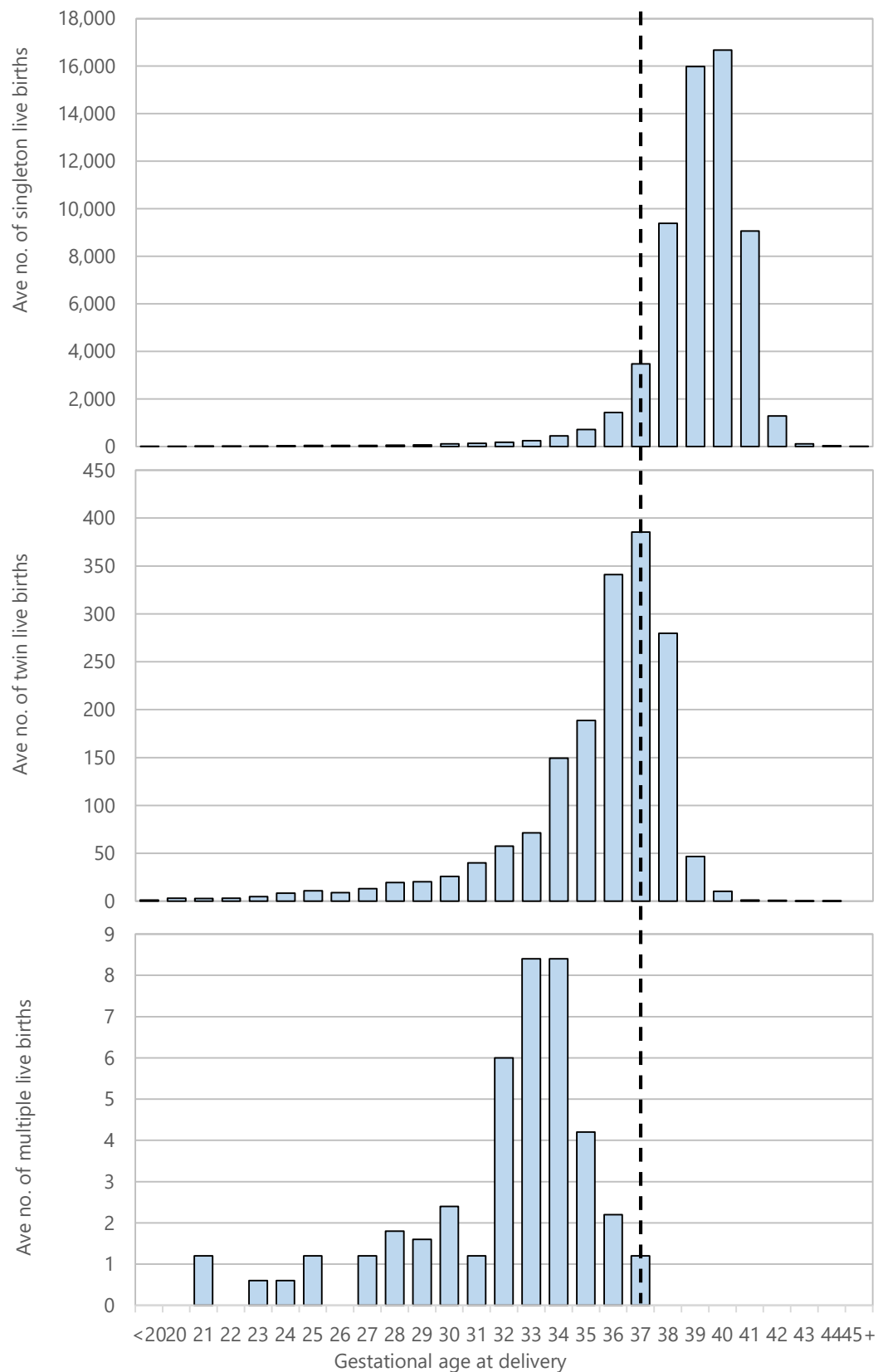
Between 2010 and 2014 there were 17,954 live pre-term births of singleton infants, 4,847 twins and 205 other multiple births. The distribution by gestational age differed by plurality, with pre-term birth rates of 6.0% of live singleton births, 57.2% of live twin births and 97.2% of other live multiple births (**Table 14**). The peak gestational age at birth for singleton infants was 40 weeks, for twins 37 weeks and for other multiple births 33–34 weeks (**Figure 10**).

Table 14. Preterm live births, by plurality, New Zealand 2010–2014

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

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

Figure 10. Distribution of live births, by plurality and gestational age at delivery, New Zealand 2010–2014



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

## Plurality: Distribution by demographic factors

Between 2010 and 2014 there was *no significant difference* in the pre-term birth rates of twins by NZDep2013 score or infant sex. Pre-term birth rates were *slightly but significantly lower* for Māori twins compared with European/Other and *slightly but significantly higher* for Asian/Indian compared with European/Other. Pre-term birth rates were *significantly higher* for twins born to mothers aged under 20 years and aged 25–29 years compared with mothers aged 30–34 years (**Table 15**).

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

Table 15. Distribution of preterm live births among twins, by demographic factor, New Zealand 2010–2014

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

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

Table 16. Distribution of preterm live births among multiple births, by demographic factor, New Zealand 2010–2014

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

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

## Length of stay by plurality and gestational age

The mean and median length of stay for pre-term twins were longer than for singleton infants, and were higher still for other multiple births (**Table 17**). The increased length of stay was more noticeable for twins and other multiple births at less than 32 weeks gestational age compared with 32–36 weeks gestational age (**Figure 11**).

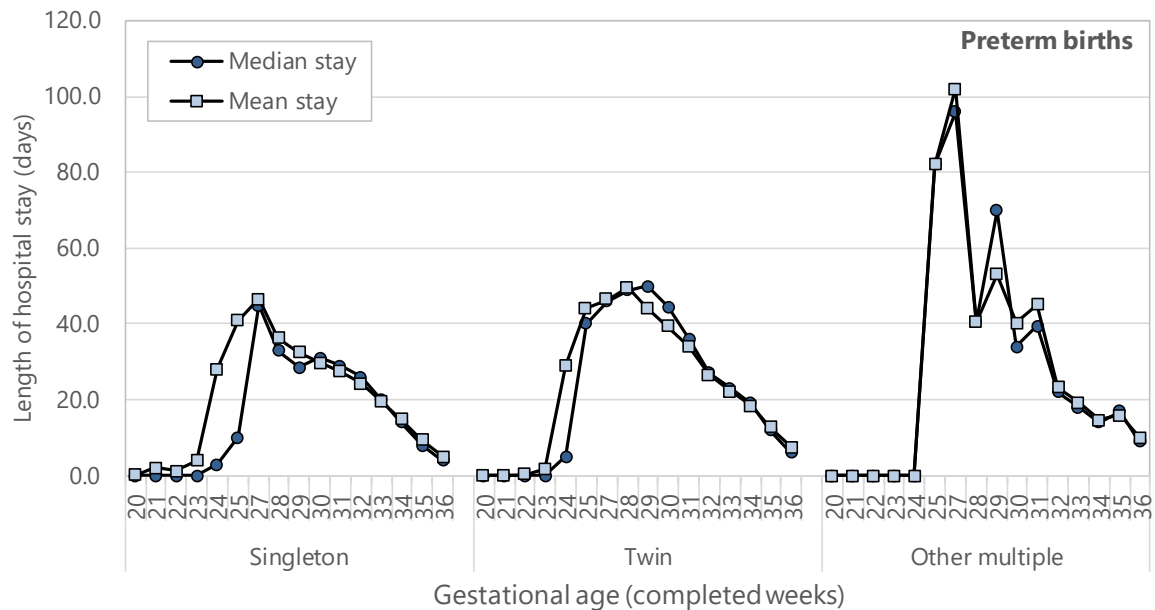
Table 17. Length of hospital stay of preterm babies, by plurality, New Zealand 2010–2014

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

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



Figure 11. Length of hospital stay of preterm babies, by plurality and gestation, New Zealand 2010–2014

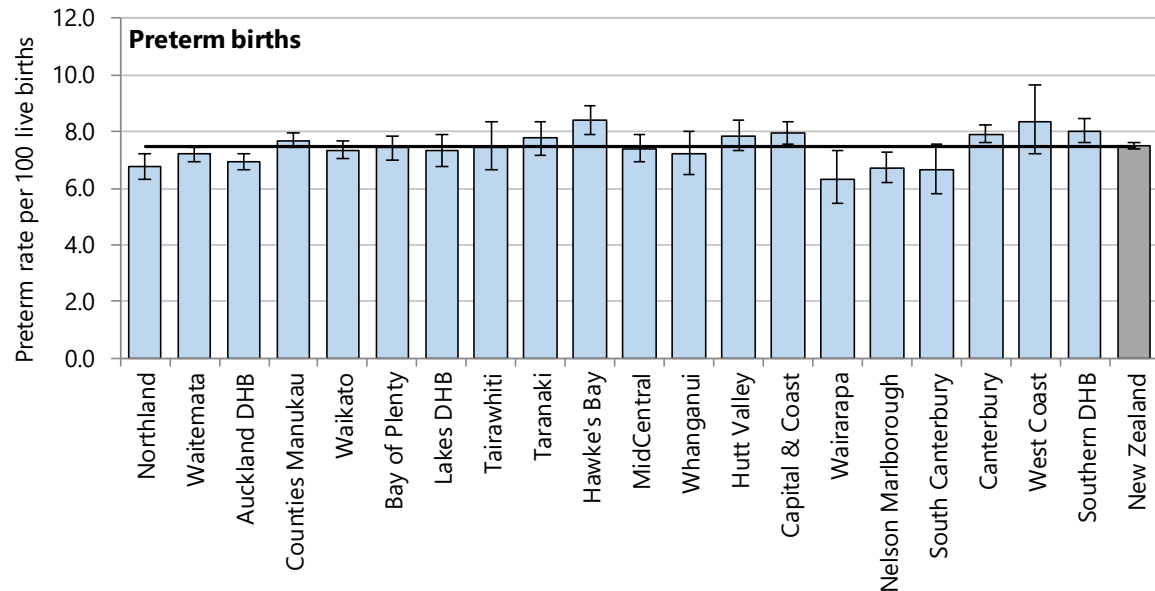


National Minimum Dataset (hospital live births between 20–36 weeks gestation)

## Distribution by region

Pre-term birth rates were close to the New Zealand rate in all DHBs but were *significantly higher* in Counties Manukau, Taranaki, Hawke's Bay, Hutt Valley, Capital & Coast, Canterbury, West Coast, and Southern DHBs, and *significantly lower* in Northland, Auckland, Waitemata, Whanganui, Wairarapa, Nelson Marlborough and South Canterbury DHBs (**Figure 12, Table 18**).

Figure 12. Preterm live births, by district health board, New Zealand 2010–2014



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

Table 18. Distribution of preterm live births, by district health board, New Zealand 2010–2014

DHB	Number: 2010–2014	Number: annual average	Rate per 100 live births	Rate ratio	95% CI
Preterm births					
Northland	773	155	6.76	0.90	0.88–0.92
Waitemata	2,837	567	7.21	0.96	0.95–0.98
Auckland	2,224	445	6.94	0.93	0.91–0.94
Counties Manukau	3,278	656	7.69	1.03	1.01–1.04
Waikato	1,995	399	7.36	0.98	0.97–1.00
Bay of Plenty	1,071	214	7.42	0.99	0.97–1.01
Lakes	551	110	7.31	0.98	0.95–1.00
Tairāwhiti	274	55	7.47	1.00	0.96–1.03
Taranaki	604	121	7.76	1.04	1.01–1.06
Hawke's Bay	941	188	8.40	1.12	1.10–1.15
MidCentral	824	165	7.39	0.99	0.96–1.01
Whanganui	307	61	7.22	0.96	0.93–0.99
Hutt Valley	782	156	7.85	1.05	1.02–1.07
Capital & Coast	1,502	300	7.94	1.06	1.04–1.08
Wairarapa	164	33	6.34	0.85	0.81–0.88
Nelson Marlborough	532	106	6.72	0.90	0.87–0.92
South Canterbury	205	41	6.63	0.88	0.85–0.92
Canterbury	2,437	487	7.92	1.06	1.04–1.07
West Coast	172	34	8.35	1.11	1.07–1.16
Southern	1,433	287	8.03	1.07	1.05–1.09
New Zealand	23,006	4,601	7.50	1.00	

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

## South Island region distribution and trends

### Comparison with New Zealand

Between 2010 and 2014 the preterm birth rates in Canterbury, West Coast and Southern DHBs were *significantly higher* than the New Zealand rate while rates in Nelson Marlborough and South Canterbury were *significantly lower* (Table 19).

Table 19. Preterm live births, South Island DHBs vs New Zealand 2010–2014

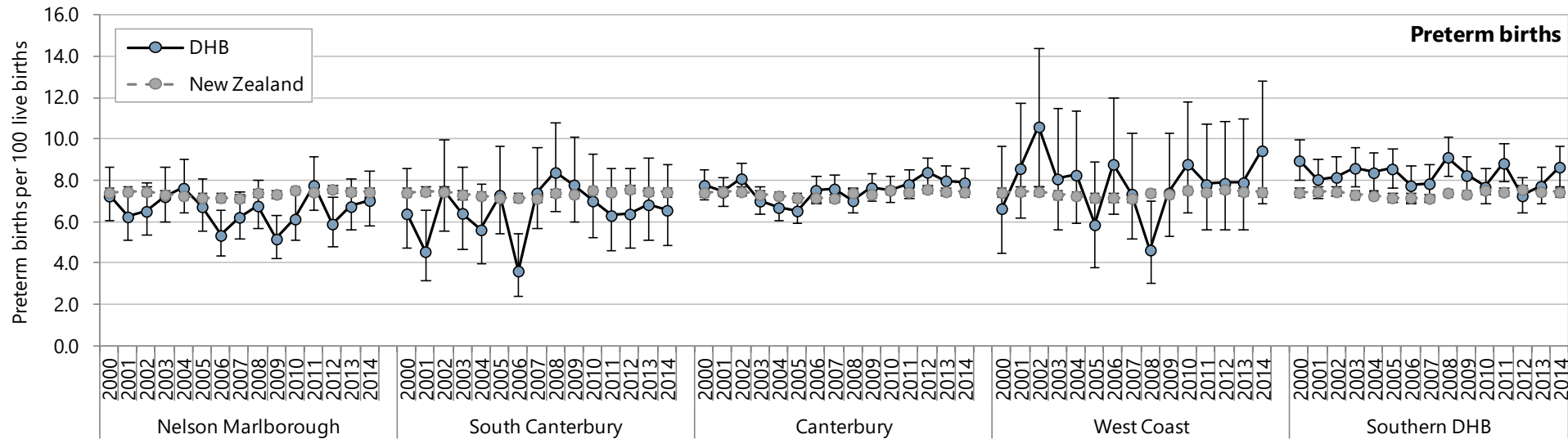
DHB	Number: 2010–2014	Number: annual average	Rate per 100 live births	Rate ratio	95% CI
Preterm births					
Nelson Marlborough	532	106	6.72	0.90	0.82–0.97
South Canterbury	205	41	6.63	0.88	0.77–1.01
Canterbury	2,437	487	7.92	1.06	1.02–1.10
West Coast	172	34	8.35	1.11	0.97–1.29
Southern	1,433	287	8.03	1.07	1.02–1.13
New Zealand	23,006	4,601	7.50	1.00	

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

### Regional trends

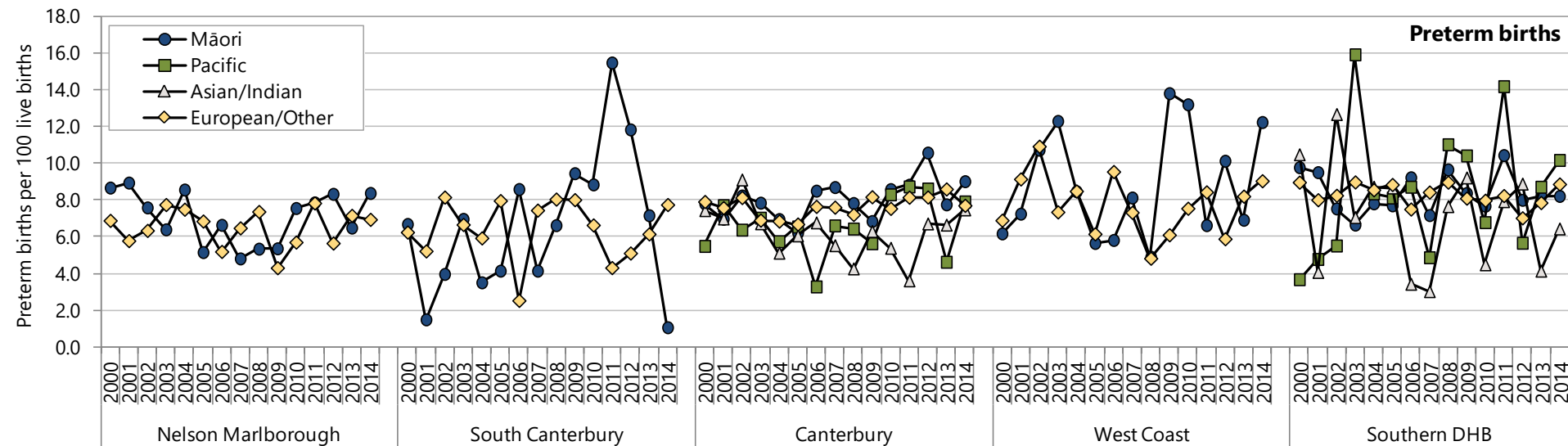
The preterm birth rate in the South Island DHBs has been stable with year to year variations in the South Island DHBs from 2000 to 2014 (Figure 13). There were no specific patterns by ethnicity in South Island DHBs. Asian/Indian and Pacific in Nelson Marlborough, South Canterbury and West Coast have been suppressed (Figure 14).

Figure 13. Preterm live births, South Island DHBs vs New Zealand 2000–2014



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

Figure 14. Preterm live births, by ethnicity, South Island DHBs 2000–2014



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

# Evidence for good practice for the prevention of spontaneous preterm birth

International guidelines
<p>Roelens K, Roberfroid D, Ahmadzai N, et al. 2014. <b>Prevention of preterm birth in women at risk: Selected topics</b>. Brussels: Belgian Health Care Knowledge Centre (KCE).  <a href="http://kce.fgov.be/sites/default/files/page_documents/KCE_228_Preterm%20birth_Report.pdf">http://kce.fgov.be/sites/default/files/page_documents/KCE_228_Preterm%20birth_Report.pdf</a></p> <p>This Belgian guideline provides recommendations based on current scientific evidence for the secondary and tertiary prevention of spontaneous preterm birth. Secondary prevention applies to asymptomatic women at risk with: a history of preterm birth or surgery to the uterine cervix; short cervix measured by ultrasound; asymptomatic changes of cervix (e.g. funnelling, effacement or dilation). Tertiary prevention applies to women in preterm labour. Recommendations in the guideline are graded according to the GRADE approach.</p>
<p>National Collaborating Centre for Women's and Children's Health. 2011. <b>Multiple pregnancy: the management of twin and triplet pregnancies in the antenatal period</b>. London: National Institute for Health and Clinical Excellence.  <a href="https://www.nice.org.uk/guidance/cg129">https://www.nice.org.uk/guidance/cg129</a></p> <p>Women with twin and triplet pregnancies have a higher risk of preterm birth. This guideline is complementary to the NICE guideline 'Antenatal care: routine care for the healthy pregnant woman' (NICE clinical guideline 62) and it specifies the additional or different care that women with twin or triplet pregnancies should receive. Chapter 8 deals specifically with preterm birth. Following discussion of the research evidence, the following recommendations are made regarding the prevention of preterm birth and its associated risks:</p> <ul style="list-style-type: none"> <li>• Be aware that women who have had a previous premature singleton birth are at increased risk</li> <li>• Do not use fibronectin testing alone, home uterine activity monitoring, or routine cervical length measuring (with or without fetal fibronectin) to predict the risk of spontaneous preterm birth in twin and triplet pregnancies.</li> <li>• Do not use the following interventions (either alone or in combination) routinely to prevent spontaneous preterm birth in twin and triplet pregnancies: bed rest (either at home or in hospital), intramuscular or vaginal progesterone, cervical cerclage or oral tocolytics</li> <li>• Inform women with twin and triplet pregnancies about the benefits of targeted (when birth is imminent) corticosteroids</li> <li>• Do not use single or multiple untargeted (routine) courses of corticosteroids and inform women that there is no benefit from using untargeted corticosteroids.</li> </ul> <p>The full guideline, a 2012 evidence update, and the guideline appendices which include the details of the evidence review on which the guidance is based (including the evidence tables) can be found at: <a href="https://www.nice.org.uk/guidance/cg129/evidence">https://www.nice.org.uk/guidance/cg129/evidence</a></p>
Systematic and other reviews from the international literature
<p>The reviews in this section deal with interventions that may prevent preterm births in general, not interventions for treating women in preterm labour or with preterm rupture of membranes. The Cochrane library now contains a large number of reviews relevant to the treatment of such women. It is suggested that readers interested in these reviews consult the Cochrane library's pregnancy and childbirth reviews that are listed under the headings: Pre-labour rupture of membranes, and Preterm labour, at:  <a href="http://www.cochranelibrary.com/app/content/browse/page/?context=topic/Pregnancy%20%26%20childbirth">http://www.cochranelibrary.com/app/content/browse/page/?context=topic/Pregnancy%20%26%20childbirth</a></p> <p>In addition, the following review, which provides an overview and summary of Cochrane reviews relevant to reducing the risk of preterm birth, may be useful.</p>
<p>Piso B, Zechmeister-Koss I, Winkler R. 2014. <b>Antenatal interventions to reduce preterm birth: an overview of Cochrane Systematic Reviews</b>. BMC Res Notes 7 265 <a href="http://www.ncbi.nlm.nih.gov/pubmed/24758148">http://www.ncbi.nlm.nih.gov/pubmed/24758148</a></p> <p>This review of Cochrane reviews includes 56 Cochrane reviews. Three interventions have been shown in Cochrane reviews to increase the incidence of preterm birth (PTB): metronidazole treatment in pregnant women with asymptomatic trichomoniasis, vitamin C, and oestrogen supplementation. The latter is no longer in use due to its other negative effects. Regarding interventions shown to have positive effects in preventing PTB, the strongest evidence is for smoking cessation programmes, which have been shown to reduce low birthweight as well as PTB, and the treatment of clinical hypothyroidism in pregnancy with levothyroxine, which is standard practice. Cervical cerclage has been shown to reduce PTBs in women at high risk of PTB and progesterone reduces PTB in women with a previous history of PTB, but not in women with multiple pregnancies or at risk of PTB for other reasons. For women with a high risk of developing pre-eclampsia, two interventions reduced PTB risk, and also had a positive effect on other pregnancy outcomes: low dose aspirin after 12 weeks' gestation and calcium supplementation, although the latter also led to a small increase in the risk of HELLP syndrome. Calcium supplementation also seems to be beneficial for women with low dietary calcium intake, but not for the general population of pregnant women. For women in developing countries and undernourished women, rates of PTB could be reduced through advice to increase protein and energy intake and zinc supplementation.</p>
<p>Sosa Claudio G, Althabe F, Belizán José M, et al. 2015. <b>Bed rest in singleton pregnancies for preventing preterm birth</b>. Cochrane Database of Systematic Reviews (3) <a href="http://onlinelibrary.wiley.com/doi/10.1002/14651858.CD003581.pub3/abstract">http://onlinelibrary.wiley.com/doi/10.1002/14651858.CD003581.pub3/abstract</a></p> <p>It is common for bed rest, either at home or in hospital, to be recommended for the prevention of preterm birth in women at high risk (for example because of a previous preterm birth or because of a short cervical length as measured by ultrasound). This review aimed to evaluate the effectiveness of prescription of bed rest for preventing preterm birth, using data from randomised, cluster-randomised, and quasi-randomised controlled trials that assessed clinical outcomes for women and their babies. There were two studies that met the review's inclusion criteria. One was unsuitable or meta-analysis as its data combined single and multiple pregnancies. This study, considered to be at low risk of selection, performance, detection and attrition bias, reported no differences in any maternal or perinatal outcomes. The other study, which provided the data that were included in the meta-analysis, involved 1266 women. There were 432 women who were prescribed bed rest at</p>

home and 834 women who received either a placebo (412 women) or no intervention (422 women). There was little difference between the intervention and control groups in preterm birth before 37 weeks: 7.9% in the intervention group vs. 8.5% in the control group; risk ratio 0.92, 95% CI 0.62 to 1.37. There were no other results reported for any of the other primary or secondary outcomes. The review authors concluded that there is no evidence to either support or refute the use of bed rest, at home or in hospital, to prevent preterm birth. They stated that bed rest could have adverse effects on women and their families (such as deep vein thrombosis or the cost of care for other children) and increase health system costs so clinicians need to discuss the pros and cons of bed rest with women at increased risk of preterm birth.

Sangkomkamhang Ussanee S, Lumbiganon P, Prasertcharoensuk W, et al. 2015. **Antenatal lower genital tract infection screening and treatment programs for preventing preterm delivery**. Cochrane Database of Systematic Reviews (2).

<http://onlinelibrary.wiley.com/doi/10.1002/14651858.CD006178.pub3/abstract>

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

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

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

Rafael Timothy J, Berghella V, Alfirevic Z. 2014. **Cervical stitch (cerclage) for preventing preterm birth in multiple pregnancy**. Cochrane Database of Systematic Reviews (9)

<http://onlinelibrary.wiley.com/doi/10.1002/14651858.CD009166.pub2/abstract>

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

Dodd Jodie M, Jones L, Flenady V, et al. 2013. **Prenatal administration of progesterone for preventing preterm birth in women considered to be at risk of preterm birth.** Cochrane Database of Systematic Reviews (7)

<http://onlinelibrary.wiley.com/doi/10.1002/14651858.CD004947.pub3/abstract>

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

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

Progesterone was associated with a statistically significant reduction in the risk of perinatal mortality (six studies; 1453 women; risk ratio (RR) 0.50, 95% CI 0.33 to 0.75), preterm birth <34 weeks (five studies; 602 women; average RR 0.31, 95% CI 0.14 to 0.69), infant birthweight <2500 g (four studies; 692 infants; RR 0.58, 95% CI 0.42 to 0.79), use of assisted ventilation (three studies; 633 women; RR 0.40, 95% CI 0.18 to 0.90), necrotising enterocolitis (three studies; 1170 women; RR 0.30, 95% CI 0.10 to 0.89), neonatal death (six studies; 1453 women; RR 0.45, 95% CI 0.27 to 0.76), admission to neonatal intensive care unit (three studies; 389 women; RR 0.24, 95% CI 0.14 to 0.40), preterm birth < 37 weeks (10 studies; 1750 women; average RR 0.55, 95% CI 0.42 to 0.74) and a statistically significant increase in pregnancy prolongation in weeks (one study; 148 women; mean difference (MD) 4.47, 95% CI 2.15 to 6.79). For most of the outcomes examined there were no differential effects seen in terms of route of administration, time of commencing therapy and dose of progesterone.

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

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

#### **Progesterone versus placebo for women with a multiple pregnancy**

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

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

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

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

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

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

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

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

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

Bacterial vaginosis is an overgrowth of anaerobic bacteria in the vagina and a lack of the normal lactobacillary flora. Having this condition in pregnancy has been associated with adverse perinatal outcomes, particularly preterm birth (PTB). This review sought to assess the effects of antibiotic treatment of bacterial vaginosis in pregnancy. It included 21 good quality trials involving 7847 women diagnosed with bacterial vaginosis or intermediate vaginal flora. Antibiotic treatment given to women with bacterial vaginosis in pregnancy was found to be effective at eradicating bacterial vaginosis (average risk ratio (RR) 0.42; 95% CI 0.31 to 0.56; 10 trials, 4403 women; random-effects,  $T^2 = 0.19$ ,  $I^2 = 91\%$ ) and it also reduced the risk of late miscarriage (RR 0.20; 95% CI 0.05 to 0.76; two trials, 1270 women, fixed-effect,  $I^2 = 0\%$ ). It did not reduce the risk of PTB at <37 weeks (average RR 0.88; 95% CI 0.71 to 1.09; 13 trials, 6491 women; random-effects,  $T^2 = 0.06$ ,  $I^2 = 48\%$ ), or the risk of preterm pre labour rupture of membranes (RR 0.74; 95% CI 0.30 to 1.84; two trials, 493 women). It did increase the risk of side-effects sufficient to stop or change treatment (RR 1.66; 95% CI 1.02 to 2.68; four trials, 2323 women, fixed-effect,  $I^2 = 0\%$ ). New evidence for this updated review indicated that treatment before 20 weeks' gestation did not reduce the risk of PTB at <37 weeks (average RR 0.85; 95% CI 0.62 to 1.17; five trials, 4088 women; random-effects,  $T^2 = 0.06$ ,  $I^2 = 49\%$ ). In women with previous PTB, treatment did not change the risk of PTB in the current pregnancy



(average RR 0.78; 95% CI 0.42 to 1.48; three trials, 421 women; random-effects,  $T^2 = 0.19$ ,  $I^2 = 72\%$ ). In women with abnormal vaginal flora (intermediate flora or bacterial vaginosis) evidence from two trials (894 women) suggested that treatment may reduce the risk of PTB at < 37 weeks (RR 0.53; 95% CI 0.34 to 0.84). A few trials compared different antibiotics, different routes of administration, or different antibiotic doses. The differences found were either not statistically significant, or statistically significant but not clinically significant. The review authors concluded that while antibiotic treatment can eradicate bacterial vaginosis in pregnancy, there is little evidence that screening and treating all pregnant women with bacterial vaginosis will prevent PTB or its consequences. They noted that limited evidence from two studies indicated that treatment of women with abnormal flora was associated with a 47% reduction in preterm births.

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

This review aimed to assess the effectiveness of antenatal management based on transvaginal ultrasound measurement of cervical length (TVU CL) screening. A short cervical length is associated with a higher risk of preterm birth. There were five RCTs deemed eligible for inclusion in the review (507 women). There were three including singleton gestations with preterm labor (PTL); one including singleton gestations with preterm premature rupture of membranes (PPROM); and one including twin gestations with or without PTL. The three trials of singleton gestations with PTL included 290 women, randomised to either knowledge of TVU CL results (147 women) or no knowledge (143 women). Knowledge of TVU CL results was associated with a non-significant decrease in PTB at <37 weeks (22.3% vs. 34.7%, respectively; average risk ratio 0.59, 95% CI 0.26 to 1.32; two trials, 242 women) and at <34 weeks (6.9% vs. 12.6%; RR 0.55, 95% CI 0.25 to 1.20; three trials, 256 women). Delivery occurred at a later gestational age in the knowledge versus no knowledge groups (mean difference (MD) 0.64 weeks, 95% CI 0.03 to 1.25; three trials, 290 women). For all other outcomes with available data (PTB at <34 or <28 weeks; birthweight <2500 grams; perinatal death; maternal hospitalization; tocolysis; and steroids for fetal lung maturity), there was no evidence of a difference between groups. The trial of singleton gestations with PPROM (n = 92) had as its primary outcome measure TVU CL safety in this population, rather than its effect on management. There was no evidence of a difference between the TVU CL and no TVU CL groups in incidence of maternal and neonatal infections. In the trial of twin gestations with or without PTL (n = 125), there was no evidence of a difference in PTB at less than 36, 34, or 30 weeks, gestational age at delivery, and other perinatal and maternal outcomes between the TVU CL and the no TVU CL groups. Life-table analysis showed significantly less PTB at <35 weeks in the TVU CL group compared with the no TVU CL group (P = 0.02). the review authors concluded that there is insufficient evidence to recommend routine screening of either symptomatic or asymptomatic pregnant women with TVU CL. They offered some suggestions for further research.

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

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

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

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

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

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

Alfirevic Z, Stampalija T, Roberts D, et al. 2012. **Cervical stitch (cerclage) for preventing preterm birth in singleton pregnancy.** Cochrane Database of Systematic Reviews 4

<http://onlinelibrary.wiley.com/doi/10.1002/14651858.CD008991.pub2/abstract>

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

Davey M, Watson L, Rayner J, et al. 2011. **Risk scoring systems for predicting preterm birth with the aim of reducing associated adverse outcomes.** Cochrane Database of Systematic Reviews (11)

<http://onlinelibrary.wiley.com/doi/10.1002/14651858.CD004902.pub4/abstract>

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

Whitworth M, Quenby S, Cockerill R, et al. 2011. **Specialised antenatal clinics for women with a pregnancy at high risk of preterm birth (excluding multiple pregnancy) to improve maternal and infant outcomes.**

<http://onlinelibrary.wiley.com/doi/10.1002/14651858.CD006760.pub2/abstract>

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



# INFANT MORTALITY AND SUDDEN UNEXPECTED DEATH IN INFANCY

## Introduction

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

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

### Data source and methods

#### Indicators

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

#### Data sources

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

#### Definition

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

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

#### Notes on interpretation

Note 1: SUDI and SIDS: SIDS is defined as "the sudden unexpected death of an infant <1 year of age, with onset of the fatal episode apparently occurring during sleep, and that remains unexplained after a thorough investigation, including performance of a complete autopsy and review of the circumstances of death and the clinical history".<sup>19</sup> Issues have emerged with defining SIDS, possibly as the result of pathologists and coroners becoming increasingly reluctant to label a death as SIDS in the context of equivocal death scene findings (e.g. death of an infant who had been co-sleeping with a parent who had recently consumed alcohol).<sup>19</sup> This has resulted in a fall in the number of SIDS deaths, and a rise in the number of deaths attributed to "suffocation/strangulation in bed" or "unspecified causes".

Note 2: Two additional codes were added to the SUDI indicator in 2013 (W78: Inhalation of gastric contents; and W79: Inhalation and ingestion of food causing obstruction of the respiratory tract) to ensure consistency with the Child and Youth Mortality Review Committee's SUDI reporting. As a result, the rates in this section are not directly comparable with those presented in NZCYES reports prior to 2013.

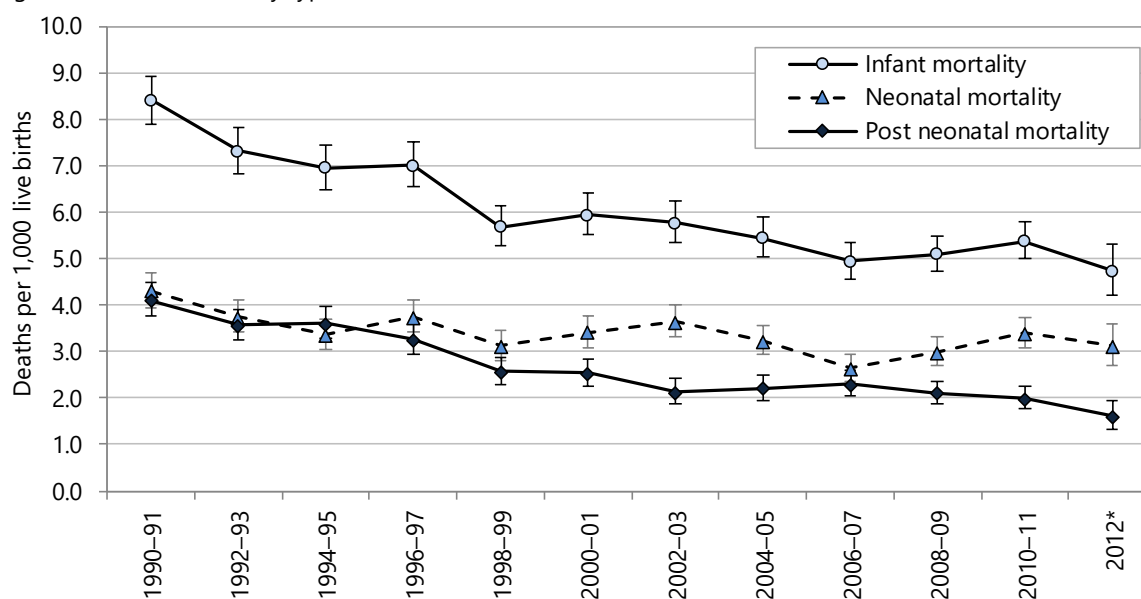
Note 3: See **Appendix 3** for an overview of the National Mortality Collection.

## National trends and distribution

The number of infant deaths in New Zealand declined from 507 in 1990 to 294 deaths in 2012. From 1990 to 2012 there was an overall fall in infant mortality rates from 8.43 deaths per 1000 live births in 1990 to 4.74 deaths per 1000 live births in 2012 (the lowest recorded rate). Most of the fall in infant mortality rates occurred between 1990 and 1998, with a further slight fall to 2005, and there has been no significant difference in rates from year to year since 2005. From 1996 this fall was more marked for post-neonatal than for neonatal mortality rates (**Figure 15**).

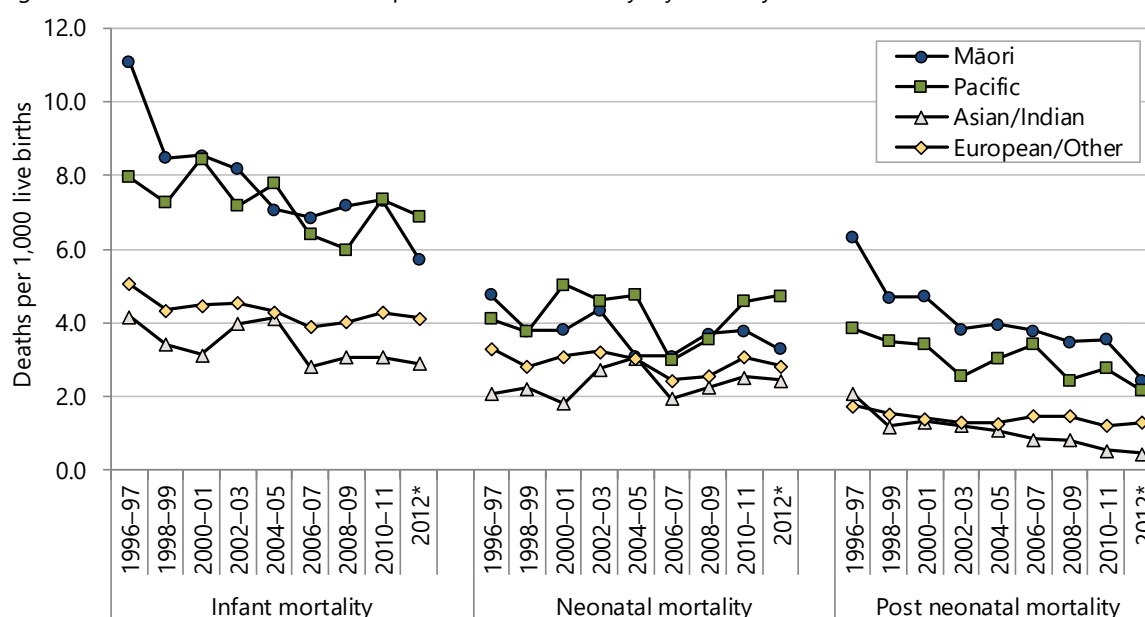
The fall in infant mortality rates was observed in all ethnic groups and was more marked for Māori, Pacific and Asian/Indian infants than for European/Other. Infant mortality rates remain higher for Māori and Pacific infants compared with European/Other and Asian/Indian infants, however the disparity in rates has lessened over time. The fall in rates for all ethnic groups was more marked for post-neonatal than for neonatal mortality (**Figure 16**).

Figure 15. Infant deaths, by type, New Zealand 1990–2012



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

Figure 16. Total infant, neonatal, and post neonatal mortality, by ethnicity, New Zealand 1996–2012



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

## Distribution by cause

Between 2008 and 2012 most infant deaths and most neonatal deaths were the result of congenital anomalies, extreme prematurity and other perinatal conditions including intrauterine or birth asphyxia. The most common underlying cause of post-neonatal death was sudden unexpected death in infancy (SUDI) which is discussed further on **page 49 (Table 20, Table 21)**.

Table 20. Infant mortality, by main underlying cause of death, New Zealand 2008–2012

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

Numerator: National Mortality Collection; Denominator: Birth Registration Dataset

Table 21. Neonatal and post neonatal mortality by main underlying cause of death, New Zealand 2008–2012

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

Numerator: National Mortality Collection; Denominator: Birth Registration Dataset

## Distribution by demographic factors

There were disparities in infant mortality rates by NZDep2013 score, ethnicity, maternal age, infant gender and gestational age at birth. Between 2008 and 2012 there was a clear social gradient in infant mortality rates, with *significantly higher* rates in areas with higher NZDep2013 scores (deciles 5–10) compared with the lowest NZDep scores (deciles 1–2). Mortality rates were *significantly higher* for Māori and Pacific infants, and *significantly lower* for Asian/Indian infants, compared with European/Other infants. Mortality rates for infants born to mothers aged under 30 years and over 35 years were *significantly higher* than for infants born to mothers aged 30–34 years. The highest difference was observed for mothers aged under 20 years. Mortality rates were *significantly higher* for male compared with female infants. The greatest disparity was observed by gestational age. The mortality rate for infants born before 37 weeks gestation was 18 times higher than the rate for infants born at or after 37 weeks and this difference was *statistically significant* (**Table 22**). Similar disparities were observed for neonatal mortality rates, although the higher rate for mothers aged 20–24 years and the lower rate for Asian/Indian infants were *not significant*. The significance of disparities in post-neonatal infant mortality rates by NZDep2013 score, ethnicity, infant gender and gestational age at birth were the same as for overall infant mortality. Post-neonatal mortality rates for infants born to mothers aged under 30 years were *significantly higher* than for infants born to mothers aged 30–34 years but were *not significantly different* for mothers aged over 35 years (**Table 23**).

Table 22. Infant mortality, by demographic factor, New Zealand 2008–2012

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

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

Table 23. Neonatal and post neonatal mortality, by demographic factor, New Zealand 2008–2012

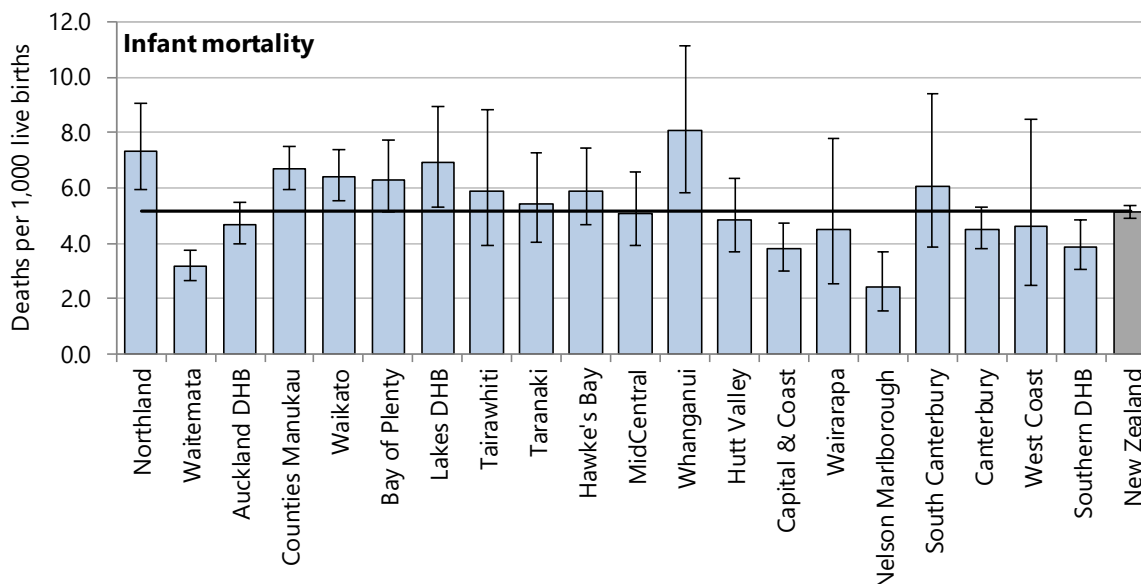
Variable	Rate per 1,000 live births	Rate ratio	95% CI	Variable	Rate per 1,000 live births	Rate ratio	95% CI
Neonatal mortality							
NZDep2013 Index of deprivation quintile				Prioritised ethnicity			
Deciles 1–2	1.79	1.00		Māori	3.65	1.30	1.13–1.50
Deciles 3–4	2.27	1.27	0.96–1.68	Pacific	4.20	1.50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

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

## Distribution by region

Between 2008 and 2012 infant mortality rates were *significantly higher* than the national rate in the Northland, Counties Manukau, Waikato, Lakes and Whanganui DHBs and *significantly lower* than the national rate in the Waitemata, Capital & Coast, Nelson Marlborough and Southern DHBs. In the remaining district health boards there were no significant differences from the national rate (**Figure 17, Table 24**).

Figure 17. Infant mortality, by district health board, New Zealand 2008–2012



Numerator: National Mortality Collection; Denominator: Birth Registration Dataset

Table 24. Infant mortality, by district health board, New Zealand 2008–2012

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

Numerator: National Mortality Collection; Denominator: Birth Registration Dataset

## South Island region distribution and trends

### Comparison with New Zealand

Between 2008 and 2012 infant mortality rates were *significantly lower* than the national rate in Nelson Marlborough and Southern DHBs, but were *not significantly different* in South Canterbury, Canterbury and West Coast DHBs. Similar patterns were observed for neonatal mortality rates. For post neonatal mortality, the rates were *significantly lower* than the national rate in Nelson Marlborough and Canterbury DHBs, while rates were *not significantly different* in South Canterbury and Southern DHBs (**Table 25**).

Table 25. Infant mortality, by type, South Island DHBs vs New Zealand 2008–2012

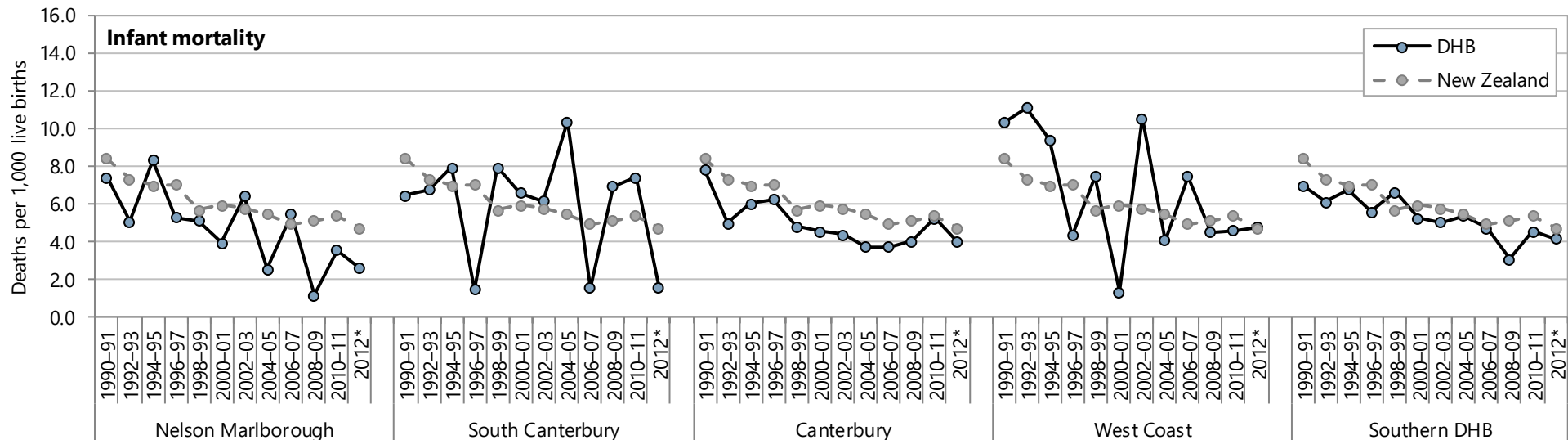
DHB	Number: 2008–2012	Number: annual average	Rate per 1,000 live births	Rate ratio	95% CI
Infant mortality					
Nelson Marlborough	20	4	2.40	0.47	0.30–0.73
South Canterbury	19	4	6.06	1.18	0.75–1.85
Canterbury	144	29	4.50	0.87	0.74–1.04
West Coast	10	2	4.61	0.90	0.48–1.67
Southern	72	14	3.87	0.75	0.60–0.95
New Zealand	1,633	327	5.14	1.00	
Neonatal mortality					
Nelson Marlborough	14	3	1.68	0.53	0.31–0.90
South Canterbury	15	3	4.78	1.50	0.90–2.50
Canterbury	98	20	3.06	0.96	0.78–1.18
West Coast	10	2	4.61	1.45	0.78–2.70
Southern	41	8	2.21	0.69	0.51–0.95
New Zealand	1,010	202	3.18	1.00	
Post neonatal mortality					
Nelson Marlborough	6	1	0.72	0.37	0.16–0.82
South Canterbury	4	1	1.28	0.65	0.24–1.74
Canterbury	46	9	1.44	0.73	0.54–0.99
West Coast	0	..	..	..	..
Southern	31	6	1.67	0.85	0.59–1.22
New Zealand	623	125	1.96	1.00	

Numerator: National Mortality Collection; Denominator: Birth Registration Dataset

### Regional trends

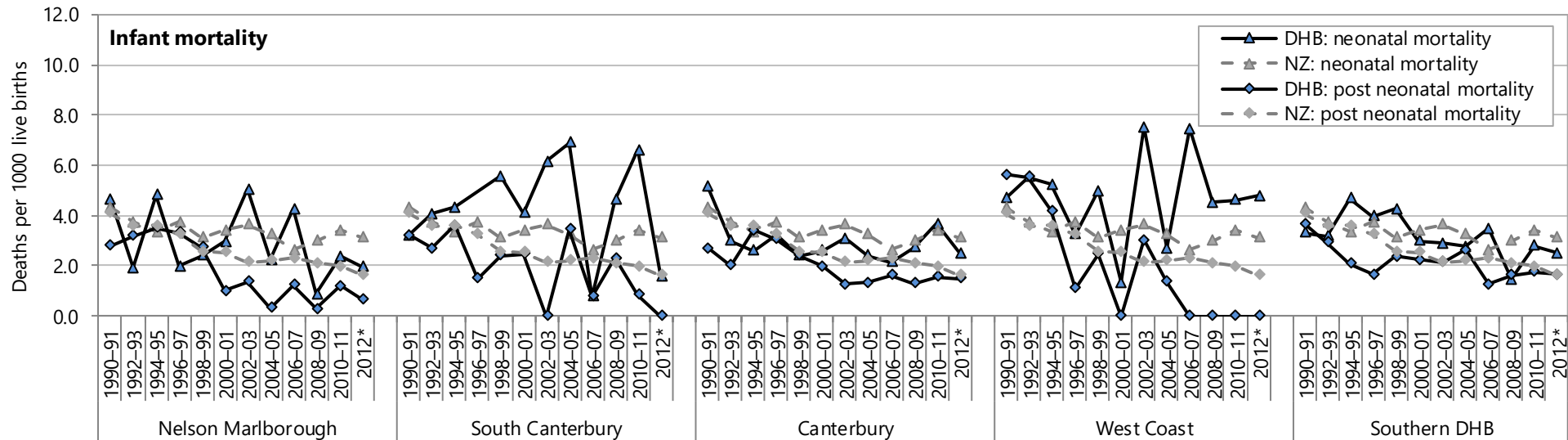
In the South Island DHBs there was an overall fall in infant mortality rates from 1990 to 2012. Falling rates of post neonatal mortality were observed during this period. The patterns for rates of neonatal mortality were less clear, although the 2012 rates were lower than the 1990 rates in all South Island DHBs except for the West Coast (**Figure 18**, **Figure 19**).

Figure 18. Infant mortality, South Island DHBs vs New Zealand 1990–2012



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

Figure 19. Neonatal mortality and post neonatal mortality, South Island DHBs vs New Zealand 1990–2012



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



## Regional distribution by cause

In the South Island DHBs, perinatal conditions and congenital anomalies were the most frequent causes of infant mortality between 2008 and 2012 (**Table 26**).

Table 26. Infant mortality by cause, South Island DHBs 2008–2012

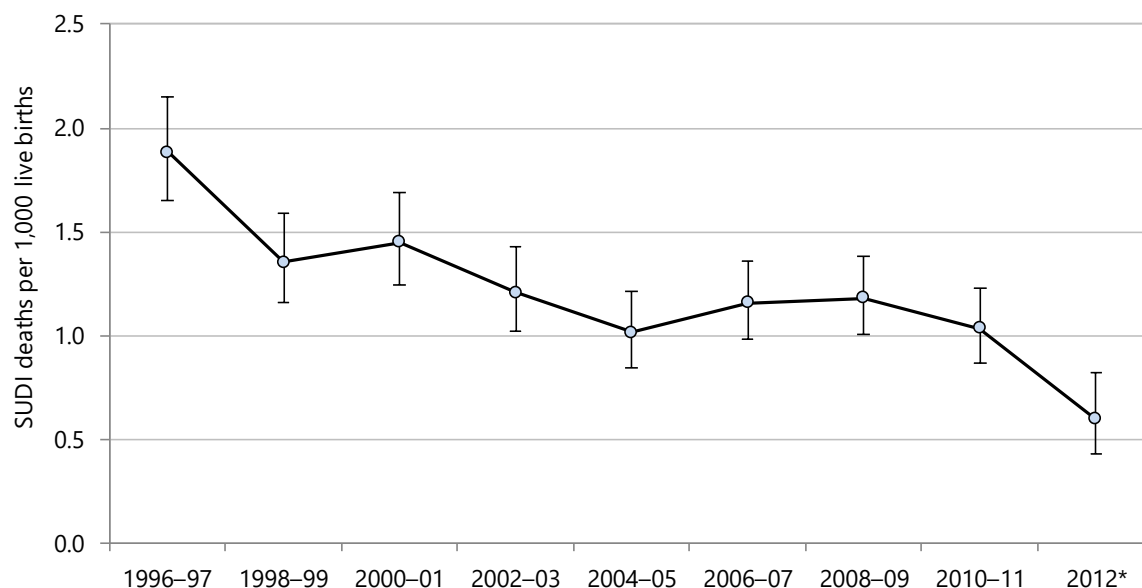
Cause of death	Number: 2008–2012	Number: annual average	Rate per 1,000 live births	Per cent
Infant mortality				
Nelson Marlborough				
Congenital anomalies	5	1.0	0.60	25.0
Extreme prematurity	<5	s	s	s
Other perinatal conditions	7	1.4	0.84	35.0
Other causes	6	1.2	0.72	30.0
Nelson Marlborough total	20	4.0	2.40	100.0
South Canterbury				
Congenital anomalies	6	1.2	1.91	31.6
Extreme prematurity	6	1.2	1.91	31.6
Other causes	7	1.4	2.23	36.8
South Canterbury total	19	3.8	6.06	100.0
Canterbury				
Congenital anomalies	32	6.4	1.00	22.2
Extreme prematurity	27	5.4	0.84	18.8
Other perinatal conditions	46	9.2	1.44	31.9
SUDI: SIDS	10	2.0	0.31	6.9
SUDI: suffocation or strangulation in bed	11	2.2	0.34	7.6
Injury or poisoning	5	1.0	0.16	3.5
Other causes	13	2.6	0.41	9.0
Canterbury total	144	28.8	4.50	100.0
West Coast				
Perinatal conditions	7	1.4	3.23	70.0
Other causes	<5	s	s	s
West Coast total	10	2.0	4.61	100.0
Southern DHB				
Congenital anomalies	11	2.2	0.59	15.3
Extreme prematurity	7	1.4	0.38	9.7
Other perinatal conditions	27	5.4	1.45	37.5
SUDI: SIDS	9	1.8	0.48	12.5
Other causes	18	3.6	0.97	25.0
Southern DHB total	72	14.4	3.87	100.0

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

## Sudden unexpected death in infancy (SUDI)

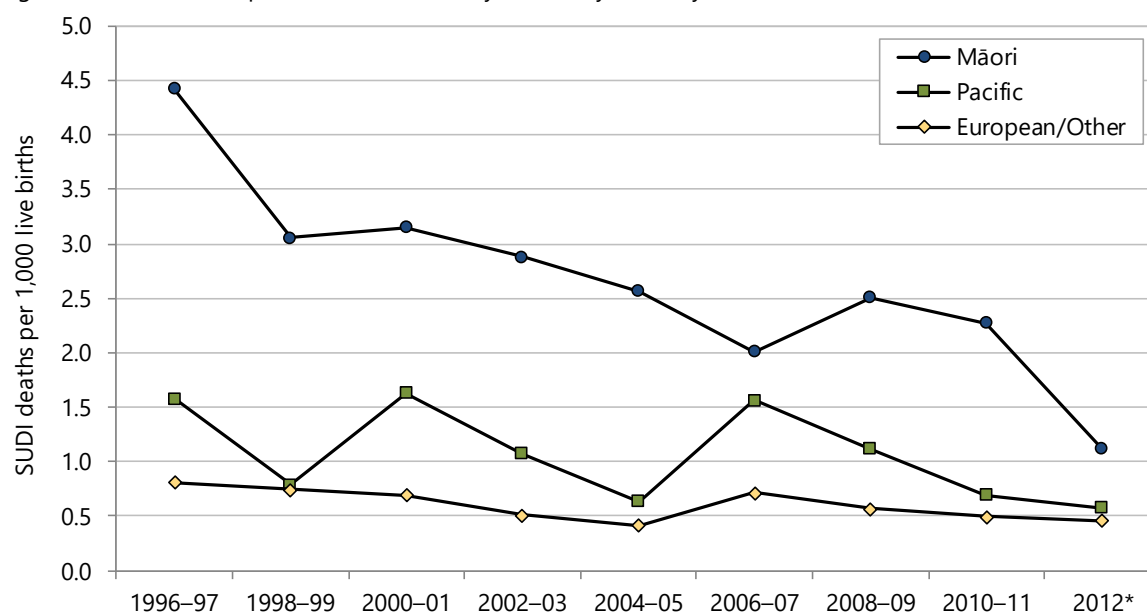
From 1996 to 2012 there was an overall *significant fall* in SUDI rates from 1.88 to 0.6 deaths per 1,000 live births (**Figure 20**). The fall in SUDI rates from 1996–2012 was greatest for Māori infants, with lesser falls for Pacific and European/Other ethnic groups. Asian/Indian analyses were suppressed due to small numbers. Māori rates were consistently highest and European/Other consistently lowest, however, the gap between ethnic groups was closing by 2012 (**Figure 21**).

Figure 20. Sudden Unexpected Death in Infancy (SUDI), New Zealand 1996–2012



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

Figure 21. Sudden unexpected death in infancy (SUDI), by ethnicity, New Zealand 1996–2012



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

## Distribution by cause

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

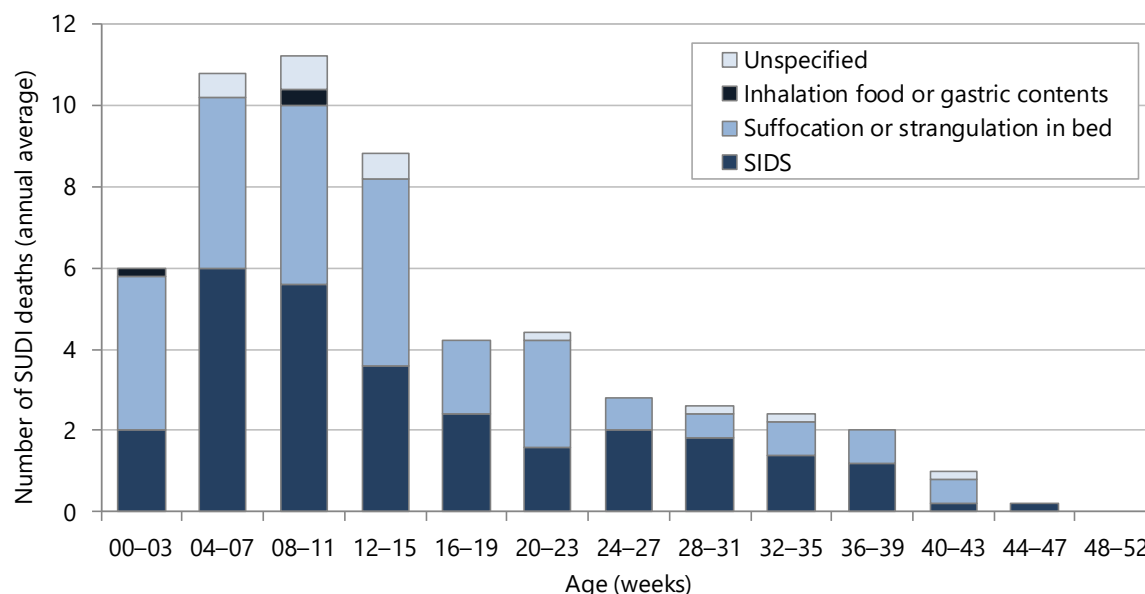
## Distribution by demographic factors

Between 2008 and 2012 SUDI was most common from 4–15 weeks of age, with the highest numbers from 4 to 15 weeks of age, followed by deaths in the first three weeks and at 16–23 weeks. Numbers reduced with increasing age from 24–47 weeks and there were no deaths from 48–52 weeks. Suffocation or strangulation in bed was the predominant cause of death for 0–3 week olds and remained a common diagnosis until 23 weeks,

while SIDS was the most common diagnosis for 4 to 11 weeks and again after 24 weeks of age. Inhalation of food or gastric contents was not noted as an underlying cause of death after age 11 weeks (**Figure 22**).

There were disparities in SUDI rates by NZDep2013 index of deprivation score, ethnicity, gender, gestational age at birth and maternal age between 2008 and 2012. In areas with the highest NZDep2013 scores (deciles 7–10) SUDI rates were *significantly higher* compared with areas with lower scores (deciles 1–6) where there was *no significant difference* between deciles. Māori and Pacific SUDI rates were *significantly higher* compared with Asian/Indian and European/Other ethnic groups. Male rates were *significantly higher* than female rates. Infants born at 20–26 weeks gestation had *significantly higher* SUDI rates than infants born at more than 37 weeks gestation. SUDI rates were *significantly higher* for infants born to mothers aged under 30 years compared with infants born to mothers aged 30 years or older, with the increasing risk of SUDI with decreasing maternal age (**Table 27**).

Figure 22. Sudden unexpected death in infancy (SUDI), by type and age in weeks, New Zealand 2008–2012



National Mortality Collection; Numbers are annual average

Table 27. Sudden unexpected death in infancy (SUDI), by demographic factor, New Zealand 2008–2012

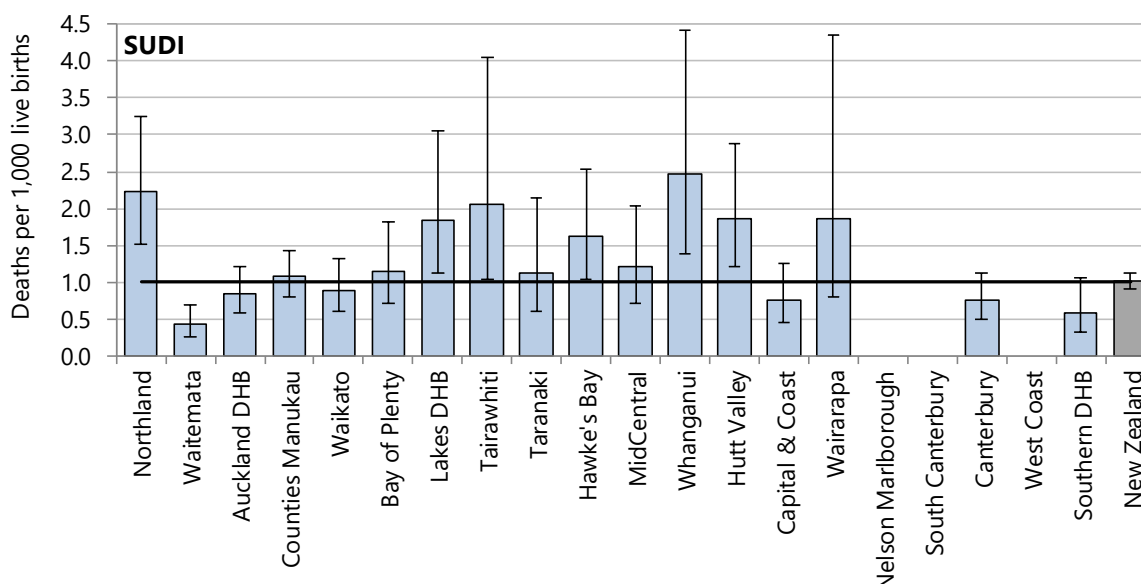
Variable	Rate per 1,000 live births	Rate ratio	95% CI	Variable	Rate per 1,000 live births	Rate ratio	95% CI
Sudden unexpected death in infancy (SUDI)							
NZDep2013 Index of deprivation quintile				Prioritised ethnicity			
Deciles 1–2	0.31	1.00		Māori	2.14	4.13	3.18–5.35
Deciles 3–4	0.49	1.61	0.84–3.10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

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

## Distribution by region

Between 2008 and 2012 SUDI rates were *significantly higher* than the national rate in the Northland, Lakes, Tairāwhiti, Hawke's Bay, Whanganui and Hutt Valley DHBs and *significantly lower* in the Waitemata DHB. In remaining district health boards there was no significant difference from the national rate (**Figure 23, Table 28**).

Figure 23. Sudden unexpected death in infancy (SUDI), by district health board, New Zealand 2008–2012



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

Table 28. Sudden unexpected death in infancy (SUDI), by district health board, New Zealand 2008–2012

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

Numerator: National Mortality Collection; Denominator: Birth Registration Dataset

## South Island region distribution and trends

### Comparison with New Zealand

Between 2008 and 2012 SUDI rates were *not significantly different* from the national rate in Canterbury and Southern DHBs, while rates were suppressed due to small numbers in Nelson Marlborough, South Canterbury, and West Coast DHBs (**Table 29**).

Table 29. Sudden unexpected death in infancy, South Island DHBs vs New Zealand 2008–2012

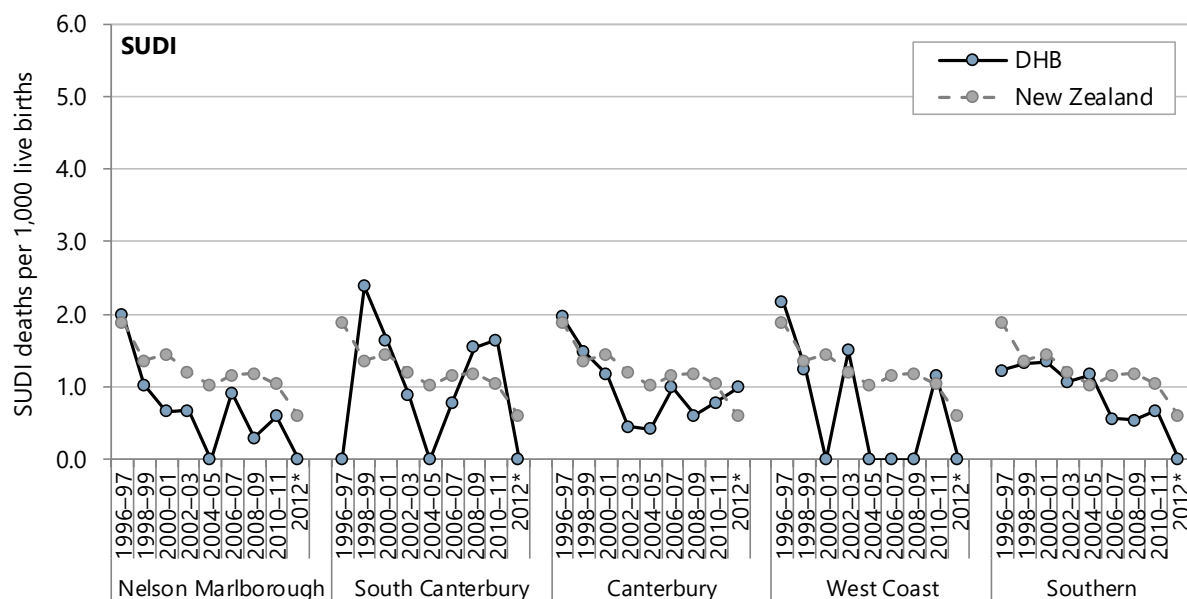
DHB	Number: 2008–2012	Number: annual average	Rate per 1,000 live births	Rate ratio	95% CI
Sudden unexpected death in infancy					
Nelson Marlborough	<5	s	s	s	s
South Canterbury	<5	s	s	s	s
Canterbury	24	5	0.75	0.74	0.49–1.13
West Coast	<5	s	s	s	s
Southern	11	2	0.59	0.59	0.32–1.07
New Zealand	320	64	1.01	1.00	

Numerator: National Mortality Collection; Denominator: Birth Registration Dataset

### Regional trends

In the South Island DHBs, the rate of SUDI fell consistently from 1996–97 to 2012. Care should be applied when interpreting these rates due to the small numbers of SUDI deaths in each DHB, particularly South Canterbury DHB (**Figure 24**).

Figure 24. Sudden unexpected death in infancy, South Island DHBs vs New Zealand, 1996–2012



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

# Evidence for good practice relevant to infant mortality and SUDI prevention

Ministry of Health web pages
<p>Ministry of Health. 2014. <b>Keeping baby safe and warm in bed.</b> <a href="http://www.health.govt.nz/your-health/healthy-living/babies-and-toddlers/keeping-baby-safe-and-warm-bed">http://www.health.govt.nz/your-health/healthy-living/babies-and-toddlers/keeping-baby-safe-and-warm-bed</a></p> <p>This web page contains advice for parents on putting their baby to sleep in a safe place to reduce the risk of suffocation during sleep. A pamphlet containing this information can be ordered or downloaded from the webpage.</p>
New Zealand guidelines
<p>Ministry of Health. 2012. <b>Observation of mother and baby in the immediate postnatal period: consensus statements guiding practice.</b> Wellington: Ministry of Health  <a href="http://www.health.govt.nz/system/files/documents/publications/observation-mother-baby-immediate-postnatal-period-consensus-statements.pdf">http://www.health.govt.nz/system/files/documents/publications/observation-mother-baby-immediate-postnatal-period-consensus-statements.pdf</a></p> <p>This guidance is intended to address the prevention of sudden unexpected early neonatal death, risk factors for which include unsupervised skin-to-skin contact, inexperienced mothers, and mothers being left unsupervised in the immediate postnatal period. The guidance was developed by members of the New Zealand College of Midwives and the Royal Australian and New Zealand College of Obstetricians and Gynaecologists – New Zealand Committee, with the support of the Ministry of Health. It is endorsed by the Ministry of Health and it is expected that all practitioners supporting mothers and babies in the immediate postnatal period will use this document to guide their practice.</p>
International guidelines
<p>National Institute for Health and Care Excellence. 2014. <b>Addendum to Clinical Guideline 37, Postnatal Care.</b> London: National Institute for Health and Care Excellence. <a href="http://www.nice.org.uk/guidance/cg37/evidence/cg37-postnatal-care-full-guideline-addendum2">http://www.nice.org.uk/guidance/cg37/evidence/cg37-postnatal-care-full-guideline-addendum2</a></p> <p>This addendum to the NICE guideline on routine postnatal care updates the guideline section on reducing the risk of sudden infant death syndrome (SIDS). The update was considered necessary because of the publication of new information on the association between co-sleeping and SIDS. Unlike the original guideline which only reviewed evidence for the first 6–8 weeks after birth, this update considered evidence relevant to the first year of life. The review on which the recommendations were based included 11 individual studies and two individual patient data meta-analysis studies. All of the studies were observational (case control) rather than experimental therefore observed relationships between co-sleeping and SIDS could not definitively confirm that co-sleeping is a risk factor for SIDS. In summary, the new recommendations made are:</p> <ol style="list-style-type: none"> <li>1. Recognise that co-sleeping can be intentional or unintentional. Discuss this with parents and carers and inform them that there is an association between co-sleeping (parents or carers sleeping on a bed or sofa or chair with an infant) and SIDS.</li> <li>2. Inform parents and carers that the association between co-sleeping (sleeping on a bed or sofa or chair with an infant) and SIDS is likely to be greater when they, or their partner, smoke.</li> <li>3. Inform parents and carers that the association between co-sleeping (sleeping on a bed or sofa or chair with an infant) and SIDS may be greater with: parental or carer recent alcohol consumption, or parental or carer drug use, or low birthweight or premature infants.</li> </ol>
<p>Task Force on Sudden Infant Death Syndrome. 2011. <b>SIDS and Other Sleep-Related Infant Deaths: Expansion of SIDS and Other Sleep-Related Infant Deaths.</b> Pediatrics, 128(5), 1030-39.  <a href="http://pediatrics.aappublications.org/content/128/5/1030">http://pediatrics.aappublications.org/content/128/5/1030</a></p> <p>This policy statement from the American Academy of Pediatrics is an expansion of previous AAP recommendations. It was reaffirmed in October 2014. The new recommendations not only focus on SIDS prevention but also on safe sleep environments that can reduce the risk of all sleep-related infant deaths including suffocation, asphyxia and entrapment. The recommendations described in this publication include placing the baby in a supine position to sleep, using a firm sleeping surface, breastfeeding, sharing a room (but not a bed), routine immunisations, considering the use of a pacifier, and avoiding soft bedding, overheating and exposure to tobacco smoke, alcohol and illicit drugs. The evidence base for these recommendations is published as:</p> <p>Task Force on Sudden Infant Death Syndrome. 2011. <b>Technical Report: SIDS and Other Sleep-Related Infant Deaths: Expansion of Recommendations for a Safe Infant Sleeping Environment.</b> Pediatrics, 128(5), e1341-e67.</p>
Evidence-based medicine reviews
<p>Horne RSC, Hauck FR, Moon RY, et al. 2014. <b>Dummy (pacifier) use and sudden infant death syndrome: Potential advantages and disadvantages.</b> Journal of Paediatrics and Child Health 50(3) 170-74. <a href="http://dx.doi.org/10.1111/jpc.12402">http://dx.doi.org/10.1111/jpc.12402</a></p> <p>There has been some controversy over whether parents should be advised that the use of a pacifier (dummy) may reduce the risk of sudden infant death syndrome (SIDS). Several systematic reviews have shown a strong association between the lack of pacifier use in the final sleep and SIDS, but it is uncertain by what mechanism pacifier use is protective and whether pacifier use is a marker for some other factor that influences SIDS risk. This article describes the evidence, discussion and conclusions from the Epidemiology and Physiology Working Groups of the International Society for the Study and Prevention of Perinatal and Infant Death (ISPID) on this issue. It discusses potential disadvantages of dummy use and states that, while the current evidence regarding the effect of dummy use on breastfeeding duration and frequency has some methodological limitations, it reinforces the importance of introducing a dummy to breastfed infants only after breastfeeding has become well established, generally after 3–4 weeks. It also states that the evidence suggests that there is an association between otitis media and dummy use, although this has largely been observed in later infancy rather than in early infancy when most SIDS deaths occur. The ISPID found itself unable to provide a definitive recommendation regarding the use of dummies (pacifiers) for reducing SIDS risk, but members were agreed that parents of newborns should be educated about the evidence and potential benefits and risks to using dummies, so that they can make informed choices regarding their own infants.</p>

<p>Ball HL, Volpe LE. 2013. <b>Sudden Infant Death Syndrome (SIDS) risk reduction and infant sleep location – Moving the discussion forward</b>. Social Science &amp; Medicine 79(0) 84-91.</p> <p>The authors of this paper argue that SIDS reduction campaigns have assumed that parents who are appropriately instructed will choose to place their baby to sleep in an approved location such as a crib, but that public health practitioners have failed to recognise the importance of infant sleep location to ethnic and sub-cultural identity and therefore their messages advising parents not to bed share with their baby have been rejected by target populations. They argue that more detailed research about bed sharing is needed so that more sophisticated and focussed infant sleep safety measures that are culturally embedded can be developed.</p>
<p>Strehle E-M, Gray WK, Gopiseti S, et al. 2012. <b>Can home monitoring reduce mortality in infants at increased risk of sudden infant death syndrome? A systematic review</b>. Acta Paediatrica 101(1) 8-13. <a href="http://dx.doi.org/10.1111/j.1651-2227.2011.02464.x">http://dx.doi.org/10.1111/j.1651-2227.2011.02464.x</a></p> <p>This systematic review aimed to evaluate the effectiveness of home monitoring devices for the prevention of sudden infant death syndrome (SIDS). The review authors identified 11 relevant studies meeting their inclusion criteria: 10 cohort studies and one RCT. The RCT was a small study (100 infants in total) designed to assess the feasibility of a larger scale RCT. Across all 11 studies, 2210 infants were monitored for a total of 12,160 months, giving a mean monitoring time of 5.5 months. During monitoring there were 11 deaths described as SIDS deaths, a rate of 5.9 per 1,000 (95% CI 1.4 to 11.0). Several studies reported deaths in infants who were not monitored or for whom monitoring had ceased. The review authors concluded that there is no high level evidence that home monitoring may be useful for preventing SIDS and that the wide variety of monitoring devices used makes comparisons between studies difficult. They noted that a methodologically rigorous controlled study to provide a more definitive evaluation of home monitoring may not be possible due to ethical concerns.</p>
<p>Mitchell EA, Freemantle J, Young J, et al. 2012. <b>Scientific consensus forum to review the evidence underpinning the recommendations of the Australian SIDS and Kids Safe Sleeping Health Promotion Programme--October 2010</b>. Journal of Paediatrics &amp; Child Health 48(8) 626-33. <a href="http://onlinelibrary.wiley.com/doi/10.1111/j.1440-1754.2011.02215.x/abstract">http://onlinelibrary.wiley.com/doi/10.1111/j.1440-1754.2011.02215.x/abstract</a></p> <p>This paper is a summary from a 1-day scientific consensus forum that reviewed the evidence underpinning the Australian SIDS and Safe Sleeping Health Promotion Programme. The Consensus forum recommended that future "Reducing the Risk" campaigns should focus on back to sleep, face uncovered, avoidance of cigarette smoking both before and after birth, safe sleeping environment (avoiding letting babies sleep on sofas, in strollers etc.), and sleeping baby in own cot in parents' room.</p>
<p>Hauck FR, Thompson JMD, Tanabe KO, et al. 2011. <b>Breastfeeding and Reduced Risk of Sudden Infant Death Syndrome: A Meta-analysis</b>. Pediatrics 128(1) 103-10. <a href="http://pediatrics.aappublications.org/content/128/1/103.abstract">http://pediatrics.aappublications.org/content/128/1/103.abstract</a></p> <p>The authors of this review identified 24 original case-control studies that provided data on the relationship between breastfeeding and SIDS risk. Eighteen studies met the review's quality criteria and contribute data to the meta-analyses. The number of cases in each study ranged from 23 to 591. For infants who received any amount of breast milk for any duration, the univariable summary odds ratio (SOR) was 0.40 (95% CI 0.35–0.44), and the multivariable SOR was 0.55 (95% CI 0.44–0.69). For any breastfeeding at two months of age or older, the univariable SOR was 0.38 (95% CI 0.27–0.54). The univariable SOR for exclusive breastfeeding of any duration was 0.27 (95% CI 0.24–0.31). The review authors concluded that breastfeeding is protective against SIDS, more so when breastfeeding is exclusive. They stated that breastfeeding recommendations should be included with other SIDS prevention messages, both to reduce the risk of SIDS and also for the many other child and maternal health benefits breastfeeding provides.</p>
<p><b>Other relevant publications</b></p>
<p>Horne RSC, Hauck FR, Moon RY. 2015. <b>Sudden infant death syndrome and advice for safe sleeping</b>. BMJ 350: h1989 <a href="http://www.bmj.com/content/350/bmj.h1989">http://www.bmj.com/content/350/bmj.h1989</a></p> <p>This recent clinical review aims to provide healthcare professionals with the most up to date information for parents and caregivers about SIDS and infant safety while sleeping. It discusses the major risk factors for SIDS: prone sleeping position, smoking in pregnancy, being born preterm and using bedding which may cover the baby's head. It states that breastfeeding, sharing a room with parents and use of a dummy (pacifier) are protective. There is a detailed discussion of the risk associated with bed sharing and it is noted that although earlier studies found a risk associated with bed sharing only if the mother smoked, more recent studies have found an increased risk for infants &lt;3 months even if neither parent is a smoker. While apnoea monitors are popular with parents who have lost a previous baby to SIDS, there is a lack of evidence for their efficacy.</p>
<p>Fleming P J, Blair P S, Pease A. 2015. <b>Sudden unexpected death in infancy: aetiology, pathophysiology, epidemiology and prevention in 2015</b>. Archives of Disease in Childhood. Published online first February 19, 2015. DOI: 10.1136/archdischild-2014-306424 <a href="http://adc.bmj.com/content/early/2015/02/19/archdischild-2014-306424.full.pdf+html">http://adc.bmj.com/content/early/2015/02/19/archdischild-2014-306424.full.pdf+html</a></p> <p>This paper notes that changes in the way sudden infant deaths are classified by pathologists and coroners, and a reluctance to use the term 'sudden infant death syndrome' have made it difficult to assess and compare national and international data on incidence. It reviews current understanding of the epidemiology and aetiology of SUDI, and current hypotheses regarding the pathophysiology of the processes which may lead to death. It also reviews interventions to reduce SUDI, and their variable effectiveness, before discussing new approaches that may offer the possibility of prevention in the future.</p>
<p>Hutchison BL, Thompson JMD, Mitchell EA. 2015. <b>Infant care practices related to sudden unexpected death in infancy: a 2013 survey</b>. NZMJ, Volume 128, Number 1408</p> <p>This paper reports on a postal survey of women recently delivered at National Women's Health which aimed to evaluate mothers' knowledge of, and practices related to, risk factors for sudden unexpected death in infancy (SUDI) and to compare results with a similar survey conducted in 2005. Compared to the earlier survey, significantly more mothers in the 2013 survey cited advice to avoid bed sharing, keep the face clear, use a firm sleep surface, avoid soft bedding, and sleep in the same room as the parent. There was a marked increase in reported sources of this information. Significantly more mothers than previously reported that their babies were usually placed to sleep on their backs, and that their baby slept in their own bed in the parents' room. Fewer reported bed sharing and smoking in pregnancy.</p>



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

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

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

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

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

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

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

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

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

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

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

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

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

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



<p>concluded that their research had highlighted important information regarding the current state of Māori mothers' knowledge and usage of child care practices and they stated that the challenge now is to develop appropriate health promotion tools for use in this community that might improve knowledge and so change behaviour, especially in regard to smoking cessation, safe sleeping environments, safe sleeping position and duration of breastfeeding.</p>
<p>New Zealand College of Midwives. 2010. <b>Consensus Statement: Safe sleeping for Baby</b>. Christchurch: New Zealand College of Midwives. <a href="http://www.midwife.org.nz/pdf/resources/20%20Safe%20Sleeping%20for%20Baby.pdf">http://www.midwife.org.nz/pdf/resources/20%20Safe%20Sleeping%20for%20Baby.pdf</a></p> <p>This consensus statement sets out the recommendations on safe sleeping for babies that midwives should inform mothers/families/whānau about.</p>
<p>McManus V, Abel S, McCreanor T, et al. 2010. Narratives of deprivation: <b>Women's life stories around Māori sudden infant death syndrome</b>. <i>Social Science &amp; Medicine</i>, 71(3), 643-9.</p> <p>This paper reports on life story interviews conducted between 2002 and 2004 with nineteen Māori mothers whose infants died of SIDS. These mothers' stories have common themes of alienation, marginalisation and exclusion and lives lived with serious deprivation within an affluent society. The authors state that is unhelpful to view some risk factors as non-modifiable and argue that new approaches that build on the WHO Social determinants of health framework are needed to stem the tide of deaths of Māori babies from SIDS.</p>
<p>Child and Youth Mortality Review Committee, Te Rōpū Arotake Auau Mate o te Hunga Tamariki, Taiohi. 2009. <b>Fifth Report to the Minister of Health: Reporting mortality 2002–2008</b>. Wellington: Child and Youth Mortality Review Committee. <a href="http://www.hqsc.govt.nz/assets/CYMRC/Publications/cymrc-5th-report-chp1-sudi.pdf">http://www.hqsc.govt.nz/assets/CYMRC/Publications/cymrc-5th-report-chp1-sudi.pdf</a></p> <p>Chapter one of this report provides quantitative data on mortality from SUDI during 2002–2008, and qualitative information obtained from local mortality review. It also contains recommendations from the CYMRC on reducing the incidence of SUDI in New Zealand.</p> <p>A full page quick reference guide on SUDI prevention, from the CYMRC, can be found here: <a href="http://www.hqsc.govt.nz/assets/CYMRC/Publications/Protecting-Infants-from-SUDI.pdf">http://www.hqsc.govt.nz/assets/CYMRC/Publications/Protecting-Infants-from-SUDI.pdf</a></p>
<p style="text-align: center;"><b>Websites</b></p>
<p>Child and Youth Mortality Review Committee. <b>SUDI</b>. <a href="http://www.hqsc.govt.nz/our-programmes/mrc/cymrc/publications-and-resources/sudi/">http://www.hqsc.govt.nz/our-programmes/mrc/cymrc/publications-and-resources/sudi/</a></p> <p>This web page, by the Child and Youth Mortality Review Committee, has a range of resources and links related to SUDI.</p>
<p><b>Safe sleep videos from the Northland DHB</b> <a href="http://www.hqsc.govt.nz/our-programmes/mrc/cymrc/publications-and-resources/publication/1907/">http://www.hqsc.govt.nz/our-programmes/mrc/cymrc/publications-and-resources/publication/1907/</a></p> <p>In conjunction with the regional Child Health Network and Whakawhetu, the Northland DHB produced four television commercials to promote SUDI prevention. The videos were launched for Safe Sleep Day in December 2013. The four videos, entitled: PLACE baby in his or her own baby bed; ELIMINATE smoking in pregnancy, in the whānau and the home; POSITION baby on his or her back to sleep; and ENCOURGE and support mum, so baby is breastfed, can be viewed on YouTube by following the links on the webpage.</p>
<p><b>Whakawhetu: National SUDI Prevention for Māori</b> <a href="http://www.whakawhetu.co.nz/">http://www.whakawhetu.co.nz/</a></p> <p>Whakawhetū National SUDI Prevention for Māori is a national kaupapa Māori programme dedicated to reducing the rate of SUDI (Sudden Unexpected Death in Infancy) for Māori. They provide policy advice, disseminate evidence-based information, resources, training and education to the health sector and Māori communities, facilitate an annual Safe Sleep Day in December of every year, work with communities to develop local solution, and work with DHBs to support their work to reduce SUDI.</p>
<p><b>TAHA Well Pacific Mother and Infant Service</b> (<a href="http://www.taha.co.nz">www.taha.co.nz</a>)</p> <p>The Pacific Health Programme, in the Department of Māori and Pacific Health at the University of Auckland, has developed a SUDI prevention programme for Pacific families in Auckland.</p>
<p><b>Change for Our Children</b> (<a href="http://www.changeforourchildren.co.nz">www.changeforourchildren.co.nz</a>)</p> <p>Change for our Children is on a mission to build a strong culture of respect for children that is visible in our country's systems and services, conversations and communities, hearts and homes. This site contains, among other useful resources, information on the pepi-pod project which provides a means of enabling babies to be close to a parent but have their own safe sleeping space, and some useful publications both from the organisation and elsewhere. There is a link to The Pepi Shop which is an initiative allowing parents to buy their own Pepi-Pod® sleep space online via Trademe.</p>

