

INFANT MORTALITY AND SUDDEN UNEXPECTED DEATH IN INFANCY

Introduction

Infant mortality, defined as the death of a child before his or her first birthday, is widely used as an indicator of the health of a country [373]. In a recent OECD report, New Zealand's infant mortality rates were shown to be lower than those in the United States, Turkey, Chile and Mexico, but higher than those of the rest of the OECD countries for 2009–2011 [374]. Mortality is higher during the first year of life than at any other time during childhood and adolescence in New Zealand [375]. Around half of all infant deaths occur in the first week of life [376].

The past sixty years have seen a steady decline in New Zealand's infant mortality rates, from 25.7 per 1,000 live births in 1953 to 4.9 in 2003, but the rate of decline has slowed over the past decade. The infant mortality rate in 2013 was 4.4 per 1,000 [377]. Infant mortality rates are generally higher for Pacific and Māori infants and for males [378]. There are significant socioeconomic inequalities and in 2008 and 2009, the infant mortality rate in the most deprived NZ Deprivation Index quintile was over twice that in the least deprived quintile [379]. The causes of infant mortality differ markedly with the age of the infant so total infant mortality rates are of limited utility for guiding population health interventions. For neonates (babies in the first 27 days of life), prematurity is a major cause of death, often in association with extremely low birthweight [379] and congenital malformations are also a common cause of death. Sudden Unexpected Death in Infancy (SUDI), and congenital anomalies are the most common causes of death in the post neonatal period (28 days to one year) [380].

The following section uses information from the National Mortality Collection to review neonatal, post neonatal, and total infant mortality rates, and SUDI rates since 1990.

Data Source and Methods

Definition

1. *Total infant mortality: Death of a live born infant prior to 365 days of life*
2. *Neonatal mortality: Death of a live born infant in the first 27 days of life*
3. *Post neonatal mortality: Death of a live born infant after 27 days but prior to 365 days of life*
4. *Sudden Unexpected Death in Infancy: Death of a live born infant <365 days of life, where the cause of death is Sudden Infant Death Syndrome (SIDS), Accidental suffocation/strangulation in bed, Inhalation of gastric contents/food, or Ill-defined/unspecified causes*

Data Sources

Numerator: National Mortality Collection: All deaths in the first year of life, using the definitions outlined above. Cause of death was derived from the ICD-10-AM main underlying cause of death as follows: Congenital anomalies: CVS (Q20); Congenital anomalies: CNS (Q00–Q07); Congenital anomalies: Other (remainder of Q00–Q99); Intrauterine/Birth asphyxia (P20–P21); Extreme prematurity (P07.2); Other perinatal conditions (P00–P96 excluding P07.2 and P20–P21); SUDI: SIDS (R95); SUDI: Unspecified (R96, R98, R99); SUDI: Suffocation/strangulation in bed (W75); SUDI: Inhalation of gastric contents/food (W78, W79); Injury/Poisoning (V01–Y36).

Denominator: Birth Registration Dataset (live births only)

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” [381]. 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 [382]). 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: In New Zealand, while SIDS rates have declined, there are still large ethnic differences and SIDS rates are six times higher for Māori infants than for European infants [2].



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

Total Infant, Neonatal and Post Neonatal Mortality

New Zealand Distribution and Trends

Distribution by Cause

In New Zealand during 2007–2011, extreme prematurity, and congenital anomalies were the leading causes of neonatal mortality, although intrauterine/birth asphyxia also made a significant contribution. SUDI was the leading cause of post neonatal mortality, followed by congenital anomalies (**Table 1**).

New Zealand Trends

In New Zealand during the 1990s neonatal and post neonatal mortality both declined. While there was some year to year variation during the 2000s, neonatal and post neonatal mortality rates in 2011 were very similar to what they were in the early 2000s (**Figure 1**).

Trends by Ethnicity

In New Zealand during 1996–2011, while there was some year-to-year variation, neonatal mortality was generally higher for Pacific and Māori infants than for European/Other and Asian/Indian infants. Post neonatal mortality remained consistently higher for Māori and Pacific infants than for European/Other and Asian/Indian infants (**Figure 2**).

Distribution by NZDep Index decile, Maternal age, Ethnicity, Gender, and Gestation at birth

Neonatal mortality: In New Zealand during 2007–2011, neonatal mortality was *significantly higher* for Pacific and Māori infants than for European/Other infants, for males, and for those from less deprived to more deprived areas (NZDep deciles 3–10). Rates were also *significantly higher* for preterm babies, and the babies of younger (<20 years) mothers (**Table 2**).

Post neonatal mortality: During 2007–2011, post neonatal mortality was also *significantly higher* for Māori and Pacific infants than for European/Other and Asian/Indian infants, for males, and for those from average to more deprived areas (NZDep deciles 5–10). Rates were also *significantly higher* for preterm babies, and the babies of younger (<20 years) mothers (**Table 2**).



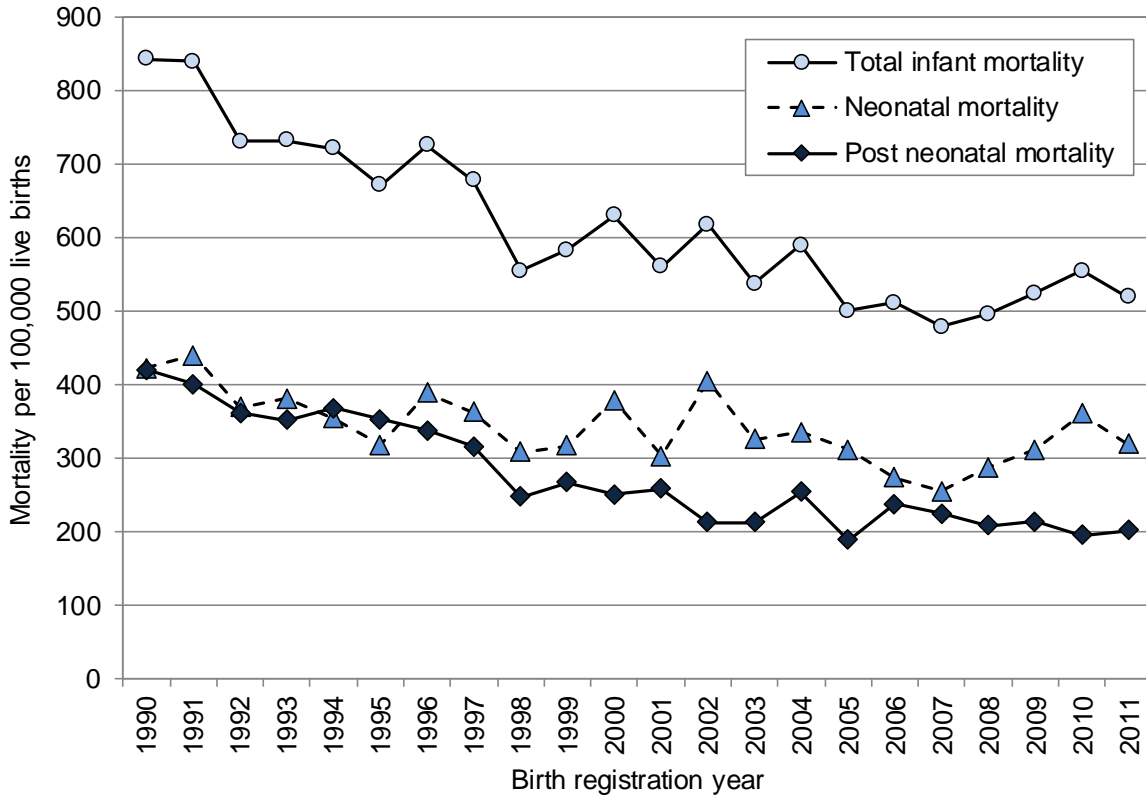
Table 1. Neonatal and post neonatal mortality by cause of death, New Zealand 2007–2011

Cause of death	Number: total 2007–2011	Number: annual average	Rate	Percent of deaths
New Zealand				
Neonatal mortality				
Extreme prematurity	246	49.2	76.73	25.1
Congenital anomalies: CVS	61	12.2	19.03	6.2
Congenital anomalies: CNS	45	9.0	14.04	4.6
Congenital anomalies: Chromosomal	38	7.6	11.85	3.9
Congenital anomalies: other	104	20.8	32.44	10.6
Intrauterine/birth asphyxia	32	6.4	9.98	3.3
Other perinatal conditions	377	75.4	117.59	38.4
SUDI: SIDS	12	2.4	3.74	1.2
SUDI: all other types	25	5.0	7.80	2.5
Injury/poisoning	6	1.2	1.87	0.6
Other causes	36	7.2	11.23	3.7
Total neonatal mortality	982	196.4	306.29	100.0
Post neonatal mortality				
SUDI: SIDS	147	29.4	45.85	22.0
SUDI: suffocation/strangulation in bed	108	21.6	33.69	16.2
SUDI: all other types	16	3.2	4.99	2.4
Congenital anomalies: CVS	51	10.2	15.91	7.6
Congenital anomalies: Chromosomal	27	5.4	8.42	4.0
Congenital anomalies: CNS	8	1.6	2.50	1.2
Congenital anomalies: other	38	7.6	11.85	5.7
Other perinatal conditions	75	15.0	23.39	11.2
Injury/poisoning	29	5.8	9.05	4.3
Other causes	169	33.8	52.71	25.3
Total post neonatal mortality	668	133.6	208.35	100.0
New Zealand total	1,650	330.0	514.64	

Source: Numerator: National Mortality Collection; Denominator: Birth Registration Dataset; Note: CVS = Cardiovascular system; CNS = Central Nervous System; SUDI = Sudden Unexpected Death in Infancy; SIDS = Sudden Infant Death Syndrome; Rates per 100,000 live births

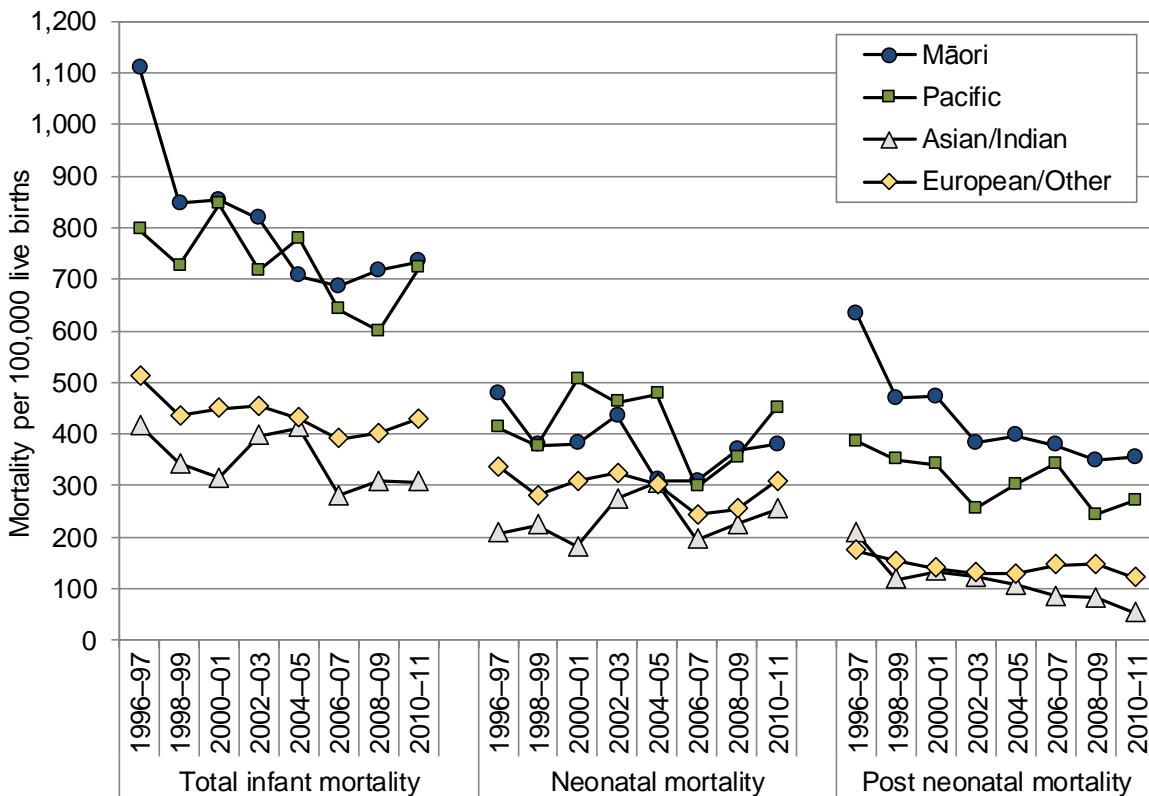


Figure 1. Total infant, neonatal and post neonatal mortality, New Zealand 1990–2011



Source: Numerator: National Mortality Collection; Denominator: Birth Registration Dataset

Figure 2. Total infant, neonatal and post neonatal mortality by ethnicity, New Zealand 1996–2011



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



Table 2. Distribution of neonatal and post neonatal mortality by NZ Deprivation Index decile, maternal age, ethnicity, gender, and gestation at birth, New Zealand 2007–2011

Variable	Rate	Rate ratio	95% CI	Variable	Rate	Rate ratio	95% CI
Neonatal mortality							
NZ Deprivation Index decile				Ethnicity			
Deciles 1–2	169.6	1.00		Māori	353.6	1.28	1.11–1.48
Deciles 3–4	251.4	1.48	1.12–1.96	Pacific	386.0	1.40	1.16–1.70
Deciles 5–6	265.4	1.56	1.20–2.04	Asian/Indian	222.1	0.81	0.63–1.03
Deciles 7–8	317.0	1.87	1.45–2.41	European/Other	275.4	1.00	
Deciles 9–10	434.2	2.56	2.01–3.25	Gender			
Maternal age group				Female	276.8	1.00	
<20 years	534.7	1.00		Male	334.2	1.21	1.06–1.37
20–24 years	364.7	0.68	0.55–0.85	Gestation at birth			
25–29 years	274.2	0.51	0.41–0.64	20–36 weeks	2,880.1	36.37	31.37–42.16
30–34 years	235.7	0.44	0.35–0.55	37+ weeks	79.2	1.00	
35+ years	292.0	0.55	0.44–0.68				
Post neonatal mortality							
NZ Deprivation Index decile				Ethnicity			
Deciles 1–2	100.5	1.00		Māori	356.7	2.61	2.20–3.10
Deciles 3–4	115.0	1.14	0.78–1.67	Pacific	271.3	1.98	1.56–2.52
Deciles 5–6	161.9	1.61	1.14–2.28	Asian/Indian	63.4	0.46	0.30–0.72
Deciles 7–8	189.1	1.88	1.36–2.61	European/Other	136.7	1.00	
Deciles 9–10	367.2	3.65	2.70–4.95	Gender			
Maternal age group				Female	177.9	1.00	
<20 years	457.7	1.00		Male	237.1	1.33	1.14–1.55
20–24 years	342.5	0.75	0.59–0.95	Gestation at birth			
25–29 years	179.0	0.39	0.30–0.50	20–36 weeks	833.2	5.93	5.01–7.02
30–34 years	126.2	0.28	0.21–0.36	37+ weeks	140.5	1.00	
35+ years	121.9	0.27	0.20–0.35				

Source: Numerator: National Mortality Collection; Denominator: Birth Registration Dataset; Note: Rates are per 100,000 live births; Rate ratios are unadjusted; Ethnicity is level 1 prioritised; Decile is NZDep06



South Island DHBs Distribution and Trends

Distribution by Cause

In all of the five South Island DHBs during 2007–2011, extreme prematurity and congenital anomalies were the most frequent causes of neonatal mortality, while SUDI was the most frequent cause of post neonatal mortality (**Table 3–Table 5**).

Table 3. Neonatal and post neonatal mortality by cause of death, Nelson Marlborough and South Canterbury 2007–2011

Cause of death	Number: total 2007–2011	Number: annual average	Rate per 100,000	Percent of deaths
Nelson Marlborough				
Neonatal mortality				
Extreme prematurity	4	0.8	47.03	19.0
Other perinatal conditions	7	1.4	82.29	33.3
Congenital anomalies	6	1.2	70.54	28.6
Other causes	4	0.8	47.03	19.0
Total neonatal mortality	21	4.2	246.88	100.0
Post neonatal mortality				
Congenital anomalies/other perinatal conditions	3	0.6	35.27	42.9
Other causes	4	0.8	47.03	57.1
Total post neonatal mortality	7	1.4	82.29	100.0
Nelson Marlborough total	28	5.6	329.18	
South Canterbury				
Neonatal mortality				
Extreme prematurity	6	1.2	188.38	42.9
Congenital anomalies	4	0.8	125.59	28.6
Other causes	4	0.8	125.59	28.6
Total neonatal mortality	14	2.8	439.56	100.0
Post neonatal mortality				
All causes	5	1.0	156.99	100.0
Total post neonatal mortality	5	1.0	156.99	100.0
South Canterbury total	19	3.8	596.55	

Source: Numerator: National Mortality Collection; Denominator: Birth Registration Dataset; Note: Rates per 100,000 live births



Table 4. Neonatal and post neonatal mortality by cause of death, Canterbury and the West Coast 2007–2011

Cause of death	Number: total 2007–2011	Number: annual average	Rate per 100,000	Percent of deaths
Canterbury				
Neonatal mortality				
Extreme prematurity	23	4.6	69.97	23.0
Intrauterine/birth asphyxia	5	1.0	15.21	5.0
Other perinatal conditions	42	8.4	127.76	42.0
Congenital anomalies: CVS	7	1.4	21.29	7.0
Congenital anomalies: CNS	5	1.0	15.21	5.0
Congenital anomalies: Chromosomal	4	0.8	12.17	4.0
Congenital anomalies: other	8	1.6	24.34	8.0
Other causes	6	1.2	18.25	6.0
Total neonatal mortality	100	20.0	304.20	100.0
Post neonatal mortality				
SUDI: Suffocation/strangulation in bed	11	2.2	33.46	23.4
SUDI: All other types	9	1.8	27.38	19.1
Congenital anomalies: CVS	4	0.8	12.17	8.5
Congenital anomalies: all other	5	1.0	15.21	10.6
Other perinatal conditions	6	1.2	18.25	12.8
Injury/poisoning	5	1.0	15.21	10.6
Other causes	7	1.4	21.29	14.9
Total post neonatal mortality	47	9.4	142.97	100.0
Canterbury total	147	29.4	447.18	
West Coast				
Neonatal mortality				
Congenital anomalies	3	0.6	138.95	27.3
Other causes	8	1.6	370.54	72.7
Total neonatal mortality	11	2.2	509.50	100.0
Post neonatal mortality				
Total post neonatal mortality	0	-	-	-
West Coast total	11	2.2	509.50	

Source: Numerator: National Mortality Collection; Denominator: Birth Registration Dataset; Note: CVS = Cardiovascular system; CNS = Central Nervous System; SUDI = Sudden Unexpected Death in Infancy; Rates per 100,000 live births



Table 5. Neonatal and post neonatal mortality by cause of death, Southern DHB 2007–2011

Cause of death	Number: total 2007–2011	Number: annual average	Rate per 100,000	Percent of deaths
Southern				
Neonatal mortality				
Extreme prematurity	7	1.4	37.43	17.9
Congenital anomalies: CNS and CVS	4	0.8	21.39	10.3
Congenital anomalies: other	5	1.0	26.73	12.8
Perinatal conditions	19	3.8	101.59	48.7
Other causes	4	0.8	21.39	10.3
Total neonatal mortality	39	7.8	208.52	100.0
Post neonatal mortality				
SUDI: all types	10	2.0	53.47	33.3
Congenital anomalies	3	0.6	16.04	10.0
Other perinatal conditions	7	1.4	37.43	23.3
Other causes	10	2.0	53.47	33.3
Total post neonatal mortality	30	6.0	160.40	100.0
Southern DBH total	69	13.8	368.92	

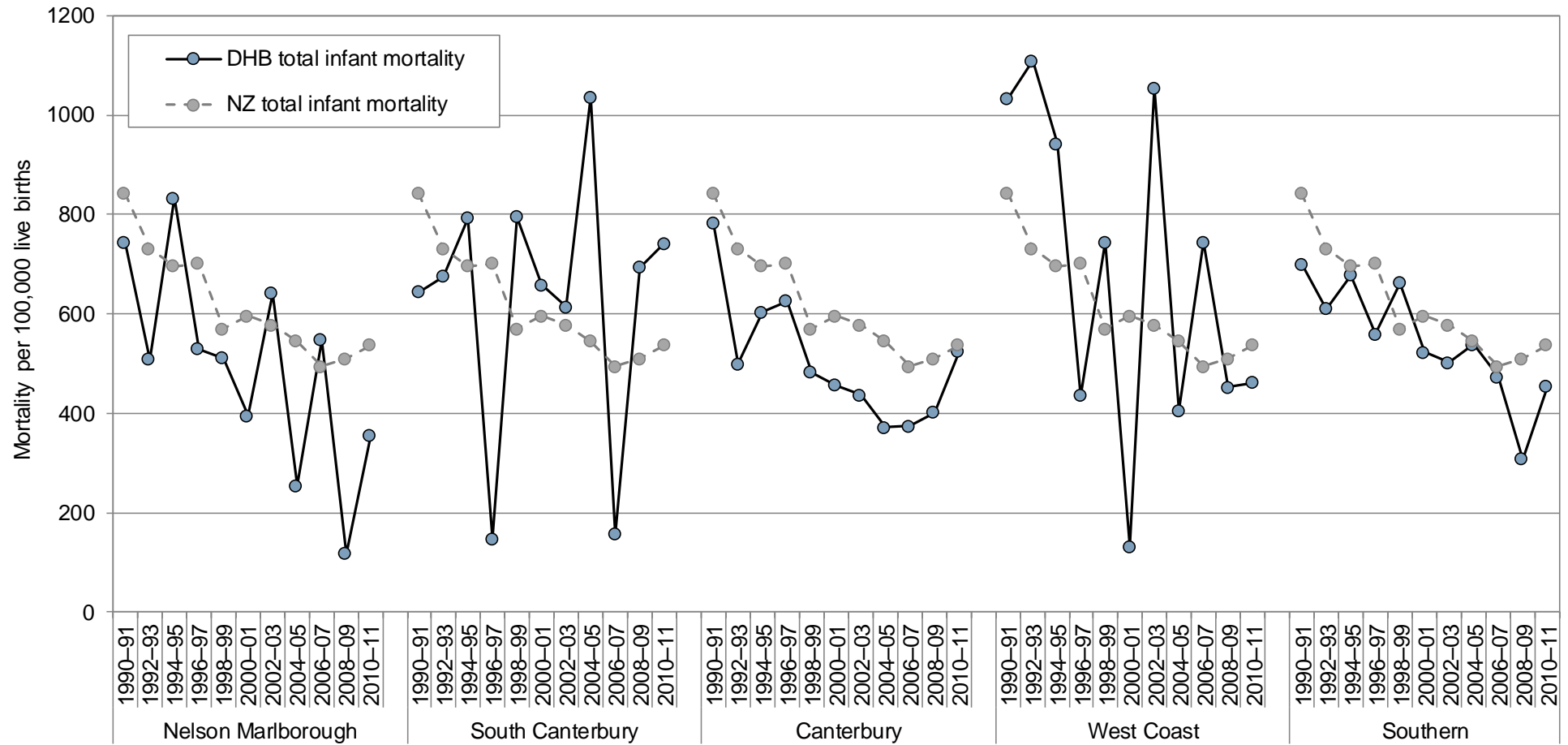
Source: Numerator: National Mortality Collection; Denominator: Birth Registration Dataset; Note: CVS = Cardiovascular system; CNS = Central Nervous System; SUDI = Sudden Unexpected Death in Infancy; Rates per 100,000 live births

South Island DHBs Trends

In the South Island DHBs during 1990–2011, total infant and post-neonatal mortality rates exhibited a general downward trend, while trends in neonatal mortality were more variable (**Figure 3, Figure 4**).

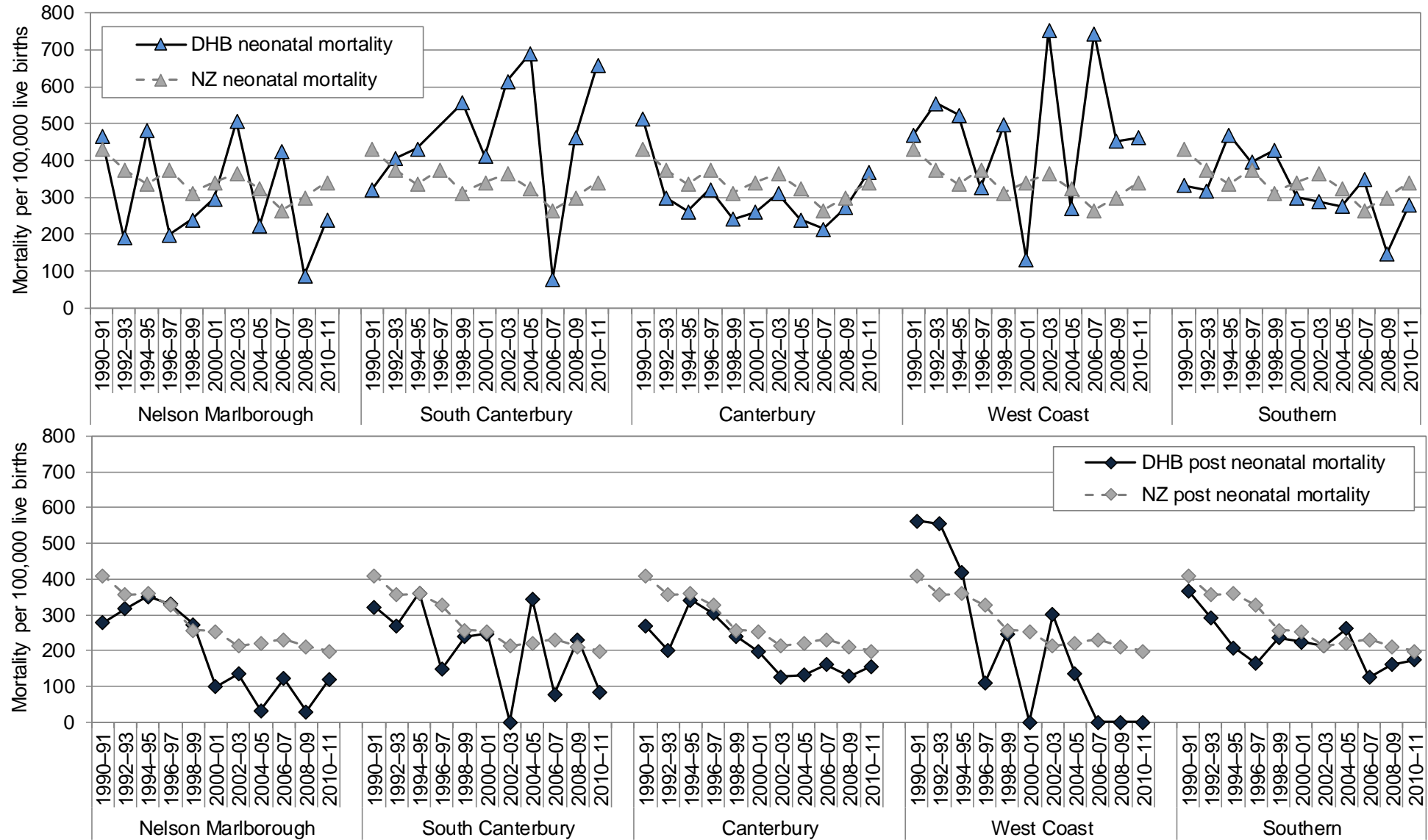


Figure 3. Total infant mortality, South Island DHBs vs. New Zealand 1990–2011



Source: Numerator: National Mortality Collection; Denominator: Birth Registration Dataset

Figure 4. Neonatal and post neonatal mortality, South Island DHBs vs. New Zealand 1990–2011



Source: Numerator: National Mortality Collection; Denominator: Birth Registration Dataset

South Island DHBs vs. New Zealand

In the South Island DHBs during 2007–2011, while neonatal mortality varied, Southern DHB was *significantly lower* than the New Zealand rate, while rates in the remaining South Island DHBs were not significantly different from the New Zealand rate. During the same period, post-neonatal mortality rates in Nelson Marlborough and Canterbury were *significantly lower* than the New Zealand rate, while rates in the remaining South Island DHBs were not significantly different from the New Zealand rate (**Table 6**).

Table 6. Neonatal and post neonatal mortality, South Island DHBs vs. New Zealand 2007–2011

DHB	Number: total 2007– 2011	Number: Annual average	Rate per 100,000	Rate ratio	95% CI
Neonatal mortality					
Nelson Marlborough	21	4	246.88	0.81	0.52–1.24
South Canterbury	14	3	439.56	1.44	0.85–2.43
Canterbury	100	20	304.20	0.99	0.81–1.22
West Coast	11	2	509.50	1.66	0.92–3.01
Southern	39	8	208.52	0.68	0.49–0.94
New Zealand	982	196	306.29	1.00	
Post neonatal mortality					
Nelson Marlborough	7	1	82.29	0.39	0.19–0.83
South Canterbury	5	1	156.99	0.75	0.31–1.81
Canterbury	47	9	142.97	0.69	0.51–0.92
West Coast	0	-	-	-	-
Southern	30	6	160.40	0.77	0.53–1.11
New Zealand	668	134	208.35	1.00	

Source: Numerator: National Mortality Collection; Denominator: Birth Registration Dataset

Sudden Unexpected Death in Infancy (SUDI)

New Zealand Distribution and Trends

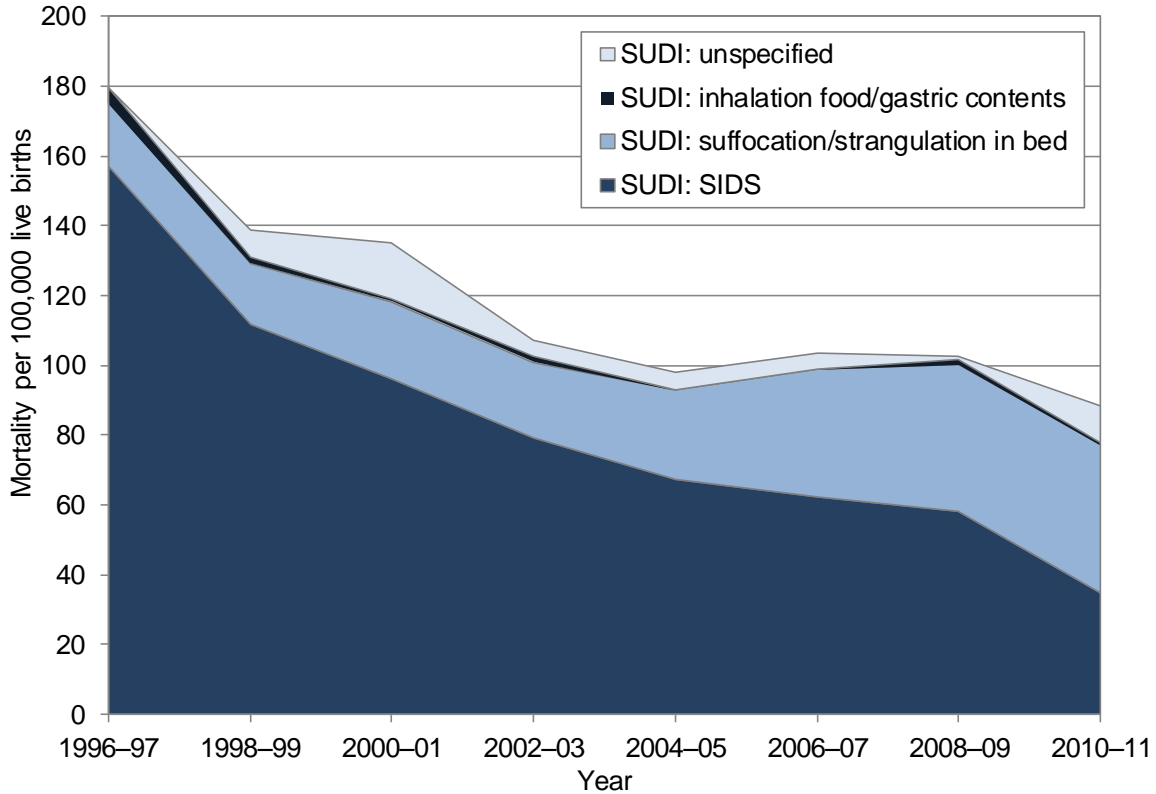
New Zealand Trends

In New Zealand, SUDI rates declined during the late 1990s and early 2000s, but levelled off after 2002–03. When broken down by SUDI sub-type, deaths attributed to SIDS continued to decline throughout 1996–2011, while deaths due to suffocation or strangulation in bed became more prominent as the period progressed. It is unclear, however, whether this represented a diagnostic shift in the coding of SUDI, or whether the sleeping environment made an increasingly greater contribution to SUDI as the period progressed (**Figure 5**).

Distribution by Age

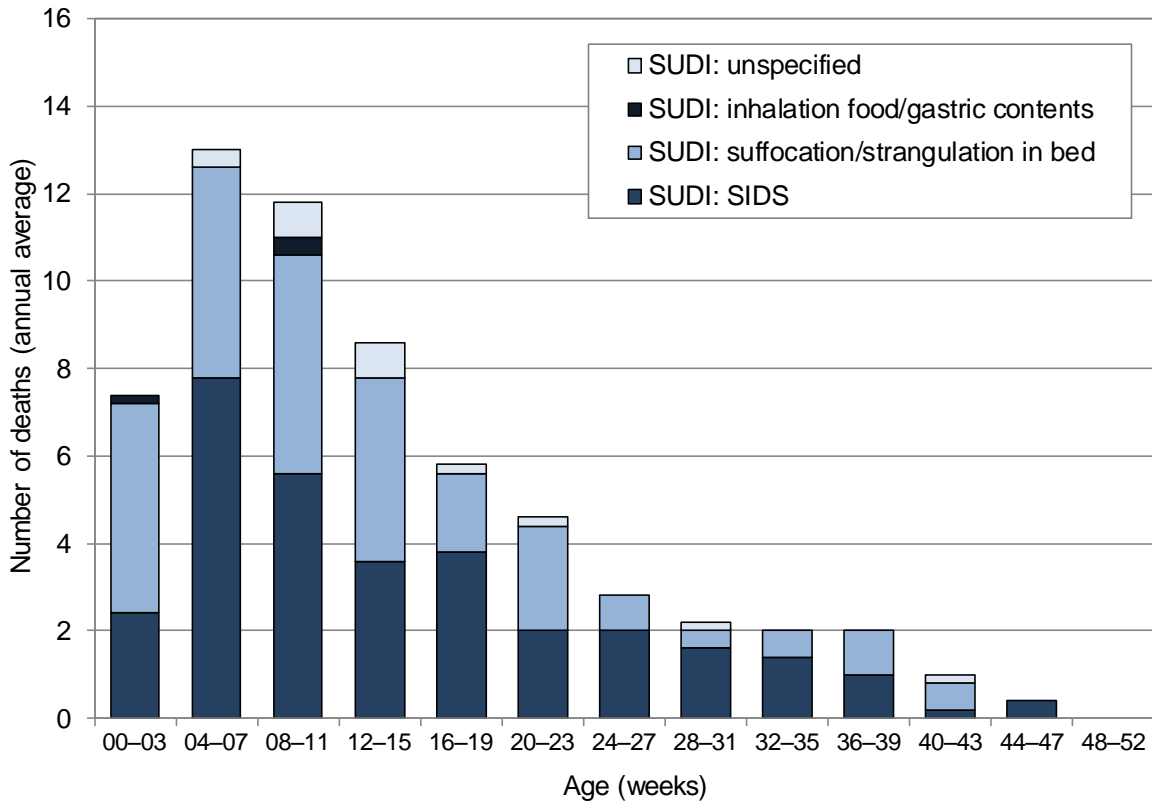
In New Zealand during 2007–2011, SUDI mortality was highest in infants 4–7 weeks, followed by those aged 8–11 weeks, and then those 12–15 weeks of age. Suffocation or strangulation in bed accounted for 64.9% of all SUDI deaths in those aged 0–3 weeks, and 36.9% of SUDI deaths in those aged 4–7 weeks (**Figure 6**).

Figure 5. Sudden Unexpected Death in Infancy by type, New Zealand 1996–2011



Source: Numerator: National Mortality Collection; Denominator: Birth Registration Dataset

Figure 6. Sudden Unexpected Death in Infancy by type and age in weeks, New Zealand 2007–2011



Source: National Mortality Collection



Distribution by NZDep Index decile, Maternal age, Ethnicity, Gender, and Gestation at birth

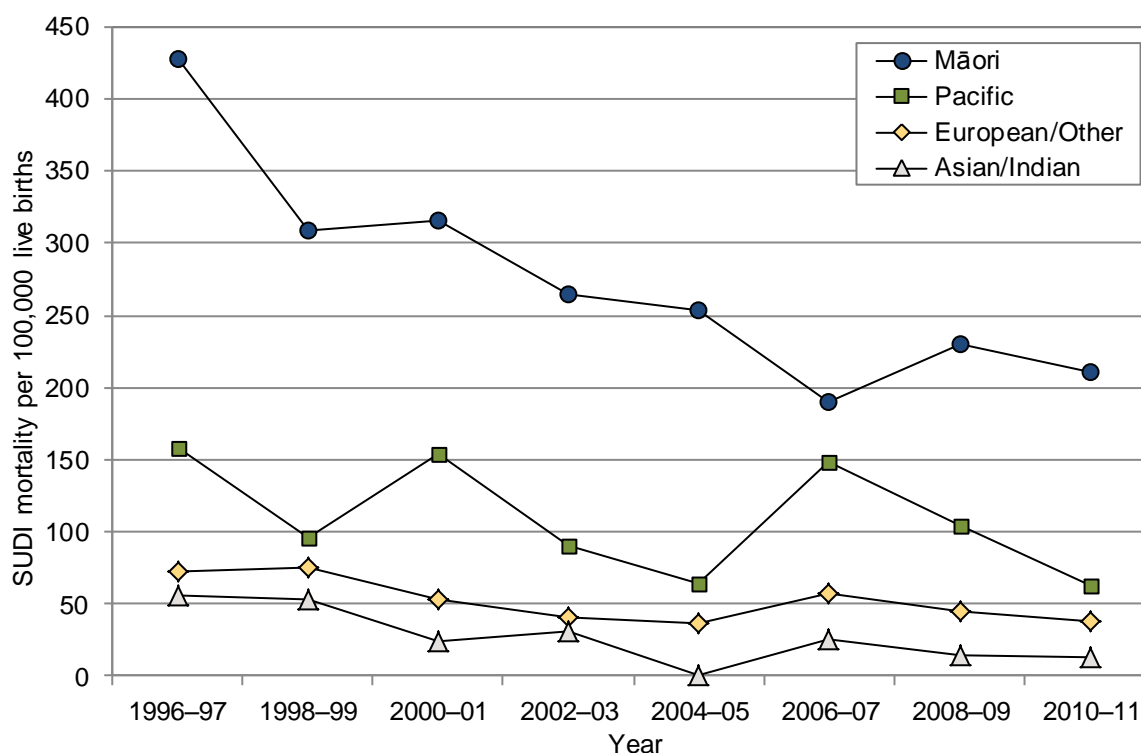
In New Zealand during 2007–2011, SUDI rates were *significantly higher* for Māori and for Pacific infants than for European/Other and Asian/Indian infants (**Table 7**). Similar ethnic differences were seen during 1996–2011 (**Figure 7**). SUDI rates were also *significantly higher* during 2007–2011 for those from more deprived areas (NZDep deciles 7–10), for babies that were male, or were preterm, and for the babies of younger (<20 years) mothers (**Table 7**).

Table 7. Distribution of Sudden Unexpected Death in Infancy by NZ Deprivation Index decile, maternal age, ethnicity, gender, and gestation at birth, New Zealand 2007–2011

Variable	Rate	Rate ratio	95% CI	Variable	Rate	Rate ratio	95% CI
Sudden Unexpected Death in Infancy							
NZ Deprivation Index decile				Ethnicity			
Deciles 1–2	33.5	1.00		Māori	211.3	4.70	3.58–6.17
Deciles 3–4	35.1	1.05	0.53–2.05	Pacific	95.1	2.12	1.41–3.19
Deciles 5–6	60.1	1.79	1.00–3.23	Asian/Indian	14.4	0.32	0.13–0.80
Deciles 7–8	104.8	3.13	1.83–5.36	European/Other	44.9	1.00	
Deciles 9–10	184.8	5.52	3.30–9.22	Gender			
Maternal age group				Female	76.4	1.00	
<20 years	295.2	1.00		Male	114.6	1.50	1.19–1.89
20–24 years	183.2	0.62	0.46–0.84	Gestation at birth			
25–29 years	77.4	0.26	0.19–0.37	20–36 weeks	232.6	3.04	2.27–4.08
30–34 years	42.5	0.14	0.10–0.21	37+ weeks	76.5	1.00	
35+ years	36.9	0.12	0.08–0.20				

Source: Numerator: National Mortality Collection; Denominator: Birth Registration Dataset; Rates are per 100,000 live births; Rate ratios are unadjusted; Ethnicity is Level 1 prioritised; Decile is NZDep06

Figure 7. Sudden Unexpected Death in Infancy by ethnicity, New Zealand 1996–2011



Source: National Mortality Collection; Note: Ethnicity is level 1 prioritised

South Island DHBs Distribution and Trends

South Island DHBs vs. New Zealand

In the South Island DHBs during 2007–2011, SUDI rates were not significantly different from the New Zealand rate (**Table 8**).

Table 8. Sudden Unexpected Death in Infancy (SUDI), South Island DHBs vs. New Zealand 2007–2011

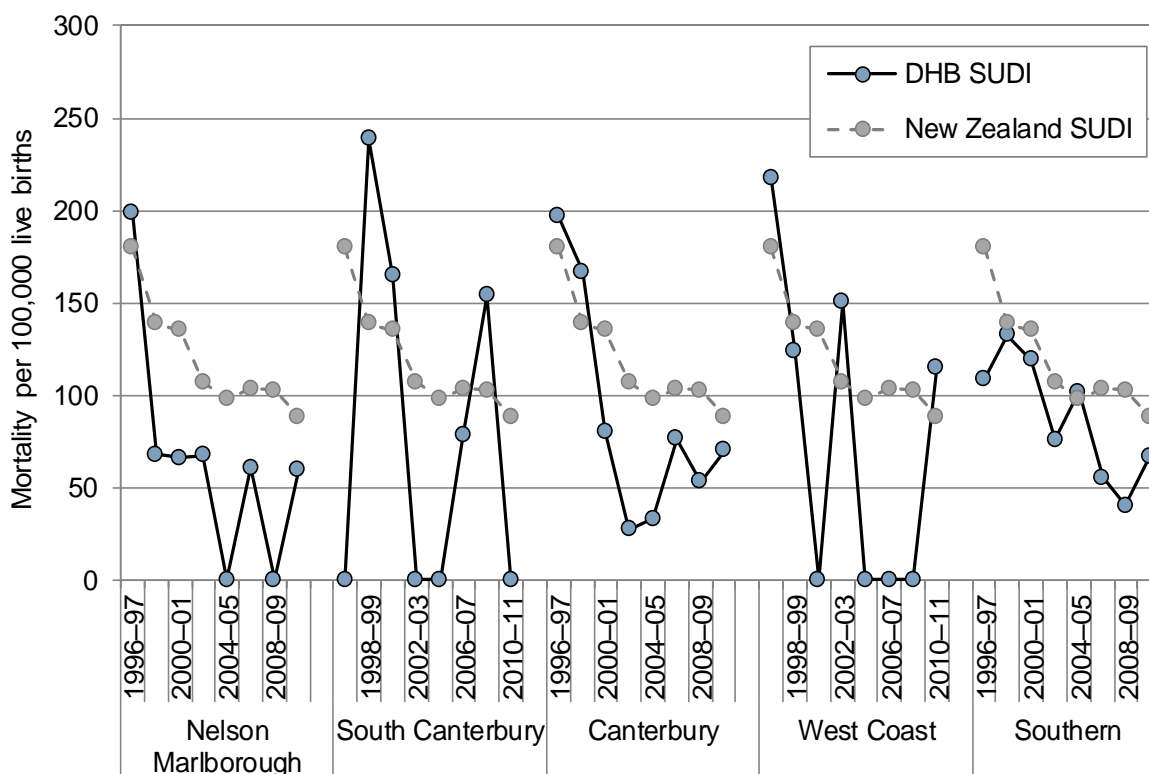
DHB	Number: total 2007–2011	Number: annual average	Rate per 100,000	Rate ratio	95% CI
Sudden unexpected death in infancy					
Nelson Marlborough	3	0.6	35.27	0.37	0.12–1.14
South Canterbury	3	0.6	94.19	0.98	0.31–3.06
Canterbury	20	4.0	60.84	0.63	0.40–1.00
West Coast	<3	s	s	s	s
Southern	10	2.0	53.47	0.56	0.30–1.04
New Zealand	308	61.6	96.07	1.00	

Source: Numerator: National Mortality Collection; Denominator: Birth Registration Dataset; Note: Rates are per 100,000 live births

South Island DHBs Trends

In South Island DHBs, large year to year variations (possibly as a result of small numbers) made precise interpretation of SUDI trends difficult (**Figure 8**).

Figure 8. Sudden Unexpected Death in Infancy (SUDI), South Island DHBs vs. New Zealand 1996–2011



Source: Numerator: National Mortality Collection; Denominator: Birth Registration Dataset



Local Policy Documents and Evidence-Based Reviews Relevant to the Prevention of Sudden Unexpected Death in Infancy (SUDI)

The causes of infant mortality differ markedly with the age of the infant and reflect different causal pathways arising from conception through the first year of life. A review of interventions to address all the causes of infant mortality is beyond the scope of this review. **Table 9** (below) therefore provides a brief overview of local policy documents and evidence-based reviews relevant to the prevention of sudden unexpected death in infancy, a relatively discrete cause of infant mortality, and a cause that is both amenable to prevention and characterised by marked inequalities in New Zealand. Maternal smoking, an important risk factor for SUDI, is addressed in Error! Reference source not found. (page **Error! Bookmark not defined.**).

Table 9. Local Policy Documents and Evidence Based Reviews Relevant to the Prevention of Sudden Unexpected Death in Infancy (SUDI)

Ministry of Health publications
<p>Ministry of Health. 2013. Keep your baby safe during sleep. Wellington: Ministry of Health. https://www.healthed.govt.nz/system/files/resource-files/HE1228-Safe%20Sleep%20WEB.pdf</p> <p>This brief pamphlet intended for parents and caregivers describes the best ways of protecting babies from dying suddenly in their sleep. The advice it contains is aligned with that in the 2013 Child and Youth Mortality Review Committee publication, Special Report: Unintentional suffocation, foreign body inhalation and strangulation (see below)</p>
<p>Ministry of Health and the Child and Youth Mortality Review Committee. 2010. Preventing Sudden Unexpected Death in Infancy (SUDI): Information for parents and caregivers. https://www.healthed.govt.nz/system/files/resource-files/HE1919.pdf</p> <p>This website provides recommendations to parent and carers on reducing the risk of SUDI. Recommendations include: no smoking during pregnancy; putting babies to sleep on their backs; creating a safe sleeping environment; and breastfeeding. The recommended sleeping environment is having the baby sleeping in a cot or bassinet near the parents' bed. It advises that co-sleeping (a parent who sleeps with their baby in bed) is dangerous when: the baby's mother smoked during pregnancy; the adult in bed with the baby has been drinking, or taking drugs or medicines that might reduce their awareness; and the co-sleeping adult is excessively tired.</p>
New Zealand guidelines
<p>Ministry of Health. 2012. Observation of mother and baby in the immediate postnatal period: consensus statements guiding practice. Wellington: Ministry of Health. http://www.health.govt.nz/system/files/documents/publications/observation-mother-baby-immediate-postnatal-period-consensus-statements.pdf</p> <p>This consensus statement was developed by the New Zealand College of Midwives and the Royal Australian and New Zealand College of Obstetricians and Gynaecologists with support from the Ministry of Health. It states that this guidance will be included in every DHB's Maternity Quality and Safety Programme and it is expected that all practitioners supporting mothers and babies in the immediate post natal period will use it to guide their practice. The rationale for this document is the prevention of Sudden Unexpected Neonatal Deaths (SUND), the risk factors for which are unsupervised skin-to-skin contact, inexperienced mothers, and mothers being left unsupervised in the immediate post-natal period. The statement covers the responsibilities of practitioners and district health boards or employers and the involvement of the family and whānau.</p>
Evidence-based medicine reviews
<p>Strehle EM, Gray WK, Gopiseti S, et al. 2012. Can home monitoring reduce mortality in infants at increased risk of sudden infant death syndrome? A systematic review. <i>Acta Paediatrica</i>, 101(1), 8–13</p> <p>Early research on SIDS suggested that central apnoea attacks and apparent life-threatening events (ALTEs) were precursors of SIDS so home apnoea monitors were sometimes provided to infants considered at high risk, such as ex-premature babies. Later epidemiological studies disproved a direct link between ALTEs and SIDS but identified other risk factors including maternal smoking and prone sleeping position. This systematic review aimed to collate the best available evidence (up to June 30, 2010) on the effectiveness of home monitoring for preventing SIDS. The review authors identified only one RCT plus 12 cohort studies. Across all studies, 2,210 infant were monitored for a total of 12,160 months giving a mean monitoring time of 5.5 months. The RCTs was a small pilot study involving a total of 100 infants born to parents who had lost a previous child to SIDS. Participants were randomised to receive either weighing scales or an apnoea monitor. The authors of this study did not advocate widespread use of home monitoring. The review authors considered that this study had a number of methodological flaws. The 12 cohort studies included two that were published separately but included overlapping data so there were 10 unique studies. These used a variety of types of monitors. Two studies suggested that home monitoring may reduce SIDS in at-risk infants. The review authors found it difficult to draw conclusions from the various studies due to differing inclusion criteria, definitions of at risk infants and monitoring devices and the subjective nature of parental reports of ALTEs. They concluded that there was no high level evidence that home monitoring is effective for preventing SIDS. They noted that it may now be considered unethical to conduct a methodologically rigorous controlled trial to provide more definitive evidence.</p>

Hauck FR, et al. 2011. **Breastfeeding and Reduced Risk of Sudden Infant Death Syndrome: A Meta-analysis.** Pediatrics, 128(1), 103–10. <http://pediatrics.aappublications.org/content/early/2011/06/08/peds.2010-3000>

This meta-analysis measured the association between breastfeeding and sudden infant death syndrome (SIDS), with the aim of identifying whether breastfeeding specifically lowers the risk of SIDS. Eighteen original case-control studies from Europe, North America and Australasia, were included. 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 to 0.44), and the multivariable SOR was 0.55 (95% CI 0.44–0.69), suggesting that breastfeeding itself is protective and not merely a marker of other potentially protective factors. For any breastfeeding at two months of age or older, the univariable SOR was 0.38 (95% CI: 0.27–0.54). The effect was strongest for exclusive breastfeeding of any duration (univariable SOR 0.27, 95% CI 0.24–0.31). While the findings are based on observational studies, the consistency of the results led the authors conclude that mothers should be recommended to breastfeed their infants as a potential way to reduce the risk of SIDS.

Task Force On Sudden Infant Death Syndrome. 2011. **Policy Statement. SIDS and Other Sleep-Related Infant Deaths: Expansion of Recommendations for a Safe Infant Sleeping Environment.** Pediatrics, 128 (5), 1030–39. <http://pediatrics.aappublications.org/content/128/5/1030>

Task Force on Sudden Infant Death Syndrome. 2011. **Technical Report. SIDS and Other Sleep-Related Infant Deaths: Expansion of Recommendations for a Safe Infant Sleeping Environment.** Pediatrics, 128(5), e1341–e67. <http://pediatrics.aappublications.org/content/128/5/e1341.full>

This policy statement and background technical report from the American Academy of Pediatrics (AAP) provides an updated set of evidence-based recommendations on SIDS prevention and safe sleep environments that can reduce the risk of all sleep-related infant deaths including suffocation, asphyxia and entrapment. Recommendations include placing the baby in a supine position to sleep, using a firm sleeping surface, breastfeeding, room-sharing without bed-sharing, routine immunisations, considering the use of a pacifier, and avoiding soft bedding, overheating and exposure to tobacco smoke, alcohol and illicit drugs. The technical report provides the rationale for the recommendations.

Vennemann M, et al. 2007. **Do immunisations reduce the risk for SIDS? A meta-analysis.** Vaccine, 25(26), 4875–79.

This meta-analysis, aimed at examining the relationship between immunisation and SIDS, identified nine case-control studies, four of which were adjusted for potential confounders. The summary OR was 0.58 (95% CI 0.46–0.73) in the univariate analysis, suggesting that immunisations were protective, but the presence of heterogeneity made it difficult to combine these studies. The summary OR for the four studies that reported multivariate ORs was 0.54 (95% CI 0.39–0.76) with no evidence of heterogeneity. The authors conclude that immunisations are associated reduced risk of SIDS. A number of explanations are offered, including infection as a risk factor for SIDS, and the healthy vaccinee effect (vaccination may be avoided during illness), making the reduction in SIDS with immunisations a marker of the wellbeing of the infant, and not causally linked. It is recommended that immunisations be part of SIDS prevention campaigns.

Mitchell EA, et al. 2006. **Should Pacifiers Be Recommended to Prevent Sudden Infant Death Syndrome?** Pediatrics, 117(5), 1755–58.

This report aimed to: review the evidence for a reduction in the risk of SIDS with pacifier use, discuss possible mechanisms for the reduction in SIDS risk, and assess other possible effects of pacifiers on infants and children. It is reported that in New Zealand pacifier use is low overall (approximately 10%) but there is wide variation within the country from 3% in the far south to 30% in the northern North Island. The pooled the results of 7 case-control studies and one prospective study revealed a pooled OR of 0.83 (95% CI 0.75 to 0.93) for routine pacifier use. Eight case-control studies also examined pacifier use for the last sleep, with a pooled OR of 0.48 (95% CI 0.43 to 0.54), supporting consistent evidence of a reduction in SIDS with pacifier use. Possible mechanisms for this effect are discussed. Potential negative effects were reviewed, including: a possible reduction in the duration of breastfeeding (3 RCTs, conflicting results): and an increased risk of infection, particularly otitis media, although this may result from reverse causality. The authors conclude that the evidence supports an association between pacifier use and a reduced risk of SIDS and their use should therefore not be discouraged, although they do not support active recommendation. It is suggested that discussion of pacifier use should include advice to offer a pacifier only when breastfeeding is established, after the neonatal period and that they should only be used for sleeping periods in the first year of life.

Hauck FR, et al. 2005. **Do Pacifiers Reduce the Risk of Sudden Infant Death Syndrome? A Meta-analysis.** Pediatrics, 116(5), e716–e23.

This meta-analysis measured the association between pacifier use and sudden infant death syndrome (SIDS), with the aim of identifying whether pacifier use lowers the risk of SIDS. Seven case-control studies were included. The calculated summary odds ratios (SORs) identified a reduction in SIDS risk associated with pacifier use, suggesting that pacifier use is protective for SIDS. For usual pacifier use the univariate SOR was 0.90 (95% CI 0.59–0.85) and the multivariate SOR was 0.71 (95% CI 0.59–0.85). For pacifier use during the last sleep the univariate SOR was 0.47 (95% CI 0.40–0.55) and multivariate SOR was 0.39 (95% CI 0.31–0.50). The authors recommend pacifier use for infants up to 1 year of age (introduced after breastfeeding has been well established in breastfed infants). Concerns about possible adverse effects, including on breastfeeding, and otitis media, led to a further review in 2006 (see above).

Other relevant publications

Glengarry JM, Crawford J, Morrow PL, et al. 2014. **Long QT molecular autopsy in sudden infant death syndrome.** Archives of Disease in Childhood, 99(7).

Long QT syndrome (LQTS) is a group of inherited cardiac ion channelopathies, with 13 known genotypes, which predispose to sudden death due to ventricular tachycardia (an abnormally fast heart rate with irregular beats). It is believed that LQTS may be a cause of sudden infant death. This study, done in Auckland, reports on experience with

long QT molecular autopsy in 102 cases of sudden infant death syndrome (SIDS). The study had two parts. One was a two-year prospective population-based series of 71 SIDS cases (1 September 2006 to 21 August 2008) where all referrals for testing were accepted and testing was done at no cost (the 'unselected' group). The second part involved investigation of 31 selected SIDS cases from before and after the prospective study period. The cardiac genetic team reviewed the police report and final autopsy report of some SIDS case on an ad-hoc basis and tested only those where it was felt there was an increased likelihood of arrhythmic death (the 'selected'). Of the total 102 cases, 49 (47%) were Māori and 24 (23%) were Pacific Island. Risk factors for SIDS were common and bed sharing was reported in 49%. In the 'unselected' group three infants (4%) had rare genetic variants, and in the 'selected' group, five (16%). Only two of the variants, both in infants in the selected group, were regarded as being of definite or probable pathogenicity with the others being of possible or doubtful pathogenicity. The study authors found engaging families challenging. Only three out of the eight variant positive (38%) and 19 of the 94 variant-negative (19%) families participated in cardiac or genetic screening. The study authors concluded that LQT molecular autopsy has a very low yield in unselected SIDS cases where risk factors are common but that diagnostic yield can be higher with case selection. They stated that it is essential to engage the family prior to testing to counsel them about the possible uncertainty of the results and to permit family phenotype/genotype cosegregation studies.

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: Child and Youth Mortality Review Committee. <http://www.hqsc.govt.nz/assets/CYMRC/Publications/CMYRC-special-report-March-2013.pdf>

It is increasingly recognised that unintentional suffocation is a significant contributing factor to SUDI and that a considerable proportion of deaths that might once have been considered as SUDI are attributable to traumatic asphyxia occurring in an unsafe sleeping situation such as becoming wedged between bedding and a firm surface or being overlain by someone sharing the bed. This report provides information from the New Zealand Mortality Review Database concerning the children and young people aged less than 25 years who died due to suffocation, foreign body inhalation and strangulation between 1 January 2002 and 31 December 2009. Fifty of the 79 deaths in the report were due to unintentional suffocation in bed and most of these were infants. The report includes a discussion of issues identified and recommendations to prevent future deaths.

Abel S, Tipene-Leach D. 2013. **SUDI prevention: A review of Māori safe sleep innovations for infants.** New Zealand Medical Journal, 126(1379). <http://journal.nzma.org.nz/journal/126-1379/5764/>

This article reviews some of the Māori-initiated innovations for providing safe sleep environments for babies. The authors note that neither health promotion nor coroners urging parents not to bed share with their babies have had much impact among Māori and suggest that bed sharing amongst Māori is both a culturally-valued behaviour and common practice in resource-poor homes. The Wahakura is a bassinet-type basket woven from flax. It has a thin foam mattress and is designed to be placed in the parental bed to provide a safe sleeping space for the baby and to appeal to Māori mothers who might otherwise reject advice not to bed share in an unsafe fashion. Wahakura have proved very popular but require considerable skill and time to make so it does not appear economically feasible to provide them to all who could benefit. An alternative is the pēpi-pod, a plastic container with a decorative cover and a mattress, sheet and blanket. In early 2013, the pēpi-pod was being actively deployed in five regions: Otara, Waikato, Rotorua, Hawke's Bay and Christchurch. Evaluations in Christchurch and Hawke's Bay have found that pēpi-pods are highly acceptable to families. A RCT comparing outcomes from an enhanced safe sleep education programme that uses pēpi-pods with those from a standard safe sleep education programme is currently underway (the *Haumarū moe o te pēpi* study, funded by Cure Kids and the Auckland Medical Research Foundation).

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

This article argues that, in the US, failure to recognise the role of bed sharing in ethnic and sub-cultural identity has led to inappropriate and ineffective interventions that are ignored by the target population. The authors note that outside Western post-industrial settings, mother-infant contact during sleep remains the norm and that there is a well-documented association between bed sharing and breastfeeding although it is unclear if the association is causal (in either direction). They state that research needs to address those combinations of circumstances that make certain behaviours risky for infants in ways that are supportive and concordant with the local infant care landscape.

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 usage and impact of an online tool, a 24 slide presentation with voiceover, aimed at mainstream health professionals in New Zealand. The online tool, 'Baby Essentials Online', was intended to extend the reach of face-to-face sessions and enable rural and after-hours participation. It was promoted through a network of 'safe sleep' champions. Between 18 November and 31 December 2011 there were 3286 completed sessions, and 2683 (81.7%) had complete data. Usage reached people across regions, roles and ethnic groups. On completing the course, most people (68.8%) gave a high rating to their 'increased confidence to be a safe sleep advocate for babies'. Having a high increased confidence rating was significantly associated with spending more time per slide and with being of Māori, Pacific or Other ethnicity compared to European. The study authors concluded that this simple online tool achieved its aims of high usage and wide participation was a cost effective means of increasing confidence to discuss safe infant sleeping with others. They stated that "e-Learning modes should be considered where there is a need to align large numbers of people in a short time with understandings and actions for addressing a specific health issue". The updated 'Baby Essentials Online', and summary versions in 20 non-English languages, can be accessed here: http://www.changeforourchildren.co.nz/safe_start_programme/baby_essentials_online

Mitchell E A, Blair P S. 2012. **SIDS prevention: 3000 lives saved but we can do better.** NZMJ, 125(1359), 50–7. <http://journal.nzma.org.nz/journal/125-1359/5277/>

This article provides a good overview of the situation in New Zealand regarding sudden infant death. It highlights the success of efforts to encourage supine (on the back) sleeping and argues that more lives could be saved if more focus was placed on discouraging parents from bed sharing with their babies, particularly in hazardous situations such as on a couch or sofa or when the parent has been smoking, drinking or taking other drugs.

Hutchison BL, Rea C, Stewart AW, et al. 2011. **Sudden unexpected infant death in Auckland: a retrospective case review.** Acta Paediatrica, 100(8), 1108–12.

<http://www.whakawhetu.co.nz/sites/default/files/Sudden%20unexpected%20infant%20death%20in%20Auckland%20a%20retrospective%20case%20review.pdf>

This paper reports on a review of all autopsy reports of SUDI deaths in the Auckland region from October 2000 to December 2009. Of the 332 post-mortems done in the region during the period, two-thirds (221) were classified as SUDI. Of these 83% were Māori or Pacific infants. The median age at death was 11 weeks. Overall, 60% were bed sharing at the time of death. Of the 11% of deaths which occurred in babies aged 7–28 days, 92% occurred while bed sharing. The position the infant was placed for sleep was known in only 58% (129) of cases. Of these 57% were placed in a non-recommended position (non-supine) position. The study authors stated that there is a need to improve SUDI prevention messages, particularly for Māori and Pacific families.

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. <http://journal.nzma.org.nz/journal/123-1326/4445>

This paper reports on a survey of Māori mothers who gave birth in the Counties Manukau DHB Area from 21 July to 31 December 2008. The survey aimed to determine the mothers' knowledge about SIDS prevention and SIDS-related child care practices. Forty-one per cent of those eligible participated (299 out of 734, mostly due to difficulty contacting mothers rather than mothers declining to participate). Survey results were compared with a similar 2005 survey of mostly European mothers who gave birth at National Women's Hospital (NWH). It was found that the Māori mothers had much lower knowledge about SIDS prevention practices and were likely to have gained the knowledge they did have from a midwife, Plunket or the hospital rather than from an antenatal class. More Māori babies slept on their front and Māori mothers stopped breastfeeding significantly earlier. Although similar proportions of Māori and NWH mothers reported that their baby "usually" and "last night" slept in their own bed, 65% of the mothers in this survey reported some bed sharing (vs 27% of the NWH mothers), and of these, 39% shared for more than two hours. More than half the Māori mothers had smoked in pregnancy and a third used potentially unsafe objects such as pillows or rolled blankets to maintain their baby's sleep position. The study authors stated that their findings highlight the need for appropriate health promotion message to be developed for the Māori community.

Child and Youth Mortality Review Committee, Te Rōpū Arotake Auau Mate o te Hunga Tamariki, Taiohi. 2009. **Chapter 1: Sudden Unexpected Death in Infancy (SUDI) in Fifth Report to the Minister of Health: Reporting mortality 2002–2008.** Wellington: Child and Youth Mortality Review Committee.

<http://www.hqsc.govt.nz/assets/CYMRC/Publications/cymrc-5th-report-chp1-sudi.pdf>

This report includes an analysis of SUDI mortality data from 2003–2007, including an assessment of risk factors for SUDI, recommendations from local mortality review groups, and observations and recommendations from the Child and Youth Mortality Review Committee on how to reduce incidents of SUDI in New Zealand.

Websites

Change for our children <http://www.changeforourchildren.co.nz/>

Change for our Children is a 'social innovation company' that aims to build a culture of respect for children. Their website includes a variety of resources related to SUDI prevention, including reports on the pēpi-pod projects which provide cheap plastic baby beds to create a safe sleeping spaces for babies, and resources relating to the Safe Start Programme which aims to ensure all New Zealanders, know, accept and act on the facts concerning safe sleep for babies: http://www.changeforourchildren.co.nz/safe_start_programme/index.

SUDI <http://www.hqsc.govt.nz/our-programmes/mrc/cymrc/publications-and-resources/sudi/>

This website provides links to SUDI prevention publications and resources developed by the Child and Youth Mortality Review Committee (CMYRC), a statutory committee accountable to the Health Quality and Safety Commission. Resources include safe sleeping guidelines, links to CMYRC mortality reports, and examples of DHB safe sleeping policies.

Whakawhetu <http://www.whakawhetu.co.nz/>

Whakawhetu National SUDI Prevention for Māori (previously known as Māori SIDS) is a national kaupapa Māori organisation dedicated to reducing the rate of SUDI for Māori. The organisation provides policy advice, disseminates evidence-based information, and delivers training, education and workforce development with the aim of strengthening SUDI prevention services that engage with whānau. The website includes safe sleeping advice, news, resources and information. It provides information on the wahakura, a woven flax baby bed designed to protect baby by providing a safe sleeping space in an adult bed, and the pēpi-pod, a plastic baby bed which is a cheaper alternative to a wahakura.

TAHA <http://www.taha.org.nz/>

TAHA Well Pacific Mother and Infant Service works collaboratively in the health sector on key areas of health and wellbeing for Pacific mothers and infants with the purpose of reducing a range of maternal and infant morbidity and mortality. The website provides links to a variety of resources, including SUDI prevention resources.

Note: these publications listed were identified using the search methodology outlined in Appendix 1.