FETAL DEATHS

Introduction

The Perinatal and Maternal Mortality Review Committee defines a fetal death as "*the death of a baby born at 20 weeks gestation or beyond, or weighing at least 400g if gestation is unknown. Fetal death includes stillbirth and termination of pregnancy*" [1].

Internationally, fetal death rates in high-income countries have shown little or no improvement over the past two decades [2]. Maternal overweight and obesity has been identified as one of the leading modifiable risk factors. Other risk factors include advanced maternal age (35+ years), smoking and primiparity [2]. A range of pregnancy-related disorders also increase the risk of a fetal death including fetal growth restriction, placental abruption, and maternal diabetes and hypertension [2].

In New Zealand, research suggests that the risk of fetal death is higher for older women (35+ years), and those in their first or fourth or higher pregnancies. A range of lifestyle and social factors are also associated with an increased risk, including smoking, being overweight or obese, not being married or in paid work, and living in a more deprived (NZDep deciles 9–10) area [3,4,5]. Indian and Pacific women have higher fetal death rates than European women [3,4], although in one recent study, the excess risk for Pacific women disappeared once a number of other risk factors were taken into account [5]. In this same study, unexplained antepartum deaths (39.4%) and fetal growth restriction (18.7%) accounted for almost 60% of fetal deaths, with the post mortem rate being 47% (73 of 155 cases) [5].

The following section reviews the distribution of fetal deaths in the South Island DHBs using information from the National Mortality Collection and the Birth Registration Dataset. The section concludes with a brief review of policy documents and evidence-based reviews which consider how fetal deaths might be prevented at the population level.

Data Sources and Methods

Indicator

1. *Intermediate Fetal Deaths*

Numerator: National Mortality Collection: Fetal deaths occurring between 20 and 27 weeks gestation.

Denominator: Birth Registration Dataset: All births 20+ weeks gestation.

2. Late Fetal Deaths

Numerator: National Mortality Collection: Fetal deaths occurring at 28+ weeks gestation.

Denominator: Birth Registration Dataset: All births 28+ weeks gestation.

In the National Mortality Collection, all fetal deaths are assigned a main underlying fetal cause of death. In addition other fetal and maternal causes contributing to the death are also listed. In this section, the main underlying fetal cause of death was assigned using the following ICD-10-AM codes: Malnutrition/Slow Fetal Growth (P05), Prematurity/Low Birth Weight (P07), Intrauterine Hypoxia (P20), Congenital Pneumonia (P23), Infections Specific to Perinatal Period (P35–P39), Hydrops Fetalis not due to Haemolytic Disease (P83.2), Aspiration of Meconium/Amniotic Fluid/Mucus (P24.0, P24.1), Polycythaemia Neonatorum (P61.1), Fetal Blood Loss (P50), Unspecified Cause (P95), Congenital Anomalies: Central Nervous System (Q00–Q07), Congenital Anomalies: Cardiovascular System (Q20–Q28), Chromosomal Anomalies (Q90–Q99), Congenital Anomalies: Other (remainder Q08–Q89), Other Causes (remainder ICD-10-AM).

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

Notes on Interpretation

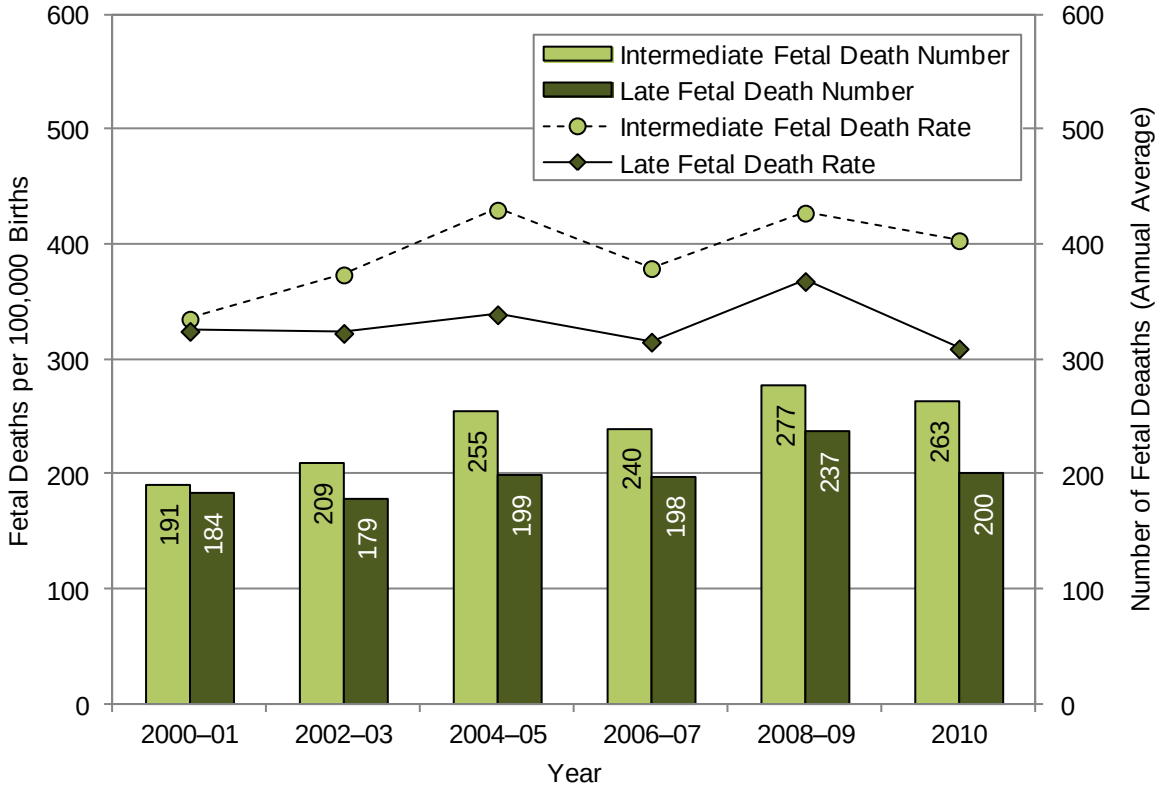
Note 1: Death Registration data do not differentiate between spontaneous fetal deaths and late terminations of pregnancy, as all fetal deaths 20+ weeks gestation require a death registration. The admixture of spontaneous and induced fetal deaths is likely to be most prominent at earlier gestations (e.g. 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.

New Zealand Distribution and Trends

New Zealand Trends

In New Zealand, intermediate fetal deaths increased during the early 2000s, but became relatively static after 2004–05, while late fetal deaths were relatively static throughout 2000–2010 (**Figure 1**).

Figure 1. Intermediate and Late Fetal Deaths, New Zealand 2000–2010



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

Distribution by Cause

Intermediate Fetal Deaths: In New Zealand during 2006–2010, unspecified cause was the most frequently listed main fetal cause of death for babies dying in utero between 20 and 27 weeks of gestation, followed by prematurity/low birth weight and congenital and chromosomal anomalies (**Table 1**).

Late Fetal Deaths: During 2006–2010, unspecified cause was also the most frequently listed main fetal cause of death for babies dying in utero at 28+ weeks gestation, followed by malnutrition/slow fetal growth and intrauterine hypoxia. Congenital anomalies as a group, however, still made a significant contribution (**Table 1**).

Distribution by Gestational Age and Cause

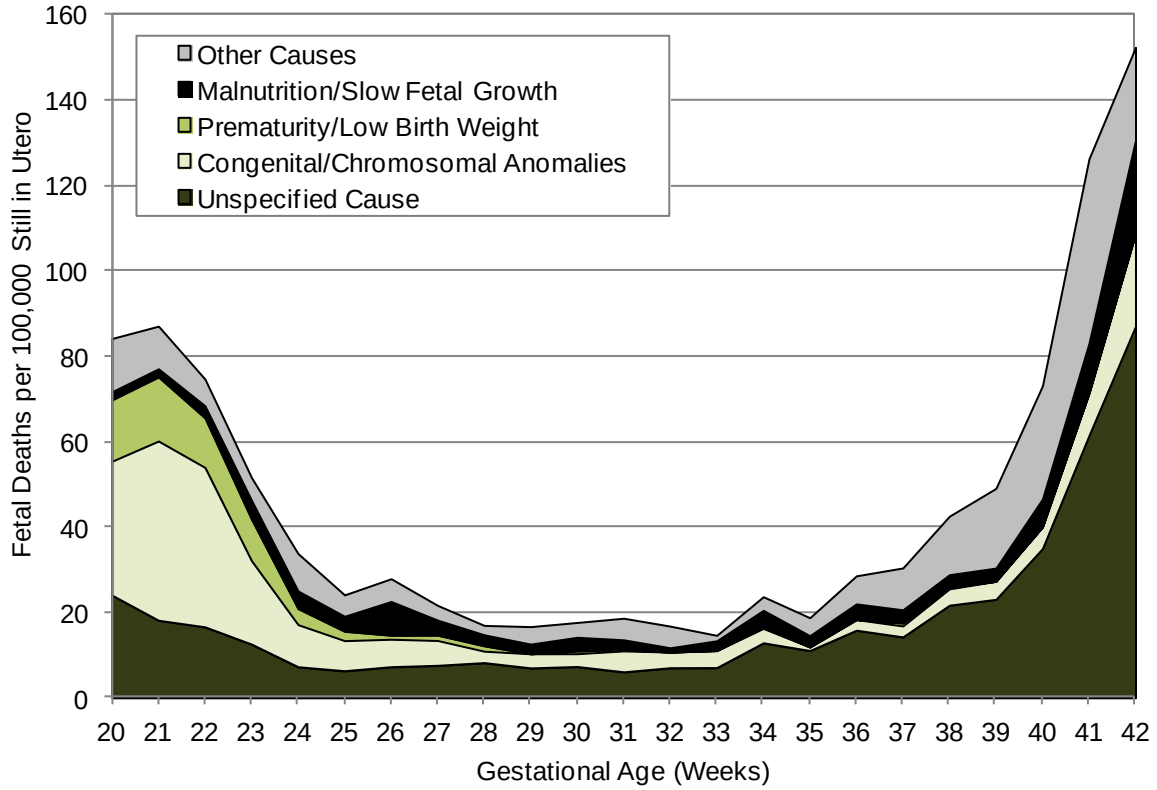
In New Zealand during 2006–2010, fetal deaths exhibited a J-shaped distribution with gestational age, with a peak occurring prior to 25 weeks, and then rates increasing rapidly again after 37 weeks. When broken down by cause, fetal deaths arising from congenital anomalies and prematurity/low birth weight were highest in babies less than 25 weeks gestation, while unspecified fetal deaths increased rapidly after 37 weeks. Note: These rates were calculated by dividing the number of fetal deaths at each gestational age by the number of babies remaining in utero. Thus, while the absolute number of babies dying in utero did not rise exponentially towards term, the risk for those remaining in utero did. Further, it was not always possible to distinguish between spontaneous fetal deaths and late terminations of pregnancy and thus the high mortality rates (e.g. from congenital anomalies) prior to 25 weeks must be interpreted with this in mind (**Figure 2**).

Table 1. Intermediate and Late Fetal Deaths by Main Fetal Cause of Death, New Zealand 2006–2010

Main Fetal Cause of Death	No. of Deaths: Total 2006–2010	No. of Deaths: Annual Average	Rate per 100,000 Births	% of Fetal Deaths
Intermediate Fetal Deaths				
Unspecified Cause	318	63.6	99.17	24.5
Prematurity/Low Birth Weight	188	37.6	58.63	14.5
Chromosomal Anomalies	165	33.0	51.46	12.7
Congenital Anomalies: CNS	123	24.6	38.36	9.5
Congenital Anomalies: CVS	91	18.2	28.38	7.0
Congenital Anomalies: Other	135	27.0	42.10	10.4
Malnutrition/Slow Fetal Growth	95	19.0	29.63	7.3
Congenital Pneumonia	34	6.8	10.60	2.6
Infections Specific to Perinatal Period	24	4.8	7.48	1.9
Fetal Blood Loss	23	4.6	7.17	1.8
Hydrops Fetalis (not Haemolytic Disease)	19	3.8	5.93	1.5
Intrauterine Hypoxia	19	3.8	5.93	1.5
Polycythaemia Neonatorum	12	2.4	3.74	0.9
Other Causes	50	10.0	15.59	3.9
New Zealand Total	1,296	259.2	404.16	100.0
Late Fetal Deaths				
Unspecified Cause	513	102.6	161.31	48.0
Malnutrition/Slow Fetal Growth	116	23.2	36.48	10.9
Intrauterine Hypoxia	102	20.4	32.07	9.6
Aspiration Meconium/Amniotic Fluid/Mucus	36	7.2	11.32	3.4
Chromosomal Anomalies	36	7.2	11.32	3.4
Congenital Anomalies: CNS	34	6.8	10.69	3.2
Congenital Anomalies: CVS	20	4.0	6.29	1.9
Congenital Anomalies: Other	48	9.6	15.09	4.5
Fetal Blood Loss	37	7.4	11.64	3.5
Infections Specific to Perinatal Period	27	5.4	8.49	2.5
Prematurity/Low Birth Weight	11	2.2	3.46	1.0
Hydrops Fetalis (not Haemolytic Disease)	8	1.6	2.52	0.7
Congenital Pneumonia	6	1.2	1.89	0.6
Polycythaemia Neonatorum	3	0.6	0.94	0.3
Other Causes	71	14.2	22.33	6.6
New Zealand Total	1,068	213.6	335.83	100.0

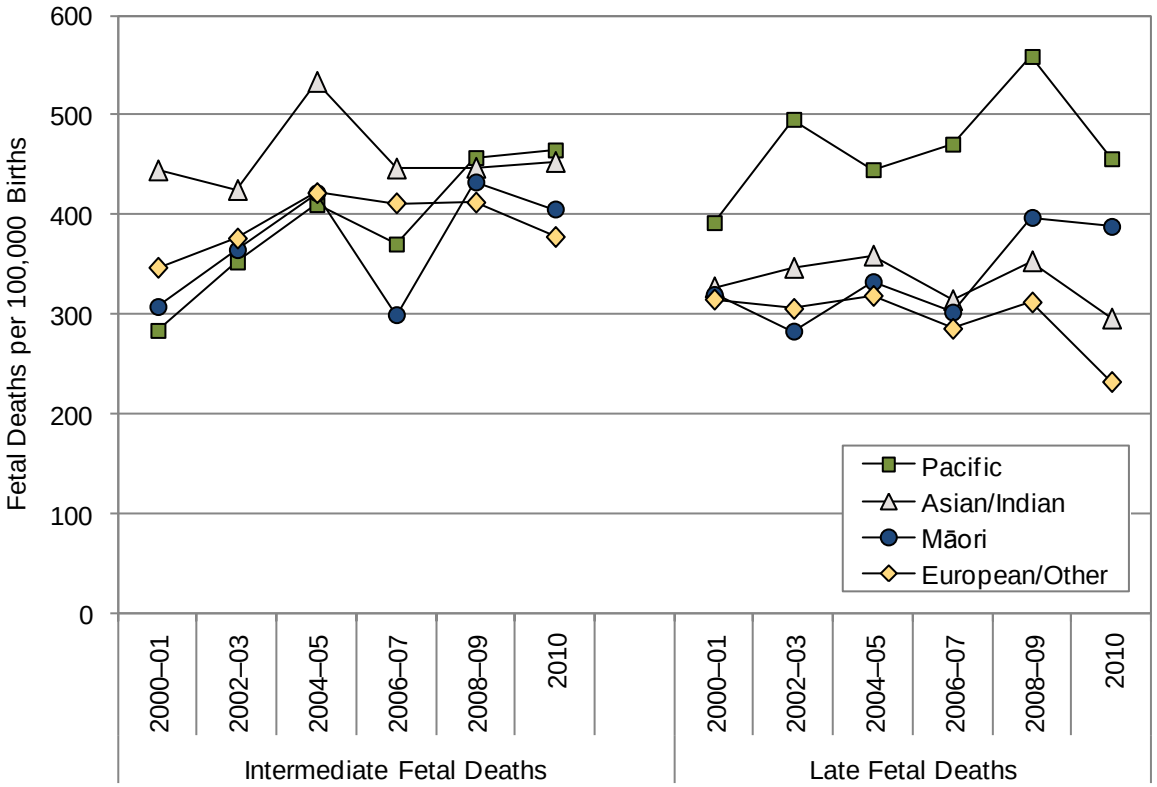
Source: Numerator: National Mortality Collection; Denominator: Birth Registration Dataset

Figure 2. Fetal Deaths by Gestational Age and Main Fetal Cause of Death, New Zealand 2006–2010



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

Figure 3. Intermediate and Late Fetal Deaths by Ethnicity, New Zealand 2000–2010



Source: Numerator: National Mortality Collection; Denominator: Birth Registration Dataset; Note: Ethnicity is Level 1 Prioritised

Distribution by Ethnicity, NZDep Decile, Maternal Age and Gender

Intermediate Fetal Deaths: In New Zealand during 2006–2010, there were no *significant* gender, ethnic or socioeconomic (as measured by NZDep06) differences in intermediate fetal death rates. Mortality however, was *significantly* higher for the babies of younger (<25 years) and older (35+ years) women, than for the babies of women aged 30–34 years (**Table 2**). During 2000–2010, intermediate fetal death rates were consistently higher for Asian/Indian babies than for European/Other babies, although rates for Māori and Pacific babies were more variable (**Figure 3**).

Late Fetal Deaths: In New Zealand during 2006–2010, late fetal deaths were *significantly* higher for Pacific > Māori > European/Other babies, and for babies from average to more deprived (NZDep deciles 5–10) areas. Rates were also *significantly* higher for the babies of teenage women, than for the babies of women aged 30–34 years (**Table 2**). During 2000–2010, late fetal death rates were consistently higher for Pacific babies than for babies from other ethnic groups (**Figure 3**).

Table 2. Intermediate and Late Fetal Deaths by Ethnicity, NZ Deprivation Index Decile, Gender and Maternal Age, New Zealand 2006–2010

Variable	Rate per 100,000 Births	Rate Ratio	95% CI	Variable	Rate per 100,000 Births	Rate Ratio	95% CI
Intermediate Fetal Deaths							
Prioritised Ethnicity				Gender			
Asian/Indian	448.2	1.11	0.93–1.32	Female	394.6	1.00	
European/Other	405.1	1.00		Male	407.7	1.03	0.93–1.15
Māori	374.3	0.92	0.81–1.05	Maternal Age			
Pacific	425.2	1.05	0.88–1.25	<20 Years	442.9	1.25	1.00–1.55
NZ Deprivation Index				20–24 Years	422.3	1.19	1.01–1.41
Deciles 1–2	373.2	1.00		25–29 Years	380.9	1.07	0.92–1.26
Deciles 3–4	447.0	1.20	0.99–1.46	30–34 Years	354.8	1.00	
Deciles 5–6	427.3	1.14	0.95–1.39	35+ Years	464.2	1.31	1.12–1.53
Deciles 7–8	402.9	1.08	0.90–1.30				
Deciles 9–10	384.0	1.03	0.86–1.23				
Late Fetal Deaths							
Prioritised Ethnicity				Gender			
Asian/Indian	326.0	1.14	0.92–1.41	Female	347.3	1.00	
European/Other	285.6	1.00		Male	323.7	0.93	0.83–1.05
Māori	357.4	1.25	1.09–1.44	Maternal Age			
Pacific	503.4	1.76	1.48–2.10	<20 Years	422.5	1.36	1.09–1.71
NZ Deprivation Index				20–24 Years	349.3	1.13	0.94–1.35
Deciles 1–2	224.7	1.00		25–29 Years	305.0	0.99	0.83–1.17
Deciles 3–4	263.8	1.17	0.91–1.51	30–34 Years	309.6	1.00	
Deciles 5–6	334.8	1.49	1.18–1.88	35+ Years	362.0	1.17	0.99–1.39
Deciles 7–8	327.8	1.46	1.16–1.83				
Deciles 9–10	448.0	1.99	1.61–2.47				

Source: Numerator: National Mortality Collection; Denominator: Birth Registration Dataset; Note: Baby's ethnicity is Level 1 Prioritised; Decile is NZDep2006

South Island DHBs Distribution and Trends

South Island DHBs vs. New Zealand

In the South Island DHBs during 2006–2010, intermediate and late fetal death rates were not *significantly* different from the New Zealand rate (**Table 3**).

Table 3. Intermediate and Late Fetal Deaths, South Island DHBs vs. New Zealand 2006–2010

DHB/Area	Number of Deaths: Total 2006−2010	Number of Deaths: Annual Average	Rate per 100,000 Births	Rate Ratio	95% CI
Intermediate Fetal Deaths					
Nelson Marlborough	37	7.4	436.7	1.08	0.78–1.50
South Canterbury	9	1.8	279.2	0.69	0.36–1.33
Canterbury	129	25.8	389.3	0.96	0.80–1.15
West Coast	4	0.8	188.1	0.47	0.17–1.24
Otago	45	9.0	432.2	1.07	0.80–1.44
Southland	36	7.2	442.3	1.09	0.79–1.52
New Zealand	1,296	259.2	404.2	1.00	
Late Fetal Deaths					
Nelson Marlborough	18	3.6	214.3	0.64	0.40–1.02
South Canterbury	12	2.4	374.1	1.11	0.63–1.97
Canterbury	97	19.4	295.0	0.88	0.71–1.08
West Coast	7	1.4	330.5	0.98	0.47–2.07
Otago	31	6.2	300.4	0.89	0.63–1.28
Southland	25	5.0	310.0	0.92	0.62–1.37
New Zealand	1,068	213.6	335.8	1.00	

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

South Island DHBs Distribution by Cause

Intermediate Fetal Deaths: In the South Island DHBs during 2006–2010, congenital and chromosomal anomalies (combined) and unspecified cause were the most frequently listed main fetal causes of death in babies dying in utero between 20 and 27 weeks gestation, although prematurity/low birth weight also made a contribution (**Table 4**, **Table 5**).

Table 4. Intermediate Fetal Deaths by Main Fetal Cause of Death, Nelson Marlborough 2006–2010

Main Fetal Cause of Death	No. of Deaths: Total 2006−2010	No. of Deaths: Annual Average	Rate per 100,000 Births	% of Intermediate Fetal Deaths
Intermediate Fetal Deaths				
Nelson Marlborough				
Unspecified Cause	10	2.0	118.04	27.0
Prematurity/Low Birth Weight	7	1.4	82.63	18.9
Chromosomal Anomalies	5	1.0	59.02	13.5
Congenital Anomalies: CNS	3	0.6	35.41	8.1
Congenital Anomalies: CVS/Other	5	1.0	59.02	13.5
Other Causes	7	1.4	82.63	18.9
Nelson Marlborough Total	37	7.4	436.75	100.0

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

Table 5. Intermediate Fetal Deaths by Main Fetal Cause of Death, South Canterbury, Canterbury, the West Coast, Otago and Southland 2006–2010

Main Fetal Cause of Death	No. of Deaths: Total 2006−2010	No. of Deaths: Annual Average	Rate per 100,000 Births	% of Intermediate Fetal Deaths
Intermediate Fetal Deaths				
South Canterbury				
Unspecified Cause	4	0.8	124.11	44.4
Prematurity/Low Birth Weight	<3	s	s	s
Congenital Anomalies	<3	s	s	s
Other Causes	<3	s	s	s
South Canterbury Total	9	1.8	279.24	100.0
Canterbury				
Unspecified Cause	14	2.8	42.25	10.9
Prematurity/Low Birth Weight	20	4.0	60.35	15.5
Chromosomal Anomalies	22	4.4	66.39	17.1
Congenital Anomalies: CNS	14	2.8	42.25	10.9
Congenital Anomalies: CVS	11	2.2	33.19	8.5
Congenital Anomalies: Other	14	2.8	42.25	10.9
Malnutrition/Slow Fetal Growth	10	2.0	30.18	7.8
Congenital Pneumonia	6	1.2	18.11	4.7
Infections Specific to Perinatal Period	5	1.0	15.09	3.9
Intrauterine Hypoxia	5	1.0	15.09	3.9
Other Causes	8	1.6	24.15	6.2
Canterbury Total	129	25.8	389.30	100.0
West Coast				
All Causes	4	0.8	188.04	100.0
West Coast Total	4	0.8	188.04	100.0
Otago				
Unspecified Cause	12	2.4	115.26	26.7
Prematurity/Low Birth Weight	4	0.8	38.42	8.9
Chromosomal Anomalies	6	1.2	57.63	13.3
Congenital Anomalies: CNS/CVS/Other	14	2.8	134.48	31.1
Malnutrition/Slow Fetal Growth	3	0.6	28.82	6.7
Other Causes	6	1.2	57.65	13.3
Otago Total	45	9.0	432.26	100.0
Southland				
Unspecified Cause	9	1.8	110.57	25.0
Prematurity/Low Birth Weight	8	1.6	98.28	22.2
Chromosomal Anomalies	4	0.8	49.14	11.1
Congenital Anomalies: CNS	5	1.0	61.43	13.9
Congenital Anomalies: CVS/Other	4	0.8	49.15	11.1
Other Causes	6	1.2	73.73	16.7
Southland Total	36	7.2	442.30	100.0

Source: Numerator: National Mortality Collection; Denominator: Birth Registration Dataset; s: suppressed due to small numbers

Table 6. Late Fetal Deaths by Main Fetal Cause of Death, South Island DHBs 2006–2010

Main Fetal Cause of Death	No. of Deaths: Total 2006−2010	No. of Deaths: Annual Average	Rate per 100,000 Births	% of Late Fetal Deaths
Late Fetal Deaths				
Nelson Marlborough				
Unspecified Cause	8	1.6	95.23	44.4
Intrauterine Hypoxia	3	0.6	35.71	16.7
Congenital/Chromosomal Anomalies	3	0.6	35.71	16.7
Other Causes	4	0.8	47.61	22.2
Nelson Marlborough Total	18	3.6	214.26	100.0
South Canterbury				
Unspecified Cause	6	1.2	187.03	50.0
Intrauterine Hypoxia	<3	s	s	s
Other Causes	4	0.8	124.69	33.3
South Canterbury Total	12	2.4	374.06	100.0
Canterbury				
Unspecified Cause	27	5.4	82.10	27.8
Malnutrition/Slow Fetal Growth	11	2.2	33.45	11.3
Intrauterine Hypoxia	13	2.6	39.53	13.4
Congenital/Chromosomal Anomalies	11	2.2	33.45	11.3
Aspiration Meconium/Amniotic Fluid/Mucus	8	1.6	24.33	8.2
Fetal Blood Loss	6	1.2	18.25	6.2
Infections Specific to Perinatal Period	4	0.8	12.16	4.1
Other Causes	17	3.4	51.70	17.5
Canterbury Total	97	19.4	294.97	100.0
West Coast				
Unspecified Cause	<3	s	s	s
Other Causes	5	1.0	236.07	71.4
West Coast Total	7	1.4	330.50	100.0
Otago				
Unspecified Cause	14	2.8	135.65	45.2
Malnutrition/Slow Fetal Growth	3	0.6	29.07	9.7
Intrauterine Hypoxia	5	1.0	48.45	16.1
Congenital/Chromosomal Anomalies	5	1.0	48.45	16.1
Other Causes	4	0.8	38.76	12.9
Otago Total	31	6.2	300.36	100.0
Southland				
Unspecified Cause	15	3.0	185.99	60.0
Intrauterine Hypoxia	3	0.6	37.20	12.0
Other Causes	7	1.4	86.79	28.0
Southland Total	25	5.0	309.98	100.0

Source: Numerator: National Mortality Collection; Denominator: Birth Registration Dataset; s: suppressed due to small numbers

South Island DHBs Distribution by Cause

Late Fetal Deaths: In the South Island DHBs during 2006–2010, unspecified cause was the most frequently listed fetal cause of death in babies dying at 28+ weeks gestation, although intrauterine hypoxia, malnutrition/slow fetal growth and congenital and chromosomal anomalies also made a contribution (**Table 6**).

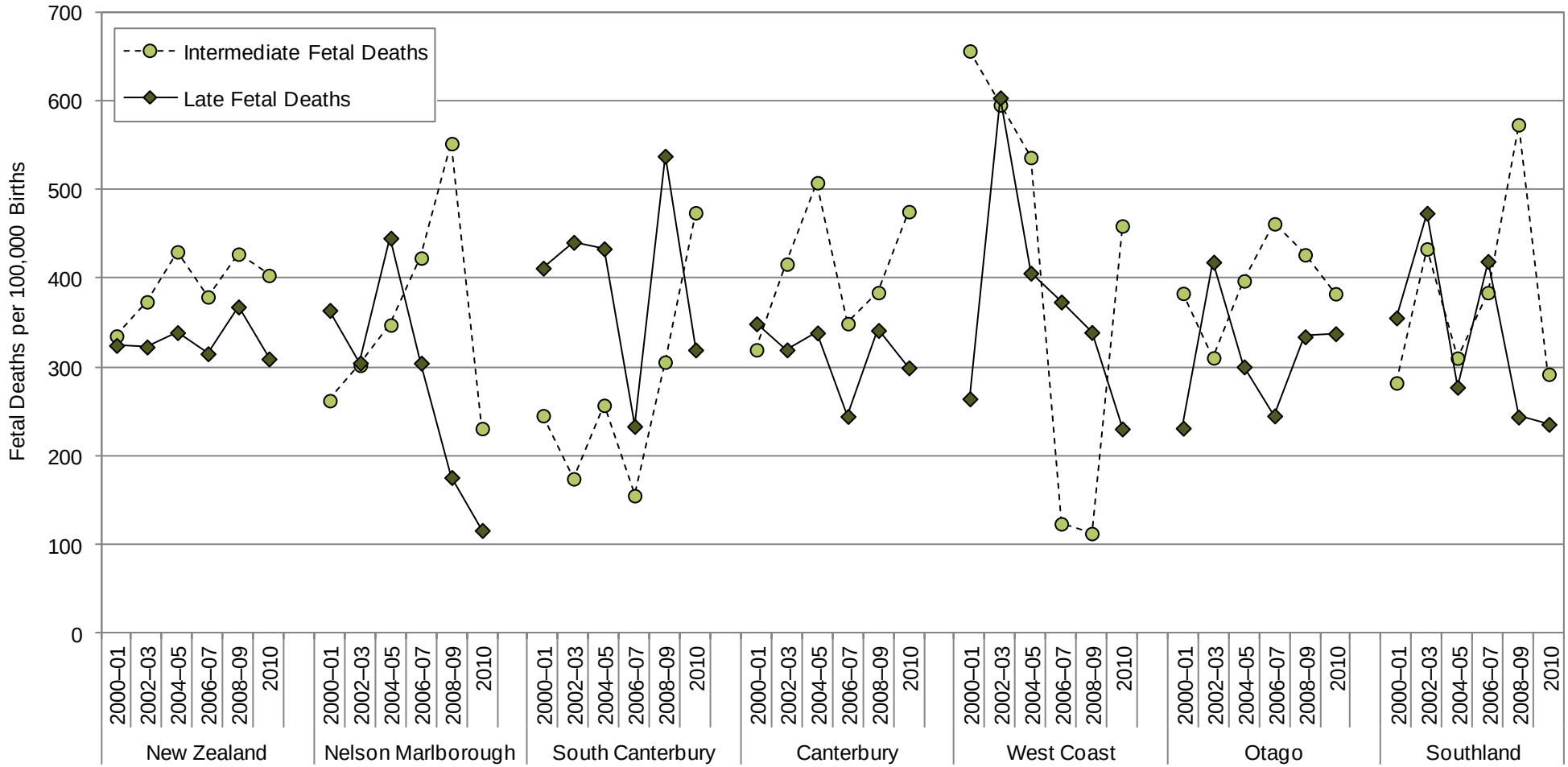
South Island DHBs Trends

In the South Island DHBs during 2000–2010, large year-to-year variations, possibly as the result of small numbers, made trends in intermediate and late fetal deaths difficult to interpret (**Figure 4**).

Local Policy Documents and Evidence-Based Reviews Relevant to Fetal Deaths

In New Zealand at present, there is no single strategy which focuses on the prevention of fetal deaths. Thus any local strategies developed will need to incorporate evidence from a variety of sources. **Table 7** provides an overview of a range of New Zealand policy documents and overseas evidence-based reviews which may be useful in this context.

Figure 4. Intermediate and Late Fetal Deaths, South Island DHBs vs. New Zealand 2000–2010



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

Table 7. Local Policy Documents and Evidence-Based Reviews Relevant to Fetal Deaths

Ministry of Health Policy Documents
Ministry of Health. 2011. **New Zealand Maternity Standards: A set of standards to guide the planning, funding and monitoring of maternity services by the Ministry of Health and District Health Boards**. Wellington: Ministry of Health. http://www.health.govt.nz/publication/new-zealand-maternity-standards These standards provide guidance for the provision of safe, equitable and high quality maternity services throughout New Zealand. They consist of three high level strategic statements to guide the funding, planning, provision and monitoring of maternity services by the Ministry of Health, DHBs, service providers and health practitioners. The standards underpin the DHB maternity service specifications, the Primary Maternity Services Notice 2007, the Maternal Referral Guidelines, and other high-level guidelines and requirements.
Ministry of Health. 2011. **Guidelines for consultation with obstetric and related medical services (Referral Guidelines)**. Wellington: Ministry of Health. http://www.health.govt.nz/publication/guidelines-consultation-obstetric-and-related-medical-services-referral-guidelines These guidelines are intended for lead maternity carers and outline criteria and processes for referral to primary care, referral for specialist consultation, and referral for the transfer of clinical responsibility for care, transfer of clinical responsibility for care in an emergency and emergency transport.
International and Australasian Guidelines
Royal College of Obstetricians and Gynaecologists (RCOG). 2011. **Reduced fetal movements (Green-top guideline; no. 57)**. London (U.K.): Royal College of Obstetricians and Gynaecologists (RCOG). http://www.rcog.org.uk/files/rcog-corp/GTG57RFM25022011.pdf The purpose of this guideline is to provide advice to clinicians, based on the best available evidence, on the management of women presenting with reduced fetal movements in pregnancy (excluding those with multiple pregnancy). The guidelines are structured as a series of clinical questions. The authors note that the available evidence is limited and that this is reflected in the low grading of some of the recommendations. Appendix 1 provides a care algorithm (flowchart) and Appendix 2 explains the grading scheme used for the evidence and recommendations. There is a comprehensive list of references.
Queensland Maternity and Neonatal Clinical Guidelines Program. 2010. **Stillbirth Care**. Brisbane: Queensland Government. http://www.health.qld.gov.au/qcg/documents/g_still5-0.pdf These guidelines are intended for health professionals in Queensland maternity services and they are consistent with the Perinatal Society of Australia and New Zealand (PSANZ) Clinical Practice Guideline for Perinatal Mortality. They cover clinical standards, diagnosis and birth, investigations, autopsy and subsequent pregnancy care. They are concise and well referenced but do not discuss the research evidence.
Preston S, Mahomed K, Chadha Y, et al. 2010. **Clinical Practice Guideline for the Management of Women who report Decreased Fetal Movements**. Brisbane: Australian and New Zealand Stillbirth Alliance (ANZSA). http://www.stillbirthalliance.org.au/doc/FINAL%20DFM%20guideline%20Ed1V1%201_16Sept2010.pdf The purpose of this guideline is to assist clinicians provide evidence-based best-practice management for women with singleton pregnancies who report, or are concerned about, decreased fetal movements (DFM) in the third trimester of pregnancy. It does not deal with the management of specific pregnancy conditions such as fetal growth restriction, hypertension or diabetes which may be identified in the course of care. Mothers are often concerned about DFM and there is good evidence that maternal perception of DFM is associated with many adverse outcomes. Fetal growth restriction appears to be a major contributor to these. While women should be made aware of the importance of fetal movement and provided with information, routine fetal movement counting is not recommended. The guidelines discuss the evidence and recommendations are each accompanied by an indication of the evidence level and the strength of the recommendation although the authors note that there is an absence of robust research in this area and more high quality research is needed on both screening tools and management.
Royal College of Obstetricians and Gynaecologists (RCOG). 2010. **Late intrauterine fetal death and stillbirth**. London, U.K.: Royal College of Obstetricians and Gynaecologists (RCOG). http://www.rcog.org.uk/files/rcog-corp/GTG%2055%20Late%20Intrauterine%20fetal%20death%20and%20stillbirth%2010%2011%2010.pdf 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/doc/Section_1_Version_2.2_April_2009.pdf

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, perinatal post-mortem examination, investigation of stillbirths and neonatal deaths and the use of perinatal mortality classifications.

National Collaborating Centre for Women's and Children's Health. 2010. **Pregnancy and complex social factors. A model for service provision for pregnant women with complex social factors**. London (UK): National Institute for Health and Clinical Excellence (NICE). http://www.nice.org.uk/nicemedia/live/13167/50861/50861.pdf

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), 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
- women who experience domestic abuse

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.

Also available through national Institute for Health and Clinical Excellence is a "NICE Pathway" that provides an overview for pregnancy and complex social factors: http://pathways.nice.org.uk/pathways/pregnancy-and-complex-social-factors.

National Institute for Health and Clinical Excellence. 2010. **Dietary interventions and physical activity interventions for weight management before, during and after pregnancy**. London: National Institute for Health and Clinical Excellence. http://www.nice.org.uk/nicemedia/live/13056/49926/49926.pdf

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: http://guidance.nice.org.uk/PH27 .

Flenady V, New K, MacPhail J, et al. 2005. **Clinical Practice Guideline for Smoking Cessation in Pregnancy**. Brisbane: Centre for Clinical Studies, Mater Health Services. http://www.stillbirthalliance.org.au/doc/Guideline_for_Smoking_Cessation_in_Pregnancy.pdf

The purpose of this guideline is to assist clinicians in identifying pregnant women who smoke and assisting them to quit. Smoking cessation interventions for pregnant women can reduce smoking rates and reduce pre term births and low birth weights. Smoking rates are particularly high among teenage and indigenous Australians. The guideline is based on the "5As" approach to smoking cessation (Ask, Advise, Assess, Assist, Arrange Support). For women not ready to quit, motivation interventions using the 5R's framework (relevance, risk, rewards, roadblocks and repetition) may be used to improve motivation to quit. Recommendations in the guidelines are accompanied by a grade indicating the level of evidence and by references.

Systematic and Other Reviews from the International Literature

Chamberlain C, O'Mara-Eves A, Oliver S, Caird JR, et al. 2013. **Psychosocial interventions for supporting women to stop smoking in pregnancy.** Cochrane Database of Systematic Reviews Issue 10. Art. No.: CD001055. DOI:10.1002/14651858.CD001055.pub4.

Smoking during pregnancy increases the risk of the mother having complications during pregnancy and the baby being born preterm (before 37 weeks). This updated systematic review identifies that psychosocial interventions to support women to stop smoking in pregnancy can increase the proportion of women who stop smoking in late pregnancy and reduce low birthweight and preterm births. Eighty-six trials were included in the review with 79 of them involving 29,000 women providing data on smoking abstinence in late pregnancy. Most were conducted in high income countries. Detailed results are provided in the review, with the key findings being that interventions that provided an incentive to stop smoking appeared to support the most women to quit (one study; RR 3.64, 95% CI 1.84–7.23) and an alternative intervention (one study; RR 4.05, 95% CI 1.48–11.11). In studies comparing counselling and usual care (the largest comparison), it was unclear whether interventions prevented smoking relapse among women who had stopped smoking spontaneously in early pregnancy (eight studies; average RR 1.06, 95% CI 0.93–1.21). However, a clear effect was seen in smoking abstinence at zero to five months postpartum (10 studies; average RR 1.76, 95% CI 1.05–2.95), a borderline effect at six to 11 months (six studies; average RR 1.33, 95% CI 1.00 to1.77), and a significant effect at 12 to 17 months (two studies, average RR 2.20, 95% CI 1.23–3.96), but not in the longer term. Feedback interventions had a significant effect only when compared with usual care and provided in conjunction with other strategies, such as counselling (two studies; average RR 4.39, 95% CI 1.89–10.21), but the effect was unclear when compared with a less intensive intervention (two studies; average RR 1.19, 95% CI 0.45–3.12). Peer provided social support appeared effective (five studies; average RR 1.49, 95% CI 1.01–2.19), but the effect of partner support was not clear (one study).

Alfirevic Z, Devane D, Gyte GML. 2013. **Continuous cardiotocography (CTG) as a form of electronic fetal monitoring (EFM) for fetal assessment during labour**. Cochrane Database of Systematic Reviews Issue 5. Art. No.: CD006066. DOI: 10.1002/14651858.CD006066.pub2.

Cardiotocography (CTG, electronic fetal monitoring) records changes in the fetal heart rate in relation to uterine contractions. It is used to identify babies who may be hypoxic so that additional methods of assessment of fetal wellbeing (e.g. blood sampling) can be used or delivery expedited by instrumental methods (with vacuum extraction or forceps) or caesarean section. This review included 13 RCTs or quasi-RCTs (37,000+ women in total), only two of which were of high quality. The authors concluded that continuous CTG during labour is associated with a reduction in neonatal seizures but no significant differences in cerebral palsy, infant mortality, or other standard measures of infant wellbeing. Continuous CTG monitoring was, however, associated with increases in caesarean section (RR 1.63, 95% CI 1.29 to 2.07, 11 trials, n=18,861) and instrumental vaginal births (RR 1.15, 95% CI 1.01 to 1.33, 10 trials n=18,615).

Koopmans L, Wilson T, Cacciatore J, Flenady V. 2013. **Support for mothers, fathers and families after perinatal death.** Cochrane Database of Systematic Reviews, Issue 6. Art. No.: CD000452. DOI: 10.1002/14651858.CD000452.pub3.

In the developed world it is widely accepted that a perinatal death is devastating for the parents and family. This review assessed the effects of the provision of counselling or any form of medical, nursing, social or psychological support, or both, for mothers, fathers and families after perinatal death. There were no RCTs identified and the review authors state that more research is needed to determine what kinds of support and counselling are most helpful. However, some well-designed descriptive studies have shown that, under the right circumstances and guided by compassionate, sensitive, experienced staff, parents' experiences of seeing and holding their deceased baby is often very positive. The sensitive nature of this topic and small sample sizes make it difficult to develop rigorous clinical trials. Hence, other research designs may further inform practice in this area. Where justified, methodologically rigorous trials are needed. However, methodologically rigorous trials should be considered comparing different approaches to support.

Dodd JM, Crowther CA. 2012. **Specialised antenatal clinics for women with a multiple pregnancy for improving maternal and infant outcomes**. Cochrane Database of Systematic Reviews Issue 8. Art. No.: CD005300. DOI: 10.1002/14651858.CD005300.pub3.

Women who have a multiple pregnancy are at greater risk of a number of adverse outcomes, including prematurity (the greatest risk), hypertension, gestational diabetes, and stillbirth. This review assessed the benefits and harms of "specialised" antenatal clinics compared to standard antenatal care, for women with multiple pregnancy. Only one study provided data, and this was on perinatal mortality with no statistically significant differences identified between specialised antenatal care and standard care (RR 1.02; 95% CI 0.26 to 4.03). Women receiving specialised care were significantly more likely to have a caesarean section (RR 1.38; 95% CI 1.06 to 1.81.)

Coleman T, Chamberlain C, Davey MA, et al. 2012. **Pharmacological interventions for promoting smoking cessation during pregnancy.** Cochrane Database of Systematic Reviews Issue 9. Art. No.: CD010078. DOI:10.1002/14651858.CD010078.

Pharmacotherapies (nicotine replacement therapy (NRT), bupropion and varenicline) are effective treatments for smoking cessation among the non-pregnant population, but the efficacy and safety of these therapies are not known for smokers who are pregnant. This review included six trials of NRT (n = 1745 pregnant smokers). No statistically significant difference was seen for smoking cessation in later pregnancy after using NRT as compared to control (RR 1.33 95% CI 0.93 to 1.91, six studies, 1745 women). Subgroup analysis comparing placebo-RCTs with those which did not use placebos found that efficacy estimates for cessation varied with trial design (placebo RCTs, RR 1.20, 95% CI 0.93 to 1.56, four studies, 1524 women; non-placebo RCTs, RR 7.81, 95% CI 1.51 to 40.35, two studies, 221 women). There were no statistically significant differences in rates of miscarriage, stillbirth, premature birth, birthweight, low birthweight, admissions to neonatal intensive care or neonatal death between NRT or control groups. However, further research evidence is required for determining efficacy and safety as there was insufficient evidence to determine whether NRT was effective or safe for promoting smoking cessation, or what effect NRT had on birth outcomes.

Grivell RM, Wong L, Bhatia V. 2012. **Regimens of fetal surveillance for impaired fetal growth**. Cochrane Database of Systematic Reviews Issue 6. Art. No.: CD007113. DOI: 10.1002/14651858.CD007113.pub3

There are wide variations in the policies and protocols for fetal surveillance in pregnancies where fetal growth impairment is suspected and there are many different techniques used for assessment of fetal growth and wellbeing. This review reports on one RCT done in New Zealand (167 women and babies) which compared a twice-weekly surveillance regimen (biophysical profile, non-stress 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 no difference between the groups in the primary maternal outcome (emergency caesarean for fetal distress) but women in the twice-weekly surveillance group were more likely to have induction of labour than those in the fortnightly surveillance group (Risk ratio 1.25, 95% CI 1.04-1.50) and overall their babies were born four day earlier. There was insufficient data to assess perinatal mortality or serious morbidity. No fetal deaths occurred in either group.

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.

The **Cochrane Collection** contains a large number of other reviews relating to tests which may be used to assess fetal wellbeing. Some of the interventions which have been the subject of Cochrane reviews are: fetal movement counting, fetal and umbilical Doppler ultrasound, amniotic fluid index vs. single deepest vertical pocket as a screening test, biochemical tests of placental function, biophysical profiles, routine ultrasound at 24 weeks, symphysis-fundal height measurement, fetal fibronectin testing, and near infrared spectroscopy.

Other Relevant Publications

Perinatal and Maternal Mortality Review Committee. 2013. **Seventh Annual Report of the Perinatal and Maternal Mortality Review Committee: Reporting Mortality 2011**. Wellington: Health Quality & Safety Commission
http://www.hqsc.govt.nz/assets/PMMRC/Publications/Seventh-PMMRC-Report-FINAL-June-2013.pdf

The Perinatal and Maternal Mortality Review Committee (PMMRC) reviews all perinatal and maternal deaths in New Zealand with the aim of identifying areas for improvement in maternal and newborn care. This report is based on the data collected by the Mortality Review Data Group. A perinatal death is defined as one occurring after 20 weeks gestation (or of a baby weighing at least 400g if gestation is unknown) and up to and including the 28th day of life. Besides reporting statistics, the report also makes recommendations for future work by the PMMRC, the Ministry of Health, lead maternity cares, DHBs and others. This report notes a significant increase in perinatal related mortality among babies born in multiple pregnancies from 2007 to 2011. Of all perinatal related deaths, 19% were identified as potentially avoidable in 2011. The most common contributory factors were barriers to access or engagement with care followed by personnel factors. Māori and Pacific mothers were significantly more likely to have potentially avoidable perinatal related deaths than New Zealand European mothers, and there was a significant increase in potentially avoidable perinatal related death with increasing socioeconomic deprivation. The report also noted that in an audit of babies who had died in 2010 with potentially identifiable congenital abnormalities, one in four women who had sought care with a primary health care provider before 14 weeks was not offered first or second trimester antenatal screening and that folate prophylaxis was infrequent and poorly documented.

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

This paper examines the role of antenatal care plays in the prevention of stillbirth in high income countries. The 151 cases in this study were women with a singleton, late stillbirth without congenital abnormality, with controls being 310 ongoing pregnancies randomly selected at the same gestation at which the stillbirth occurred. Cases and controls constituted 72% of each of their respective potential cohorts. Findings indicate that a two fold increase in late stillbirth was associated with accessing less than half the recommended antenatal visits (adjusted odds ratio, aOR, 2.68; 95% CI, 1.04-6.90) when compared with accessing the recommended number of visits. Compared to babies identified as being small-for-gestational-age (SGA) during the antenatal period, babies who were SGA or had not been identified as SGA prior to birth, were more at risk of being stillborn (aOR, 9.46; 95% CI, 1.98-45.13). The authors concluded that the study reiterated the importance of regular antenatal care attendance.

Stacey T, Thompson JMD, Mitchell EA, et al. 2011. **Relationship between obesity, ethnicity and risk of late stillbirth: a case control study**. BMC Pregnancy & Childbirth, 11, 3.

This paper reports on the Auckland Stillbirth study, a case-control study conducted from July 2006 to June 2009. Women who had a late stillbirth (≥ 28 weeks) were matched with two controls of the same gestation as each case. In the univariate analysis of results, Pacific ethnicity, overweight and obesity, grand multiparity, not being married, not being in paid work, social deprivation, exposure to tobacco smoke and use of recreational drugs were associated with an increased risk of late stillbirth. In the multivariate analysis Maternal overweight and obesity, nulliparity, grand multiparity, not being married and not being in paid work were independently associated with late stillbirth but Pacific ethnicity was no longer significant (adjusted Odds Ratio 0.99; 0.51-1.91). The disparity in stillbirth rates between Pacific and European women can be explained by confounding factors such as high parity and maternal obesity.

Note: The publications listed were identified using the search methodology outlined in Appendix 1 (Search Methods for Policy Documents and Evidence-Based Reviews)

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