Perinatal and Maternal Mortality in New Zealand 2008 Fourth Report to the Minister of Health July 2009 to June 2010

Perinatal and Maternal Mortality Review Committee

He matenga ohorere, he wairua uiui, wairua mutungakore

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The grief of a sudden, untimely death will never be forgotten

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Chair's Introduction

I am pleased to present the fourth report of the Perinatal and Maternal Mortality Review Committee (PMMRC). The aim of the committee is to identify areas in maternity and newborn care where improvements could be made. This report provides an accurate estimate of the absolute numbers and rates of perinatal and maternal deaths in New Zealand for 2008, describes the risk factors for perinatal and maternal deaths, and seeks to identify where the attention of maternity and neonatal services might be best focused to prevent perinatal and maternal deaths.

This is the second full report of both perinatal and maternal data, providing 12 months data for 2008. The data are the result of the collaborative efforts of the PMMRC, lead maternity carers (LMCs), local coordinators and clinicians of the District Health Boards, with support from a National Coordinator and the Mortality Review Data Group of the University of Otago. These data are one measure of the quality and safety of the New Zealand maternity services. The maternal mortality rate in 2008 was 13.7 per 100,000 maternities, and the perinatal mortality rate for the same year was 10.0 per 1000 total births. These data suggest that our rates of maternal and perinatal mortality are similar to both Australia and the United Kingdom.

Communication continues to be central to ensuring cooperation and collaboration in reporting perinatal mortality. In November 2009, we held a national one day workshop, Making Pregnancy Safer, which was open to all clinicians, policy makers and consumers. We received excellent feedback from both this workshop and a critique of our third annual report by two international speakers at the workshop. However, the feedback raised some areas of concern, and we have used these concerns to develop our work plans for the future. We plan to hold a similar workshop annually, focusing on improving quality and reducing mortality and morbidity.

The annual local coordinators' training workshop was held in March 2010, and several new initiatives were discussed at that time. For their part, the local coordinators have been active in reviewing perinatal deaths within their own District Health Boards. All these meetings and analyses aim to improve local services. I have been fortunate enough to be able to attend several of the meetings and have been impressed with the quality of the review and the clinicians' engagement in the issues discussed.

In the legislation that established the PMMRC, we were asked to review major morbidity. I am pleased to report that two new initiatives for reporting on morbidity commenced at the beginning of 2010. The first is the Neonatal Encephalopathy Working Group (NEWG), a subcommittee to the PMMRC, which has been collecting national data on the prevalence and risk factors for neonatal encephalopathy, including information on those infants who survive. The second initiative is the collaborative project of the Australasian Maternity Outcomes Surveillance System (AMOSS), lead by the AMOSS working group (AMOSSWG). This initiative collects information on women who suffer major morbidity from a range of rare conditions, including amniotic fluid embolism, placenta accreta, antenatal pulmonary embolism, eclampsia, morbid obesity, influenza with admission to an intensive care unit, and peripartum hysterectomy. I am grateful to all members of the respective working groups for helping get these two initiatives underway so smoothly.

Finally, thank you to everyone who has supported the work of the committee in preparing this 2008 report. The PMMRC appreciates the efforts of midwives, doctors, consumer groups and the staff of the Ministry of Health and District Health Boards who are working to improve maternity care and the health of mothers and newborn infants in New Zealand. We look forward to working with you in the future.

Professor Cindy Farquhar
Chair of the Perinatal and Maternal Mortality Review Committee

Executive Summary and Recommendations

Terms of reference and mortality definitions

- The Perinatal and Maternal Mortality Review Committee (PMMRC) is responsible for reviewing maternal deaths and all deaths of infants born after 20 weeks gestation to 28 completed days after birth, or weighing at least 400 g if gestation is unknown.
- A maternal death is the death of a woman while pregnant or within 42 days of termination of pregnancy, irrespective of the duration and site of the pregnancy, from any cause related to, or aggravated by, the pregnancy or its management. It does not include accidental or incidental causes of death of a pregnant woman.
- Maternities are all live births and all fetal deaths at 20 weeks or beyond, or weighing at least 400 g if gestation was unknown. In 2008, the maternal mortality ratio was calculated per 100,000 maternities.
- Perinatal mortality is fetal or early neonatal deaths, after 20 weeks gestation until less than 7 days of age or weighing at least 400 g if gestation was unknown.
- The perinatal related mortality rate is fetal death (including terminations of pregnancy and stillbirths) and neonatal death (up to 28 days) per 1000 total babies born at 20 weeks or beyond, or weighing at least 400 g if gestation is unknown.
- Neonatal mortality is all infant deaths from live birth to 28 days of age inclusive.

Key points

Perinatal mortality

- In 2008, the perinatal mortality rate was 10.0 per 1000 births, and the perinatal related mortality was 10.6 per 1000 births. This is comparable to 2007 rates and to rates in both Australia in 2007 and the United Kingdom in 2008.
- The intrapartum stillbirth rate (0.49/1000) continues to be of concern as the majority of these babies are term and not small for gestational age and therefore may have been preventable deaths. Many of these babies, along with neonates who suffer hypoxic ischaemic encephalopathy, will be reviewed further by the Neonatal Encephalopathy Working Group (NEWG) of the PMMRC. In addition, information on potentially avoidable factors will be available from 2009 data, which may provide further insight into causative factors.
- As in 2007, there were 10 neonatal deaths of healthy babies due to sudden unexpected death in infancy (SUDI). Smoking and co-sleeping are risk factors for SUDI. In eight of these deaths, there was co-sleeping, and nine of the babies had mothers who smoked.
- A combined analysis of 2007 and 2008 data found that Māori and Pacific women were more likely to have a stillbirth or neonatal death compared with New Zealand European and Asian (not including Indian) women. The reasons for these inequalities are unknown and require further investigation.
- In 2008, we have reported both maternal and baby ethnicity. Ethnicity is reported using both prioritised and sole/combination ethnicity classifications.
- Māori and Pacific women and those women living in areas of high socioeconomic deprivation are more likely to have a stillbirth or neonatal death as a result of spontaneous preterm birth.
- Women under the age of 20 and over the age of 40, Pacific and Māori (sole ethnicity) women and women residing in areas with deprivation deciles of 8 or higher all independently have an increased risk of stillbirth. A lack of detailed information about all women who give birth in New Zealand prevents analysis of the contribution of smoking and body mass index (BMI) to perinatal related mortality.

- In 2008, 49 percent of women who had stillborn babies and 45 percent of mothers of neonatal deaths were overweight or obese. Lack of national data on all mothers who give birth in New Zealand makes it difficult to draw conclusions about the role of obesity in perinatal related death.
- Post-mortems were offered in almost 90 percent of stillbirths and neonatal deaths and were performed in approximately half of these cases.

Maternal mortality

- There were nine maternal deaths in 2008. In 2007, there were 11 and in 2006 there were 15 [1]. It is not possible to comment on trends of maternal mortality based on only three years of data.
- Of these 35 maternal deaths, eight were mothers with pre-existing medical conditions, and seven were suicides.

Recommendations arising from the fourth Report

For the Ministry of Health and District Health Boards

1. Possible causes for the increase in perinatal-related death of babies born to Pacific women, Māori women, women under the age of 20 and over the age of 40, and women who live in areas of high socioeconomic deprivation should be researched. This information is necessary in order to develop appropriate strategies to reduce these possibly preventable deaths.

2. Maternal mental health services should be integrated into maternity services and access should be provided to a mother and baby unit in the North Island.

3. The low uptake of post-mortems amongst families who experience perinatal loss should be investigated.

4. National guidelines should be developed for the management of postpartum haemorrhage, encompassing a massive transfusion protocol.

For clinicians and lead maternity carers

5. Although further research is required, clinicians and lead maternity carers (LMCs) should be aware that Pacific women, Māori women, women under 20 and over 40 years of age, and those women who live in areas of high socioeconomic deprivation are at higher risk of a perinatal death.

6. Clinicians and LMCs should be encouraged to collect accurate ethnicity details at the time of booking.

7. Clinicians and LMCs should be encouraged to conduct antenatal screening and document any mental health history to identify women who are at increased risk of mental illness. Suggested screening questions include:

- Do you *currently receive* or have you *ever received* treatment for a serious mental illness?
- Do you have a family history of serious mental health problems, including perinatal mental illness?

For future PMMRC reporting

8. The PMMRC should undertake further analysis and discussion on the ways of reporting ethnicity and perinatal deaths.

9. The PMMRC should analyse the data collected in 2009 for potentially avoidable factors, with an emphasis on intrapartum stillbirths.

1 This is one more than as stated in previous reports. This is because the data sets that the PMMRC reports on are dynamic and are updated as additional information becomes available.

Recommendations from the third PMMRC report

The following seven recommendations of the third report of the PMMRC are included in this report as they are still to be implemented or are ongoing (PMMRC. 2009a).

1. Birth information
    a. In order to report on the quality of all aspects of New Zealand maternity services, a national perinatal epidemiology unit should be established.
    b. The current birth registration dataset should be required to include key maternity data. (For example, parity, major complications, mode of birth, history of smoking, BMI, and previous obstetric history.)
    c. New legislation should enable Births, Deaths and Marriages to accept National Health Index data and update the routine National Health Index dataset with regard to ethnicity.
    d. The Ministry of Health should continue to support and fund DHBs and lead maternity carers (LMCs) to complete perinatal mortality data.
2. Sudden unexpected deaths in infancy (SUDI)
    a. The Ministry of Health should prioritise the preparation and dissemination of a comprehensive statement for parents and caregivers on risk factors and methods of prevention of SUDI to be provided to pregnant women.
    b. National guidelines should be developed for safe sleeping arrangements in postnatal wards, to improve ward safety and to model safe sleeping practices that parents can follow after discharge.
3. DHB disparities
    a. Further research is warranted to understand the higher rate of perinatal related mortality in the Counties Manukau region.
4. Early booking
    a. The Ministry of Health, DHBs and professional colleges should collaboratively explore barriers to early booking, with a view to increasing the number of women who book with an LMC before 10 weeks gestation. A national media campaign should be considered.
5. Access to perinatal post-mortems
    a. The reasons for the differences in rates of optimally investigated perinatal deaths between DHBs need investigation.
6. Access to care
    a. Strategies to improve awareness of antenatal care services and increase access among women who are isolated for social, economic, cultural or language reasons should be developed.
7. Team approach to care
    a. Women with complex medical conditions require a multidisciplinary approach to care, often across more than one DHB. Each woman requiring such care should be assigned a key clinician to facilitate her care.
8. Seat belts in pregnancy
    a. There is a need for greater public awareness of the importance of wearing a seat belt during pregnancy. All pregnant women should know that three-point seatbelts should be worn throughout pregnancy, with the lap strap placed as low as possible beneath the ‘bump’, lying across the thighs, and the diagonal shoulder strap placed above the ‘bump’, lying between the breasts.

1. Perinatal Mortality 2008

1.1 Introduction

In New Zealand, maternity care is funded by the Ministry of Health (the Ministry). It is provided nationally by 21 District Health Boards (DHBs) and by lead maternity carers (LMCs), who receive funding from the Ministry. LMCs may be self-employed midwives, general practitioners (GPs), private obstetricians or hospital-based midwives and obstetricians. Their services are free, except in the case of private obstetricians, who have the right to charge for their services.

LMCs are required to sign access agreements with any maternity facility where they intend to provide care.

Women have the right to choose who they engage as their LMC. However, professional colleges and the Ministry provide guidelines about appropriate care for mothers with risk factors.

1.2 Methodology

Data sources

The perinatal deaths presented in this report occurred between 1 January and 31 December 2008. For fetal deaths, the date of birth is used as 'date of death'. For neonatal deaths, the actual date of death is used.

An expanded description of data collection methods for this report is available in the first Perinatal and Maternal Mortality Review Committee (PMMRC) report (PMMRC 2007).

After the PMMRC was established, and following consultation with stakeholders, it was agreed that a review of all perinatal deaths would require the assistance of the LMC and the DHBs to collect detailed clinical information on each perinatal death.

The PMMRC approached all the DHBs, requesting their help to establish a network of local PMMRC coordinators. Individual coordinators within each DHB identified perinatal deaths and oversaw the collection of the required data. These data were submitted to the Mortality Review Data Group at the University of Otago, which added them to a central national dataset. The coordinators were also responsible for initiating local clinical reviews of each case, including assigning classification codes, and ensuring appropriate, timely follow-up with parents.

The dataset of perinatal deaths is a compilation of data submitted by the local coordinators, death notifications and some additional data from Births, Deaths and Marriages (BDM). A website commissioned by the PMMRC and run by the University of Otago enables web-based data entry. LMCs are required to complete rapid reporting forms within 48 hours of a perinatal death. One form contains information on the mother (for example, her past medical and obstetric history and details of the birth), and the other form contains information on the baby. The forms' base questions are assessed and adjusted annually to ensure that the data collected remains current and robust.

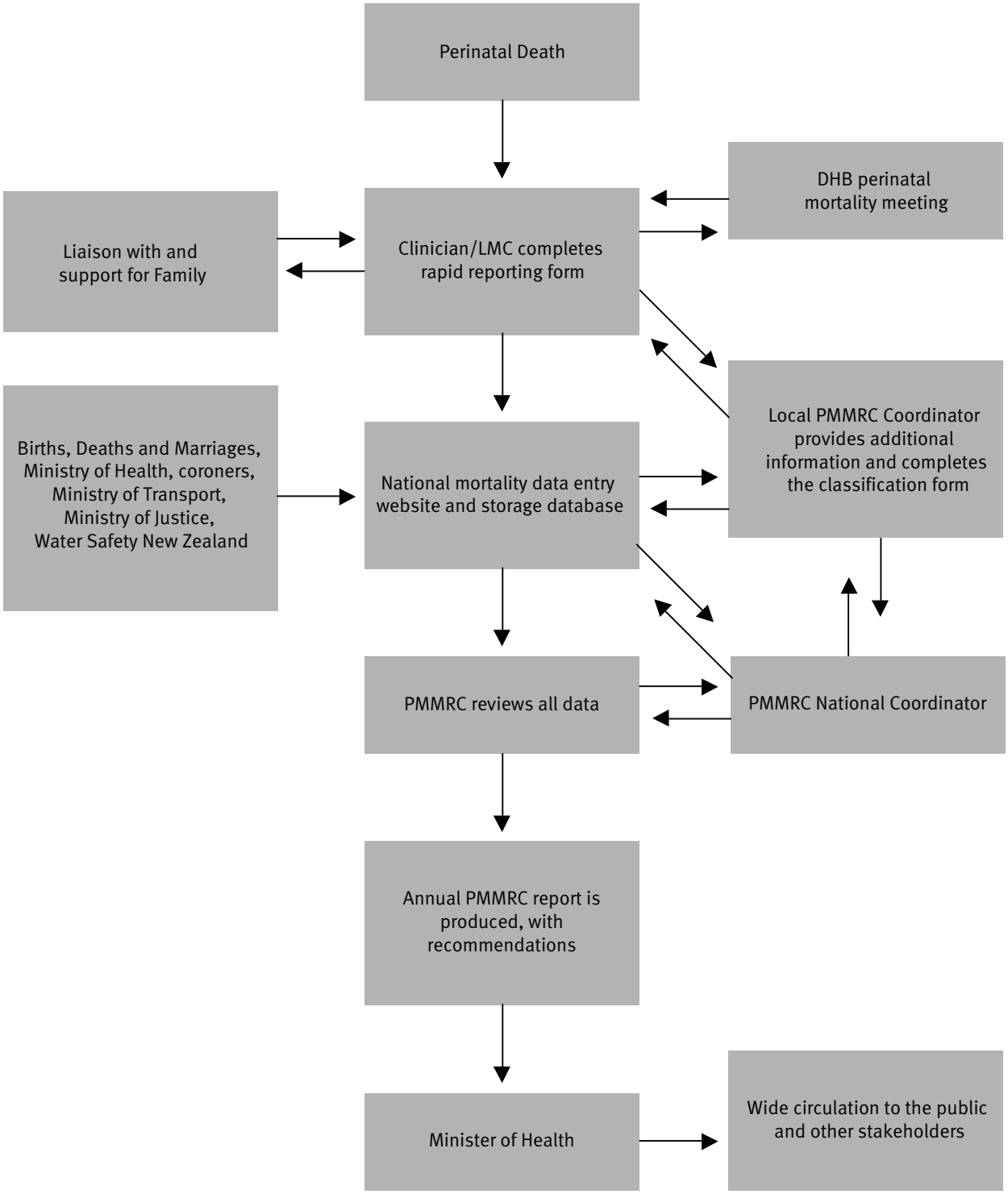
After local review, the local coordinator completes the PMMRC classification form. The classification system that has been adopted is the Perinatal Society of Australia and New Zealand (PSANZ) system of classification (PSANZ 2005). This system includes both perinatal and neonatal classifications (listed in Appendix A below). The local coordinator also includes a post-mortem and histology reports with the classification form. Figure 1 outlines the PMMRC process.

A user guide describing the definitions and data elements used by the PMMRC (PMMRC 2009b) is available online (http://www.pmmrc.health.govt.nz).

Perinatal deaths that occur outside hospital are most often identified through the coroner or the BDM register. In such cases, the local coordinator arranges for the mother's LMC to complete the rapid reporting forms.

A national coordinator for the PMMRC was appointed in October 2006. This position was established to ensure that all rapid reporting and classification forms were completed in a timely manner and to provide support and education to local coordinators.

Figure 1 Flow of information in the PMMRC's perinatal data collection process



PMMRC data validation

Data are regularly 'cleaned' to eliminate duplicate records and follow up missing mother or baby information, clarify DHB of residence (where this is inconsistent with the given residential address) and rectify other inconsistencies.

The national coordinator reviews all causes of perinatal death classifications and checks complicated cases with Professor Lesley McCowan (PMMRC member with expertise in stillbirth research and classifications).

The national coordinator audits all data supplied on a random selection of 10 percent of perinatal deaths by comparing these data with clinical records from the relevant DHBs. As part of the audit of data, the national coordinator assigns a perinatal death classification (PDC) and neonatal death classification (NDC) (as applicable) to all audited deaths and compares them with the original classification. In 2008, in 4 percent of cases, the audited and original classification varied; in another 9 percent of cases, the subcategory varied. The remainder of the entered data fields on the rapid reporting forms were accurate in cases where data were entered, but available data had not been entered in some records.

Denominator data

The denominator in this report consists of New Zealand birth registrations during the 2008 calendar year. This dataset best approximates the number of births in a year in New Zealand. It is closer to the true number of births than the hospital discharge dataset as it includes births outside hospitals. Furthermore, it presents ethnicity data of babies as notified by parents upon birth registration. This best approximates the collection of ethnicity for the numerator, which is collected from the birth registration dataset where available. Ethnicity in the hospital discharge dataset (otherwise known as the national minimum dataset, NMDS) is also provided by mothers for themselves and for their babies and becomes part of the National Health Index (NHI) dataset. However, comparisons of the two datasets have shown significant differences in ethnicity.

The birth registration dataset of New Zealand births is collated by BDM from birth notifications supplied by public and private hospitals and by LMCs in the case of home births. These births are only added to the birth registration dataset when the birth is registered by the parents, which can occur up to some years following birth. The registration dataset is based on date of registration and so includes births from previous years and less than all births from the current year. While this dataset is probably the most accurate representation of total number of births in a year, it does not truly represent denominator data.

A disadvantage of the birth registration dataset for reporting maternity analyses in New Zealand is that it includes limited maternity data. The dataset does not include an individual's unique NHI identification number (for either the mother or the baby), and so the data it contains cannot be linked to hospital discharge data or LMC data for further analyses.

The denominator birth registration dataset includes both live births and stillbirths. As this dataset relates to stillbirths registered in the calendar year and not deaths in the calendar year and does not record which babies died as neonates in this set, the full registration set has been used as the denominator for rates (without removing the stillbirths). However, for the purposes of the multivariate analysis for stillbirth, where individual level data are relevant, in this report, the stillbirths have been removed from the birth registration set and have been replaced by the stillbirths from the PMMRC dataset.

Data analysis

Frequencies and discrete statistics were computed from the PMMRC database by the University of Otago's Mortality Review Data Group. Percentages have been displayed with one decimal place. In some cases, due to rounding, the percentages do not add to exactly 100 percent.

In figures where graphs have two y axes, the data relating to the left-side y axis are presented as bars, and the data relating to the right-side y axis are presented as points, joined by a line where they represent continuous or ordinal data.

Ninety-five percent confidence intervals (CIs) for mortality rates have been calculated using the 'exact' method. The CI represents the degree of uncertainty around the point estimate of the rate for this particular 12-month period.

This uncertainty depends on the absolute number of deaths and the number of births from which the deaths arose. If the number of births is large, then the CI (that is, the level of uncertainty) is generally small; if the number of births is small, the CI is large. The CI represents the limits within which the 'true' rate is most likely to lie. This calculation is necessary when numbers are small because the point estimate of the rate calculated from the data given may, by chance, have taken a wide range of values. The CI describes this range.

It is possible to compare rates by looking at the CIs. If the CIs for two rates do not overlap, it is likely that the rates are different. This is equivalent to the rates being statistically significantly different at the $p<0.05$ level. If the CIs do overlap, the rates may or may not be different.

In Figure 26, which shows perinatal related mortality rates by the mother's DHB of residence, the CIs for perinatal related mortality rates by DHB have been plotted along with the national perinatal related mortality rate. If the CI for the DHB of residence rate does not include the national rate, then it is likely that this DHB of residence rate differs from the national average rate.

Cases that have missing data have still been included in the data tables and are generally discussed in the text. Percentages in the tables generally include missing data, though the text sometimes describes findings among women with complete data only. However, where missing data exceed 30 percent of all possible data points, the data have generally not been presented.

In this report, for mortality rates by demographic variables, the figures include rates calculated for the two full years that the PMMRC has collected data (2007 and 2008) combined. This increases the numbers and improves the confidence around the estimates given. The data for the 2008 year alone are presented in table form in the text and the two-year data combined in table form in Appendix B: Data Tables.

PMMRC data collected since the inception of the database (July 2006–December 2008) have been used to analyse congenital abnormalities and perinatal asphyxia (see 1.6: Specific Areas of Interest: Congenital Abnormality below).

A multivariate logistic regression analysis, using STATA9.2 software, was undertaken to determine whether maternal age, ethnicity and socioeconomic deprivation were independently associated with stillbirth. Stillbirth was the only outcome analysed as stillbirths are identifiable in the denominator dataset but neonatal deaths are not. Data on stillbirths from the PMMRC dataset were added to the birth registration set, having excluded stillbirths. Maternal age was categorised into age bands. Deprivation index was included in models as a continuous variable and as two categories, deciles 1–7 and 8–10, in keeping with the univariate data. The categorised variable was retained in the final models. Two logistic regression models were built, one using prioritised maternal ethnicity and one using sole/combination maternal ethnicity. All variables were retained in the final models.

1.3 Definitions

Ethnicity

Ethnicity data on perinatal related deaths were collected in two ways: from information supplied to the BDM Registrar (with priority given to information in the birth registration over information in the death registration) and from rapid reporting forms completed by LMCs (for example, in cases were the death had not been registered by the time of analysis). In both instances, ethnicity was recorded as that identified by the mother/parents. The ethnicity in the deaths dataset (held by BDM) was not validated. Death registration forms are usually completed by either the parents or a funeral director.

Maternal and baby ethnicities in the denominator birth registration set are those provided by the parent(s) to BDM at birth registration and are thus consistent with numerator data.

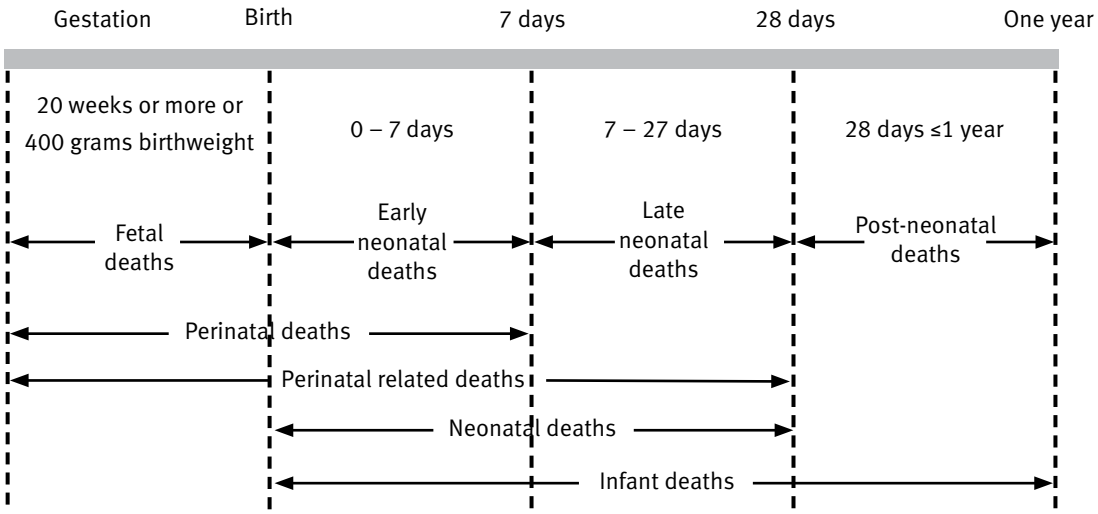
Multiple ethnicities can be identified for both mother and baby. The PMMRC followed the Ethnicity Data Protocols for the New Zealand Health and Disability Sector guidelines (Ministry of Health 2004) for prioritising ethnicity for the 2006 and 2007 reports. These prioritised ethnicity into the following heirarchy: Māori, Pacific peoples, Indian, Other Asian, Other and New Zealand European. Indian has been identified as a separate ethnicity from Other Asian because local data would suggest that Indian pregnancies are at higher risk than other Asian ethnicities pregnancies.

In 2008, other methods of outputting ethnicity data were explored, and because this has an effect on perinatal mortality rates by ethnicity, data for both prioritised and sole/combination ethnicity have been reported and discussed in this report. Total response for ethnicity, based on the level-2 data available (up to three ethnicities per individual) are provided for reference (Statistics New Zealand 2005; Ministry of Health 2004; Cormack and Harris 2009).

Ethnicity-specific, perinatal related mortality rates in this report have been analysed using mother and baby ethnicity.

Mortality rates

Figure 2 Definitions of perinatal and infant mortality



Adapted from NZHIS 2007 and Ministry of Health 2010.

Fetal death

Fetal death is the death of a fetus born at 20 weeks gestation or beyond (› 20 weeks), or weighing at least 400 g if gestation is unknown. Fetal death includes stillbirth and terminations of pregnancy. Note: the term 'stillbirth' does not include terminations in this report.

Fetal death rate is calculated per 1000 babies born at 20 weeks gestation or beyond or weighing at least 400 g if gestation is unknown.

Neonatal death

Neonatal death is the death of any baby showing signs of life at 20 weeks gestation or beyond (for the purposes of this PMMRC dataset), or weighing at least 400 g if gestation is unknown. **Early neonatal death** is a death that occurs within the first seven days of life (including on the seventh day). **Late neonatal death** is a death that occurs between the eighth day and the 28th day (including on the 28th day).

Neonatal death rate is calculated per 1000 live-born babies at 20 weeks gestation or beyond, or weighing at least 400 g if gestation is unknown.

Perinatal mortality

The perinatal mortality rate is calculated in New Zealand as fetal deaths and early neonatal deaths per 1000 total babies born alive or born dead at 20 weeks gestation or beyond, or weighing at least 400 g if gestation is unknown.

In some places, this report refers to a United Kingdom definition of perinatal mortality, which comes from the Centre for Maternal and Child Enquiries (CMACE 2010). This definition excludes fetal deaths before 24 weeks gestation.

Perinatal related mortality rate refers to fetal deaths and early and late neonatal deaths per 1000 total babies born at 20 weeks gestation or beyond, or weighing at least 400 g if gestation is unknown.

Lethal and terminated fetal abnormalities

Lethal and terminated fetal abnormalities are all fetal deaths classified by the Perinatal Society of Australia and New Zealand (PSANZ) perinatal death classification system as PDC1 (congenital abnormality) and neonatal deaths classified by the PSANZ neonatal death classification system as NDC1 (congenital abnormality).

Intrapartum stillbirth

Intrapartum stillbirth rate calculates deaths of babies of at least 24 weeks gestation without congenital abnormality who entered labour alive but then died during labour as a rate per 10,000 births.

Customised birthweight centiles

Customised birthweight centiles adjust newborn size for maternal weight, height, ethnicity and parity, as well as for infant sex and gestation at birth. Centile calculators are available online from the Gestation Network (see Gestation Network 2007). For fetal deaths, the gestation at the time of estimated death (not birth) is used to calculate the birthweight centile.

New Zealand Index of Deprivation

The New Zealand Index of Deprivation 2006 (NZDep 2006) is an area-based measure of socioeconomic deprivation based on variables from the Census of Population and Dwellings 2006 in New Zealand. The score is assigned according to maternal place of residence and is presented as a decile or quintile. Increasing deciles of deprivation, from least deprived at decile 1 to most deprived at decile 10, are associated with higher mortality and rates of many diseases (Salmond and Crampton 2002a, 2002b).

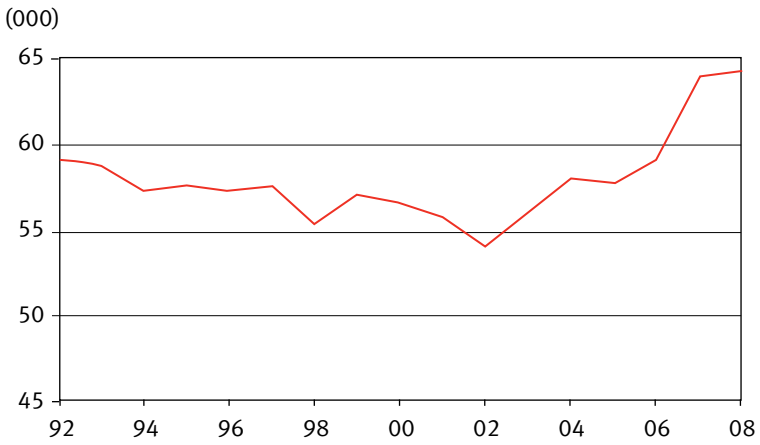
Lead maternity carer

The lead maternity carer (LMC) is defined as the practitioner or caregiver service selected by the mother as the service that will have the legal, professional and practical responsibility for ensuring that both herself and her baby receive clinically appropriate care up to and following birth.

1.4 Births in New Zealand

New Zealand Birth Registrations 2008

Figure 3 Total live birth registrations in New Zealand, 1992–2008

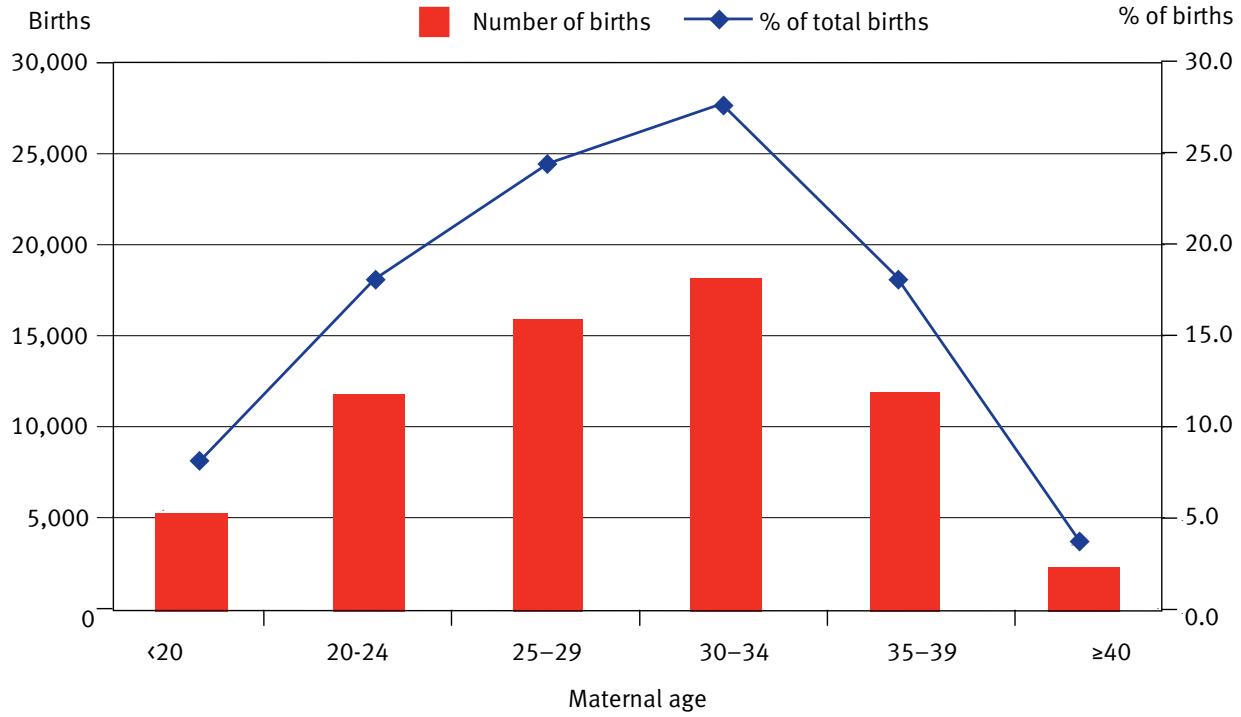


Source: Statistics New Zealand 2008

Figure 3 shows a small increase in live births from 2007, but the rapid increase in numbers of births between 2006 and 2007 has not continued.

Maternal age

Figure 4 Distribution of maternal age among births in New Zealand, 2008



The greatest number of births in New Zealand in 2008 occurred in the five-year maternal band of 30–34 years of age (27.6 percent). In 2008 in New Zealand, 8.1 percent of births were to teenage mothers and 3.7 percent to women 40 years or older.

Ethnicity

In 2008, the birth registration dataset included two ethnicities for 29 percent of all babies registered compared with two ethnicities for 14.5 percent of mothers registered. The set included three ethnicities for 5.5 percent of babies and three ethnicities for 1.3 percent of mothers. This difference in the number of ethnicities a mother reports compared with the number of ethnicities she gives for her baby has an effect on the findings when ethnicity is analysed. Total responses for maternal and baby ethnicity in the 2008 birth registration set are given in Table 1 below.

Table 1 Total responses for mother and baby ethnicity among 2008 birth registrations

	Ethnicity total response (baby)		Ethnicity total response (mother)	
	n = 65,872		n = 65,872	
	n	%	n	%
Māori	19,615	29.8	15,530	23.6
Pacific peoples	10,421	15.8	7,938	12.1
Indian	2,603	4.0	2,367	3.6
Other Asian	4,794	7.3	4,584	7.0
Other	5,826	8.8	6,594	10.0
New Zealand European	43,402	65.9	38,698	58.7

Total response includes any response given, and therefore total responses add to greater than 100 percent. As noted above, more ethnicities were given for babies than for mothers, and therefore the percent response is greater for almost all ethnicities for babies than for mothers.

Prioritised ethnicity assigns only one ethnicity per person, prioritising responses according to the following hierarchy: Māori, Pacific peoples, Indian, Other Asian, Other (including other European and missing responses) and New Zealand European (NZ European). Using prioritised ethnicity output, 46.9 percent of mothers identified as New Zealand European, 23.6 percent as Māori, 10.6 percent as Pacific peoples, 3.4 percent as Indian, 6.7 percent as Other Asian, and 6.7 percent as other ethnicities. Using prioritised ethnicity output for baby ethnicity, the distribution is different, with more babies than their mothers prioritised to Māori, Pacific or Indian ethnicities rather than New Zealand European, other Asian or other ethnicities. The distribution of prioritised ethnicity among mothers and babies in the 2008 birth registration dataset is shown in Figure 5 below (with further information provided later in Table 10).

Figure 5 Distribution of prioritised ethnicity (mother and baby) among births in New Zealand 2008

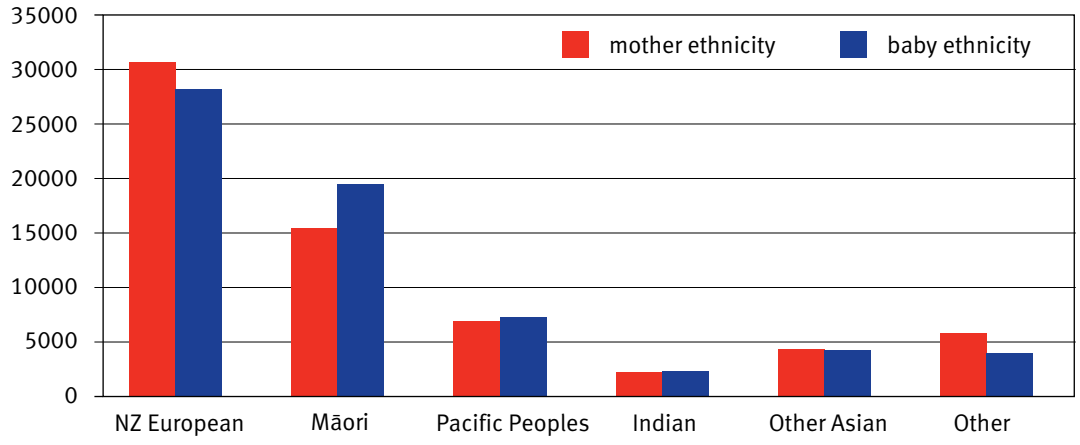
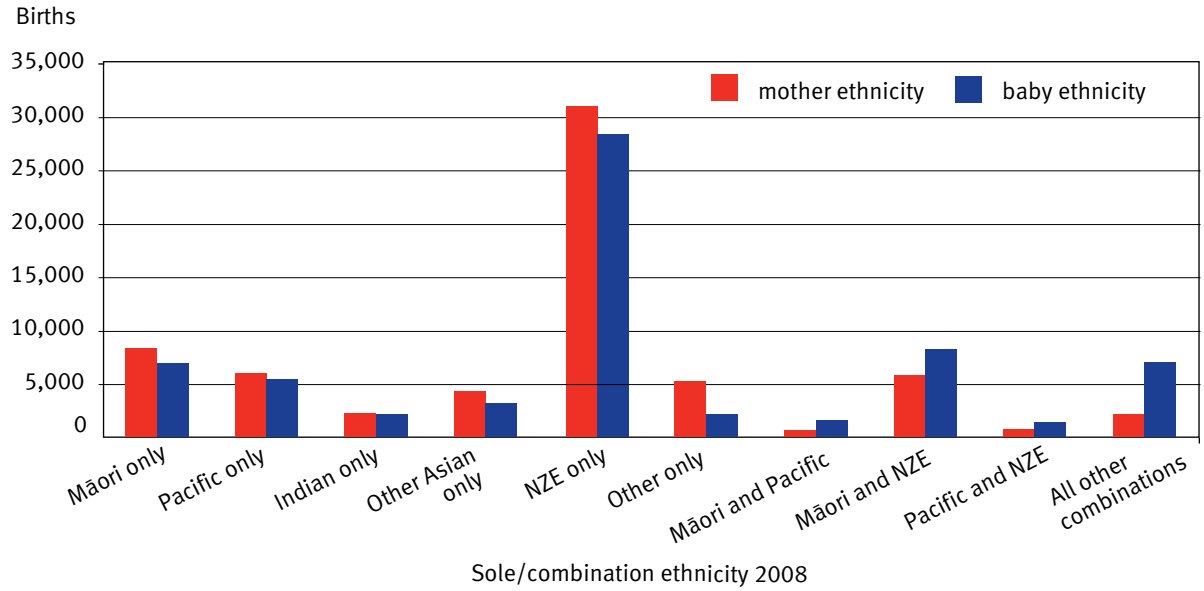


Figure 6 (with further information in Table 11) illustrates sole/combination ethnicity. In sole/combination, each person is again represented in only one category. All groups described in the prioritised ethnicity variable are represented as sole responses, and then the more common combined responses are presented. The remainder are included as 'all other combinations'. As a result of the increased number of ethnicities given per baby in sole/combination, the combined groups are more common than sole groups compared to mother's ethnicity. Sole/combination shows how often mothers describe themselves (and their babies) by more than one ethnicity.

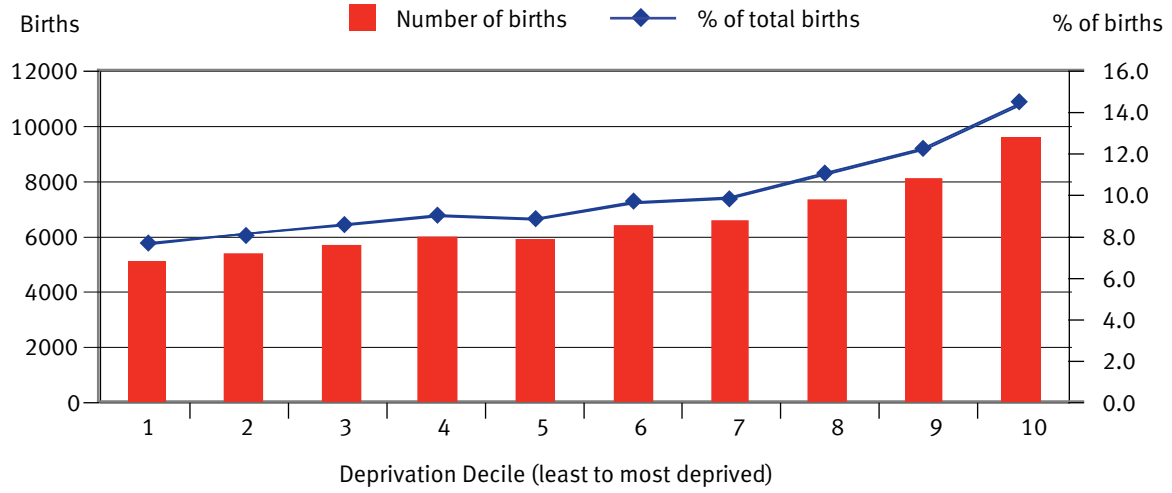
Roughly half of the mothers and babies who gave Māori as an ethnicity also gave a second ethnicity. If the mothers/babies identified with two ethnicities have different perinatal related mortality rates to those identified as Māori alone, this will provide a different view of the data to that seen using prioritised ethnicity, and it may be useful in understanding which babies are at increased risk of perinatal-related mortality.

Figure 6 Distribution of sole/combination ethnicity (mother and baby) among birth registrations in 2008



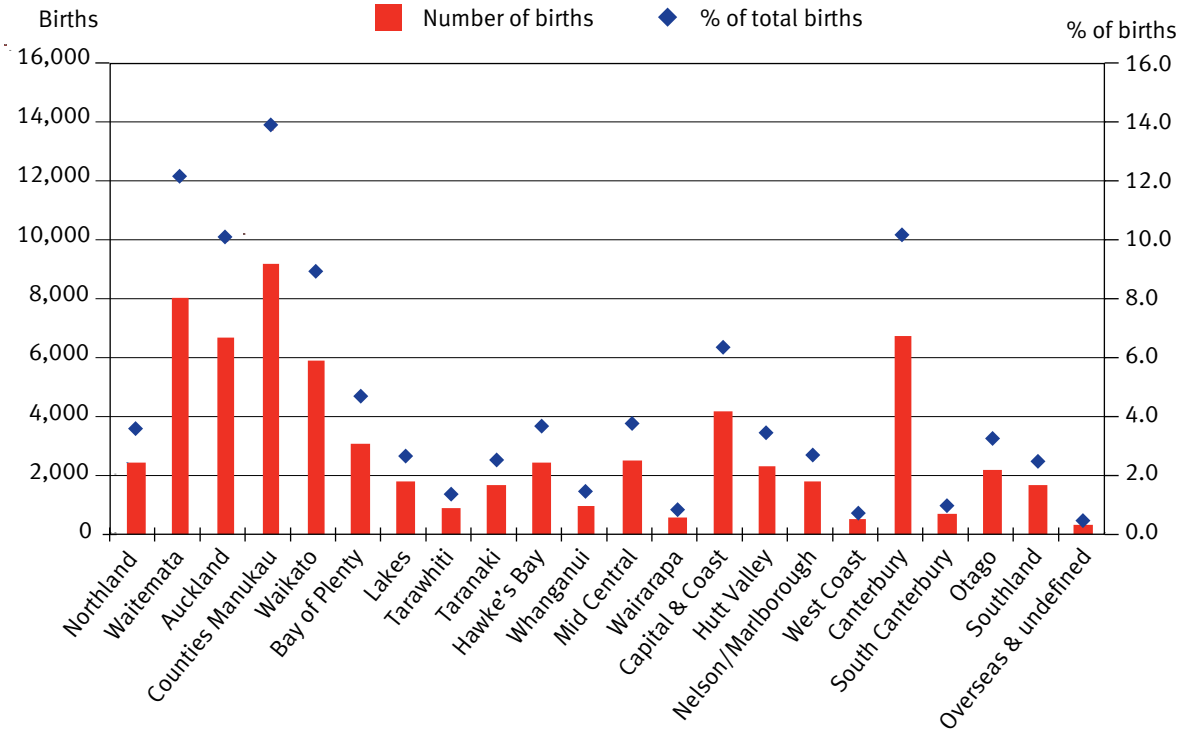
Deprivation deciles and DHB residence

Figure 7 Distribution of deprivation deciles among births in New Zealand 2008



The proportion of babies born in the most deprived decile areas in New Zealand is greater than the proportion in any other decile areas, and the proportion of births increases fairly consistently with increasing deprivation.

Figure 8 Distribution of births by DHB of maternal residence, 2008



In 2008, 36 percent of babies were born to parents residing in the three Auckland DHB regions of Waitemata, Auckland and Counties Manukau. Twenty percent were born to parents residing in the South Island.

Associations between demographic variables

Ethnicity and deprivation quintile

Figure 9 Distribution of deprivation quintiles by prioritised ethnicity (of mother) among births registered in 2008

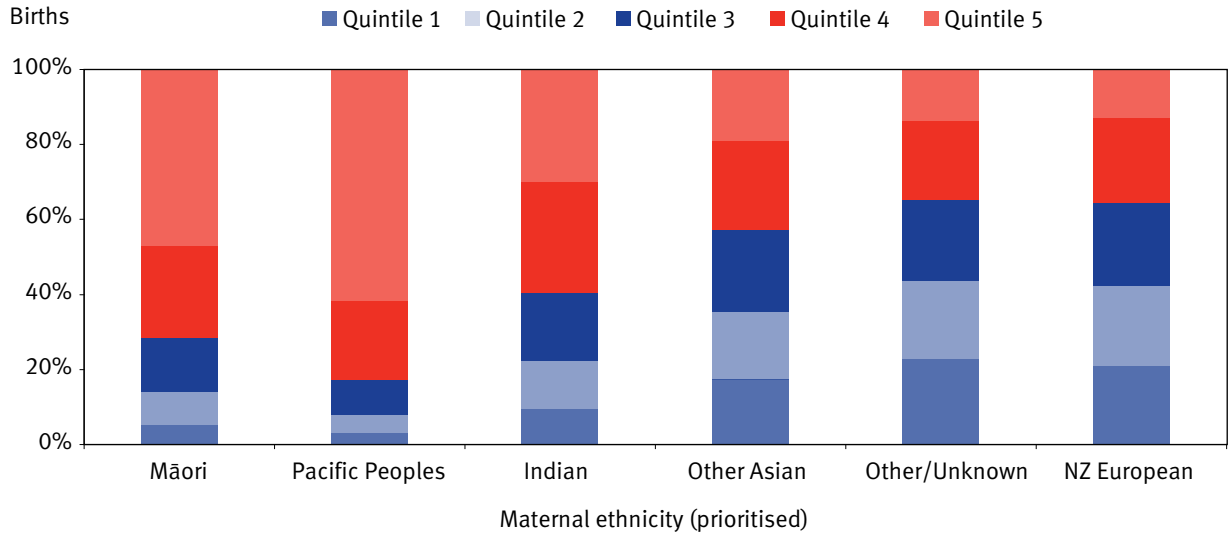


Figure 10 Distribution of deprivation quintiles by sole/combination ethnicity (of mother) among births registered in 2008

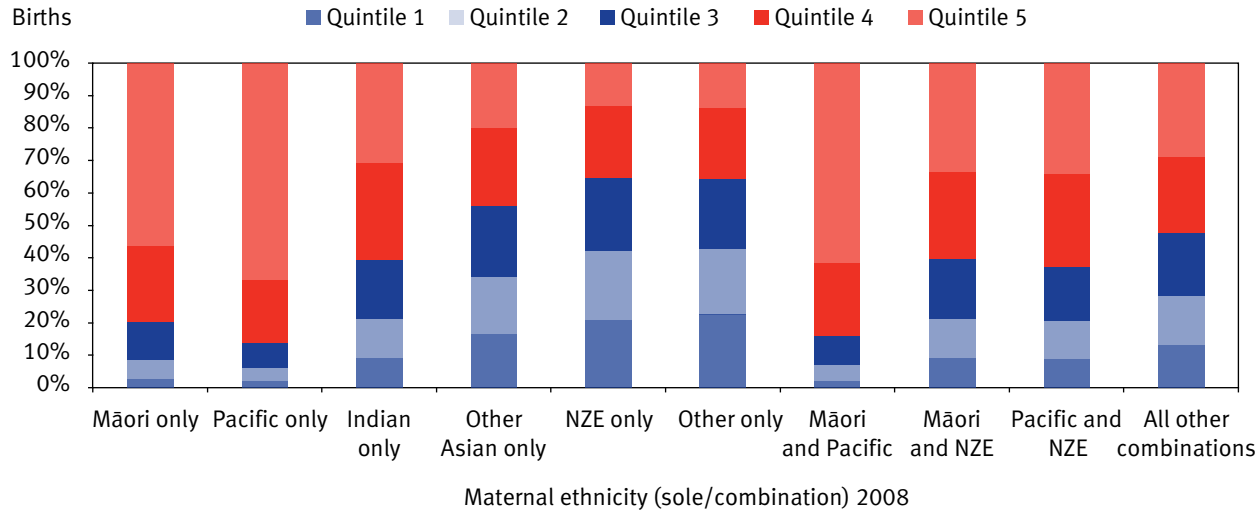


Figure 9 and Figure 10 show the association between maternal ethnicity and deprivation deciles. Figure 9 demonstrates the distribution of deprivation deciles across prioritised ethnicity, while Figure 10 uses sole/combination ethnicity. Both figures suggest an unequal distribution of deprivation (NZDep06) by ethnicity with considerably greater levels of deprivation among Māori, Pacific and Indian mothers. Area deprivation among the sole categories of Māori and Pacific peoples and the Māori-Pacific combined group (Figure 10) is greater than that seen among Māori and Pacific peoples using prioritised ethnicity (Figure 9). The categories of combined Māori and Pacific with New Zealand European describe two groups with lower levels of socioeconomic deprivation.

Age and ethnicity

Figure 11 Distribution of maternal age by maternal ethnicity (prioritised) among birth registrations in 2008

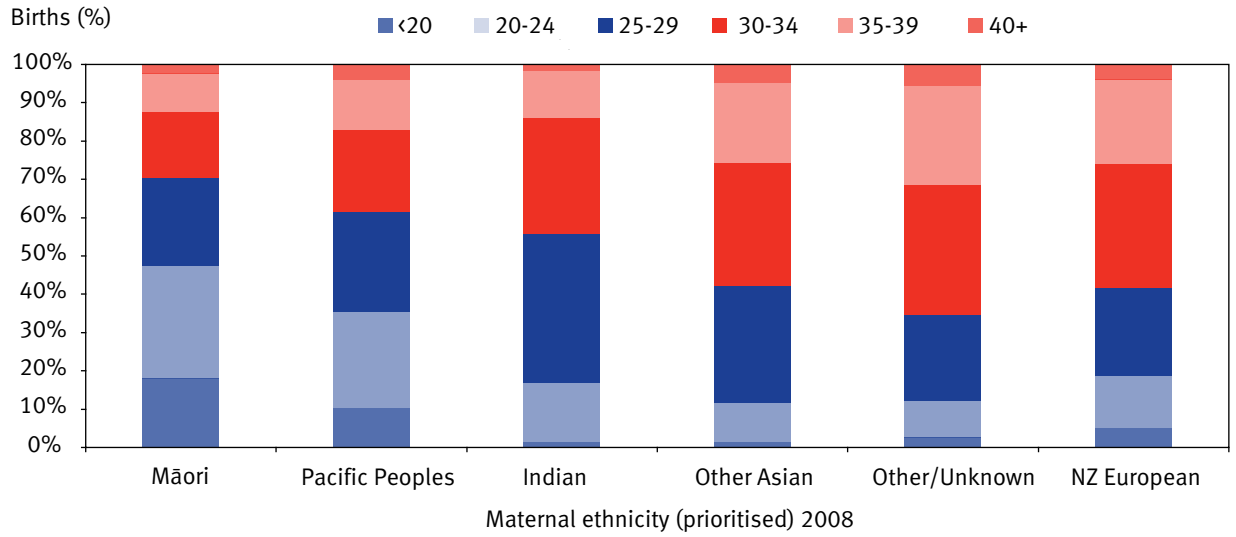


Figure 12 Distribution of maternal age by maternal ethnicity (sole/combination) among birth registrations in 2008

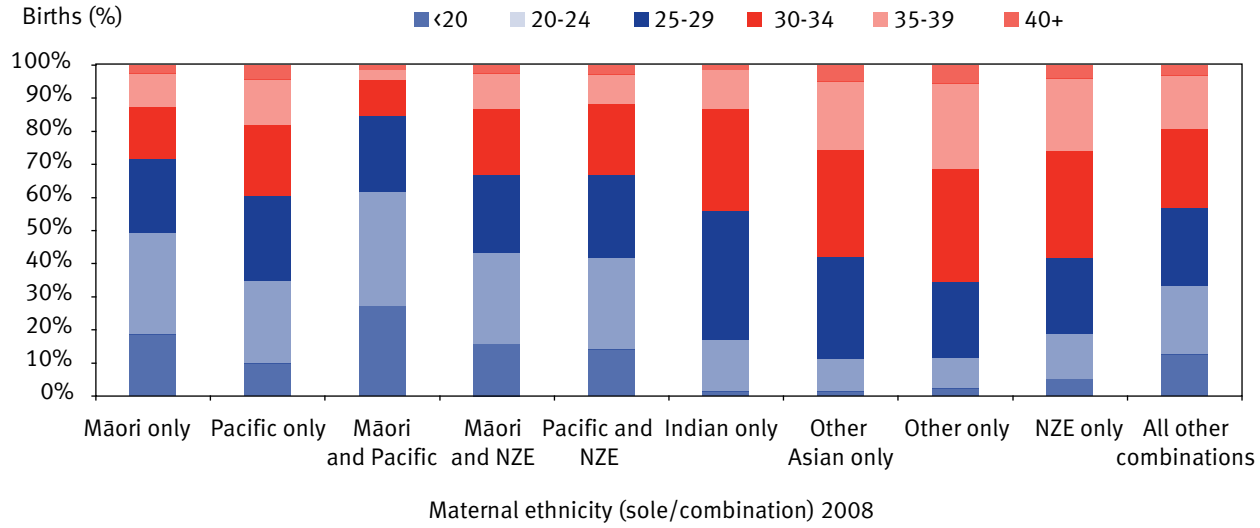
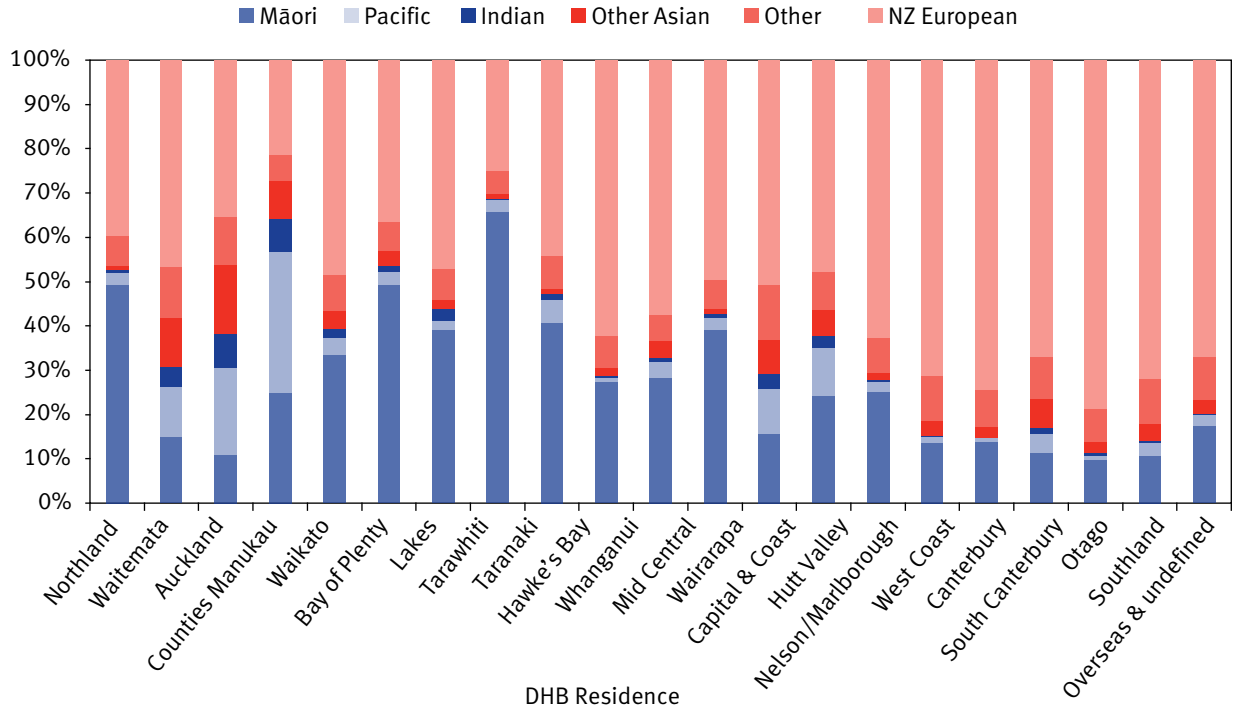


Figure 11 and Figure 12 demonstrate the differences in age of mothers according to maternal ethnicity among births registered in New Zealand in 2008. Mothers who identify themselves as combined Māori and Pacific have the youngest age distribution, followed by mothers identifying as sole Māori. Mothers identifying themselves as sole non-Indian Asian ethnicity have the oldest age distribution. The differences in maternal age distribution by ethnicity may reflect both differences in the age distribution of the underlying populations as well as different maternal age at birth by ethnicity.

DHB of residence, ethnicity and deprivation deciles

DHB and ethnicity

Figure 13 Distribution of maternal ethnicity (prioritised[2]) by DHB of maternal residence, among birth registrations in 2008

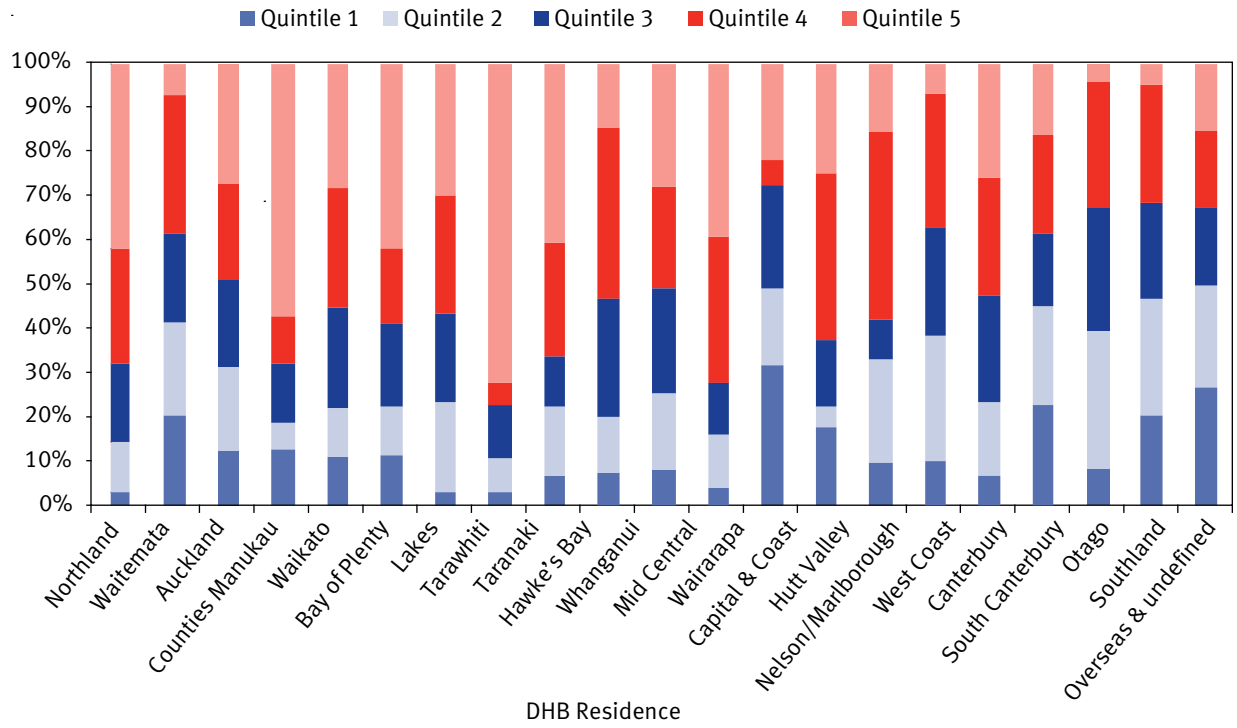


2 prioritised ethnicity used for simplicity

There is a wide variation in distribution of maternal ethnicity across the different regions in New Zealand. In the South Island, there are a higher proportion of New Zealand European mothers among mothers giving birth than in the North Island. Northland, Lakes and Tairawhiti have the highest proportions of births to Māori mothers of any region; and Auckland and Counties Manukau have the highest proportion of births to Pacific peoples.

DHB and deprivation deciles

Figure 14 Distribution of deprivation quintile by DHB of maternal residence, among birth registrations in 2008



The distribution of maternal socioeconomic deprivation is also not uniform across the country, with the greatest number of births to homes in the highest deprivation quintile occurring in the Tairawhiti and Counties Manukau regions. This is consistent with population distribution of deprivation in New Zealand.

1.5 Perinatal mortality 2008

Table 2 Summary of New Zealand perinatal mortality rates, 2008

	Using NZ definition		Using UK definition[3]	
	n	Rate	n	Rate
Total births	65,872		65,641	
Fetal deaths (terminations of pregnancy and stillbirths)	524	8.0[4]	293	4.5
Terminations of pregnancy	145	2.2		
Stillbirths	379	5.8	256	3.9
Early neonatal deaths < 7 days	133		133	
Late neonatal deaths 7–27 days	43		43	
Neonatal deaths < 28 days	176	2.7[5]	176	2.7
Perinatal mortalities	657	10.0[6]	426	6.5
Perinatal related mortalities	700	10.6[7]	469	7.1
Perinatal mortalities excluding lethal and terminated fetal abnormalities[8]	488	7.4	355	5.4
Perinatal related mortalities excluding lethal and terminated fetal abnormalities[8]	516	7.9	383	5.8

3 Rates calculated using the United Kingdom (CEMACH) definition for perinatal mortality: babies stillborn after 24 weeks' gestation and deaths of live-born babies per 1000 live births and stillbirths (CEMACH 2006)
4 Fetal death rate per 1000 babies born (includes terminations and stillbirths)
5 Neonatal death rate per 1000 live-born babies
6 Fetal deaths and early neonatal deaths per 1000 babies born
7 Fetal deaths and early and late neonatal deaths per 1000 babies born
8 Lethal and terminated fetal abnormalities are all fetal deaths with PSANZ-PDC of congenital abnormality and neonatal deaths with PSANZ-NDC of congenital abnormality

Perinatal mortality rates in 2008 were consistent with rates for 2007. In 2007 and 2008, the rates published by the PMMRC use numerator data collected specifically by LMCs and collated by the PMMRC and denominator data from birth registrations.

International comparisons

CMACE Perinatal Mortality 2008 reported a perinatal mortality rate of 7.5/1000 total births, a stillbirth rate of 5.1/1000 total births and a neonatal mortality rate of 3.2/1000 total births (CMACE 2010). The comparable New Zealand rates per 1000 total births for 2008 are 6.5, 4.5, and 2.7 respectively.

In 2007, Australia reported a perinatal mortality rate (equivalent to our perinatal related mortality rate) of 10.3/1000 births (AIHW National Perinatal Statistics Unit. 2009, with rates varying by jurisdiction from 8.2/1000 in Western Australia to 12.9/1000 in Victoria (CCOPMM. 2007). The comparable New Zealand rate for 2008 is 10.6/1000.

Thus, the perinatal mortality rate in New Zealand is comparable to rates in both Australia and the United Kingdom.

1.6 Investigation of perinatal related mortality

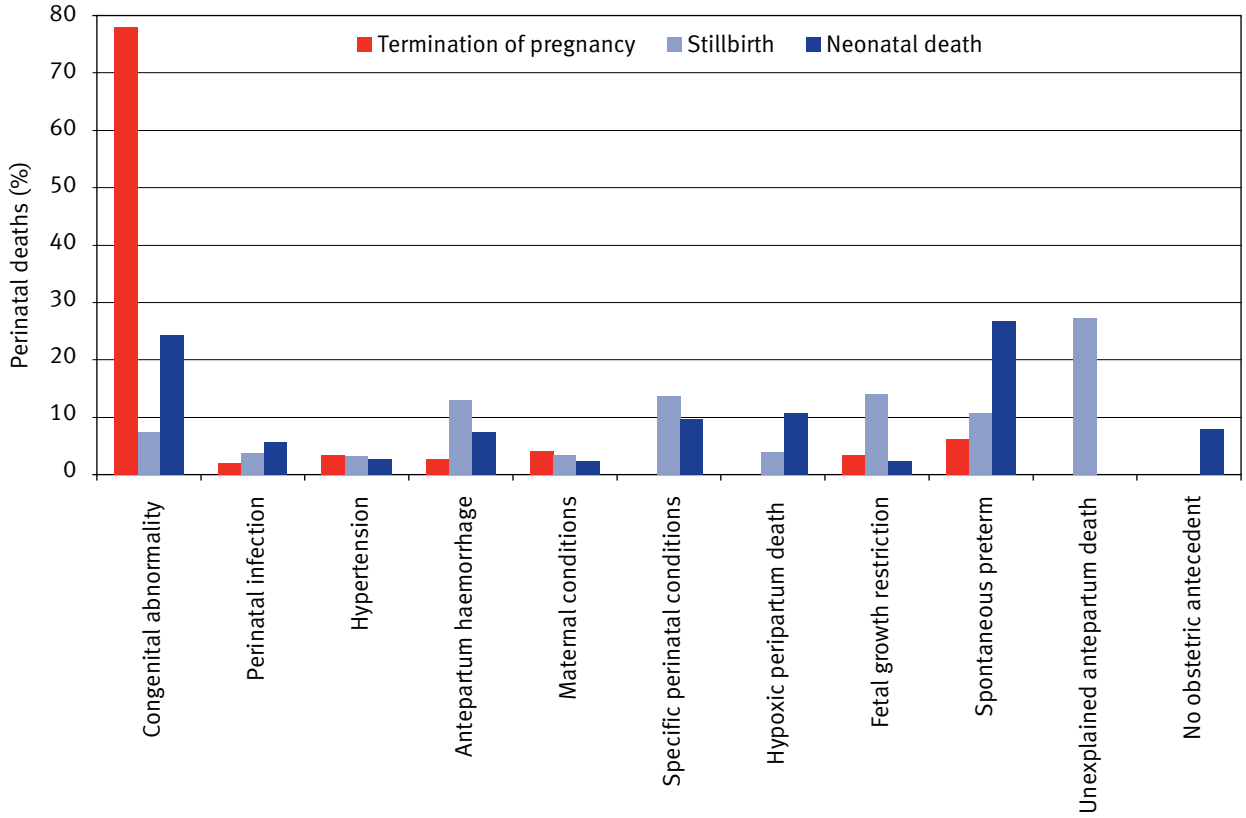
Causes of perinatal death

Obstetric antecedent classification

Table 3 Perinatal related deaths by primary obstetric antecedent cause 2008

	Fetal deaths							
	Termination of pregnancy		Stillbirths		Neonatal deaths		Total	
	n = 145		n = 379		n = 176		n = 700	
Perinatal death classification (PDC)	n	%	n	%	n	%	n	%
Congenital abnormality	113	77.9	28	7.4	43	24.4	184	26.3
Perinatal infection	3	2.1	14	3.7	10	5.7	27	3.9
Hypertension	5	3.4	12	3.2	5	2.8	22	3.1
Antepartum haemorrhage	4	2.8	49	12.9	13	7.4	66	9.4
Maternal conditions	6	4.1	13	3.4	4	2.3	23	3.3
Specific perinatal conditions			52	13.7	17	9.7	69	9.9
Hypoxic peripartum death			15	4.0	19	10.8	34	4.9
Fetal growth restriction	5	3.4	53	14.0	4	2.3	62	8.9
Spontaneous preterm	9	6.2	40	10.6	47	26.7	96	13.7
Unexplained antepartum death			103	27.2			103	14.7
No obstetric antecedent					14	8.0	14	2.0

Figure 15 Relative distribution of fetal and neonatal deaths by PSANZ-PDC 2008



Stillbirth

There were 379 stillbirths in 2008, a rate of 5.8/1000 total births.

The most frequent causes (PSANZ-PDC) of stillbirth in 2008 were antepartum haemorrhage, specific perinatal conditions, fetal growth restriction and spontaneous preterm birth, with 27 percent of stillbirths classified as 'unexplained'. This distribution of antecedent cause of stillbirth is unchanged from 2007.

Of stillbirths from 24 weeks, the pattern is similar although spontaneous preterm birth is no longer a major contributor (see Table 17: Primary obstetric antecedent cause (PDC) of fetal death by gestational age, 2008).

Of the 103 unexplained stillbirths, 47 (46 percent) were at term. Furthermore, of the 118 term stillbirths, 47 (40 percent) were unexplained.

A post-mortem was offered in 91 percent of cases of unexplained stillbirth, although 48 percent declined the offer, and post-mortem was completed in only 34 percent. Partial investigation was undertaken in a further 33 percent. Thirty three percent of unexplained deaths were uninvestigated, not having a post-mortem, placental histology or karyotype.

Intrapartum stillbirth

Table 4 Timing of stillbirth relative to labour, 2008

Timing of stillbirth	Stillbirths n=379	
	n	%
Antepartum	265	69.9
Intrapartum – first stage	34	9.0
Intrapartum – second stage	11	2.9
Intrapartum – unknown stage	30	7.9
Unknown	39	10.3

There were at least 75 stillbirths in labour in 2008. Of these, 32 occurred at or beyond 24 weeks in babies who did not die of congenital abnormality. The intrapartum stillbirth rate (in labour deaths of babies of 24 weeks and beyond, excluding deaths caused by lethal congenital abnormality) was 0.49/1000, similar to the 2007 rate (0.44/1000). The majority of these babies were term (72 percent of those who died at 24 or more weeks) and not small for gestational age (SGA) (66 percent). A post-mortem was offered in almost all cases (94 percent), but adequate investigation (post-mortem) was completed in fewer than 50 percent. Further exploration is needed to determine if there are potentially avoidable causative or contributing factors.

The intrapartum stillbirth rate for babies born at term who did not die of congenital abnormality was 0.40/1000 in 2008. Of 108 term stillbirths without lethal congenital abnormality, 23 (21 percent) occurred in labour, and 14 of these were hypoxic peripartum deaths.

International comparisons of intrapartum stillbirth rates are difficult to conduct due to differences in definition.

Termination of pregnancy

The predominant antecedent cause of death among terminations beyond 20 weeks was congenital abnormality (n = 113). There were 26 terminations performed after 24 weeks gestation. The primary antecedent classifications for these cases were congenital abnormality in 20 and perinatal infection, hypertension, maternal condition, fetal growth restriction and spontaneous preterm in the remainder.

Neonatal deaths

Table 5 Clinical details of neonatal deaths 2008

	Neonatal deaths					
	Total		< 24 weeks		≥ 24 weeks	
	n = 176		n = 48		n = 128	
	n	%	n	%	n	%
Age at death						
≤ 1 day	103	58.5	47	97.9	56	43.8
2–7 days	33	18.8	1	2.1	32	25.0
8–14 days	28	15.9			28	21.9
15–21 days	8	4.5			8	6.3
22–28 days	4	2.3			4	3.1
Place of death						
Home	17	9.7	1	2.1	16	12.5
Hospital						
Delivery suite	40	22.7	27	56.3	13	10.2
Postnatal ward	5	2.8			5	3.9
Neonatal unit	71	40.3	5	10.4	66	51.6
Operating theatre	8	4.5	1	2.1	7	5.5
Emergency department	8	4.5	5	10.4	3	2.3
Other	22	12.5	9	18.8	13	10.2
Unknown	3	1.7			3	2.3
Other	2	1.1			2	1.6
Apgar 5 minutes						
0–3	89	50.6	43	89.6	46	35.9
4–5	10	5.7			10	7.8
6–7	21	11.9	3	6.3	18	14.1
≥ 8	52	29.5			5.2	40.6
Unknown	4	2.3	2	4.2	2	1.6
Resuscitation at birth						
Yes	101	57.4	13	27.1	88	68.8
No	74	42.0	35	72.9	39	30.5
Unknown	1	0.6			1	0.8
Outcome of resuscitation						
Baby resuscitated and transferred to another clinical care area	80	79.2	4	30.8	76	86.4
Baby unable to be resuscitated	20	19.8	9	69.2	11	12.5
Unknown	1	1.0			1	1.1

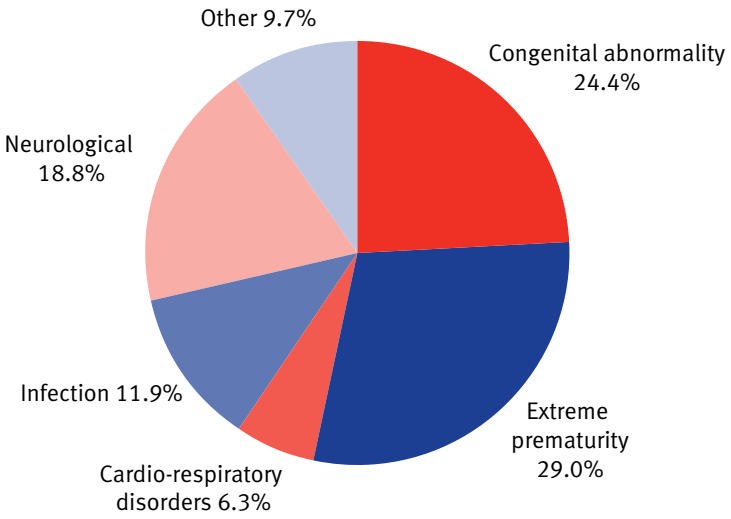
Almost half of all neonatal deaths at 24 weeks or beyond occurred at less than one day of age (44 percent) and nearly 70 percent within the first week. More than half of these were in poor condition at birth, with Apgar scores of 7 or less at 5 minutes of age.

Of those babies who died after birth at 24 weeks gestation or more, 12.5 percent (11 babies) could not be resuscitated at birth.

Five babies over 24 weeks gestation died in postnatal wards. These babies were born at 35–41 weeks gestation and were initially admitted to a neonatal intensive care unit (NICU) or special care baby unit (SCBU) and then transferred to the postnatal ward for palliative care. The cause of death in all but one was hypoxic ischaemic encephalopathy.

There were 10 cases of sudden unexpected death in infancy (SUDI) among the neonatal deaths. Nine of these babies had a mother who smoked, and eight were co-sleeping.

Figure 16 Primary neonatal death classification (PSANZ-NDC), 2008



Congenital abnormality and extreme prematurity were reported as the primary neonatal cause of death in more than half of all neonatal deaths in 2008. Neurological conditions accounted for a further 18.8 percent, principally due to hypoxic ischaemic encephalopathy. The distribution of neonatal causes of death is consistent with the findings for 2007.

Table 6 Association between obstetric antecedent cause of death (PDC) and neonatal cause of death (NDC) among all neonatal deaths, 2008

		Neonatal death classification (NDC)							
Perinatal death classification (PDC)	Total	Congenital abnormality	Extreme prematurity	Cardio-resp disorder	Infection	Neurological	Gastro-intestinal	Other	Unknown
Congenital abnormality	43	43							
Perinatal infection	10		4		6				
Hypertension	5			1	3	1			
Antepartum haemorrhage	13		11		1	1			
Maternal conditions	4	1	1			3			
Specific perinatal condition	17		7	4	2	1		3	
Hypoxic peripartum death	19					19			
Fetal growth restriction	4			6	1	3			
Spontaneous preterm	47		28		6	4		3	
Unexplained antepartum death									
No obstetric antecedent	14				2	1		11	
Total	176	43	51	11	21	33		17	

All neonatal deaths are assigned at least one neonatal death classification (NDC), along with an obstetric antecedent cause (PDC). Table 6 demonstrates how these classification systems relate to each other. For example, of the neurological causes of neonatal death, the majority followed peripartum hypoxia (19) and a smaller number followed other antenatal antecedent events such as spontaneous preterm birth (4). Infections were the cause of death following a range of antecedent events.

Demography of perinatal deaths

Gender

Table 7 Termination, stillbirth, neonatal and perinatal related death rates (per 1000) by gender, 2008

	Total births		Fetal deaths						Neonatal deaths			Total perinatal related deaths		
			Termination of pregnancy			Stillbirths								
	n = 65,872		n = 145			n = 379			n = 176			n = 700		
	n	%	n	%	Rate	n	%	Rate	n	%	Rate	n	%	Rate
Gender														
Male	33,901	51.5	64	44.1	1.89	207	54.6	6.11	102	58.0	3.03	373	53.3	11.00
Female	31,971	48.5	80	55.2	2.50	172	45.4	5.38	74	42.0	2.33	326	46.6	10.20
Unknown			1	0.7								1	0.1	

There are no statistically significant differences in perinatal related mortality rates between male and female babies.

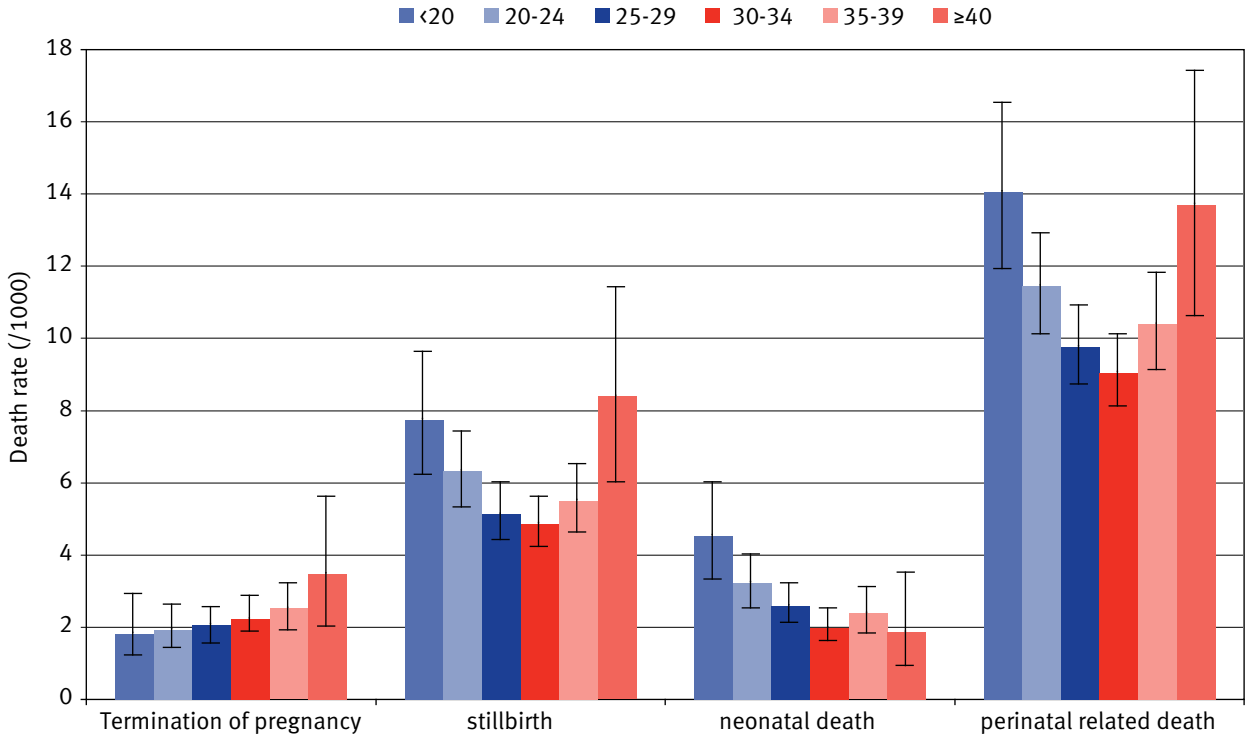
Maternal age

Table 8 Maternal age and perinatal related mortality rates (per 1000), 2008

	Total births		Fetal deaths						Neonatal deaths			Total perinatal related deaths		
			Termination of pregnancy			Stillbirths								
	n = 65,872		n = 145			n = 379			n = 176			n = 700		
	n	%	n	%	Rate	n	%	Rate	n	%	Rate	n	%	Rate
Maternal age														
<20	5,365	8.1	7	4.8	1.30	50	13.2	9.32	29	16.5	5.46	86	12.3	16.03
20–24	11,895	18.1	26	17.9	2.19	72	19.0	6.05	32	18.2	2.71	130	18.6	10.93
25–29	16,018	24.3	35	24.1	2.19	77	20.3	4.81	41	23.3	2.58	153	21.9	9.55
30–34	18,152	27.6	41	28.3	2.26	93	24.5	5.12	37	21.0	2.05	171	24.4	9.42
35–39	11,995	18.2	26	17.9	2.17	66	17.4	5.50	32	18.2	2.69	124	17.7	10.34
≥40	2,447	3.7	10	6.9	4.09	21	5.5	8.58	4	2.3	1.66	35	5.0	14.30
Unknown									1	0.6		1	0.1	

A consistent association between maternal age and perinatal related mortality is seen in New Zealand and across the developed world, with the highest rates at the extremes of age. The association is more complicated than this, as shown in Figure 17, with higher rates of late termination and stillbirth among mothers aged 40 and over and high rates of stillbirth and neonatal death among teenage mothers (< 20 years of age). The association between young maternal age and perinatal mortality is most likely confounded by socioeconomic deprivation and smoking.

Figure 17 Perinatal related mortality rates (per 1000) by maternal age (with 95 percent CIs), 2007 and 2008 combined



Ethnicity

In this 2008 report, there have been significant changes to the way ethnicity data are classified and presented. Mother and baby ethnicity has been presented to give them equal significance, and output of ethnicity has been presented using two methods. Further discussion on these changes can be found under 1.2: Methodology and 5: Māori Caucus Discussion Themes Particularly Relevant to Perinatal and Maternal Mortality Review.

Mothers' ethnicity has been included in the body of the report because of the provision of antenatal care to mothers rather than to babies. Baby ethnicity continues to have equal prominence because this reflects maternal and paternal ethnicity.

Ethnicity has been reported as prioritised ethnicity (as outlined in Ethnicity Data Protocols for the Health and Disability Sector (Ministry of Health 2004) and as reported in the 2006 and 2007 PMMRC reports) and as sole/combination categories. Both of these methods of describing ethnicity allocate each individual to a single mutually exclusive ethnicity category. It was decided to include both of these methods in the 2008 report as the data would suggest that the prioritisation method alone may not represent the disparities in perinatal related mortality by ethnicity adequately. The analysis suggests that people who define themselves with more than one ethnicity may be exposed to different risks from those who define themselves by one ethnicity.

The prioritised ethnicity allocates each birth to a single ethnic group using the hierarchy: Māori, Pacific peoples, Indian, other Asian, other groups (including other European and not stated) and finally New Zealand European. This method is frequently used in health statistics in New Zealand. It prioritises minority ethnic groups who might otherwise be swamped by New Zealand European, but by ignoring multiple responses, it does not follow the principal of allowing individuals to identify themselves in the groups with which they most feel affinity. It is a simple system that results in relatively few groups for analysis.

Sole/combination ethnicity also results in a single category for each birth but produces a larger number of groups, which may make analysis and interpretation more difficult. This method has not been used in the PMMRC reports previously. The groups presented in this report were developed after considering advice given by New Zealand Statistics (Ministry of Health 2004) and using a pragmatic approach based on the perinatal related mortality data. Therefore the categories used in this report are: Māori, Pacific peoples, Indian, other Asian, other only, New Zealand European, Māori/New Zealand European, Māori/Pacific peoples, Pacific peoples/New Zealand European and 'combinations not elsewhere defined'.

The data tables provided in this section relate to perinatal related deaths in 2008 collated by the PMMRC and births registered in the 2008 year. Table 9, showing total ethnicity responses for perinatal related deaths in 2008, has been included for completeness. The figures illustrate rates based on the combined data for 2007 and 2008. The inclusion of 2007 and 2008 data in the figures results in larger numbers and thus more robust estimates with tighter Confidence Intervals. The PMMRC hopes that these data will add clarity to the report.

Table 9 Total ethnicity responses for mother and baby among perinatal related deaths, 2008

	Baby ethnicity total response among perinatal related deaths		Mother ethnicity total response among perinatal related deaths	
	n = 700		n = 700	
	n	%	n	%
Māori	201	28.8	170	24.3
Pacific peoples	120	17.2	101	14.4
Indian	31	4.4	31	4.4
Other Asian	46	6.6	41	5.9
Other	58	8.3	63	9.0
New Zealand European	396	56.7	365	52.1

Babies' ethnicity for the PMMRC set of perinatal deaths has been extracted, in order of priority, from BDM registration of birth (478), BDM registration of death (82) or PMMRC rapid response forms (139). No ethnicity information was available for one perinatal death in 2008.

Table 10 Termination, stillbirth, neonatal and perinatal related death rates (per 1000 births) by maternal and baby ethnicity (prioritised), 2008

	Births		Fetal deaths						Neonatal deaths			Total perinatal related deaths		
			Termination of pregnancy			Stillbirths								
	n = 65,872		n = 145			n = 379			n = 176			n = 700		
	n	%	n	%	Top rate	n	%	Stillbirth rate	n	%	Neonatal death rate	n	%	Perinatal related death rate
Ethnicity prioritised (baby)														
Māori	19,615	29.8	17	11.7	0.9	120	31.7	6.1	64	36.4	3.3	201	28.7	10.2
Pacific Peoples	7,291	11.1	12	8.3	1.6	66	17.4	9.1	26	14.8	3.6	104	14.9	14.3
Indian	2,319	3.5	10	6.9	4.3	12	3.2	5.2	9	5.1	3.9	31	4.4	13.4
Other Asian	4,298	6.5	13	9.0	3.0	20	5.3	4.7	6	3.4	1.4	39	5.6	9.1
Other/Not stated	4,020	6.1	9	6.2	2.2	31	8.2	7.7	3	1.7	0.8	43	6.1	10.7
NZ European	28,329	43.0	83	57.2	2.9	131	34.6	4.6	68	38.6	2.4	282	40.3	10.0
Ethnicity prioritised (mother)														
Māori	15,530	23.6	12	8.3	0.8	100	26.4	6.4	58	33.0	3.8	170	24.3	10.9
Pacific Peoples	6,987	10.6	11	7.6	1.6	62	16.4	8.9	24	13.6	3.5	97	13.9	13.9
Indian	2,260	3.4	10	6.9	4.4	12	3.2	5.3	8	4.5	3.6	30	4.3	13.3
Other Asian	4,397	6.7	13	9.0	3.0	19	5.0	4.3	7	4.0	1.6	39	5.6	8.9
Other/Not stated	5,809	8.8	13	9.0	2.2	39	10.3	6.7	5	2.8	0.9	57	8.1	9.8
NZ European	30,889	46.9	86	59.3	2.8	147	38.8	4.8	74	42.0	2.4	307	43.9	9.9

The relationship between ethnicity and perinatal related mortality is complicated. This is because the rates of termination of pregnancy, stillbirth and neonatal death in relation to ethnicity vary for each of these modes of perinatal related death. Irrespective of how ethnicity is described (prioritised or sole/combination, mother or baby), Māori and Pacific mothers have lower rates of late termination of pregnancy, and Asian (including Indian and other Asian), New Zealand European and other mothers have higher rates.

The differences described in ethnic-specific late termination have a marked effect on the ethnic-specific perinatal related mortality rate, as shown in the figures to follow, and disguise the ethnic trends seen in stillbirth and neonatal deaths. For this reason, all figures show the specific rates for termination of pregnancy, stillbirth and neonatal death as well as the overall perinatal related mortality rates. Overall, perinatal related mortality rates should not be used when describing the association with ethnicity.

The use of maternal versus baby ethnicity has a small effect on the magnitude of the ethnic-specific mortality rates but not on the comparison between ethnicities.

Figure 18 Termination of pregnancy, stillbirth, neonatal and perinatal related death rates (per 1000) by baby ethnicity (prioritised), 2007 and 2008 combined

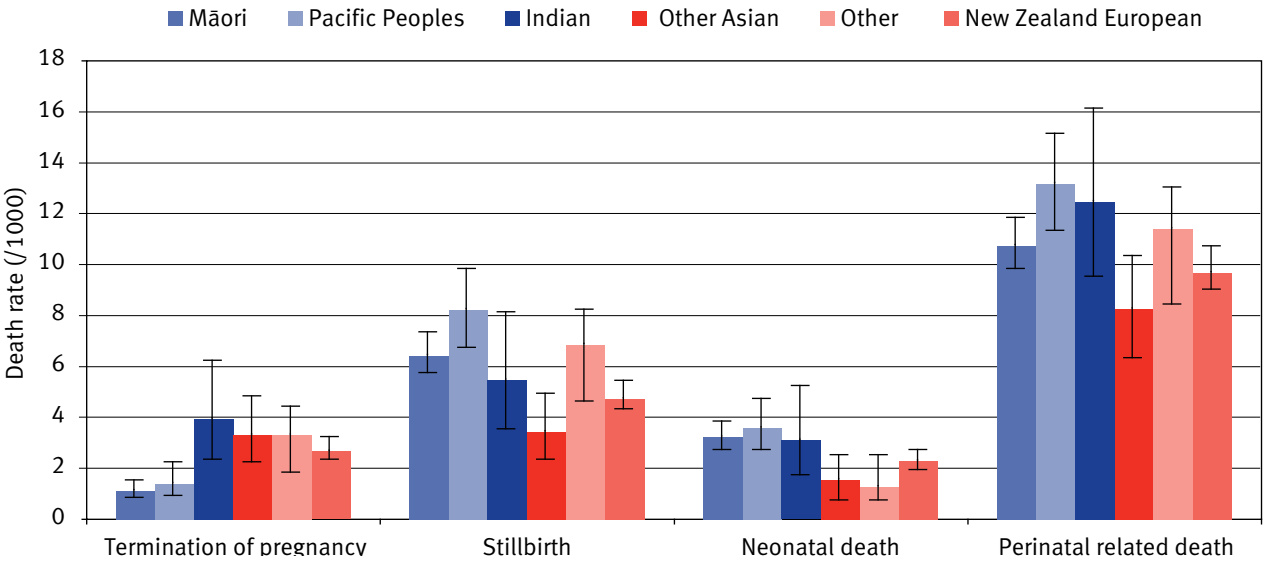
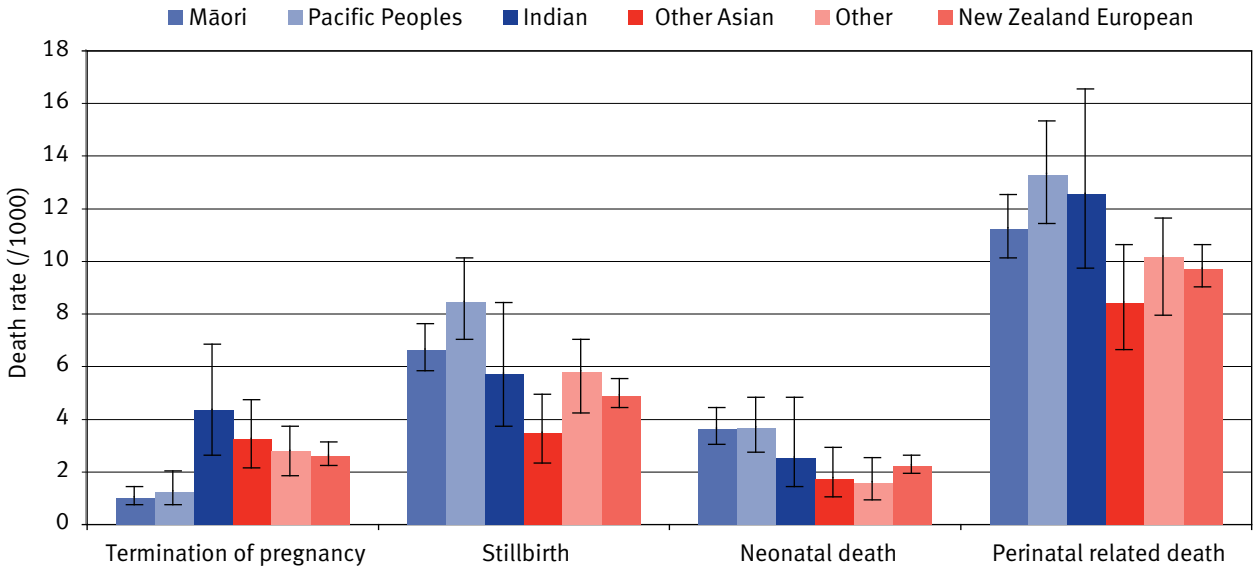


Figure 19 Termination of pregnancy, stillbirth, neonatal death and perinatal related mortality rates (per 1000) by maternal ethnicity (prioritised), 2007 and 2008 combined



Prioritised Māori and Pacific baby ethnicities indicate increased risk of both stillbirth and neonatal death compared with New Zealand European and non-Indian Asian babies. Prioritised Māori and Pacific mother ethnicities indicate increased risk of stillbirth compared with New Zealand European and non-Indian Asian mothers and prioritised Māori mother ethnicity indicates increased risk of neonatal death compared with New Zealand European and non-Indian Asian mothers. Numbers of Indian mothers/babies are small, and no conclusions can be drawn for this group.

The estimated stillbirth risk among Pacific peoples is higher than among Māori, but this difference is not statistically significant.

Table 11 Termination of pregnancy, stillbirth, neonatal and perinatal related death rates (per 1000) by maternal and baby ethnicity (sole/combination), 2008

	Births		Fetal deaths						Neonatal deaths			Total perinatal related deaths		
			Termination of pregnancy			Stillbirths								
	n = 65,872		n = 145			n = 379			n = 176			n = 700		
	n	%	n	%	Top rate	n	%	Stillbirth rate	n	%	Neonatal death rate	n	%	Perinatal related death rate
Sole/combination ethnicity (baby)														
NZE only	28,286	42.9	83	57.2	2.9	131	34.6	4.6	68	38.6	2.4	282	40.3	10.0
Māori only	6,874	10.4	5	3.4	0.7	53	14.0	7.7	46	26.1	6.7	104	14.9	15.1
Pacific only	5,410	8.2	10	6.9	1.8	58	15.3	10.7	23	13.1	4.3	91	13.0	16.8
Indian only	2,057	3.1	10	6.9	4.9	10	2.6	4.9	8	4.5	3.9	28	4.0	13.6
Other Asian only	3,183	4.8	10	6.9	3.1	13	3.4	4.1	6	3.4	1.9	29	4.1	9.1
Other only[9]	2,112	3.2	6	4.1	2.8	18	4.7	8.5	2	1.1	1.0	26	3.7	12.3
Māori and Pacific	1,521	2.3	0	0.0	0.0	10	2.6	6.6	2	1.1	1.3	12	1.7	7.9
Māori and NZE	8,159	12.4	11	7.6	1.3	47	12.4	5.8	12	6.8	1.5	70	10.0	8.6
Pacific and NZE	1,323	2.0	1	0.7	0.8	5	1.3	3.8	3	1.7	2.3	9	1.3	6.8
All other combinations	6,947	10.5	9	6.2	1.3	34	9.0	4.9	6	3.4	0.9	49	7.0	7.1
Sole/combination ethnicity (mother)														
NZE only	30,863	46.9	86	59.3	2.8	147	38.8	4.8	74	42.0	2.4	307	43.9	9.9
Māori only	8,252	12.5	4	2.8	0.5	65	17.2	7.9	47	26.7	5.7	116	16.6	14.1
Pacific only	5,992	9.1	10	6.9	1.7	59	15.6	9.8	22	12.5	3.7	91	13.0	15.2
Indian only	2,177	3.3	10	6.9	4.6	11	2.9	5.1	8	4.5	3.7	29	4.1	13.3
Other Asian only	4,226	6.4	13	9.0	3.1	18	4.7	4.3	7	4.0	1.7	38	5.4	9.0
Other only[9]	5,214	7.9	12	8.3	2.3	34	9.0	6.5	5	2.8	1.0	50	7.1	9.6
Māori and Pacific	600	0.9	0	0.0	0.0	2	0.5	3.3	2	1.1	3.3	4	0.6	6.7
Māori and NZE	5,731	8.7	7	4.8	1.2	30	7.9	5.2	9	5.1	1.6	46	6.6	8.0
Pacific and NZE	711	1.1	0	0.0	0.0	2	0.5	2.8	1	0.6	1.4	3	0.4	4.2
All other combinations	2,106	3.2	3	2.1	1.4	11	2.9	5.2	1	0.6	0.5	15	2.1	7.1

9 includes not stated

Figure 20 Termination of pregnancy, stillbirth, neonatal and perinatal related death rates (per 1000) by baby ethnicity (sole/combination categories), 2007 and 2008 combined

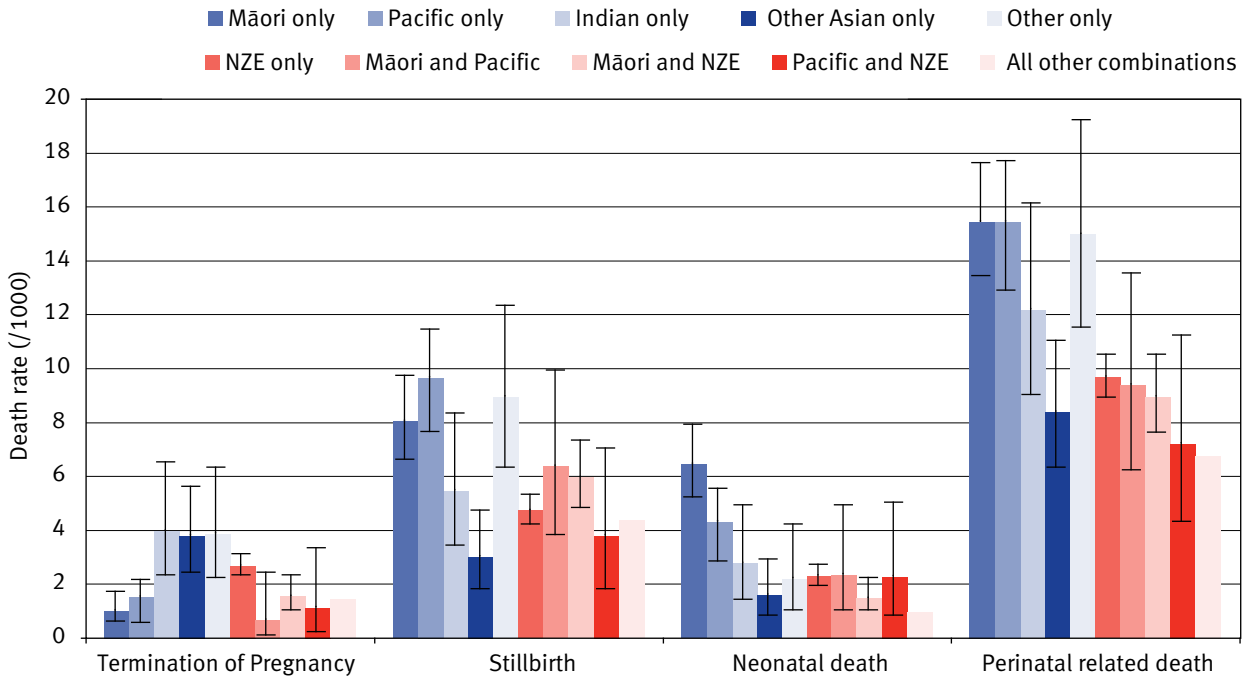
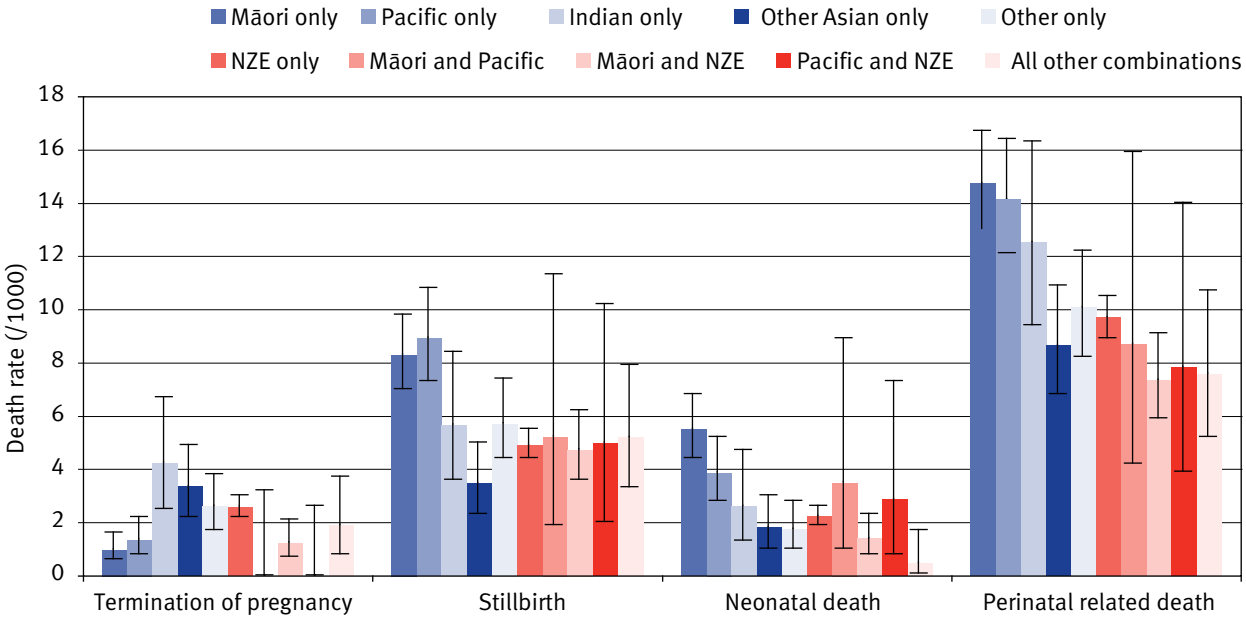


Figure 21 Termination of pregnancy, stillbirth, neonatal and perinatal related death rates (per 1000) by maternal ethnicity (sole/combination categories), 2007 and 2008 combined



The sole/combination method of categorising ethnicity provides further information on the association between ethnicity and perinatal mortality risk, especially for Māori. This is because babies who have been identified as combined ethnicities (including Māori and Pacific) appear to be at lower risk than those identified with sole groups. The reasons for this are not evident from these data, but the association between sole/combination ethnicity and deprivation deciles and age, illustrated in the denominator data in Figure 9 , Figure 10 , Figure 11, and 12 show that ethnicity is a marker for at least these factors. Babies identified as sole Māori, sole Pacific and combination Māori and Pacific have mothers who are more socioeconomically deprived than combinations that include New Zealand European as an ethnicity. Other markers for perinatal death, which are associated with ethnicity and may be represented by this variable, include obesity and smoking.

The same excess of stillbirth and neonatal death associated with Māori and Pacific ethnicity are seen using sole/combination ethnicity as with prioritised ethnicity. A significant difference is also seen in overall perinatal related mortality between sole Māori, Pacific peoples and non-Indian Asian and New Zealand European. The stillbirth and neonatal death rates are higher for sole Māori and sole Pacific than for prioritised Māori and Pacific (Figures 20 and Figure 21 compared with Figure 19 and 20). It appears that Māori who also identify as New Zealand European are at lower risk than the sole Māori group. However, it is not possible to interpret the mortality rates for the combined Pacific and Māori group as the numbers are small and so the Confidence Intervals are wide. These findings may be useful in identifying mothers/babies who require further care in pregnancy.

Confidence Intervals around stillbirth and neonatal death rates for the Indian ethnicity are large, but it would appear that some of the excess in perinatal mortality for Indian babies is due to a higher rate of late termination in this group.

Figures 22 and 23 below show PDC-specific combined perinatal related mortality rates (excluding termination of pregnancy) for Māori, Pacific and New Zealand European mothers (prioritised and sole/combination ethnicity). There is a significant excess of stillbirth/neonatal mortality due to spontaneous preterm birth for Māori and Pacific mothers.

Figure 22 Māori, Pacific and New Zealand European (prioritised maternal ethnicity) PDC-specific perinatal related mortality rates (per 1000) (excluding termination of pregnancy), 2007 and 2008 combined

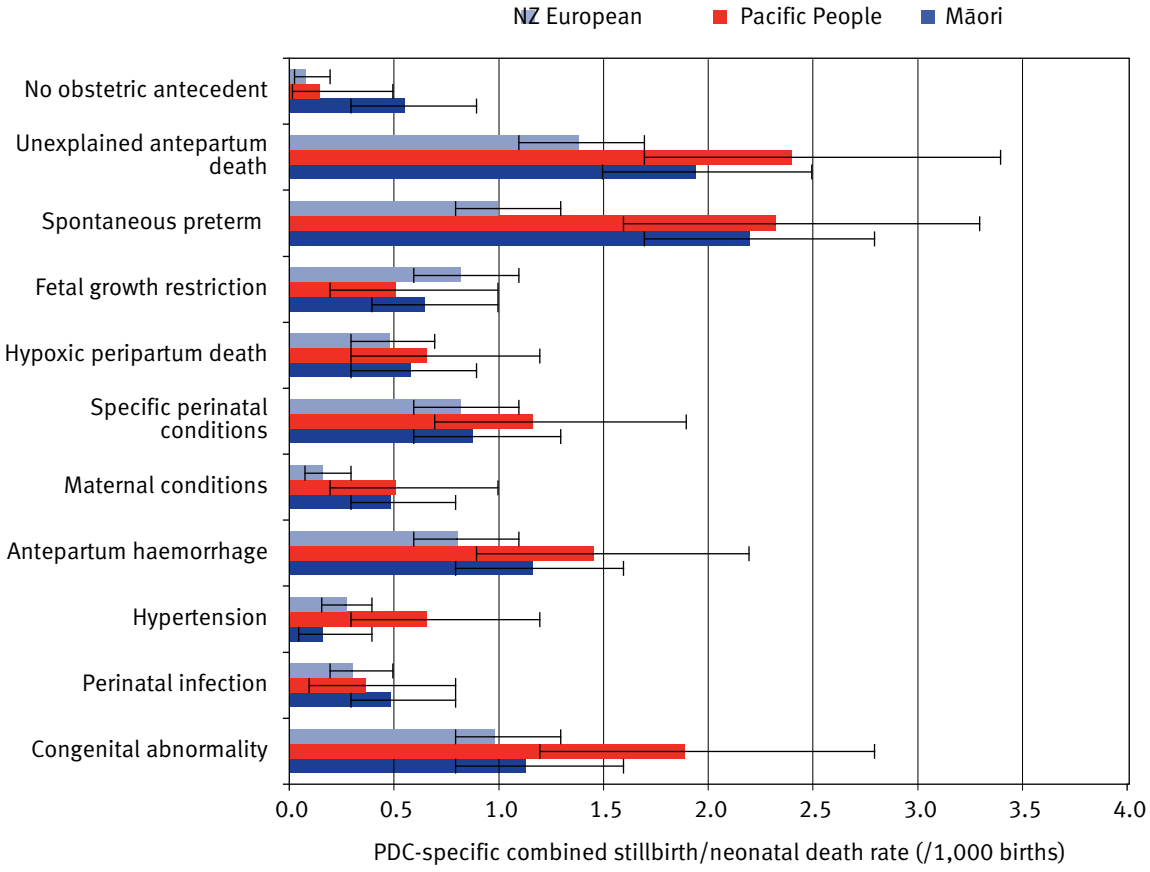
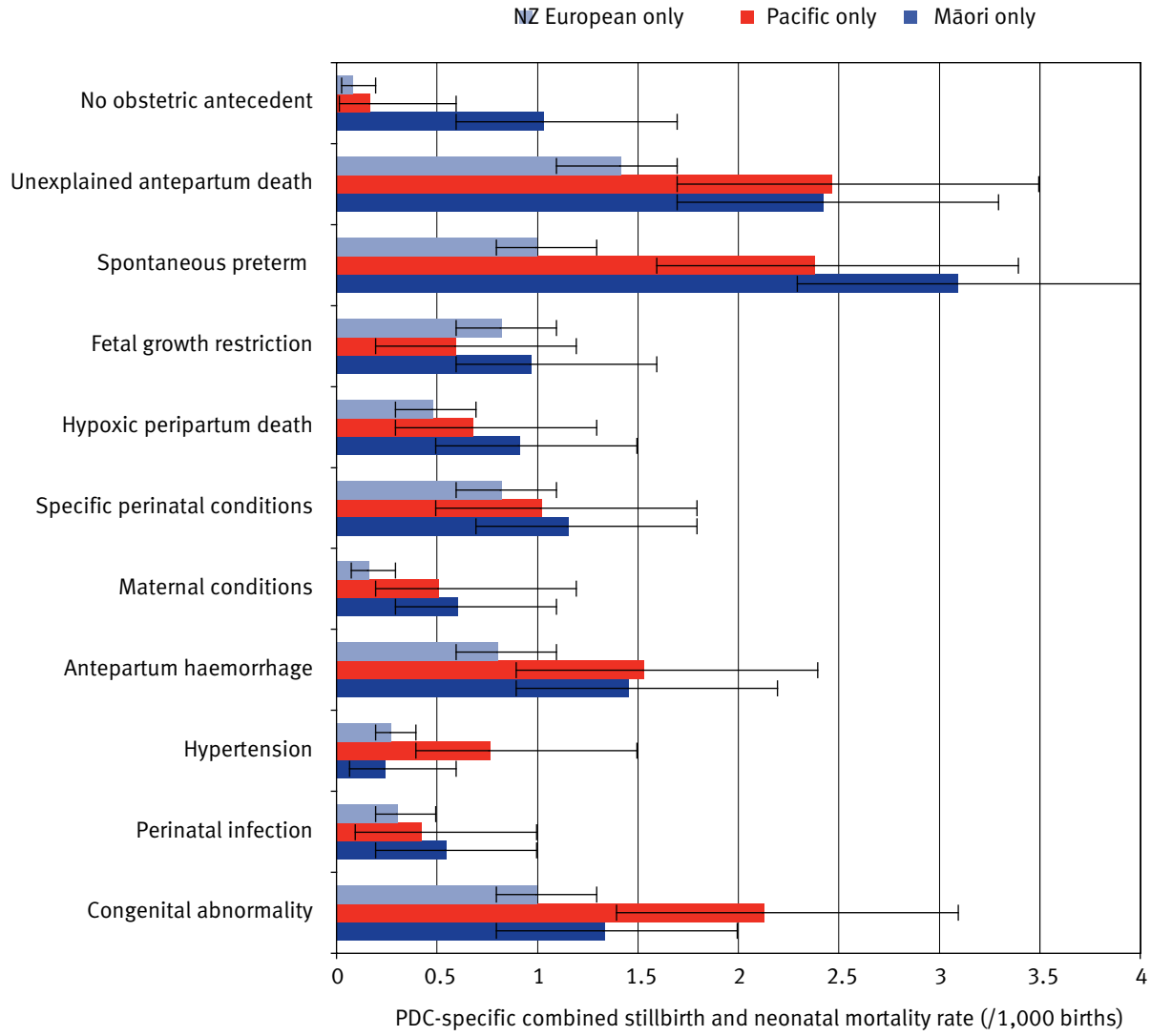


Figure 23 Māori only, Pacific only and New Zealand European only (sole/combination maternal ethnicity) PDC-specific perinatal related mortality rates (per 1000) (excluding termination of pregnancy), 2007 and 2008 combined



As was the case in 2007, there were more SUDI deaths among Māori babies in 2008 (reflected in deaths with no obstetric antecedent) compared to those among New Zealand European babies in the same year.

Socioeconomic disadvantage

Table 12 Termination of pregnancy, stillbirth, neonatal and perinatal related mortality rates (per 1000) by deprivation index (Dep2006) quintile, 2008

Deprivation quintile	Total births		Fetal deaths				Neonatal deaths		Perinatal related deaths		
			Termination of pregnancy		Stillbirths						
	n = 65,872		n = 145		n = 379		n = 176		n = 700		
	n	%	n	Rate	n	Rate	n	Rate	n	%	Rate
1	9,698	14.7	31	3.20	50	5.16	21	2.18	102	14.6	10.52
2	10,564	16.0	33	3.12	48	4.54	23	2.19	104	14.9	9.84
3	12,278	18.6	29	2.36	63	5.13	28	2.30	120	17.1	9.77
4	14,902	22.6	34	2.28	70	4.70	36	2.43	140	20.0	9.39
5	18,133	27.5	17	0.94	138	7.61	63	3.50	218	31.1	12.02
Unknown	297	0.5	1		10		5		16	2.3	

In contrast to 2007, there was no significant increase in perinatal related mortality with increasing deprivation. This is perhaps misleading and results from the inclusion of late terminations in the definition of perinatal related mortality.

Figure 24 Perinatal related mortality by deprivation quintile (Dep2006) and by death types and distribution of perinatal deaths by deprivation quintile 2007 and 2008 combined

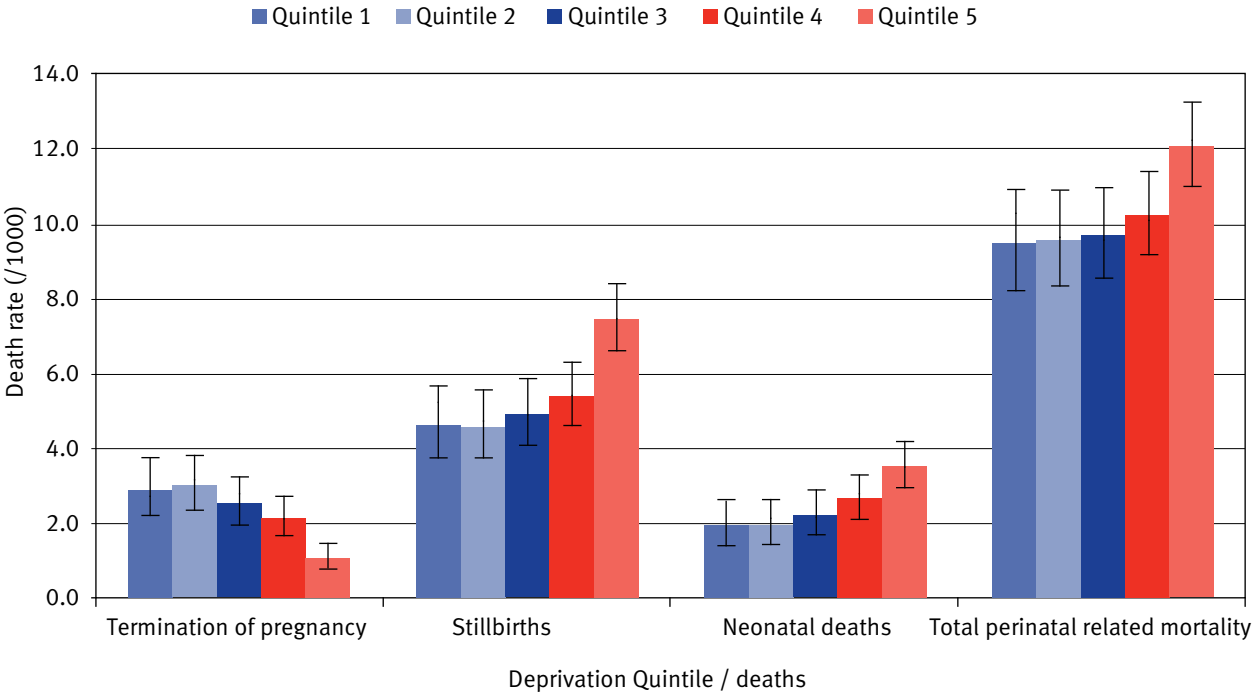
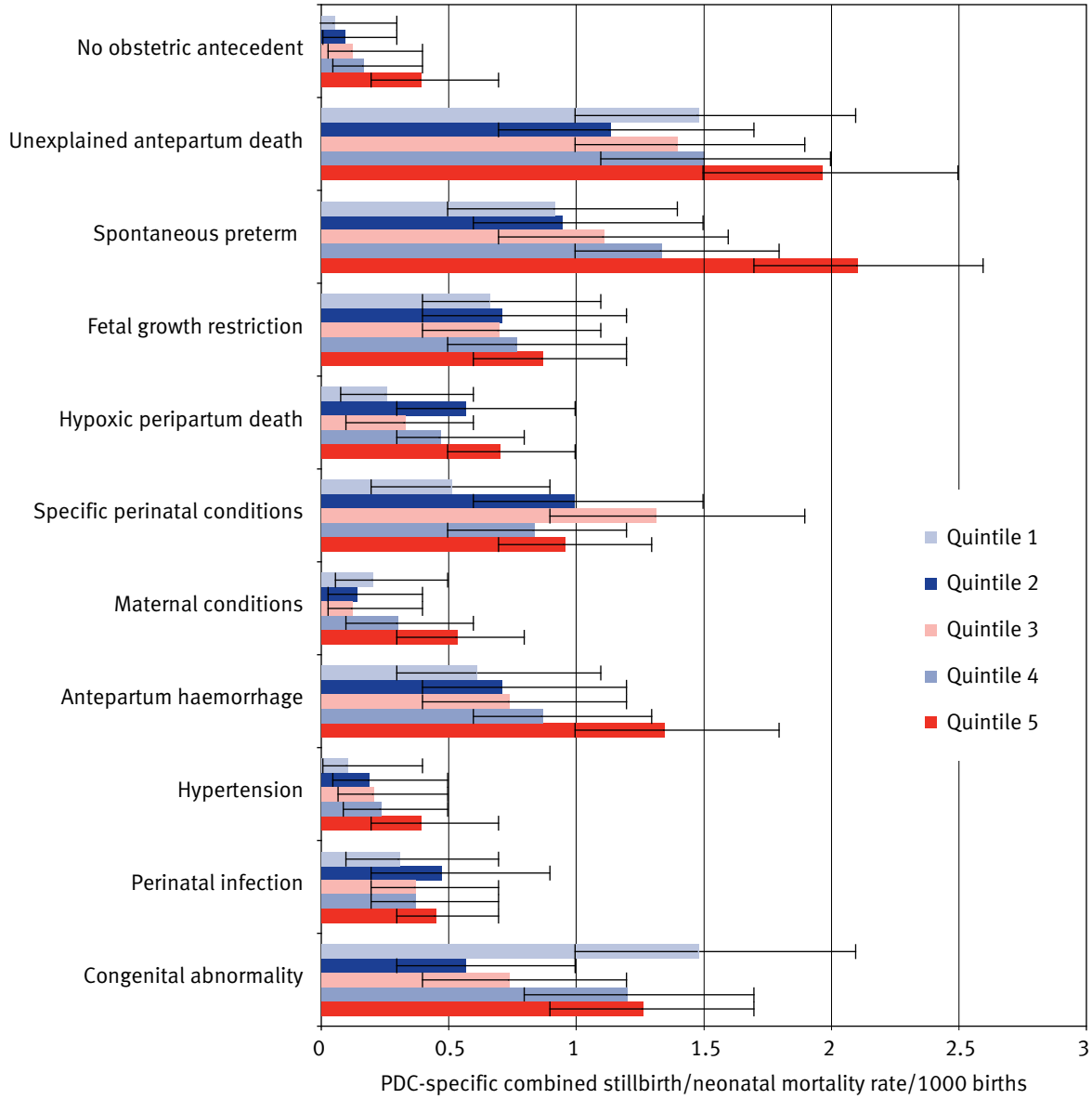


Figure 24 includes combined data from 2007 and 2008 and shows a significantly lower rate of late termination (≥ 20 weeks) among the most deprived but a significantly increased rate of stillbirth and neonatal death in this group compared to almost all less deprived quintiles.

Figure 25 PDC-specific perinatal related mortality rates (per 1000) (excluding termination of pregnancy) by deprivation quintile, 2007 and 2008 combined



Combined stillbirth and neonatal death rates have been presented for each antecedent cause (PDC) in Figure 25 by deprivation quintile. The aim of this analysis is to determine whether all causes of perinatal mortality are increased by increasing deprivation or whether there are some specific causes of perinatal mortality that increase with deprivation. Two years of data have been pooled to increase confidence around the rate estimates. However, as can be seen from the figure, the Confidence Intervals are often wide.

Combined data from 2007 and 2008 show that increasing socioeconomic deprivation (quintiles 1–5) is associated with increased stillbirth and neonatal death, predominantly from spontaneous preterm birth. There may be an association between increasing deprivation and antepartum haemorrhage, but this was not statistically significant. The addition of further years' data will clarify whether there is an association in this regard.

Place of residence

Figure 26 Perinatal related mortality rates (per 1000) by DHB of residence (mother) compared with New Zealand perinatal related mortality, 2007 and 2008 combined

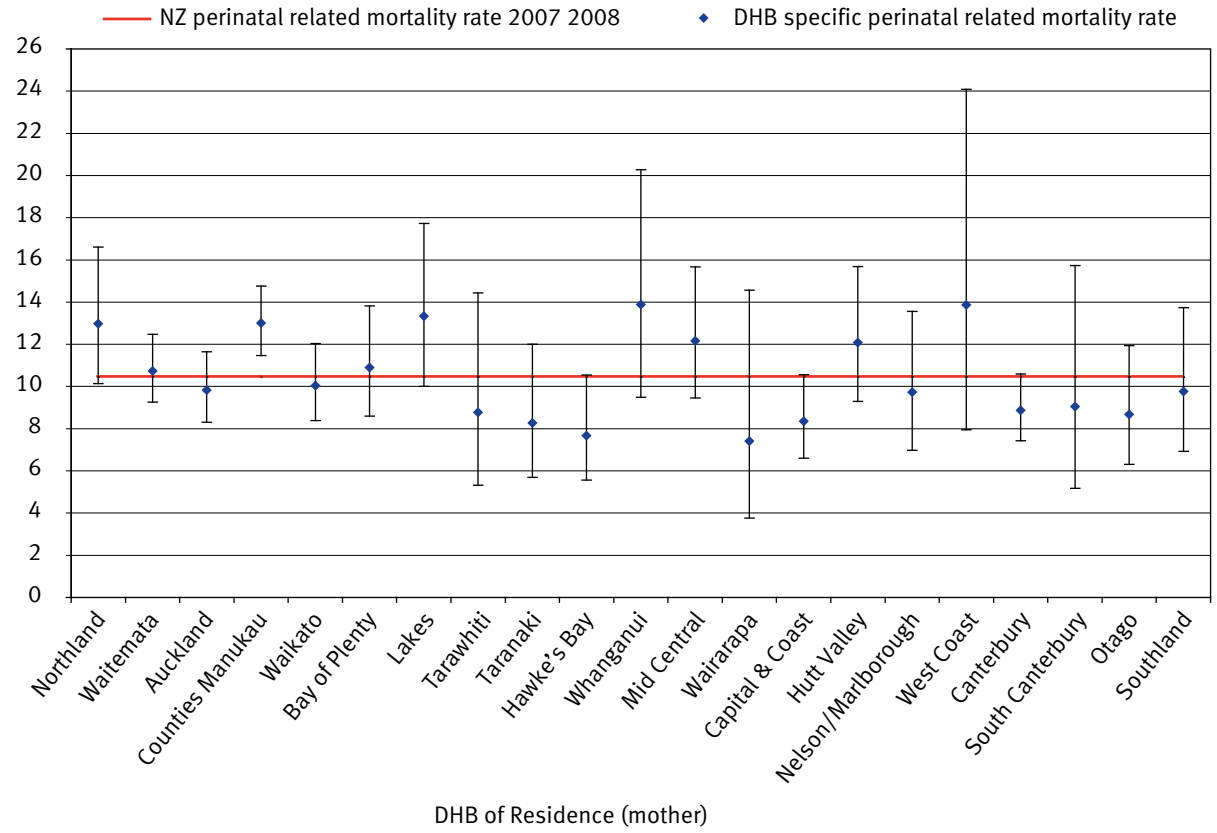


Figure 26 shows the rates of perinatal related mortality per 1000 total births by DHB of residence for 2007 and 2008 combined. Two-year rates are presented in an attempt to reduce the fluctuations due to small numbers, which are apparent in one-year data. In 2011, the PMMRC plan to present three-year rates, and these rates will provide a more robust estimate of regional differences.

The Confidence Intervals, represented by the error bars above and below the point estimate for each area, span the range of values that are consistent with the point estimate given the size of the population in the area. If these ranges do not include the national rate, represented by the horizontal line, the rate in that area was statistically significantly different from the national rate.

The perinatal related mortality rate exceeded the national rate in the Counties Manukau DHB region. A significantly higher perinatal mortality rate was also reported for Counties Manukau residents for the period 2000–2004 in the *Fetal and Infant Deaths 2003 & 2004* and *Fetal and Infant Deaths 2006* reports (NZHIS 2007 and Ministry of Health 2010 respectively) and in the 2007 PMMRC report.

Independent associations between demographic variables and stillbirth

Multivariate logistic regression analysis of factors associated with stillbirth, using live birth registrations and the PMMRC records of stillbirths for 2007 and 2008, was undertaken (see Appendix C: Multivariate Analysis). The purpose of this analysis was to determine whether the demographic variables available for analysis were associated with stillbirth independent of each other.

Stillbirths were investigated because only stillbirths are identifiable in the birth registration set. The stillbirths were removed from the registration set and replaced with the stillbirths from the PMMRC dataset for analysis.

Multivariate analysis using 2007 and 2008 PMMRC and registration data, and including maternal ethnicity (sole/combination and prioritised output), age and deprivation deciles, showed that all of these variables were independently associated with stillbirth (see tables C1 and C2).

The age groups of under 20 years and 40 years and over when compared with the 25–35 years age group were both independently associated with increased risk of stillbirth.

Two multivariate models were run, one using sole/combination maternal ethnicity and one using prioritised maternal ethnicity. Whichever model was used, socioeconomic deprivation and age remained significant variables. The model using sole/combination ethnicity showed an increase in risk of stillbirth associated with sole Māori and sole Pacific ethnicity compared with sole New Zealand European ethnicity. The model including prioritised ethnicity found an independent increase in risk associated only with prioritised Pacific ethnicity. This is in keeping with the differing associations seen in the univariate analyses using sole/combination and prioritised ethnicity data.

Deprivation deciles were categorised as deciles 8 and above compared with deciles 7 and below in line with univariate findings. An increase in risk of stillbirth, independent of ethnicity and maternal age, was associated with deprivation deciles 8 and above.

The reasons for an association between ethnicity, age, socioeconomic deprivation and an increased risk of stillbirth cannot be determined from the analysis. It cannot be assumed that these are causative factors. Variables representing important risk factors, such as smoking, body mass index (BMI), access to care and medical complications of pregnancy, all of which have been associated with risk of perinatal death in other studies are not available in the registration dataset and so the importance of these factors cannot be tested.

In summary, women under the age of 20 and over the age of 40, Pacific and Māori (sole ethnicity) women and women residing in areas with deprivation deciles of 8 or above all independently have an increased risk of stillbirth. It is not possible to analyse the contribution of smoking and BMI to perinatal-related mortality because of a lack of detailed information about all women who give birth in New Zealand.

These findings may be useful in apportioning resources where they are most needed and highlight the need for further research.

Multiple births

Table 13 Multiple birth and perinatal related mortality rates (per 1000), 2008

			Fetal deaths											
	Total births		Termination of pregnancy			Stillbirths			Neonatal deaths			Perinatal related deaths		
	n = 65,872		n = 145			n = 379			n = 176			n = 700		
Type of birth	n	%	n	%	Rate	n	%	Rate	n	%	Rate	n	%	Rate
Singleton	63,932	97.1	142	97.9	2.22	345	91.0	5.40	157	89.2	2.47	644	92.0	10.07
All multiples	1,940	2.9	3	2.1	1.55	34	9.0	17.53	19	10.8	9.98	56	8.0	28.87
Twins	1,928	2.9	2	1.4	1.0	32	8.4	16.6	17	9.7	8.9	51	7.3	26.5
Multiples (1/2 died)			1			14			12			27		
Multiples (2/2 died)			1			18			5			24		
Multiples (3/3 died)						1			2			3		
Multiples (2/4 died)			1			1						2		
Dichorionic diamniotic			3			13			9			25		
Monochorionic diamniotic						19			7			26		
Monoamniotic														
Unknown						2			3			5		

Among perinatal deaths in 2008, 8 percent were born in a multiple pregnancy. Babies born in multiple pregnancies had a perinatal related mortality rate of 28.9/1000, almost three times the rate of singletons. In twin pregnancies alone, the perinatal mortality rate was 26.5/1000.

It is established that twin babies who share a placenta (monochorionic) contribute disproportionately to twin deaths. These deaths generally occur as a result of communicating circulations in the placenta. A reduction in the occurrence of these deaths is expected as a result of the availability of laser therapy for twin-twin transfusion syndrome. In 2008, as in 2007, the cause of death among monochorionic twins was twin-twin transfusion syndrome in around half of all perinatal related deaths.

Early assessment of chorionicity (before 14 weeks) by ultrasound scan, and early referral of monochorionic twins to tertiary care, is critical to improving outcomes in monochorionic twins.

Multiple birth and infertility treatment

Perinatal death among multiple births was strongly associated with use of in vitro fertilisation (IVF) and clomiphene therapy. Twenty-one percent (12 out of 56) of perinatal related deaths among babies from multiple pregnancies were pregnancies where either IVF or clomiphene therapy were used compared to three percent in singleton pregnancies. This is a reflection of the increased rate of twinning following IVF and ovulation induction. There was no association seen between fertility treatment and type of twinning.

Maternal body mass index (BMI)

Table 14 Maternal BMI among perinatal related deaths in 2008

	Fetal deaths							
	Termination of pregnancy		Stillbirths		Neonatal deaths		Perinatal related deaths	
	n = 145		n = 379		n = 176		n = 700	
	n	%	n	%	n	%	n	%
Maternal BMI								
Underweight (< 18.50)	4	2.8	6	1.6	3	1.7	13	1.9
Normal range (18.50–24.99)	62	42.8	107	28.2	43	24.4	212	30.3
Overweight (25.00–29.99)	25	17.2	83	21.9	42	23.9	150	21.4
Obese Class 1 (30.00–34.99)	12	8.3	48	12.7	23	13.1	83	11.9
Obese Class 2 (35.00–39.99)	4	2.8	34	9.0	8	4.5	46	6.6
Obese Class 3 (≥ 40)	4	2.8	20	5.3	6	3.4	30	4.3
Unknown	34	23.4	81	21.4	51	29.0	166	23.7

In 2008, BMI data were available for 76 percent of mothers of perinatal related deaths. At least 49 percent of the mothers of stillborn babies and 45 percent of mothers of neonatal deaths were overweight or obese. Evidence is increasingly linking obesity with poor pregnancy outcomes, including perinatal death.

Unfortunately, background BMI data are not available for pregnant women in New Zealand, so the contribution of obesity to perinatal death cannot be accurately estimated.

Maternal smoking and drug use

Table 15 Maternal smoking at time of perinatal death and perinatal related mortality 2008

	Fetal deaths							
	Termination of pregnancy		Stillbirths		Neonatal deaths		Perinatal related deaths	
	n = 145		n = 379		n = 176		n = 700	
	n	%	n	%	n	%	n	%
Maternal smoking (current)								
Yes	25	17.2	113	29.8	62	35.2	200	28.6
No	110	75.9	247	65.2	100	56.8	457	65.3
Unknown	10	6.9	19	5.0	14	8.0	43	6.1

At least 30 percent of mothers of stillborn babies and 35 percent of mothers of babies who died after birth were recorded as smoking at the time of their baby's death. Smoking status was unknown in a further 5–8 percent of mothers.

Background smoking rates in pregnancy are not available for the total population of mothers in New Zealand. Estimates of smoking during pregnancy range from 10–23 percent (McCowan et al 2009; NZCOM 2004; National Women's Hospital 2008). *Australia's Mothers and Babies 2007* (AIHW National Perinatal Statistics Unit 2009) reported an average rate of 16.6 percent for smoking at any time during pregnancy from the states where data were collected. These estimates and comparisons would suggest a possible association between smoking and perinatal mortality in New Zealand.

Published studies consistently demonstrate that smoking is associated with preterm and SGA birth, placental abruption, stillbirth and perinatal mortality. Data on smoking in the birth registration dataset in New Zealand would enable analyses to determine the independent contribution of smoking to perinatal related mortality.

Other drugs

Data were obtained on the use of alcohol and recreational drugs by 82 percent of mothers whose babies died in 2008. Alcohol was reportedly used by 8 percent of mothers and marijuana by 5 percent. No other recreational drug use was reported by more than 1 percent of mothers.

Gestation and birthweight

Table 16 Termination, stillbirth, neonatal and perinatal related death rates (per 1000) by gestation and birth weight, 2008

	Births		Fetal deaths						Neonatal deaths			Total perinatal related deaths		
			Termination of pregnancy			Stillbirths								
	n = 65,872		n = 145			n = 379			n = 176			n = 700		
	n	%	n	%	Rate	n	%	Rate	n	%	Rate	n	%	Rate
Gestation at birth														
20–23 weeks[10]	316	0.5	108	74.5	*	123	32.5	*	48	27.3	*	279	39.9	*
24–27 weeks	279	0.4	25	17.2	89.61	46	12.1	164.87	27	15.3	129.81	98	14.0	351.25
28–31 weeks	574	0.9	7	4.8	12.20	37	9.8	64.46	20	11.4	37.74	64	9.1	111.50
32–36 weeks	4,075	6.2	5	3.4	1.23	55	14.5	13.50	21	11.9	5.23	81	11.6	19.88
37–40 weeks	48,492	73.6				100	26.4	2.06	42	23.9	0.87	142	20.3	2.93
41+ weeks	12,090	18.4				18	4.7	1.49	18	10.2	1.49	36	5.1	2.98
Unknown	46	0.1												
Birthweight														
<500 g[10]	252	0.38	80	55.2	*	110	29.0	*	27	15.3	*	217	31.0	*
500–999 g	313	0.48	51	35.2	162.94	73	19.3	233.23	47	26.7	248.68	171	24.4	546.33
1000–1499 g	415	0.63	7	4.8	16.87	21	5.5	50.60	14	8.0	36.18	42	6.0	101.20
1500–1999 g	814	1.24	5	3.4	6.14	31	8.2	38.08	7	4.0	9.00	43	6.1	52.83
2000–2499 g	2,449	3.72	2	1.4	0.82	32	8.4	13.07	11	6.3	4.55	45	6.4	18.37
2500–2999 g	8,835	13.41				43	11.3	4.87	17	9.7	1.93	60	8.6	6.79
3000–3499 g	21,503	32.64				37	9.8	1.72	24	13.6	1.12	61	8.7	2.84
3500–3999 g	20,988	31.86				17	4.5	0.81	16	9.1	0.76	33	4.7	1.57
4000–4499 g	8,347	12.67				9	2.4	1.08	9	5.1	1.08	18	2.6	2.16
≥ 4500 g	1,869	2.84				3	0.8	1.61	3	1.7	1.61	6	0.9	3.21
Unknown	87	0.13				3	0.8	34.48	1	0.6	11.90	4	0.6	45.98

10 data unreliable where asterisk is present.

Table 16 provides estimates of mortality rates by gestation and birthweight. Estimates of mortality rates for low gestations and birthweights are likely to be less accurate as the numbers of births in these categories are small and the rate is therefore highly reliant on the accuracy of reporting. Few babies born at 20–23 weeks or weighing under 500 g survive.

The majority of perinatal deaths occur in babies under 24 weeks and under 1000 g. Perinatal death is uncommon after 31 weeks and above 1499 g.

There is no significant rise in perinatal related mortality risk at the upper extremes of gestation or birthweight.

Obstetric antecedent and neonatal cause of death by gestational age

Table 17 Primary obstetric antecedent cause (PDC) of fetal death by gestational age, 2008

Perinatal death classification (PDC)		20–23 weeks		24–27 weeks		28–31 weeks		32–36 weeks		37–40 weeks		41+ weeks	
	Total	n	%	n	%	n	%	n	%	n	%	n	%
Congenital abnormality	**141**	98	69.5	19	13.5	9	6.4	6	4.3	8	5.7	1	0.7
Perinatal infection	**17**	5	29.4	1	5.9	2	11.8	4	23.5	4	23.5	1	5.9
Hypertension	**17**	4	23.5	5	29.4	4	23.5	2	11.8	1	5.9	1	5.9
Antepartum haemorrhage	**53**	24	45.3	4	7.5	7	13.2	8	15.1	9	17.0	1	1.9
Maternal conditions	**19**	8	42.1	5	26.3	1	5.3	1	5.3	3	15.8	1	5.3
Specific perinatal conditions	**52**	26	50.0	5	9.6	6	11.5	7	13.5	8	15.4		
Hypoxic peripartum death	**15**							1	6.7	9	60.0	5	33.3
Fetal growth restriction	**58**	9	15.5	15	25.9	5	8.6	10	17.2	16	27.6	3	5.2
Spontaneous preterm	**49**	40	81.6	8	16.3	1	2.0						
Unexplained antepartum death	**103**	17	16.5	9	8.7	9	8.7	21	20.4	42	40.8	5	4.9
Total	**524**	231	44.1	71	13.5	44	8.4	60	11.5	100	19.1	18	3.4

Because congenital abnormality most often results in fetal death following termination of pregnancy, these cases predominate among deaths before 24 weeks.

Forty-nine stillbirths (9 percent) were assigned as antecedent causes of spontaneous preterm birth. Almost all these cases have clinical or histological evidence of chorioamnionitis. Eighty percent occurred before 24 weeks.

Table 18 Primary antecedent cause (PDC) of neonatal death and gestational age, 2008

Perinatal death classification (PDC)		20–23 weeks		24–27 weeks		28–31 weeks		32–36 weeks		37–40 weeks		41+ weeks	
	Total	n	%	n	%	n	%	n	%	n	%	n	%
Congenital abnormality	43					10	23.3	12	27.9	14	32.6	7	16.3
Perinatal infection	10	3	30.0	2	20.0	1	10.0	1	10.0	2	20.0	1	10.0
Hypertension	5			2	40.0	3	60.0						
Antepartum haemorrhage	13	11	84.6	1	7.7			1	7.7				
Maternal conditions	4	1	25.0			1	25.0			1	25.0	1	25.0
Specific perinatal conditions	17	7	41.2	5	29.4	1	5.9	2	11.8	2	11.8		
Hypoxic peripartum death	19							1	5.3	11	57.9	7	36.8
Fetal growth restriction	4					1	25.0	1	25.0	2	50.0		
Spontaneous preterm	47	26	55.3	17	36.2	3	6.4	1	2.1				
No obstetric antecedent	14								14.3	10	71.4	2	14.3
Total	176	48	27.3	27	15.3	20	11.4	21	11.9	42	23.9	18	10.2

In contrast to fetal death, congenital abnormality, which is still a predominant cause of death, occurs among babies born at or near term. Congenital abnormality is the most common cause of neonatal death among term babies, accounting for 35 percent. The next most common cause is hypoxic peripartum death.

Table 19 Primary neonatal cause (NDC) of neonatal death by gestational age, 2008

Primary neonatal cause (NDC)		20–23 weeks		24–27 weeks		28–31 weeks		32–36 weeks		37–40 weeks		41+ weeks	
	Total	n	%	n	%	n	%	n	%	n	%	n	%
Congenital abnormality	43					10	23.3	12	27.9	14	32.6	7	16.3
Extreme prematurity	51	46	90.2	5	9.8								
Cardio-respiratory disorders	11	2	18.2	7	63.6	1	9.1	1	9.1				
Infection	21			9	42.9	6	28.6	2	9.5	2	9.5	2	9.5
Neurological	33			3	9.1	3	9.1	3	9.1	16	48.5	8	24.2
Gastrointestinal													
Other	17			3	17.6			3	17.6	10	58.8	1	5.9
Total	176	48	27.3	27	15.3	20	11.4	21	11.9	42	23.9	18	10.2

Spontaneous preterm birth or extreme prematurity predominate as obstetric/neonatal causes of death in preterm babies.

Antenatal caregiver

Table 20 Booking status of mothers of perinatal deaths, 2008

	Fetal deaths							
	Termination of Pregnancy		Stillbirths		Neonatal deaths		Perinatal related deaths	
	n = 145		n = 379		n = 176		n = 700	
Was the mother booked with a LMC?	n	%	n	%	n	%	n	%
Yes	137	94.5	348	91.8	162	92.0	647	92.4
No	6	4.1	26	6.9	11	6.3	43	6.1
Missing	2	1.4	5	1.3	3	1.7	10	1.4

Ninety-two percent of mothers were known to have been booked with a LMC before their baby's perinatal related death. This has been a consistent finding across PMMRC reports. What is not clear from the data reported is the timing of the first antenatal visit and the number of visits before the death as, in many cases, these data are missing. Denominator data are not available for births in New Zealand, so few conclusions can be drawn from these data.

Table 21 Lead maternity carer at booking and birth, 2008

	Lead Maternity Carer at birth											
	Total		Self-employed midwife		Hospital		GP		Private obstetrician		Unknown	
	n = 510		n = 200		n = 285		n = 4		n = 18		n = 3	
Lead Maternity Carer at booking	n	%	n	%	n	%	n	%	n	%	n	%
Self employed midwife	329	64.5	199	60.5	126	38.3			1	0.3	3	0.9
Hospital	143	28.0	1	0.7	142	99.3						
GP	15	2.9			11	73.3	4	26.7				
Obstetrician (private)	23	4.5			6	26.1			17	73.9		
Total	501		189	64.7	267	53.3	11	2.2	18	3.6	16	3.2

In 2008, among the women booked with an LMC at the time of their baby's death, 65 percent were first booked with a self-employed midwife; 28 percent under a hospital midwife, clinic or obstetrician; and 5 percent with a private obstetrician. At birth, 56 percent were booked with a hospital service, 39 percent with a self-employed midwife, and 4 percent with a private obstetrician.

Screening for diabetes in pregnancy

Table 22 Screening for diabetes among booked women with no pre-existing diabetes and where perinatal death occurred at or beyond 28 weeks' gestation 2008

	n = 295	
Screened for diabetes	n	%
Yes	162	54.9
No	71	24.1
Unknown	62	21.0

Screening for diabetes in pregnancy is recommended for all women between 24 and 28 weeks by the Ministry, the Royal Australian and New Zealand College of Obstetricians and Gynecologists (RANZCOG) and the New Zealand College of Midwives (NZCOM). At least a quarter of mothers of babies who died were not screened for diabetes between 24 and 28 weeks pregnancy. This figure is unchanged from 2007. This lack of screening could mask a higher rate of mortality due to diabetes.

A significant proportion of women who could be identified as being at risk of diabetes by their ethnicity, BMI or age had not been screened. This may reflect either a lack of antenatal care at an appropriate time or a lack of screening advice to these mothers.

Screening for family violence in pregnancy

Table 23 Screening for family violence, 2008

	Fetal deaths							
	Termination of Pregnancy		Stillbirth		Neonatal deaths		Total perinatal related deaths	
	n = 145		n = 379		n = 176		n = 700	
	n	%	n	%	n	%	n	%
Experienced family violence								
Yes	6	4.1	13	3.4	5	2.8	24	3.4
No	61	42.1	148	39.1	61	34.7	270	38.6
Not asked	43	29.7	131	34.6	52	29.5	226	32.3
Unknown	35	24.1	87	23.0	58	33.0	180	25.7
Referral to relevant support								
Yes	5	83.3	7	53.8	4	80.0	16	66.7
No								
Unknown	1	16.7	6	46.2	1	20.0	8	33.3

In 2002, the Ministry published national guidelines for family violence interventions (MOH 2002a).

Data on screening for family violence are not well reported to the PMMRC. A quarter of the data are still missing/unknown.

Where screening occurred, the rate of positive screens was 24 out of 294 (8.2 percent). Of the 24 positive disclosures, at least two-thirds are known to have been referred for support.

Vaginal bleeding in pregnancy

Table 24 Vaginal bleeding during pregnancy among perinatal deaths, 2008

	Fetal deaths							
	Termination of pregnancy		Stillbirths		Neonatal deaths		Total perinatal related deaths	
	n = 145		n = 379		n = 176		n = 700	
	n	%	n	%	n	%	n	%
Vaginal bleeding during pregnancy								
Yes	24	16.6	108	28.5	61	34.7	193	27.6
No	77	53.1	158	41.7	75	42.6	310	44.3
Unknown	44	30.3	113	29.8	40	22.7	197	28.1
Gestation [11]								
‹ 20 weeks	18	12.4	44	11.6	30	17.0	92	13.1
≥ 20 weeks	13	9.0	95	25.1	48	27.3	156	22.3

11 Note: Multiple bleeds can occur in pregnancy and can occur both before and after 20 weeks.

Data on bleeding in pregnancy was poorly reported in 2008. In the 2008 year, this question was answered 'unknown' for 30 percent of stillbirths. This is disappointing given the emphasis placed on this important risk factor in previous reports. However, in 25 percent of stillbirths and 27 percent of neonatal deaths, bleeding beyond 20 weeks was reported.

Antenatal corticosteroids

Among neonatal deaths of babies delivered at between 24 and 32 weeks gestation, corticosteroids were given to 36 of 49 babies (74 percent). Among deaths of babies delivered from 20–23 weeks gestation, a further 7 of 48 babies also received antenatal corticosteroids.

Antenatal identification of SGA infants

Table 25 SGA among perinatal related deaths, 2008

	Fetal deaths							
	Termination of pregnancy		Stillbirths		Neonatal deaths		Perinatal related deaths	
	n	%	n	%	n	%	n	%
All perinatal deaths	n = 145		n = 379		n = 176		n = 700	
SGA[12]	76	52.4	191	50.4	58	33.0	325	46.4
Perinatal deaths ≥ 24 weeks	n = 37		n = 256		n = 128		n = 421	
SGA[12]	14	37.8	119	46.5	34	26.6	167	39.7
Perinatal deaths ≥ 24 weeks; excluding lethal congenital abnormality	n = 11		n = 237		n = 85		n = 333	
SGA[12]	8	72.7	103	43.5	21	24.7	132	39.6

12 Birthweight less than tenth customised centile

Customised birthweight centiles adjust for gender, gestation, ethnicity, maternal age, parity and BMI. SGA has been defined as a customised birthweight less than the tenth centile.

SGA was evident in 40 percent of perinatal related deaths at 24 weeks or beyond overall and specifically in 44 percent of stillborn babies and 25 percent of neonates whose deaths were not due to congenital abnormality. This is significantly more frequent that the expected rate of 10 percent in the population.

Table 26 Antenatal diagnosis of SGA among stillbirths and neonatal deaths at 24 weeks' gestation or more, excluding lethal congenital abnormalities, 2008

		Suspected growth restriction									
		No		Yes and confirmed by scan		Yes but normal growth on scan		Yes but no scan performed		Unknown	
	Total	n	%	n	%	n	%	n	%	n	%
SGA Stillbirths	103	54	52.4	20	19.4	5	4.9	4	3.9	20	19.4
SGA Neonatal deaths	21	7	33.3	9	42.9	1	4.8	1	4.8	3	14.3

Over 50 percent of SGA stillborn babies and 33 percent of SGA neonatal deaths born at 24 weeks or beyond who did not die of congenital abnormality had no suspected growth restriction before birth. Only a few suspected to be growth restricted did not have a scan before birth.

Place of birth and antenatal transfer

Table 27 Intended place of birth versus actual place of birth among stillbirths and neonatal deaths, 2008

		Actual Place of Birth													
Intended place of birth	**Total**	Home		Birthing Unit		Hospital Level 1		Hospital Level 2		Hospital Level 3		Other		Unknown	
	n = 555	n	%	n	%	n	%	n	%	n	%	n	%	n	%
Home	8	1	12.5	1	12.5			4	50.0	2	25.0				
Birthing unit	40	3	7.5	6	15.0			3	7.5	28	70.0				
Hospital level 1	29					7	24.1	11	37.9	9	31.0	1	3.4	1	3.4
Hospital level 2	217	5	2.3				0.5	184	84.8	26	12.0	1	0.5		
Hospital level 3	224	1	0.4					4	1.8	217	96.9	2	0.9		
Other	3							1	33.3	2	66.7				
Unknown	34	11	32.4					7	20.6	13	38.2	1	2.9	2	5.9
Total	555	21	3.8	7	1.3	8	1.4	214	38.6	297	53.5	5	0.9	3	0.5

Transfer from an intended to an actual place of birth was common among stillbirths and neonatal deaths. These transfers were generally from intended birth at home or birthing unit or level 1 hospital to level 2 or 3 hospital facility.

Thirteen neonatal deaths (7 percent) were transferred in labour, in almost all cases to a level 2 or 3 hospital facility. In the majority of cases, the antecedent cause of death was spontaneous preterm birth.

Overall, 21 stillborn babies or babies who died in the first month of life were born at home. One of these was an intended birth at home. Ten of these babies were less than 24 weeks gestation. Five were neonatal deaths after birth at term.

Maternal outcome

Table 28 Maternal outcome associated with perinatal related mortalities, 2008

	Fetal deaths							
	Termination of pregnancy		Stillbirths		Neonatal deaths		Total perinatal related deaths	
	n = 145		n = 379		n = 176		n = 700	
Maternal outcome	n	%	n	%	n	%	n	%
Alive and generally well	143	98.6	375	98.9	174	98.9	692	98.9
Alive but with serious morbidity	1	0.7	3	0.8	-	-	4	0.6
Dead	1	0.7	1	0.3	2	1.1	4	0.6

There were four maternal mortalities (indirect maternal deaths) associated with perinatal mortality in 2008, and these are discussed in more detail under 2: New Zealand Maternal Mortality in 2008 below. There were four serious morbidities among mothers whose babies died; three related to obstetric trauma and one to hypertensive disease.

Investigation of perinatal deaths

Table 29 Completeness of perinatal investigations following perinatal death, 2008

	Fetal deaths							
	Termination of pregnancy		Stillbirths		Neonatal deaths		Total perinatal related deaths	
	n = 145		n = 379		n = 176		n = 700	
Perinatal death investigations	n	%	n	%	n	%	n	%
Optimal PM/karyotype completed[13]	91	62.8	175	46.2	79	44.9	345	49.3
Partial investigations only[14]	41	28.3	115	30.3	66	37.5	222	31.7
No investigations[15]	7	4.8	49	12.9	20	11.4	76	10.9
Unknown	6	4.1	40	10.6	11	6.3	57	8.1

13 Optimal investigation or post-mortem was defined as karyotype confirming chromosomal abnormality or fully completed post-mortem.
14 No post-mortem; investigations may have included placental pathology, MRI, ultrasound scan or X-ray.
15 No post-mortem, placental pathology, MRI, ultrasound scan or X-ray.

Overall, 49 percent of perinatal related deaths were optimally investigated, meaning a post-mortem was performed for all but chromosomal abnormalities (where a karyotype confirming the diagnosis was considered adequate). The rate of optimal investigation was 46 percent in 2007 and 36 percent in 2006.

In 2008, as in 2007, there was considerable variation in the rate of optimal investigation by DHBs. In DHB areas where low rates of optimal investigation were evident, post-mortem was offered in the majority of cases (no area rate lower than 75 percent), but they were characterised by high rates of parents declining to have a post-mortem conducted.

Table 30 Rate of offer and decline of post-mortem examination, 2008

	Fetal deaths							
	Termination of pregnancy		Stillbirths		Neonatal deaths		Total perinatal related deaths	
	n = 145		n = 379		n = 176		n = 700	
Post-mortem examination offered	n	%	n	%	n	%	n	%
Post-mortem offered and parental consent given	74	51.0	198	52.2	78	44.6	350	50.1
Post-mortem offered and parents declined	44	30.3	155	40.9	61	34.9	260	37.2
Post-mortem not offered	25	17.2	18	4.8	29	16.6	72	10.3
Unknown/missing data	2	1.4	8	2.1	8	4.5	18	2.6

Post-mortem was offered to at least 81 percent of parents post termination of pregnancy, 93 percent of parents following a stillbirth, and 80 percent of parents following neonatal death. Post-mortem was declined following request in 43 percent of cases overall; 37 percent following termination, 44 percent following stillbirth and 44 percent following neonatal death. Excluding those infants with a congenital abnormality has no effect on the rates of offering or accepting post-mortem (data not presented).

In their 2008 report, CEMACE recorded a 45.4 percent rate of decline of post-mortem following stillbirth, and 51.0 percent following neonatal death in the United Kingdom in 2008. In the United Kingdom in 2008, post-mortem was not offered following 5.8 percent of stillbirths and 17.4 percent of neonatal deaths. These rates are very close to those for New Zealand in 2008, but neither is optimum.

The proportion of parents who were offered post-mortem did not vary by ethnicity, although the most common ethnic group to decline were Māori parents. Fifty-seven percent of Māori mothers offered post-mortem declined compared with 48 percent of Pacific peoples and 36 percent of New Zealand Europeans.

Table 31 Usefulness of post-mortem examination, 2008 (excludes congenital abnormalities)

	Fetal deaths							
	Termination of pregnancy		Stillbirths		Neonatal deaths		Perinatal related deaths	
	n = 16		n = 157		n = 57		n = 230	
Post-mortem findings	n	%	n	%	n	%	n	%
Changed clinical diagnosis	5	31.3	50	31.8	7	12.3	62	27.0
Confirmed clinical diagnosis	8	50.0	52	33.1	24	42.1	84	36.5
Inconclusive	0	0.0	7	4.5	1	1.8	10	4.3
Additional information obtained	0	0.0	9	5.7	1	1.8	8	3.5
Unknown/missing data	3	18.8	39	24.8	24	42.1	66	28.7

Table 31 shows the local PMMRC coordinators' assessment of the usefulness of the post-mortem in cases where it was performed. These data are provided for cases where the cause of death was not congenital abnormality. In 2008, this assessment was missing for 29 percent of cases, and as a result, more training has been provided for local PMMRC coordinators.

In at least 27 percent of cases, a post-mortem changed the clinical diagnosis, resulting in altered counselling to parents for future pregnancies. In at least 37 percent of cases, there was no change in diagnosis, and the post-mortem did not change the advice given to parents. In at least 4 percent of cases, further information was gained, but this did not change the clinical diagnosis. In at least a further 4 percent of cases, the post-mortem did not demonstrate an obvious cause of death or significant abnormality.

1.7 Specific areas of interest

This section provides further analysis into congenital abnormality and perinatal asphyxia, using data collected by the PMMRC from July 2006 to December 2008 (30 months).

Congenital abnormality

Congenital abnormality as a cause of perinatal death (PDC1) is the greatest contributor to perinatal related mortality in New Zealand, contributing 498 (28.5 percent) of perinatal related deaths over the 30 months from July 2006–December 2008. Of these, 62 percent were terminations, 17 percent stillbirths and 21 percent neonatal deaths.

The vast majority of late terminations for congenital abnormality occur from 20–28 weeks.

Table 32 Specific congenital abnormality PDC codes among perinatal related deaths, July 2006–December 2008

	Fetal deaths							
	Termination of pregnancy		Stillbirths		Neonatal deaths		Perinatal related deaths	
	n = 307		n = 86		n = 105		n = 498	
Specific congenital abnormality	n	%	n	%	n	%	n	%
Central nervous system	92	30.0	10	11.6	7	6.7	109	21.9
Cardiovascular system	35	11.4	9	10.5	23	21.9	67	13.5
Urinary system	10	3.3	4	4.7	11	10.5	25	5.0
Gastrointestinal system	5	1.6	4	4.7	5	4.8	14	2.8
Chromosomal	92	30.0	26	30.2	21	20.0	139	27.9
Metabolic	1	0.3	1	1.2	2	1.9	4	0.8
Multiple/non-chromosomal syndromes	42	13.7	12	14.0	22	21.0	76	15.3
Other and unspecified abnormality	30	9.8	20	23.3	14	13.3	64	12.9

Table 32 shows the distribution of specific congenital abnormality PDC codes for the 2006–2008 data. Chromosomal abnormalities were the most common followed by central nervous system abnormalities, though the gestation and mode of death varied by sub-classification, with central nervous system abnormalities more often represented among late terminations.

In 2009, the PMMRC plan to review clinical care among women undergoing late termination to investigate whether earlier referral and management might have been available.

Perinatal asphyxia

Babies who die of asphyxia are a group of special interest as there is a possibility that some of these deaths may have been avoidable. There are published data showing that, in a significant proportion of deaths from perinatal asphyxia, there is evidence of brain injury having occurred before the onset of labour.

These babies are identified as perinatal related deaths with a PDC of 7 (hypoxic peripartum death) or a NDC of 5.1 (hypoxic ischaemic encephalopathy). This definition excludes babies who may have suffered asphyxial insults but where the primary classification code was neither PDC 7 nor NDC 5.1. Very few babies, however, had a secondary or tertiary code of PDC 7 or NDC 5.1.

There were 87 cases reported from July 2006–December 2008, constituting 10.4 percent of neonatal deaths and 4.4 percent of stillbirths. There has been no significant change in the proportion of asphyxia cases among all perinatal related deaths over the three years of data collection.

Table 33 Asphyxial perinatal related deaths July 2006–December 2008

	Stillbirths		Neonatal deaths		Perinatal related deaths	
	n = 41		n = 46		n = 87	
Perinatal death classification (PDC)	n	%	n	%	n	%
Hypoxic peripartum death						
with intrapartum complications	11	27	13	28	24	28
non-reassuring fetal status in a normally grown infant	15	37	19	41	34	39
no intrapartum complications and no evidence of non-reassuring fetal status	2	5	3	7	5	6
unspecified hypoxic peripartum death	13	32	11	24	24	28
Gestation at birth						
32–36 weeks	1	2	1	2	2	2
37–41 weeks	39	95	44	96	83	95
≥ 42 weeks	1	2	1	2	2	2

In 39 percent of cases, there was evidence of non-reassuring fetal status before birth, such as abnormal fetal heart rate, without an associated intrapartum complication. There were intrapartum complications such as a prolapsed umbilical cord in 28 percent of cases; and the circumstances were not specified in a further 28 percent.

Post-mortem was completed in 43 percent of cases overall.

Data on avoidability of perinatal related death have been included in the PMMRC dataset starting in 2009. It is hoped that these data, along with data collection by the Neonatal Encephalopathy Working Group (NEWG) of the PMMRC, will provide some useful information in further evaluation and understanding of these deaths.

2 New Zealand Maternal Mortality in 2008

2.1 Introduction

The terms of reference of the PMMRC require the committee to review 'direct' maternal deaths. A Maternal Mortality Review Working Group (MMRWG) was established in 2006 to develop a process for the national collection of data relating to maternal deaths. The group's aim is to review maternal mortality and identify potentially avoidable causes, with the expectation that this will lead to improvements in care.

The MMRWG is chaired by Alastair Haslam (obstetrician and gynaecologist), succeeding Claire McLintock (obstetric physician) who continues on the working group, together with PMMRC members Cynthia Farquhar (PMMRC Chair, obstetrician, gynaecologist and clinical epidemologist) and Jacqui Anderson (midwife). Other members of the working group are Jeannette McFarlane (pathologist), Alison Eddy (midwife), John Walker (anaesthetist), Mollie Wilson (health manager) and Cathy Hapgood (psychiatrist). Vicki Masson (PMMRC national coordinator) provides additional support. Lynn Sadler (epidemiologist) assists with data analysis and interpretation. The MMRWG meets three times a year.

The MMRWG must identify and review all 'direct' pregnancy-related deaths. It was also decided in the first year of the working group to also review 'indirect' deaths, in particular (but not solely) those related to surgery, psychiatric illness and family violence. 2010 represents the third year of maternal death reporting after the last report of the Maternal Mortality Review Committee issued in 1995 relating to the 1991–93 triennium.

Recording maternal mortality ratios is important at the level of the general population, the maternal population and the individual. On a population level, the maternal mortality ratio acts as one barometer of how well the entire health system is functioning and is a marker of a country's overall development. At the maternal population level, studying trends in the data in order to identify and understand causes of mortality will help to improve future maternity care. On an individual level, every maternal death is a tragedy. At each level, a basic premise applies: all women have the right to good clinical care in pregnancy and, as a basic human right, should be protected from avoidable death.

2.2 Definitions

The definitions adopted by the MMRWG are based on the World Health Organization (WHO) definitions from the International Classification of Diseases (10th edition) (ICD 10) as follows:

Maternal related death: 'death of a woman while pregnant or within 42 days of termination of pregnancy, irrespective of the duration and site of the pregnancy, from any cause related to or aggravated by the pregnancy or its management, but not from accidental or incidental causes.'

The cause of each death is sub-classified, using the CEMACH classification system (Lewis 2007):

- **Direct maternal deaths:** those resulting from obstetric complications of the pregnant state (pregnancy, labour or puerperium), from interventions, omissions, incorrect treatment, or from a chain of events resulting from the above.
- **Indirect maternal deaths:** those resulting from previous existing disease or disease that developed during pregnancy and was not due to direct obstetric causes, but which was aggravated by the physiologic effects of pregnancy.
- **Coincidental maternal deaths:** deaths from unrelated causes which happen to occur in pregnancy or the puerperium.

These definitions exclude **late maternal deaths**, occurring between 42 days and one year following the birth, even though it is known that some pregnancy-related deaths occur in this later period. The MMRWG may consider and review these deaths where they can be identified.

Maternal mortality ratio is the number of maternal-related deaths per 100,000 maternities.

Maternities are defined here as all live births plus fetal deaths at 20 weeks or beyond, or weighing 400 g or more if gestation was unknown. Pregnancies ending before 20 weeks are not included in this working definition because the absolute number of pregnancies ending before this time is unknown.

Contributory and causative features considered include systems level issues (eg, funding, management, organisation, staffing levels), clinical factors (eg, skills, training, judgment), environmental factors (eg, inadequate facilities, distance) and issues relating to the woman and her family (eg, unbooked pregnancies, language barriers, social isolation, non engagement with care).

Potentially avoidable factors are defined as aspects of care that may have changed the clinical outcome had they been identified.

2.3 Methodology

Since 2006, the PMMRC has requested local coordinators notify all maternal deaths. Deaths are also brought to the MMRWG's attention by the coroner, from media reports or through other means. At the end of each year, known deaths are cross-referenced with the mortality collection at BDM to ensure that the collection is complete. Since July 2007, all maternal deaths have been required to be notified to the coroner. In 2008, all cases were referred to the coroner, who decided a post-mortem need not occur in three cases.

The MMRWG has developed a New Zealand-specific data collection tool for maternal deaths. Following notification of a maternal death, the PMMRC national coordinator issues maternal death reporting forms to the appropriate local coordinator, who is then responsible for gathering the relevant clinical information from staff involved with the woman's care.

Each completed reporting form, along with relevant clinical information, is reviewed by designated members of the MMRWG, who present a summary of the case and findings to the working group. The MMRWG then discuss each case in detail, including reviewing the presence of potentially avoidable features.

2.4 Findings

Table 34 Maternal mortalities and cause of maternal deaths, 2006–2008

Classification and cause of maternal death	2006	2007	2008
Direct maternal death	6	5	4
Amniotic fluid embolism	3		1
Postpartum haemorrhage	1	1	1
Pulmonary embolism		1	1
Peripartum cardiomyopathy		1	
Preeclampsia		2	1
Sepsis	2		[16]
Indirect maternal death	**7**	**5**	**5**
Pre-existing medical condition	2	4	2
Non-obstetric sepsis		1	
Intracranial haemorrhage	1		
Suicide	4		3
Unclassifiable	2	1	
Total	**15**	**11**	**9**
Maternal mortality ratio	**25.1**	**16.8**	**13.7**

16 There were nine deaths in 2008, including four direct deaths including severe pre eclampsia, amniotic fluid embolism, post partum haemorrhage, and pulmonary embolus in a case with sepsis. Indirect deaths included four suicides.

Table 35 Details of maternal deaths, 2006–2008

Time of death related to pregnancy	2006	2007	2008
Antepartum	6	5	3
Postpartum	9	6	6
Place of baby's birth	**2006**	**2007**	**2008**
Community	1	1	
Hospital	8	6	8
Not delivered	6	4	1
Place of maternal death	**2006**	**2007**	**2008**
Hospital	7	7	6
Community	8	4	3
Reported to the coroner	**2006**	**2007**	**2008**
Yes	13	8	9
No	2	3	
Unknown			
Were potentially avoidable factors present?	**2006**	**2007**	**2008**
Yes	3	5	6
No	10	6	2
Unknown	2		1

Four direct and five indirect maternal deaths were reported to the MMRWG in 2008. There were 65,872 maternities in 2008, making the maternal mortality ratio 13.7/100,000. As the number of maternal deaths is small in total in New Zealand, there may be large variations in the ratio from year to year. The ratios were 16.8/100,000 in 2007 and 25.1/100,000 in 2006. There was one coincidental death in 2008.

The MMRWG was advised at a later date of one maternal death in 2006, bringing the total for that year to 15. This death is still to be fully reviewed but has been included in the above tables where possible. As a result, the maternal mortality ratio from the 2006 report has been revised.

In 2008, the MMRWG determined that potentially avoidable factors were present in six of the nine maternal deaths. The MMRWG noted that a number of the women who died had presented with complex conditions and received care from a variety of personnel, not exclusively maternity related caregivers or specialists. The contributory and causative features in these potentially avoidable cases included:

Factors relating to personnel

1. Slow recognition of the severity of a woman's condition and the need to act appropriately
2. Delay in recognising a need for action in response to mental health problems
3. Lack of interdisciplinary communication and of handover of care
4. Inadequate documentation.

Factors relating to the woman and her family

5. Problems with the coordination of care in high-risk cases where the woman was not well engaged with perinatal care
6. Non-use of seatbelts during pregnancy.

Amniotic fluid embolism

There were four cases of maternal death due to amniotic fluid embolism in the three years from 2006–2008. A report relating to this condition from the MMRWG to the Minister of Health is included below as Appendix E. Amniotic fluid embolism is an unpredictable and uncommon condition, although better recognition of milder degrees of the syndrome suggests it may be more common than previously believed. The collection of cases in morbidity studies such as the United Kingdom Obstetric Surveillance System (UKOSS) and from 2010 by Australasian Obstetric Surveillance System (AMOSS) may contribute to improved understanding of this condition.

2.5 Conclusion

The MMRWG believes that the collection of maternal deaths from 2006–2008 is complete and therefore forms the basis for a realistic estimate of the maternal mortality ratio. The numbers of maternal deaths are too small in these three years to measure trends or for in depth analysis but nevertheless will invite and allow some international comparisons.

The MMRWG would like to emphasise the value of in-depth local review in response to all maternal deaths. Local review has the potential to explore matters in detail that may not be apparent to the MMRWG, provide practitioners with useful learning points and assist practitioners and families in dealing with the tragedy of maternal death.

Certain matters are common to all maternal mortality reports, and they are as follows.

Hypertension in pregnancy

- Obstetric units should adopt the evidence-based management of hypertension in pregnancy recommended by the Society of Obstetric Medicine of Australia and New Zealand (SOMANZ).

Major obstetric haemorrhage

- A national guideline for the management of post-partum haemorrhage, including a massive transfusion protocol, should be developed.

Obstetric emergencies

- All staff involved in care of pregnant women should undertake regular training in managing obstetric emergencies.

Team approach to care

- Women with complex medical conditions require a multidisciplinary approach to care, often across more than one DHB. Each woman requiring such care should be assigned a key clinician to facilitate her care.

Seatbelts in pregnancy

- There is a need for greater public awareness of the importance of wearing a seatbelt during pregnancy. All pregnant women should know that three-point seatbelts should be worn throughout pregnancy, with the lap strap placed as low as possible beneath the 'bump', lying across the thighs, and the diagonal shoulder strap placed above the 'bump', lying between the breasts.

Maternal mental health

- Maternal mental health services need to be integrated into maternity services, including providing access to a mother and baby unit in the North Island.
- Accurate antenatal screening and documentation of mental health history is needed to identify a group of women who are at increased risk of mental illness. Suggested screening questions include:
    - Do you *currently* receive or have you *ever received* treatment for a serious mental illness?
    - Do you have a family history of serious mental health problems, including perinatal mental illness?

3 Neonatal Encephalopathy Working Group Report

The purpose of the PMMRC is to reduce the number of preventable perinatal and maternal deaths; however, the role also includes developing strategic plans and methodologies to reduce morbidity.

Neonatal encephalopathy was identified by the PMMRC as an area with potential for improving services and outcomes for babies. This recognition led to the establishment, late in 2007, of the Neonatal Encephalopathy Working Group (NEWG), which was charged with reviewing New Zealand data on neonatal encephalopathy.

Neonatal encephalopathy is important because, despite advances in obstetric and neonatal care, perinatal hypoxic ischaemic insult is considered to be the most common cause of preventable neurological injury in newborns. This has significant impact on the infant, the family and society.

The NEWG definition of neonatal encephalopathy is a clinically defined syndrome of disturbed neurological function within the first week of life in the full-term infant, manifested by difficulty in initiating and maintaining respiration, depression of tone and reflexes, subnormal level of consciousness and often seizures.

Currently there is no valid national dataset of New Zealand prevalence, and the priority is to establish the true size of the problem. An observational audit designed to include neonatal encephalopathy as a condition on Paediatric Surveillance Unit (PSU) reporting cards commenced in January 2010.

Notification of a recognised case to the PSU generates a PMMRC Baby Rapid Reporting Form for a surviving infant with moderate to severe neonatal encephalopathy. The attending paediatrician completes this reporting form. The LMC completes a PMMRC Mother Rapid Reporting Form for a baby diagnosed with neonatal encephalopathy. Data are examined as soon as they arrive to ensure that the most comprehensive and accurate case details are formulated.

As with PMMRC data, individual data is confidential, and no identifying information for either an individual infant or a mother will be published. The audit will document:

- the number of newborn infants with moderate to severe neonatal encephalopathy in New Zealand
- the distribution of these affected infants in terms of geographic location
- the spread between level 2 and level 3 hospital facilities
- possible predictors of the condition and how these infants are best managed
- areas for development and implementation of effective preventative and remedial therapies with a view to reducing both the occurrence and severity of neonatal encephalopathy.

The ultimate aim is to reduce the occurrence and severity of neonatal encephalopathy, improving health outcomes for infants and decreasing disability.

Further information on NEWG can be found on the PMMRC's website: http://www.pmmrc.health.govt.nz

4 PMMRC Australasian Maternity Outcomes Surveillance System (AMOSS) Working Group Report

4.1 The importance of gathering maternal morbidity data

In New Zealand and Australia, maternal death is a rare event, yet measuring maternal mortality remains one of the major methods of assessing maternal health and the quality of maternity care. In recent years, the focus has shifted to collecting data about 'severe maternal morbidity' or 'near-miss events' as a means of providing more complete information about risk factors for potentially life-threatening obstetric complications to identify possible preventative steps.

The Australasian Maternity Outcomes Surveillance System (AMOSS) is a clinical surveillance and research system that aims to review the burden of severe and rare disorders of pregnancy. In the absence of a uniformly accepted definition for a near-miss event or severe maternal morbidity, AMOSS investigators have chosen to adopt the United Kingdom Obstetric Surveillance System (UKOSS) example, where selected severe and rare (incidence ‹ 1 in 1000) pregnancy complications are studied for a period of time by all participating hospitals. Studying these conditions prospectively across the obstetric populations of New Zealand and Australia gives researchers the potential to gather important clinical information to help develop national guidelines and provide educational resources to support clinicians who are managing women with these severe pregnancy complications.

Another key goal of AMOSS is to foster collaboration among professionals caring for pregnant women to optimise quality and safety of care provided through our maternity systems.

The AMOSS project is funded by a five-year grant from the Australian National Health and Medical Research Council and is based in the Perinatal and Reproductive Epidemiology Research Unit (PRERU) at The University of New South Wales in Sydney under the leadership of Associate Professor Elizabeth Sullivan. New Zealand has been involved with the project since its inception. Dr Claire McLintock (Chair of the AMOSS Working Group) is an Associate Investigator of the AMOSS project and has been involved in all aspects of the development of the study.

The conditions selected by AMOSS for the initial period of study that started in January 2009 include:

- antenatal pulmonary embolism
- amniotic fluid embolism
- eclampsia
- peripartum hysterectomy
- placenta accreta/percreta/increta
- influenza requiring admission to an intensive care unit
- BMI › 50 (data re numbers of women only collected in New Zealand).

The aim is to study the conditions for at least one year and added new conditions once current studies are complete, thus ensuring that the AMOSS project remains a dynamic and responsive process. Potential conditions for study in 2011–2012 include: massive blood transfusion, pregnancy in solid organ transplant recipients, pregnancy in women with rheumatic heart disease, myocardial infarction in pregnancy and stroke in pregnancy.

4.2 AMOSS in New Zealand

The AMOSS Working Group (AMOSSWG) was set up by the PMMRC in February 2010 to champion AMOSS in New Zealand, review New Zealand data, represent New Zealand to the Australian-based AMOSS advisory group, assist with prioritising conditions to be studied and ultimately help implement learning outcomes into clinical practice across New Zealand. Also, by adopting the UKOSS exemplar, the AMOSSWG will have the opportunity to conduct direct international comparisons of quality and safety in maternity care and establish international partnerships.

The AMOSSWG membership represents a wide range of health professionals involved in caring for pregnant women and their families and covers expertise in midwifery, obstetrics and gynaecology, obstetric medicine, haematology, clinical epidemiology and public health research. The AMOSSWG meets four times a year, twice by teleconference and twice in face-to-face meetings.

New Zealand is well represented on the AMOSS advisory group. Three members of the AMOSSWG are members of the advisory group: Estelle Mulligan, Ted Hughes, and Claire McLintock, in her role as an Associate Investigator for AMOSS. (Dr McLintock was invited to attend the inaugural meeting of the International Network of Obstetric Survey Systems that was held in Oxford in July 2010.)

Data collection for the AMOSS conditions commenced in all DHBs across NZ in January 2010 (to date in Australia, 151 sites are up and running). In New Zealand, the local coordinators play a pivotal role in AMOSS data collection, using the PMMRC network. Within each DHB, local coordinators determine the optimal way for their hospital to identify women who have had an AMOSS condition, using local email notification, AMOSS case report folders and personal notification. Monthly reports on the total number of cases from each DHB are sent to the AMOSS team in Sydney; and even if no cases have occurred, an email is sent to this effect – this negative reporting system ensures complete data collection of all eligible cases. For all AMOSS cases identified within a DHB, the local coordinator arranges for the clinical staff involved with the woman's care to complete the online AMOSS case report forms. Some conditions will be reported as incidence studies, but placenta accreta and peripartum hysterectomy are case-controls studies, with the two control women identified for each case (the two women who delivered immediately before the case). All information relating to AMOSS cases and controls is non-identifiable. This method of data collection ensures that individual DHBs will have access to all of their own AMOSS cases for review. In New Zealand, the AMOSS study is approved by the multi-region ethics committee.

5 Māori Caucus Discussion Themes Particularly Relevant to Perinatal and Maternal Mortality Review

Compiled by Dr Stephanie Palmer, for the PMMRC Māori Caucus

5.1 Background

The New Zealand Government has five mortality review committees (MRCs), all of which have terms of reference that acknowledge the importance of Māori representation (see http://www.moh.govt.nz/statutorybodies).

Table 36 New Zealand's mortality review committees

Date established	Name of committee	No. of Māori members	Total no. of members
2002	Child and Youth Mortality Review Committee (CYMRC)	2	9
2005	Perinatal and Maternal Mortality Review Committee (PMMRC)	2	10
2008	Family Violence Death Review Committee (FDVRC)	1	7
2009	Pandemic Influenza Mortality and Morbidity Review Group (PIMMRG)	1	8
2010	Perioperative Mortality Review Committee (POMRC)	1	8

The Māori Caucus (the Caucus) is an unofficial advisory committee to the national MRCs. It comprises Māori MRC members and occasional co-opted experts who collectively seek to:

- provide support and mentorship for Māori MRC members
- identify opportunities for collaboration and/or improving MRC outcomes for Māori
- assist in recruiting and appointing Māori MRC members
- improve the quality of MRC data collection and analysis of findings for Māori
- contribute to the development of MRC resources, information and processes for Māori.

Since its establishment in 2006, the Caucus has met six times and has discussed a range of MRC issues. This section aims to identify and consider some of the discussions that have particular relevance for perinatal mortality review. In general, the discussions focus on three main themes: ethnicity classification, mortality review as a socialising agent and how it contributes to the evidence base that informs clinical practice. The following two subsections focus briefly on some of thinking that underlies the two latter themes, while 5.4 Ethnicity Classification provides a substantive review of current key challenges for PMMRC and other MRCs in this area.

Au e Ihu, tirohia	*Look at us Jesus*
Arohaina, iho rā	*Show compassion*
Ki au pononga e mahi nei	*for the service we provide*
Whakaaetia ake ai	*allow*
Kia tau mai tou Wairua Tapu	*the presence of the Holy Spirit*
Ki ā mātou katoa	*to be with us*
Mō te ake tonu atu.	*forever*

5.2 Mortality review as a socialising agent

Caucus discussions are often mindful of the potential for mortality review to become a socialising agent for societal attitudes and behaviours, thereby actively shaping aspects of Māori culture and identity. In relation to PMMRC, a dilemma revolves around how to learn from the 1 percent (n = 202) of Māori perinatal deaths that occurred 2008 while acknowledging the 99 percent (n = 19,413) of Māori babies who did not die and ensuring that the experiences of the majority are not shaped by our grief for (and review of) the few. Beneath this overarching quandary runs a concern that the review of perinatal mortality data can sometimes lack contextual information, qualitative perspectives or additional analyses that could improve understanding and make recommendations more meaningful, or relevant, for Māori birthing whānau. With regard to this report, for example, the Caucus has discussed the underlying messages that can be validly associated with co-sleeping and post-mortem recommendations.

In the case of co-sleeping, PMMRC data identified 10 SUDIs in 2008, of whom eight were in unsafe sleeping arrangements. These data add to a substantial evidence base that identifies unsafe sleeping arrangements, such as newborn babies sleeping with their māmā, as a risk factor for SUDI. Both PMMRC and CYMRC have recommended the development of safe sleeping guidelines for postnatal wards 'to model safe sleeping practices that parents can follow after discharge'. The danger of this broad-brush approach is that co-sleeping will rapidly become generalised as an unsafe practice for all whānau, thereby, overriding the beneficial effects on bonding and breastfeeding as well as the positive experiences of māmā and babies who have been successfully co-sleeping for generations.

As a result of these concerns, the Caucus discussions have highlighted the need for:

- instigating national leadership and cohesion in developing guidelines, including, for example, developing a single universal pamphlet about co-sleeping, providing clear and consistent messages and working with the SUDI coalition (Mokopuna Ora, TAHA, Change for our Children, CYMRC and the Caucus), rather than producing a variety of information, such as pamphlets, containing mixed messages
- clearly focusing on identifying vulnerable babies in the at-risk group (for example, babies at risk of SUDI because the māmā smoke during pregnancy)
- integrating the findings from three current research projects on co-sleeping, in particular, the Wahakura project, a randomised control trial of safe bed-sharing practices, led by Dr David Tipene-Leach
- urgently re-directing the focus of tobacco control to (a) reduce smoking among women of childbearing age, (b) reduce smoking in pregnancy and (c) reduce smoking around babies/children.

Similarly, the Caucus recognise the value of perinatal post-mortems in providing whānau and practitioners with information about the cause of death. However, there is also concern that the PMMRC process may be driving the normalisation of post-mortem as a routine 'cultural' response when perinatal loss is experienced. Therefore, the priority must be to provide good information about the value of post-mortem for Māori whānau, while recognising occasions where post-mortem may not be necessary or appropriate.

In this regard, the Caucus is pleased PMMRC has begun to report on the usefulness of post-mortems being assessed by local PMMRC coordinators. Of those assessed in 2008, 27 percent led to a change in clinical diagnosis (and altered the counselling that will be offered to parents for future pregnancies), but 40–45 percent did not lead to a change in diagnosis or provide new information. Caucus discussions have also recognised the need for systems that enable responsibility to be taken for the post-mortem data, tissues and samples that are gathered to inform the process of perinatal mortality review. The Caucus is currently gathering information about DHB protocols for storing, identifying and using post-mortem data or samples.

5.3 Contributing to the evidence base that informs clinical practice

PMMRC has always been aware of its capacity to contribute to the gathering of evidence and development of guidelines that inform clinical practice. Indeed, this is one of the objectives that informed the establishment of the original templates for collecting data about perinatal deaths. Within this database, a number of variables have, therefore, aimed to gather information about the use of obstetric interventions. For a number of reasons, PMMRC has not

yet reported on these variables, often because the data is not well collected but also because denominator data and comparator groups may be difficult to obtain. PMMRC is generally supportive of Caucus discussions that have identified the need for:

- a general description of current numerator data
- a review of the literature to identify possible research questions
- ongoing refinement of the dataset to ensure the collection of key variables, the capacity for integration with other datasets, and consistency in reporting.

5.4 Ethnicity classification

The Caucus applauds the additional effort PMMRC has made to improve the reliability of data in this report. This has included aggregating data in reporting rates and special analyses as well as multivariate regression to identify the demographic variables associated with stillbirth. In consultation with Māori PMMRC members, this report has also taken an exploratory approach to ethnicity classification, thereby enabling the comparison of outcomes for prioritised and sole/combined groups. This is consistent with official recommendations and directions evident in other MRCs, particularly those of Child, Youth and Family and Statistics New Zealand, who have recently signalled a shift towards routine reporting of 'total response' ethnicity (Craig 2010; Statistics New Zealand 2004, 2005, 2006, 2009).

Whether classified by prioritised or sole/combined techniques, there is no doubt our Māori and Pacific whānau are carrying the burden of perinatal mortality, have the highest levels of deprivation and are most likely to experience the death of a baby when younger than 24 years. However, this report suggests that the risks associated with these variables are highest for sole Māori and sole Pacific ethnic groups. When compared with the findings for prioritised and other sole/combination groups, the māmā and babies of sole Māori/sole Pacific ethnicity clearly had higher rates of stillbirth and neonatal mortality, and the increased risk of stillbirth remained for babies of combined Māori/Pacific ethnicity. Furthermore, the higher deprivation and younger age groups of Māori and Pacific māmā may also be localised in sole Māori, sole Pacific and combined Māori/Pacific categories.

On the face of such findings, it seems prudent to suggest that the sole/combined method of ethnicity classification may be more effective than prioritisation as a technique for identifying disparities in perinatal mortality. Caucus discussions have focused on the wider implications of reporting sole/combined outputs for Māori and whether this would be more beneficial than prioritisation in mortality review.

The ethnicity data in PMMRC denominator and numerator datasets is collated in accordance with the most recent statistical standard for ethnicity (Cormack and Harris 2009; Statistics New Zealand 2005). To accommodate the collection of multiple ethnicities (up to six), this standard applies a hierarchical system of classification, in which a potential maximum pool of 239 codes can be aggregated up to progressively smaller categories that are more representative of New Zealand's main ethnic groups. The system contains four levels of classification with levels 1 (6 codes) and 2 (27 codes) being the most aggregated and more common levels of analysis in official reports. PMMRC obtains level-2 data (with up to three ethnicities per individual), aggregates to level 1, then follows the Ministry protocols for prioritisation (Ministry of Health 2004). This allocates each mother and baby independently to a single, mutually exclusive ethnic group with the following priority: Māori › Pacific › Asian › other groups › New Zealand European.

Prioritisation acknowledges the poorer than average health status of minority ethnic groups, particularly Māori and Pacific peoples, and ensures that the health needs of these numerically small groups are not submerged in the dominant majority (Department of Statistics 1993). This method has been used in official statistics for more than a decade and is particularly entrenched within the health sector. It provides reliable numerator and denominator data, discrete categories for comparison within the total population and a comprehensive database for time-series analysis. When viewed from a Treaty of Waitangi perspective, an ethnicity classification process that gives priority to the identification of tangata whenua is highly appropriate as a mechanism for informing the Crown's investment in targets and policies that are both responsive to the health needs of Māori and in line with Māori priorities (Minister of Health and Associate Minister of Health 2002).

[9]By definition, the process of prioritisation reallocates people in lower-order ethnic groups to a higher priority, thereby eliminating the opportunity to identify multiple ethnicities. Excepting Māori (who have highest priority), this can reduce the number of people in an ethnic group and is known to particularly undercount younger members of the Pacific population, who are more likely to claim dual ethnicity (due to high rates of inter-marriage). Amidst evidence of an increasing trend, it is feared that this method does not reflect the true ethnic make-up of New Zealand's population (as defined by the concept of self-identity) and biases data towards benefiting some groups over others (Public Health Intelligence 2008). The statistical standard has, therefore, recommended that the use of prioritisation be discontinued as a method for reporting official statistics (Statistics New Zealand 2005).

In recent Census data, the overall number of people affiliating with more than one ethnic group had increased from 9–10 percent, and the undercounts in non-Māori ethnic groups ranged from 1–30 percent (Public Health Intelligence 2008; Statistics New Zealand 2006). However, the tendency to affiliate with multiple ethnic groups, which is most common among Māori (around 50 percent), may be declining (Carter et al 2009) and can vary widely in response to the wording of Census questions (Cormack and Harris 2009).

Various scholars believe that the arguments against prioritisation are unfounded and do not acknowledge that the standard's system of hierarchical classification is continually aggregating up to broader categories, thereby re-defining original self-defined datasets and concealing the diversity, or true ethnic make-up, of New Zealand's population (Cormack and Harris 2009). For example, 'Pacific' and 'Asian' are both aggregated categories that often do not align with original self-identified input. Moreover, the 'Māori' category itself is an aggregated concept that masks more meaningful data that may have been collected about self-affiliation with iwi.

Sole-and-combined output is one of two methods recommended in the 2005 standard for reporting official statistics (Statistics New Zealand 2005). It also allocates individuals to a unique and mutually exclusive category, but this reflects the actual mix of self-affiliations. As in the PMMRC report, people may be classified under a single ethnic group (for example, Māori) or a combination of groups (for example, Māori/New Zealand European or Māori/Pacific/New Zealand European). This type of output is known to increase homogeneity (in terms of the sociocultural factors that determine self-affiliation), which is why it may be particularly powerful as a technique for identifying group differences, such as health disparities (Statistics New Zealand 2009).

PMMRC's findings add to a small body of evidence that suggests disparity and deprivation is higher among sole-Māori groups (Carter et al 2009; Didham 2005; Kukutai 2004; Robson and Reid 2001).

However, sole/combined output is more difficult to use because it produces a large number of categories that often contain very few people and are, therefore, problematic. The numerator and denominator data is also smaller, less stable and highly sensitive to ethnic mobility as well as contextual effects (Public Health Intelligence 2008). In this report, for example, Table 38 shows that the numerator groups used to calculate sole Māori/sole Pacific stillbirths and neonatal mortality rates comprised a mere 44 to 137 deaths, and the combined Māori and Pacific categories comprised as few as 4 to 6.

Table 37 Sole/combined categories in PMMRC report by actual numbers, 2007 and 2008

	Terminations of pregnancy	Stillbirths	Neonatal deaths	Total deaths
	n = 288	n = 747	n = 343	n = 1378
Ethnicity (mother)				
Māori only	16	137	90	243
Pacific only	16	105	45	165
Indian only	18	24	11	53
Other Asian only	28	29	15	72
NZ European only	161	304	138	607
Other only[17]	27	59	18	99
Māori and Pacific	0	6	4	10
Māori and NZ European	14	54	16	82
Pacific and NZ European	0	7	4	11
All other combinations	8	22	2	36
Ethnicity (baby)				
Māori only	14	111	88	212
Pacific only	16	102	45	158
Indian only	16	22	11	45
Other Asian only	24	15	10	44
NZ European only	152	270	130	560
Other only[16]	15	36	9	53
Māori and Pacific	2	19	7	28
Māori and NZ European	25	97	24	145
Pacific and NZ European	3	10	6	18
All other combinations	20	60	13	115

17 Includes not stated.

Although recent Census data on Māori and Pacific sole-ethnic groups has fluctuated between 8 and 50 percent, the variability in responses has been largely attributed to alterations in the wording of ethnicity questions (Cormack and Harris 2009). A longitudinal study has similarly found roughly 60 percent of Māori participants affiliated with the sole-Māori category, at one time or another, but this group was highly susceptible to mobility, frequently changing their ethnicity over time (Carter et al 2009). There is also evidence of an outflow from the sole-Māori group to the New Zealand European category (Statistics New Zealand 2009). In short, the sole-Māori ethnic group is highly unreliable and known to be influenced by a range of social, environmental, professional, political and economic factors, including subjective perceptions about the purpose of data collection, proximity to other Māori and engagement in Te Ao Māori (Carter et al 2009; Kukutai 2004).

In terms of aligning with Māori health aspirations, there is a groundswell of concern that the use of sole/combined classifications may serve to re-define the concept of Māori identify in official statistics. Already there is published evidence of a preference for measuring a 'core Māori' group rather than all people who choose to identify as Māori (Carter et al 2009; Kukutai 2004, 2008). Doubtless, this would have a substantial negative impact on the

identification of needs and size of target populations, and allocation of resources, which, in the long run, would further marginalise whānau, hapū and iwi. For Māori, it would seem the preferred method of reporting official ethnicity data is prioritisation. However, it is also important to collect ethnicity data that captures diversity and aligns with the wider social reality of multiple affiliations and mobility or change (Robson and Reid 2001; Te Ropu Rangahau Hauora a Eru Pomare 2000). When this type of analysis is needed, it is likely Māori would prefer the total response method of ethnicity classification.

Total response counts every ethnic group a person identifies with no matter how many have been reported. The outputs of total response and prioritised data are identical for Māori as both methods give Māori ethnicity equal weighting. In addition, every other ethnic group retains its full membership. Compared with prioritisation and sole/combined output, total response provides larger (and more stable) numerator and denominator data and is the second output recommended in New Zealand's current statistical standard (Statistics New Zealand 2005).

A disadvantage is that the categories used often contain large numbers of people with multiple affiliations, which means a single individual may appear in more than one group. This overlap can diminish or exaggerate apparent differences between two groups and undermine capacity to identify disparities or draw conclusions from statistical findings. In terms of resource allocation, total response output has been difficult to implement in public health policy because the sum of people in each category is greater than New Zealand's population count.

Within the context of perinatal mortality review, PMMRC's use of the total response output would have four notable benefits, it would:

- provide a reliable technique for comparison across populations
- be consistent with methods used in other MRCs, notably CYMRC
- align with Māori aspirations
- enable the wider social reality of multiple affiliations and ethnic mobility, or change, to be captured within mortality statistics.

Nō reira, kia piki te māramatanga ki runga i a tātou katoa

Mā te Atua tātou e tiaki, e manaaki i ngā wā katoa

6 Issues for Parents, Families and Whānau

Compiled by Dr Vicki Culling

This section is written with a focus on the support provided to families and whānau following a perinatal death but acknowledges the need for support for families and whānau who have experienced a maternal death.

This report presents the PMMRC's second full year of data collected on perinatal and maternal death in New Zealand. As we progress with data collection and analysis, we are building up a comprehensive picture of perinatal deaths from a clinical perspective. From this perspective, we have been able to make recommendations that will hopefully go some way towards starting to reduce our high number of deaths of babies, in utero and neonatally.

From a social perspective, the landscape for bereaved parents, families and whānau remains somewhat static. Since the PMMRC started reporting more comprehensively on perinatal deaths in New Zealand, support and information for the families who have experienced the deaths have not progressed to the same degree. However, there have been some incremental changes that we hope have had some positive impacts for families and whānau. These include: providing better education around perinatal death, DHBs acknowledging the importance of the support and information they provide to families and whānau around perinatal deaths, and the Ministry sponsoring the development of Sands New Zealand support information.

In recent years, most DHBs have undertaken perinatal death study days, during which all aspects of stillbirth and neonatal death are covered. The study days are attended by the array of health professionals that parents, families and whānau will encounter following a perinatal death, including, sonographers, geneticists, self-employed midwives, core hospital midwives, obstetricians, registrars and student midwives. Feedback from participants regarding the study days has been consistently positive. Interestingly, most parents and families assume that health professionals have covered all aspects of perinatal death in their core training, not realising that there is a real need for a specialised and ongoing focus that includes instruction on how to work alongside a bereaved family throughout the trauma and sadness of their loss. It is hoped that DHBs will continue to offer perinatal death study days regularly, as staff require updated information on this as much as any other topic.

Reflection by DHBs on the support and information they currently provide to bereaved parents, families and whānau has occurred as a result of the PMMRC's survey on pregnancy-loss services. The first survey was carried out in 2007, and brief results were published in that year's report. The second survey took place in 2009 (see Appendix D), the results of this survey indicate that DHBs are considering what they offer bereaved parents, families and whānau following a loss and how the organisation might better support these people. It still seems that no consistent across-the-pregnancy and infant-loss service exists around the country, and it is hoped that the PMMRC's work in this area will continue to remind both the DHBs and the Ministry of the need for sufficient and uniform services across all DHBs.

The final activity that has had some impact on families is the Ministry's provision of Sands Support Packs for the last two years (printed by the Ministry and distributed to all DHBs via local Sands groups and centrally through Sands New Zealand). The Sands Support Packs comprise six pamphlets that provide much needed information to parents at a critical and tragic time. Sands New Zealand continues to receive feedback from parents indicating that the pamphlets are very helpful. Indeed, some parents have spoken of re-reading the pamphlets a number of times and have reported that the pamphlets provided them with information they were not able to access as promptly through other sources. Currently, the Sands New Zealand Support Pack is only available in English, so this feedback has come mainly from parents and families for whom English is the first language.

Sands New Zealand is a voluntary organisation that survives on grants and donations, and the Ministry's support, in the form of printing the Sands Support Packs, has made a real difference in terms of the information available to parents and families. However, more information is needed in this area – for example, families and whānau need more information to inform their decisions regarding termination for fetal abnormality.

They also need more information about subsequent pregnancies following a loss. While small organisations are able to develop resources such as pamphlets that provide the necessary information, help is needed from the larger organisation, such as the Ministry, to make this information available nationwide. It is hoped that the Ministry will

continue to support the production of the Sands Support Packs and will consider producing more resources, and more resources in languages other than English.[18]

Support for parents, families and whānau following the death of baby is vital – whether it take the form of written information or someone to talk with. Many families are surprised to find there is no structured support available to them following a perinatal death. It is hoped that as we develop our capacity to gather robust data and to analyse that data in order to reduce the number of perinatal (and maternal) deaths, we keep in mind the need for resources, support and information that are equally robust and have just as much time and effort dedicated to them.

18 Further information regarding perinatal death (or information related to the loss of a baby/babies) is available from other New Zealand voluntary/non-profit organisations, such as Twin Loss NZ, Miscarriage Support Auckland Inc, Trauma and Birth Stress (TABS) and SIDS New Zealand Inc. Such organisations would also benefit from support to produce their resources. The Ministry focused on supporting the development of the Sands Support Packs because these packs concentrate on perinatal loss and associated areas. However, the Sands Support Packs are also useful for infant loss.

7 National Coordinator Report 2010

The PMMRC national coordination services include the following personnel:

Alison Cooper – Administration Support

Vicki Masson – National Coordinator

Dr Lynn Sadler – Perinatal Epidemiology Services

The national coordination services are provided to facilitate the PMMRC's collection of data. The service encompasses the following areas and requirements.

1. Coordinating perinatal and maternal mortality data collection

- Provide support to LMC, clinicians and local coordinators to complete the PMMRC data collection following a perinatal or maternal death.
- Ensure the data's integrity by following up on missing data and checking the accuracy of the data provided and the PSANZ classification of cause of death.
- Perform an audit of perinatal death information for accuracy, completeness and PSANZ classification.
- Support the MMRWG in its review of maternal deaths and in completing the Maternal Mortality Report.
- Note issues for improving data collection and thus assist with the development and enhancement of the PMMRC information systems.
- Work with the PMMRC, the University of Otago's Mortality Review Data Group and local coordinators to enhance the development of the PMMRC data forms and guidelines.

2. Coordinating perinatal and maternal morbidity data collection

- Support the Neonatal Encephalopathy and Australasian Maternity Outcomes Surveillance System (AMOSS) working groups with their reviews of perinatal and maternal morbidity data.
- Assist with developing data collection forms and databases, application for ethics approval and promotion of morbidity data collection in New Zealand through the PMMRC local coordinators' network.

3. Training and supporting the PMMRC DHB local coordinators

- Coordinate the annual PMMRC local coordinator workshop to train and support DHB local coordinators, with a focus on classification of the cause of death.
- Visit DHB and the PMMRC local coordinators and provide support and resources to local DHB mortality review meetings.

4. Supporting the PMMRC

- Before each PMMRC meeting, provide a report from the PMMRC database, noting issues relating to data quality, new clinical issues and any concerns that have been raised.
- Assist with planning, preparing and supporting explanations for the analysis of the data in this report.

5. Supporting families and whānau

- The national coordinator is available to answer queries from families and whānau regarding perinatal and maternal mortality and present information on the PMMRC findings and its role at conferences and workshops.

The PMMRC national coordinator services have working relationships with:

- the Ministry secretariat
- the University of Otago's Mortality Review Data Group and the CYMRC
- Coronial Services of New Zealand
- Perinatal and Reproductive Epidemiology Research Unit (PRERU), The University of New South Wales.

Appendix A: Classifications of the Perinatal Society of Australia and New Zealand

Perinatal death classification (PSANZ-PDC)

1 Congenital abnormality (including terminations for congenital abnormalities)
- 1.1 Central nervous system
- 1.2 Cardiovascular system
- 1.3 Urinary system
- 1.4 Gastrointestinal system
- 1.5 Chromosomal
- 1.6 Metabolic
- 1.7 Multiple/non chromosomal syndromes
- 1.8 Other congenital abnormality
  - 1.8.1 Musculoskeletal
  - 1.8.2 Respiratory
  - 1.8.3 Diaphragmatic hernia
  - 1.8.4 Haematological
  - 1.8.5 Tumours
  - 1.8.8 Other specified congenital abnormality
- 1.9 Unspecified congenital abnormality

2 Perinatal infection
- 2.1 Bacterial
  - 2.1.1 Group B Streptococcus
  - 2.1.2 E coli
  - 2.1.3 Listeria monocytogenes
  - 2.1.4 Spirochaetal, for example, Syphilis
  - 2.1.8 Other bacterial
  - 2.1.9 Unspecified bacterial
- 2.2 Viral
  - 2.2.1 Cytomegalovirus
  - 2.2.2 Parvovirus
  - 2.2.3 Herpes simplex virus
  - 2.2.4 Rubella virus
  - 2.2.8 Other viral
  - 2.2.9 Unspecified viral
- 2.3 Protozoal, for example, Toxoplasma
- 2.5 Fungal
- 2.8 Other specified organism
- 2.9 Other unspecified organism

3 Hypertension
- 3.1 Chronic hypertension: essential
- 3.2 Chronic hypertension: secondary, for example, renal disease
- 3.3 Chronic hypertension: unspecified
- 3.4 Gestational hypertension
- 3.5 Pre-eclampsia
  - 3.5.1 With laboratory evidence of thrombophilia
- 3.6 Pre-eclampsia superimposed on chronic hypertension
  - 3.6.1 With laboratory evidence of thrombophilia
- 3.9 Unspecified hypertension

4 Antepartum haemorrhage (APH)
- 4.1 Placental abruption
  - 4.1.1 With laboratory evidence of thrombophilia
- 4.2 Placenta praevia
- 4.3 Vasa praevia
- 4.8 Other APH
- 4.9 APH of undetermined origin

5 Maternal conditions

- 5.1 Termination of pregnancy for maternal psychosocial indications
- 5.2 Diabetes/Gestational diabetes
- 5.3 Maternal injury
  - 5.3.1 Accidental
  - 5.3.2 Non-accidental
- 5.4 Maternal sepsis
- 5.5 Lupus obstetric syndrome
- 5.6 Obstetric cholestasis
- 5.8 Other specified maternal conditions

6 Specific perinatal conditions

- 6.1 Twin-twin transfusion
- 6.2 Fetomaternal haemorrhage
- 6.3 Antepartum cord complications (for example, cord haemorrhage; true knot with evidence of occlusion)
- 6.4 Uterine abnormalities, for example, bicornuate uterus, cervical incompetence
- 6.5 Birth trauma (typically infants of ›24 weeks gestation or ›600 grams birthweight)
- 6.6 Alloimmune disease
  - 6.6.1 Rhesus
  - 6.6.2 ABO
  - 6.6.3 Kell
  - 6.6.4 Alloimmune thrombocytopenia
  - 6.6.8 Other
  - 6.6.9 Unspecified
- 6.7 Idiopathic hydrops
- 6.8 Other specific perinatal conditions (includes iatrogenic conditions such as rupture of membranes after amniocentesis, termination of pregnancy for suspected but unconfirmed congenital abnormality).

7 Hypoxic peripartum death (typically infants of ›24 weeks gestation or ›600 grams birthweight)

- 7.1 With intra-partum complications
  - 7.1.1 Uterine rupture
  - 7.1.2 Cord prolapse
  - 7.1.3 Shoulder dystocia
  - 7.1.8 Other
- 7.2 Evidence of non-reassuring fetal status in a normally grown infant (for example, abnormal fetal heart rate, fetal scalp pH/lactate, fetal pulse oximetry without intra-partum complications)
- 7.3 No intra-partum complications and no evidence of non-reassuring fetal status
- 7.9 Unspecified hypoxic peripartum death

8 Fetal Growth Restriction (FGR)

- 8.1 With evidence of reduced vascular perfusion on Doppler studies and/or placental histopathology (for example, significant infarction, acute atherosis, maternal and/or fetal vascular thrombosis or maternal floor infarction)
- 8.2 With chronic villitis
- 8.3 No placental pathology
- 8.4 No examination of placenta
- 8.8 Other specified placental pathology
- 8.9 Unspecified or not known whether placenta examined

9 Spontaneous preterm (‹37 weeks gestation)

- 9.1 Spontaneous preterm with intact membranes, or membrane rupture ‹24 hours before delivery
  - 9.1.1 With chorioamnionitis on placental histopathology
  - 9.1.2 Without chorioamnionitis on placental histopathology
  - 9.1.3 With clinical evidence of chorioamnionitis, no examination of placenta
  - 9.1.7 No clinical signs of chorioamnionitis, no examination of placenta
  - 9.1.9 Unspecified or not known whether placenta examined
- 9.2 Spontaneous preterm with membrane rupture ≥24 hours before delivery
  - 9.2.1 With chorioamnionitis on placental histopathology
  - 9.2.2 Without chorioamnionitis on placental histopathology
  - 9.2.3 With clinical evidence of chorioamnionitis, no examination of placenta
  - 9.2.7 No clinical signs of chorioamnionitis, no examination of placenta
  - 9.2.9 Unspecified or not known whether placenta examined
- 9.3 Spontaneous preterm with membrane rupture of unknown duration before delivery
  - 9.3.1 With chorioamnionitis on placental histopathology
  - 9.3.2 Without chorioamnionitis on placental histopathology
  - 9.3.3 With clinical evidence of chorioamnionitis, no examination of placenta
  - 9.3.7 No clinical signs of chorioamnionitis, no examination of placenta
  - 9.3.9 Unspecified or not known whether placenta examined

10 Unexplained antepartum death

- 10.1 With evidence of reduced vascular perfusion on Doppler studies and/or placental histopathology (for example, significant infarction, acute atherosis, maternal and/or fetal vascular thrombosis or maternal floor infarction)
- 10.2 With chronic villitis
- 10.3 No placental pathology
- 10.7 No examination of placenta
- 10.8 Other specified placental pathology
- 10.9 Unspecified or not known whether placenta examined

11 No obstetric antecedent

- 11.1 Sudden Infant Death Syndrome (SIDS)
  - 11.1.1 SIDS Category IA: Classic features of SIDS present and completely documented
  - 11.1.2 SIDS Category IB: Classic features of SIDS present but incompletely documented
  - 11.1.3 SIDS Category II: Infant deaths that meet Category I except for one or more features
- 11.2 Postnatally acquired infection
- 11.3 Accidental asphyxiation
- 11.4 Other accident, poisoning or violence (postnatal)
- 11.8 Other specified
- 11.9 Unknown/Undetermined
  - 11.9.1 Unclassified Sudden Infant Death
  - 11.9.2 Other Unknown/Undetermined

Neonatal Death Classification (PSANZ-NDC)

Neonatal death classification (PSANZ-NDC)

1 Congenital abnormality (including terminations for congenital abnormalities)

- 1.1 Central nervous system
- 1.2 Cardiovascular system
- 1.3 Urinary system
- 1.4 Gastrointestinal system
- 1.5 Chromosomal
- 1.6 Metabolic
- 1.7 Multiple/Non-chromosomal syndromes
- 1.8 Other congenital abnormality
  - 1.8.1 Musculoskeletal
  - 1.8.2 Respiratory
  - 1.8.3 Diaphragmatic hernia
  - 1.8.4 Haematological
  - 1.8.5 Tumours
  - 1.8.8 Other specified congenital abnormality
- 1.9 Unspecified congenital abnormality

2 Extreme prematurity (typically infants of M24 weeks gestation or M600 g birthweight)

- 2.1 Not resuscitated
- 2.2 Unsuccessful resuscitation
- 2.9 Unspecified or not known whether resuscitation attempted

3 Cardio-respiratory disorders

- 3.1 Hyaline membrane disease/Respiratory distress syndrome (RDS)
- 3.2 Meconium aspiration syndrome
- 3.3 Primary persistent pulmonary hypertension
- 3.4 Pulmonary hypoplasia
- 3.5 Chronic neonatal lung disease (typically, bronchopulmonary dysplasia)
- 3.8 Other

4 Infection

- 4.1 Bacterial
  - 4.1.1 Congenital bacterial
  - 4.1.2 Acquired bacterial
- 4.2 Viral
  - 4.2.1 Congenital viral
  - 4.2.2 Acquired viral
- 4.3 Protozoal, for example Toxoplasma
- 4.4 Spirochaetal, for example Syphilis
- 4.5 Fungal
- 4.8 Other
- 4.9 Unspecified organism

5 **Neurological**
- 5.1 Hypoxic ischaemic encephalopathy/Perinatal asphyxia (typically infants of >24 weeks gestation or >600 g birthweight)
- 5.2 Intracranial haemorrhage
- 5.8 Other

6 **Gastrointestinal**
- 6.1 Necrotising enterocolitis
- 6.8 Other

7 **Other**
- 7.1 Sudden Infant Death Syndrome (SIDS)
  - 7.1.1 SIDS Category IA: Classic features of SIDS present and completely documented
  - 7.1.2 SIDS Category IB: Classic features of SIDS present but incompletely documented
  - 7.1.3 SIDS Category II: Infant deaths that meet Category I except for one or more features
- 7.2 Multisystem failure – only if unknown primary cause or trigger event
- 7.3 Trauma
- 7.8 Other specified
- 7.9 Unknown/Undetermined
  - 7.9.1 Unclassified SIDS
  - 7.9.2 Other Unknown/Undetermined

Appendix B: Data Tables

Table B1 Distribution of births by deprivation deciles (Dep 2006), 2008

NZ Deprivation Index (NZDep 2006)	Total births	
	n = 65,872	
	n	%
1	4,476	6.8
2	5,222	7.9
3	5,143	7.8
4	5,421	8.2
5	6,373	9.7
6	5,905	9.0
7	6,803	10.3
8	8,099	12.3
9	8,469	12.9
10	9,664	14.7
Unknown	297	0.5

Table B2 Perinatal related mortality by prioritised maternal/baby ethnicity, 2007 and 2008 combined

Ethnicity (mother)	Births		Fetal deaths						Neonatal deaths			Total perinatal related deaths		
			Terminations of pregnancy			Stillbirths								
	n = 131,475		n = 288			n = 747			n = 343			n = 1,378		
	n	%	n	%	Rate	n	%	Rate	n	%	Rate	n	%	Rate
Māori	30,914	23.3	31	10.8	1.0	205	27.4	6.6	111	32.4	3.6	347	25.2	11.2
Pacific peoples	13,761	10.4	17	5.9	1.2	116	15.5	8.4	50	14.6	3.7	183	13.3	13.3
Indian	4,387	3.3	19	6.6	4.3	25	3.3	5.7	11	3.2	2.5	55	4.0	12.5
Other Asian	8,665	6.5	28	9.7	3.2	30	4.0	3.5	15	4.4	1.7	73	5.3	8.4
Other/Not stated	11,531	8.7	32	11.1	2.8	67	9.0	5.8	18	5.2	1.6	117	8.5	10.1
NZ European	62,217	46.8	161	55.9	2.6	304	40.7	4.9	138	40.2	2.2	603	43.8	9.7
Ethnicity (baby)														
Māori	39,078	29.4	44	15.3	1.1	251	33.6	6.4	125	36.4	3.2	420	30.5	10.7
Pacific Peoples	14,356	10.8	20	6.9	1.4	118	15.8	8.2	51	14.9	3.6	189	13.7	13.2
Indian	4,573	3.4	18	6.3	3.9	25	3.3	5.5	14	4.1	3.1	57	4.1	12.5
Other Asian	8,491	6.4	28	9.7	3.3	29	3.9	3.4	13	3.8	1.5	70	5.1	8.2
Other/Not stated	7,892	5.9	26	9.0	3.3	54	7.2	6.8	10	2.9	1.3	90	6.5	11.4
NZ European	57,085	43.0	152	52.8	2.7	270	36.1	4.7	130	37.9	2.3	552	40.1	9.7

Table B3 Perinatal related mortality by sole/combination maternal/baby ethnicity, 2007 and 2008 combined

	Births		Fetal deaths						Neonatal deaths			Total perinatal related deaths		
			Terminations of pregnancy			Stillbirths								
	n = 131,475		n = 288			n = 747			n = 343			n = 1,378		
	n	%	n	%	Rate	n	%	Rate	n	%	Rate	n	%	Rate
Ethnicity (mother)														
NZE only	62,145	47.3	161	55.9	2.6	304	40.7	4.9	138	40.2	2.2	603	43.8	9.7
Māori only	16,484	12.5	16	5.6	1.0	137	18.3	8.3	90	26.2	5.5	243	17.6	14.7
Pacific only	11,755	8.9	16	5.6	1.4	105	14.1	8.9	45	13.1	3.9	166	12.0	14.1
Indian only	4,236	3.2	18	6.3	4.2	24	3.2	5.7	11	3.2	2.6	53	3.8	12.5
Other Asian only	8,331	6.3	28	9.7	3.4	29	3.9	3.5	15	4.4	1.8	72	5.2	8.6
Other only[19]	10,318	7.8	27	9.4	2.6	59	7.9	5.7	18	5.2	1.8	104	7.5	10.1
Māori and Pacific	1,150	0.9	0	0.0	0.0	6	0.8	5.2	4	1.2	3.5	10	0.7	8.7
Māori and NZE	11,427	8.7	14	4.9	1.2	54	7.2	4.7	16	4.7	1.4	84	6.1	7.4
Pacific and NZE	1,405	1.1	0	0.0	0.0	7	0.9	5.0	4	1.2	2.9	11	0.8	7.8
All other combinations	4,224	3.2	8	2.8	1.9	22	2.9	5.2	2	0.6	0.5	32	2.3	7.6
Ethnicity (baby)														
NZE only	56,987	43.3	152	52.8	2.7	270	36.1	4.7	130	37.9	2.3	552	40.1	9.7
Māori only	13,796	10.5	14	4.9	1.0	111	14.9	8.0	88	25.7	6.4	213	15.5	15.4
Pacific only	10,560	8.0	16	5.6	1.5	102	13.7	9.7	45	13.1	4.3	163	11.8	15.4
Indian only	4,021	3.1	16	5.6	4.0	22	2.9	5.5	11	3.2	2.8	49	3.6	12.2
Other Asian only	6,315	4.8	24	8.3	3.8	19	2.5	3.0	10	2.9	1.6	53	3.8	8.4
Other only[18]	4,140	3.1	16	5.6	3.9	37	5.0	8.9	9	2.6	2.2	62	4.5	15.0
Māori and Pacific	2,984	2.3	2	0.7	0.7	19	2.5	6.4	7	2.0	2.4	28	2.0	9.4
Māori and NZE	16,308	12.4	25	8.7	1.5	97	13.0	5.9	24	7.0	1.5	146	10.6	9.0
Pacific and NZE	2,637	2.0	3	1.0	1.1	10	1.3	3.8	6	1.7	2.3	19	1.4	7.2
All other combinations	13,727	10.4	20	6.9	1.5	60	8.0	4.4	13	3.8	1.0	93	6.7	6.8

19 includes not stated

Table B4 PDC-specific perinatal related mortality rate (excluding termination of pregnancy) by maternal ethnicity (prioritised Māori, Pacific peoples, and NZ European) among births registered in 2007 and 2008 combined

	Prioritised Māori			Prioritised Pacific peoples			Prioritised NZ European		
	n = 30,914			n = 13,761			n = 62,217		
Perinatal death classification (PDC)	n	%	Rate	n	%	Rate	n	%	Rate
Congenital abnormality	35	11.1	1.1	26	15.8	1.9	61	13.7	1.0
Perinatal infection	15	4.7	0.5	5	3.0	0.4	19	4.3	0.3
Hypertension	5	1.6	0.2	9	5.5	0.7	17	3.8	0.3
Antepartum haemorrhage	36	11.4	1.2	20	12.1	1.5	50	11.2	0.8
Maternal conditions	15	4.7	0.5	7	4.2	0.5	10	2.2	0.2
Specific perinatal condition	27	8.5	0.9	16	9.7	1.2	51	11.4	0.8
Hypoxic peripartum	18	5.7	0.6	9	5.5	0.7	30	6.7	0.5
Fetal growth restriction	20	6.3	0.6	7	4.2	0.5	51	11.4	0.8
Spontaneous preterm	68	21.5	2.2	32	19.4	2.3	62	13.9	1.0
Unexplained antepartum	60	19.0	1.9	33	20.0	2.4	86	19.3	1.4
No obstetric antecedent	17	5.4	0.5	2	1.2	0.1	5	1.1	0.1

Table B5 PDC-specific perinatal related mortality rate (excluding Termination of pregnancy) by maternal ethnicity (sole Māori, sole Pacific peoples, sole NZ European) among births registered in 2007 & 2008 combined

	Sole Māori			Sole Pacific peoples			Sole NZ European		
	n = 16,484			n = 11,755			n = 62,145		
Perinatal death classification (PDC)	n	%	Rate	n	%	Rate	n	%	Rate
Congenital abnormality	22	9.7	1.3	25	16.8	2.1	62	13.9	1.0
Perinatal infection	9	4.0	0.5	5	3.4	0.4	19	4.3	0.3
Hypertension	4	1.8	0.2	9	6.0	0.8	17	3.8	0.3
Antepartum haemorrhage	24	10.6	1.5	18	12.1	1.5	50	11.2	0.8
Maternal conditions	10	4.4	0.6	6	4.0	0.5	10	2.2	0.2
Specific perinatal condition	19	8.4	1.2	12	8.1	1.0	51	11.5	0.8
Hypoxic peripartum	15	6.6	0.9	8	5.4	0.7	30	6.7	0.5
Fetal growth restriction	16	7.0	1.0	7	4.7	0.6	51	11.5	0.8
Spontaneous preterm	51	22.5	3.1	28	18.8	2.4	62	13.9	1.0
Unexplained antepartum	40	17.6	2.4	29	19.5	2.5	88	19.8	1.4
No obstetric antecedent	17	7.5	1.0	2	1.3	0.2	5	1.1	0.1

Table B6 Termination, stillbirth, neonatal and perinatal related mortality by deprivation index (NZDep2006) quintile, 2007 and 2008 combined

	Total births		Fetal deaths				Neonatal deaths		Perinatal related mortality		
			Termination of pregnancy		Stillbirths						
	n = 131,475		n = 288		n = 747		n = 343		n = 1378		
Deprivation quintile	n	%	n	rate	n	rate	n	rate	n	%	**rate**
1	19,626	14.9	57	2.90	91	4.64	38	1.95	186	13.5	9.48
2	21,165	16.1	64	3.02	97	4.58	41	1.95	202	14.7	9.54
3	24,362	18.5	62	2.54	120	4.93	54	2.23	236	17.1	9.69
4	29,955	22.8	65	2.17	162	5.41	79	2.66	306	22.2	10.22
5	35,662	27.1	39	1.09	266	7.46	125	3.54	430	31.2	12.06
Unknown	705	0.5	1		11		6		18	1.3	

Table B7 PDC-specific perinatal related mortality (excluding termination of pregnancy) rate by deprivation index (NZDep 2006) quintile, 2007 and 2008 combined[20]

	Quintile 1			Quintile 2			Quintile 3			Quintile 4			Quintile 5		
	n = 19,626			n = 21,165			n = 24,362			n = 29,955			n = 35,662		
Perinatal death classification (PDC)	n	%	rate	n	%	rate	n	%	rate	n	%	rate	n	%	rate
Congenital abnormality	29	22.5	1.5	12	8.7	0.6	18	10.3	0.7	36	14.9	1.2	45	11.5	1.3
Perinatal infection	6	4.7	0.3	10	7.2	0.5	9	5.2	0.4	11	4.6	0.4	16	4.1	0.4
Hypertension	2	1.6	0.1	4	2.9	0.2	5	2.9	0.2	7	2.9	0.2	14	3.6	0.4
Antepartum haemorrhage	12	9.3	0.6	15	10.9	0.7	18	10.3	0.7	26	10.8	0.9	48	12.3	1.3
Maternal conditions	4	3.1	0.2	3	2.2	0.1	3	1.7	0.1	9	3.7	0.3	19	4.9	0.5
Specific perinatal condition	10	7.8	0.5	21	15.2	1.0	32	18.4	1.3	25	10.4	0.8	34	8.7	1.0
Hypoxic peripartum	5	3.9	0.3	12	8.7	0.6	8	4.6	0.3	14	5.8	0.5	25	6.4	0.7
Fetal growth restriction	13	10.1	0.7	15	10.9	0.7	17	9.8	0.7	23	9.5	0.8	31	7.9	0.9
Spontaneous preterm	18	14.0	0.9	20	14.5	0.9	27	15.5	1.1	40	16.6	1.3	75	19.2	2.1
Unexplained antepartum	29	22.5	1.5	24	17.4	1.1	34	19.5	1.4	45	18.7	1.5	70	17.9	2.0
No obstetric antecedent	1	0.8	0.1	2	1.4	0.1	3	1.7	0.1	5	2.1	0.2	14	3.6	0.4

20 unknown deprivation quintile (n= 705)

Table B8 Perinatal related mortality by DHB of maternal domicile, 2008

Maternal domicile	Total births		Fetal deaths						Neonatal deaths			Total perinatal related deaths		
			Termination of pregnancy			Stillbirths								
	n = 65,872		n = 145			n = 379			n = 176			n = 700		
	n	%	n	%	rate	n	%	rate	n	%	rate	n	%	rate
Northland	2,388	3.6	3	2.1	1.26	15	4.0	6.28	9	5.1	3.80	27	3.9	11.31
Waitemata	8,013	12.2	23	15.9	2.87	49	12.9	6.12	12	6.8	1.51	84	12.0	10.48
Auckland	6,639	10.1	24	16.6	3.62	26	6.9	3.92	15	8.5	2.28	65	9.3	9.79
Counties Manukau	9,145	13.9	14	9.7	1.53	71	18.7	7.76	30	17.0	3.31	115	16.4	12.58
Waikato	5,880	8.9	20	13.8	3.40	29	7.7	4.93	17	9.7	2.92	66	9.4	11.22
Bay of Plenty	3,074	4.7	3	2.1	0.98	18	4.7	5.86	18	10.2	5.90	39	5.6	12.69
Lakes	1,750	2.7	1	0.7	0.57	21	5.5	12.00	7	4.0	4.05	29	4.1	16.57
Tairawhiti	870	1.3	1	0.7	1.15	8	2.1	9.20	1	0.6	1.16	10	1.4	11.49
Taranaki	1,634	2.5	3	2.1	1.84	9	2.4	5.51	6	3.4	3.70	18	2.6	11.02
Hawke's Bay	2,419	3.7	4	2.8	1.65	8	2.1	3.31	5	2.8	2.08	17	2.4	7.03
Whanganui	959	1.5	2	1.4	2.09	9	2.4	9.38	3	1.7	3.16	14	2.0	14.60
MidCentral	2,477	3.8	6	4.1	2.42	18	4.7	7.27	9	5.1	3.67	33	4.7	13.32
Wairarapa	535	0.8	1	0.7	1.87	1	0.3	1.87				2	0.3	3.74
Capital & Coast	4,167	6.3	9	6.2	2.16	18	4.7	4.32	5	2.8	1.21	32	4.6	7.68
Hutt Valley	2,270	3.4	6	4.1	2.64	15	4.0	6.61	6	3.4	2.67	27	3.9	11.89
Nelson Marlborough	1,770	2.7	3	2.1	1.69	6	1.6	3.39	1	0.6	0.57	10	1.4	5.65
West Coast	454	0.7				2	0.5	4.41	2	1.1	4.42	4	0.6	8.81
Canterbury	6,709	10.2	14	9.7	2.09	30	7.9	4.47	21	11.9	3.15	65	9.3	9.69
South Canterbury	648	1.0				4	1.1	6.17	3	1.7	4.66	7	1.0	10.80
Otago	2,137	3.2	4	2.8	1.87	12	3.2	5.62	2	1.1	0.94	18	2.6	8.42
Southland	1,639	2.5	4	2.8	2.44	9	2.4	5.49	2	1.1	1.23	15	2.1	9.15
Overseas	295	0.4				1	0.3	3.39	2	1.1	6.80	3	0.4	10.17

Table B9 Perinatal related mortality by DHB of maternal domicile, 2007 and 2008 combined

Maternal domicile	Total births		Fetal deaths						Neonatal deaths			Total perinatal related deaths		
			Termination of pregnancy			Stillbirths								
	n = 131,067		n = 288			n = 747			n = 343			n = 1,378		
	n	%	n	%	rate	n	%	rate	n	%	rate	n	%	rate
Northland	4,776	3.6	7	2.4	1.47	37	5.0	7.75	18	5.2	3.80	62	4.5	12.98
Waitemata	15,919	12.1	58	20.1	3.64	98	13.1	6.16	15	4.4	0.95	171	12.4	10.74
Auckland	13,423	10.2	42	14.6	3.13	58	7.8	4.32	32	9.3	2.40	132	9.6	9.83
Counties Manukau	18,223	13.9	32	11.1	1.76	134	17.9	7.35	71	20.7	3.93	237	17.2	13.01
Waikato	11,552	8.8	28	9.7	2.42	53	7.1	4.59	35	10.2	3.05	116	8.4	10.04
Bay of Plenty	6,144	4.7	9	3.1	1.46	33	4.4	5.37	25	7.3	4.10	67	4.9	10.90
Lakes	3,451	2.6	3	1.0	0.87	29	3.9	8.40	14	4.1	4.09	46	3.3	13.33
Tairawhiti	1,709	1.3	1	0.3	0.59	11	1.5	6.44	3	0.9	1.77	15	1.1	8.78
Taranaki	3,267	2.5	3	1.0	0.92	15	2.0	4.59	9	2.6	2.77	27	2.0	8.26
Hawke's Bay	4,826	3.7	7	2.4	1.45	20	2.7	4.14	10	2.9	2.08	37	2.7	7.67
Whanganui	1,872	1.4	5	1.7	2.67	15	2.0	8.01	6	1.7	3.24	26	1.9	13.89
MidCentral	4,847	3.7	12	4.2	2.48	33	4.4	6.81	14	4.1	2.92	59	4.3	12.17
Wairarapa	1,079	0.8	4	1.4	3.71	4	0.5	3.71				8	0.6	7.41
Capital & Coast	8,259	6.3	19	6.6	2.30	41	5.5	4.96	9	2.6	1.10	69	5.0	8.35
Hutt Valley	4,553	3.5	10	3.5	2.20	29	3.9	6.37	16	4.7	3.54	55	4.0	12.08
Nelson Marlborough	3,496	2.7	6	2.1	1.72	17	2.3	4.86	11	3.2	3.17	34	2.5	9.73
West Coast	865	0.7				6	0.8	6.94	6	1.7	6.98	12	0.9	13.87
Canterbury	13,640	10.4	28	9.7	2.05	59	7.9	4.33	34	9.9	2.51	121	8.8	8.87
South Canterbury	1,327	1.0	1	0.3	0.75	8	1.1	6.03	3	0.9	2.28	12	0.9	9.04
Otago	4,264	3.3	7	2.4	1.64	23	3.1	5.39	7	2.0	1.65	37	2.7	8.68
Southland	3,280	2.5	6	2.1	1.83	23	3.1	7.01	3	0.9	0.92	32	2.3	9.76
Overseas	295	0.2				1	0.1	3.39	2	0.6	6.80	3	0.2	10.17

Table B10 Perinatal related mortality by maternal age, 2007 and 2008 combined

Maternal age	Total births		Fetal deaths						Neonatal deaths			Total perinatal related deaths		
			Terminations of pregnancy			Stillbirths								
	n =131,474		n = 288			n = 747			n = 343			n = 1,378		
	n	%	n	%	Rate	n	%	Rate	n	%	Rate	n	%	Rate
< 20	10,457	8.0	18	6.3	1.72	81	10.8	7.75	46	13.4	4.44	145	10.5	13.87
20–24	23,405	17.8	45	15.6	1.92	149	19.9	6.37	75	21.9	3.23	269	19.5	11.49
25–29	31,954	24.3	68	23.6	2.13	164	22.0	5.13	83	24.2	2.62	315	22.9	9.86
30–34	36,990	28.1	80	27.8	2.16	181	24.2	4.89	73	21.3	1.99	334	24.2	9.03
35–39	23,781	18.1	60	20.8	2.52	132	17.7	5.55	56	16.3	2.37	248	18.0	10.43
≥ 40	4,887	3.7	17	5.9	3.48	40	5.4	8.18	9	2.6	1.86	66	4.8	13.51
Unknown	0	0.0							1	0.3		1	0.1	

Table B11 Perinatal related deaths by primary and associated obstetric antecedent cause of death (PDC), 2008

Perinatal death classification (PDC)	Primary perinatal classification		Associated PDC classification 1		Associated PDC classification 2		Assigned PDC classifications	
	n = 700		n = 700		n = 700		n = 700	
	n	%	n	%	n	%	n	%
Congenital abnormality	184	26.3	5	0.7			189	27.0
Perinatal infection	27	3.9	8	1.1	1	0.1	36	5.1
Hypertension	22	3.1	4	0.6			26	3.7
Antepartum haemorrhage	66	9.4	20	2.9	1	0.1	87	12.4
Maternal conditions	23	3.3	10	1.4	2	0.3	35	5.0
Specific perinatal condition	69	9.9	9	1.3	1	0.1	79	11.3
Hypoxic peripartum	34	4.9	5	0.7	1	0.1	40	5.7
Fetal growth restriction	62	8.9	25	3.6	1	0.1	88	12.6
Spontaneous preterm	96	13.7	32	4.6	1	0.1	129	18.4
Unexplained antepartum	103	14.7					103	14.7
No obstetric antecedent	14	2.0					14	2.0

Table B12 Neonatal deaths by primary and associated neonatal death classification (NDC), 2008

	Primary neonatal death classification		Associated NDC classification 1		Associated NDC classification 2		Assigned NDC classifications	
	n = 176		n = 176		n = 176		n = 176	
Primary Neonatal classification (NDC)	n	%	n	%	n	%	n	%
Congenital abnormality	43	24.4					43	24.4
Extreme prematurity	51	29.0					51	29.0
Cardio-respiratory disorders	11	6.3	10	5.7	1	0.6	22	12.5
Infection	21	11.9	7	4.0			28	15.9
Neurological	33	18.8	9	5.1			42	23.9
Gastrointestinal			1	0.6			1	0.6
Other	17	9.7	3	1.7			20	11.4

Table B13 Optimal investigation of perinatal related death by DHB of maternal residence, 2008

	Perinatal related deaths	Optimal investigation	
	n = 700		
DHB of maternal residence	n	n	%
Northland	27	8	29.6
Waitemata	84	46	54.8
Auckland	65	40	61.5
Counties Manukau	115	56	48.7
Waikato	66	26	39.4
Bay of Plenty	39	10	25.6
Lakes	29	4	13.8
Tairawhiti	10	2	20.0
Taranaki	18	1	5.6
Hawke's Bay	17	10	58.8
Whanganui	14	3	21.4
MidCentral	33	15	45.5
Wairarapa	2	2	100.0
Capital & Coast	32	25	78.1
Hutt Valley	27	24	88.9
Nelson Marlborough	10	6	60.0
West Coast	4	1	25.0
Canterbury	65	44	67.7
South Canterbury	7	5	71.4
Otago	18	12	66.7
Southland	15	4	26.7
Overseas	3	1	33.3

Table B14 Complete primary perinatal death classification (PDC) by type of perinatal related death, 2008

		Fetal deaths							
		Termination of pregnancy		Stillbirths		Neonatal deaths		Total	
		n = 145		n = 379		n = 176		n = 700	
Perinatal death classification (PDC)		n	%	n	%	n	%	n	%
	Congenital abnormality								
1.1	Central nervous system	38	26.2	2	0.5	2	1.1	42	6.0
1.2	Cardiovascular system	15	10.3	4	1.1	12	6.8	31	4.4
1.3	Urinary system	6	4.1	2	0.5	7	4.0	15	2.1
1.4	Gastrointestinal system	1	0.7	1	0.3	1	0.6	3	0.4
1.5	Chromosomal	31	21.4	10	2.6	7	4.0	48	6.9
1.6	Metabolic					1	0.6	1	0.1
1.7	Multiple/non chromosomal syndromes	12	8.3	2	0.5	6	3.4	20	2.9
1.8.1	Musculoskeletal	4	2.8					4	0.6
1.8.2	Respiratory					1	0.6	1	0.1
1.8.3	Diaphragmatic hernia			1	0.3	4	2.3	5	0.7
1.8.5	Tumours	3	2.1			2	1.1	5	0.7
1.8.8	Other specified congenital abnormality	2	1.4	1	0.3			3	0.4
1.9	Unspecified congenital abnormality	1	0.7	5	1.3			6	0.9
	Perinatal infection								
2.1.1	Group B Streptococcus			2	0.5	1	0.6	3	0.4
2.1.2	E coli			1	0.3	2	1.1	3	0.4
2.1.3	Listeria monocytogenes			1	0.3	1	0.6	2	0.3
2.1.8	Other bacterial			2	0.5	5	2.8	7	1.0
2.1.9	Unspecified bacterial			3	0.8			3	0.4
2.2.1	Cytomegalovirus	3	2.1	2	0.5	1	0.6	6	0.9
2.2.2	Parvovirus			1	0.3			1	0.1
2.2.3	Herpes simplex virus			1	0.3			1	0.1
2.2.9	Unspecified viral			1	0.3			1	0.1
	Hypertension								
3.1	Chronic hypertension: essential			2	0.5			2	0.3
3.2	Chronic hypertension: secondary, eg, renal disease			2	0.5	1	0.6	3	0.4
3.3	Chronic hypertension: unspecified			2	0.5			2	0.3
3.4	Gestational hypertension			1	0.3			1	0.1
3.5	Pre-eclampsia	4	2.8	3	0.8	3	1.7	10	1.4
3.6	Pre-eclampsia superimposed on chronic hypertension	1	0.7	1	0.3			2	0.3
3.6.1	Pre-eclampsia superimposed on chronic hypertension: with laboratory evidence of thrombophilia					1	0.6	1	0.1
3.9	Unspecified hypertension			1	0.3			1	0.1
	Antepartum haemorrhage (APH)								
4.1	Placental abruption	2	1.4	30	7.9	8	4.5	40	5.7
4.1.1	Placental abruption: with laboratory evidence of thrombophilia			5	1.3			5	0.7
4.8	Other APH			5	1.3	2	1.1	7	1.0
4.9	APH of undetermined origin	2	1.4	9	2.4	3	1.7	14	2.0

		Fetal deaths							
		Termination of pregnancy		Stillbirths		Neonatal deaths		Total	
		n = 145		n = 379		n = 176		n = 700	
Perinatal death classification (PDC)		n	%	n	%	n	%	n	%
	Maternal conditions								
5.1	Termination of pregnancy for maternal psychosocial indications	5	3.4					5	0.7
5.2	Diabetes/gestational diabetes			7	1.8			7	1.0
5.3.2	Maternal injury: non-accidental			3	0.8			3	0.4
5.5	Antiphospholipid syndrome	1	0.7	1	0.3			2	0.3
5.5.1	Other maternal thromophilia (if considered cause of death)			1	0.3			1	0.1
5.8	Other specified maternal conditions			1	0.3	4	2.3	5	0.7
	Specific perinatal conditions								
6.1	Twin-twin transfusion			12	3.2	3	1.7	15	2.1
6.2	Fetomaternal haemorrhage			3	0.8	1	0.6	4	0.6
6.3	Antepartum cord complications (eg, cord haemorrhage; true knot with evidence of occlusion)			12	3.2			12	1.7
6.3.1	Cord haemorrhage			1	0.3	1	0.6	2	0.3
6.3.2	True knot with evidence of occlusion			1	0.3			1	0.1
6.3.8	Other			1	0.3			1	0.1
6.4	Uterine abnormalities, eg, bicornuate uterus, cervical incompetence			8	2.1	7	4.0	15	2.1
6.7	Idiopathic hydrops			4	1.1	3	1.7	7	1.0
6.8	Other specific perinatal conditions (includes iatrogenic conditions such as rupture of membranes after amniocentesis, termination of pregnancy for suspected but unconfirmed congenital abnormality)			6	1.6	1	0.6	7	1.0
6.8.1	Rupture of membranes after amniocentesis			2	0.5			2	0.3
6.8.8	Other			2	0.5	1	0.6	3	0.4
	Hypoxic peripartum death								
7.1.1	With intrapartum complications: uterine rupture			1	0.3			1	0.1
7.1.2	With intrapartum complications: cord prolapse					1	0.6	1	0.1
7.1.3	With intrapartum complications: shoulder dystocia					1	0.6	1	0.1
7.1.8	With intrapartum complications: other			1	0.3	3	1.7	4	0.6
7.2	Evidence of non-reassuring fetal status in a normally grown infant. (eg, abnormal fetal heart rate, fetal scalp ph/lactate, fetal pulse oximetry without intrapartum complications)			3	0.8	8	4.5	11	1.6
7.3	No intrapartum complications and no evidence of non-reassuring fetal status			1	0.3	1	0.6	2	0.3
7.9	Unspecified hypoxic peripartum death			9	2.4	5	2.8	14	2.0

		Fetal deaths							
		Termination of pregnancy		Stillbirths		Neonatal deaths		Total	
		n = 145		n = 379		n = 176		n = 700	
Perinatal death classification (PDC)		n	%	n	%	n	%	n	%
	Fetal growth restriction (FGR)								
8.1	With evidence of reduced vascular perfusion on Doppler studies and/or placental histopathology (eg, significant infarction, acute atherosis, maternal and/or fetal vascular thrombosis or maternal floor infarction)	3	2.1	33	8.7	1	0.6	37	5.3
8.3	No placental pathology			9	2.4			9	1.3
8.4	No examination of placenta			3	0.8			3	0.4
8.8	Other specified placental pathology	2	1.4	7	1.8	3	1.7	12	1.7
8.9	Unspecified or not known whether placenta examined			1	0.3			1	0.1
	Spontaneous preterm								
9.1	Spontaneous preterm with intact membranes, or membrane rupture < 24 hours before delivery			1	0.3	2	1.1	3	0.4
9.1.1	Spontaneous preterm with intact membranes, or membrane rupture < 24 hours before delivery: with chorioamnionitis	3	2.1	7	1.8	7	4.0	17	2.4
9.1.2	Spontaneous preterm with intact membranes, or membrane rupture < 24 hours before delivery: without chorioamnionitis			3	0.8	10	5.7	13	1.9
9.1.3	Spontaneous preterm with intact membranes, or membrane rupture < 24 hours before delivery: no examination of placenta			1	0.3			1	0.1
9.1.7	No clinical signs of chorioamnionitis, no examination of placenta					4	2.3	4	0.6
9.1.9	Spontaneous preterm with intact membranes, or membrane rupture < 24 hours before delivery: unspecified or not known whether placenta examined			1	0.3	8	4.5	9	1.3
9.2.1	Spontaneous preterm with membrane rupture ≥ 24 hours before delivery: with chorioamnionitis	4	2.8	14	3.7	9	5.1	27	3.9
9.2.2	Spontaneous preterm with membrane rupture ≥ 24 hours before delivery: without chorioamnionitis	1	0.7	3	0.8	1	0.6	5	0.7
9.2.3	Spontaneous preterm with membrane rupture ≥ 24 hours before delivery: with clinical evidence of chorioamnionitis, no examination of placenta			1	0.3	3	1.7	4	0.6
9.2.7	No clinical signs of chorioamnionitis, no examination of placenta			1	0.3	1	0.6	2	0.3
9.2.9	Spontaneous preterm with membrane rupture ≥ 24 hours before delivery: unspecified or not known whether placenta examined	1	0.7			2	1.1	3	0.4
9.3.1	Spontaneous preterm with membrane rupture of unknown duration before delivery: with chorioamnionitis			1	0.3			1	0.1
9.3.2	Spontaneous preterm with membrane rupture of unknown duration before delivery: without chorioamnionitis			1	0.3			1	0.1

		Fetal deaths							
		Termination of pregnancy		Stillbirths		Neonatal deaths		Total	
		n = 145		n = 379		n = 176		n = 700	
Perinatal death classification (PDC)		n	%	n	%	n	%	n	%
9.3.3	Spontaneous preterm with membrane rupture of unknown duration before delivery: with clinical evidence of chorioamnionitis, no examination of placenta			3	0.8			3	0.4
9.3.9	Spontaneous preterm with membrane rupture of unknown duration before delivery: unspecified or not known whether placenta examined			3	0.8			3	0.4
	Unexplained antepartum death								
10.1	With evidence of reduced vascular perfusion on Doppler studies and/or placental histopathology (eg, significant infarction, acute atherosis, maternal and/or fetal vascular thrombosis or maternal floor infarction)			15	4.0			15	2.1
10.3	No placental pathology			25	6.6			25	3.6
10.4	No examination of placenta			25	6.6			25	3.6
10.8	Other specified placental pathology			31	8.2			31	4.4
10.9	Unspecified or not known whether placenta examined			7	1.8			7	1.0
	No obstetric antecedent								
11.2	Postnatally acquired infection					1	0.6	1	0.1
11.3	Accidental asphyxiation					2	1.1	2	0.3
11.4	Other accident, poisoning or violence (postnatal)					1	0.6	1	0.1
11.8	Other specified					2	1.1	2	0.3
11.9	Unknown/undetermined					1	0.6	1	0.1
11.9.1	Unclassified Sudden Infant Death					7	4.0	7	1.0

Table B15 Complete primary neonatal death classification (NDC) for neonatal death, 2008

NDC	NDC description	n	%
	Congenital abnormality		
1.1	Central nervous system	2	1.1
1.2	Cardiovascular system	12	6.8
1.3	Urinary system	7	4.0
1.4	Gastrointestinal system	1	0.6
1.5	Chromosomal	7	4.0
1.6	Metabolic	1	0.6
1.7	Multiple/non chromosomal syndromes	6	3.4
1.8.2	Respiratory	1	0.6
1.8.3	Diaphragmatic hernia	4	2.3
1.8.5	Tumours	2	1.1
	Extreme prematurity		
2.1	Not resuscitated	36	20.5
2.2	Unsuccessful resuscitation	15	8.5
	Cardio-respiratory disorders		
3.1	Hyaline membrane disease/respiratory distress syndrome (RDS)	7	4.0
3.2	Meconium aspiration syndrome		
3.4	Pulmonary hypoplasia	4	2.3
	Infection		
4.1.1	Congenital bacterial	8	4.5
4.1.2	Acquired bacterial	11	6.3
4.2.1	Congenital viral	1	0.6
4.2.2	Acquired viral	1	0.6
	Neurological		
5.1	Hypoxic ischaemic encephalopathy/perinatal asphyxia (typically infants of › 24 weeks gestation or › 600 g birthweight)	28	15.9
5.2	Intracranial haemorrhage	2	1.1
5.2.2	Subgaleal haemorrhage	1	0.6
5.2.3	Subarachnoid haemorrhage	1	0.6
5.8	Other	1	0.6
	Gastrointestinal		
6.1	Necrotising enterocolitis	2	1.2
	Other		
7.3.1	Trauma: accidental	3	1.7
7.4.2	Treatment complications: medical	2	1.1
7.8	Other specified	3	1.7
7.9	Unknown/undetermined	1	0.6
7.9.1	Unclassified Sudden Infant Death	1	0.6
7.9.1.1	Unclassified Sudden Infant Death: bed sharing	7	4.0

Appendix C: Multivariate Analysis

Multivariate analysis logistic regression output for final models for determining independent associations between maternal ethnicity, maternal age, and socioeconomic deprivation (measured by NZDep 2006)

Table C1 Crude and adjusted odds ratios (ORs) for stillbirth by ethnicity (using sole/combination maternal ethnicity), age and socioeconomic deprivation, 2007 and 2008

	Crude OR	95% CI	Adjusted OR	95% CI
Deprivation deciles 1–7	Referent		Referent	
Deprivation deciles 8–10	1.5	1.3–1.7	1.3	1.1–1.5
NZ European only	Referent		Referent	
Māori only	1.6	1.3–1.9	1.5	1.2–1.8
Pacific only	1.7	1.4–2.1	1.6	1.3–2.1
Indian only	1.0	0.7–1.5	1.2	0.8–1.8
Other Asian only	0.6	0.4–0.9	0.7	0.5–1.0
Other only	1.0	0.8–1.3	1.2	0.9–1.6
Māori and NZ European only	0.8	0.6–1.1	0.9	0.6–1.2
Pacific and NZ European only	0.9	0.4–1.8	0.8	0.4–1.9
Pacific and Māori only	0.9	0.4–2.1	0.9	0.4–2.1
All other combinations	0.9	0.6-1.4	1.0	0.7-1.6
Age < 20	1.4	1.1–1.8	1.4	1.0–1.7
Age 20–24	1.1	0.9–1.4	1.1	0.9–1.4
Age 25–34	Referent		Referent	
Age 35–39	0.9	0.8–1.1	1.1	0.9–1.4
Age ≥ 40	1.5	1.1–2.0	1.6	1.2–2.3

Table C2 Crude and adjusted odds ratios (ORs) for stillbirth by ethnicity (prioritised maternal ethnicity), age and socioeconomic deprivation, 2007 and 2008

	Crude OR	95% CI	Adjusted OR	95% CI
Deprivation deciles 1-7	Referent		Referent	
Deprivation deciles 8–10	1.5	1.3–1.7	1.3	1.1–1.6
NZ European prioritised	Referent		Referent	
Māori prioritised	1.2	1.0–1.4	1.2	0.96–1.4
Pacific prioritised	1.6	1.3–1.9	1.5	1.2–1.9
Indian prioritised	1.0	0.7–1.5	1.2	0.8–1.8
Other Asian prioritised	0.6	0.4–0.9	0.7	0.5–1.0
Other prioritised	1.0	0.8–1.3	1.2	0.9–1.6
Age < 20	1.4	1.1–1.8	1.4	1.1–1.7
Age 20–24	1.1	1.0–1.4	1.1	0.9–1.4
Age 25–34	Referent		Referent	
Age 35–39	1.0	0.8–1.2	1.1	0.9–1.4
Age ≥ 40	1.5	1.1–2.0	1.7	1.2–2.3

Appendix D: 2009 PMMRC Pregnancy Loss Services Survey Results

The 2007 PMMRC Pregnancy Loss Services Survey was updated and repeated in 2009 with responses from the PMMRC local coordinators in all 21 DHBs. This survey identified the following points.

Areas that have shown improvement since 2007 included:

- 20 DHBs now have a stillbirth protocol.
- 21 DHBs now hold perinatal mortality meetings.
- 21 DHBs now provide a postnatal appointment to parents.
- 20 DHBs now provide written material to parents, families and whānau.
- 20 DHBs now provide support for staff.

Areas that still need to be improved included:

- Eight DHBs have a pregnancy loss service.
    - Two of these DHBs report having a dedicated specialised pregnancy loss service.

A further eight DHBs provide counselling, using social workers and professional counsellors, midwives, chaplains, cultural services or Sands New Zealand. Five DHBs maintain contact for two months or less, one DHB maintains contact for 12 months and five for as long as necessary. Five DHBs felt there was a need for more written information to be made available for parents, families and whānau.

When asked to rate their own service, in 2007, seven DHBs stated that they thought they provided a very good service, eight that their service was adequate and two that their service was minimal. Four DHBs did not answer this question. Of the two DHBs who rated their service as minimal in 2007, one reported their service being adequate in 2009, and the other did not complete the question. No DHBs noted having an evaluation mechanism for their pregnancy loss service. Only one DHB noted the use of the New Zealand College of Midwives (NZCOM) evaluation mechanisms.

The 2009 PMMRC Pregnancy Loss Services Survey included additional questions on antenatal screening and training relating to the following areas.

- DHBs that have guidelines on screening during pregnancy for:
- GDM 15
- Family violence 19
- Smoking cessation 20
- DHBs that provide in-house study days on pregnancy loss 12
- DHBs that provide in-house obstetric emergency training days 8

(In 17 DHBs, staff had attended an obstetric emergency course, three had not and one DHB did not respond to the question.)

- DHB management support for organising/improving training for obstetric emergencies:
- Very well supported 12
- Some support 8
- Minimal support 1

The survey concluded by asking respondents for their comments. The 2009 themes raised centred around:

- a cohesive dedicated pregnancy loss service with resources to support this service
- study days on pregnancy loss, highlighting staff release issues and having study days outside the main centres
- the importance of the midwifery educator role.

Appendix E: Amniotic Fluid Embolism Report to the Minister of Health

Definition

Amniotic Fluid Embolism (AFE) is a rare and catastrophic obstetric emergency in which amniotic fluid, and other debris, enters the pregnant woman's bloodstream via the placental bed of the uterus and causes an allergic reaction. The incidence of AFE is in the order of 1 in 16 000 to 1 in 55 000 pregnancies.

The clinical diagnosis is based on the presentation with cardiovascular collapse or coagulopathy in the absence of other potential explanation. Women with mild cases of AFE usually recover without sequelae, but the overall fatality rate with severe AFE is high, and case fatality rates of 13 percent to 30 percent are reported in recent studies (Tuffnell 2005; Abenhaim et al 2008). Neurological damage may occur in some survivors. Perinatal outcome is good in infants born to women who develop AFE following delivery, but the perinatal mortality rate is high (154 in 1000) if AFE develops prior to delivery (Knight et al 2009).

Risk factors

Two studies from North America have reported increased rates of AFE with maternal age over 35 years, caesarean section, pre-eclampsia, placenta praevia and placental abruption (Kramer et al 2006; Abenhaim et al 2008). Medical induction of labour was found to be a risk factor in only one study (Kramer et al 2006). However, the majority of women who develop AFE have no identifiable underlying risk factors.

Signs and symptoms

AFE usually presents during labour or around delivery, although cases have also been reported in first and second trimester abortions and as late as 48 hours postpartum. Premonitory symptoms have been described and include breathlessness, chest pain, feeling cold, light-headedness, restlessness, distress, panic, nausea and vomiting, pins and needles. Pain is not usually a feature (Gist et al 2009). Early symptoms include a sudden onset of dyspnoea and hypotension, which is frequently followed by cardiovascular collapse and respiratory arrest. In 10–20 percent of cases, these events are preceded by seizure-like activity. In women who survive this initial phase, coagulopathy frequently follows. In 10–15 percent of patients, coagulopathy is the presenting manifestation.

Clinical management

Current treatment consists of **aggressive oxygenation**, treatment of **circulatory collapse** and **counteracting coagulopathy**. Prompt delivery may prevent fetal asphyxia and improve fetal outcome when AFE occurs prior to delivery.

Circulatory collapse

1. Oxygen should be given at high concentrations, and unconscious patients should be immediately intubated and ventilated.
2. Intravascular access should be obtained.
3. Vasopressors should be used to improve ventricular function; inotropes also have a place.
4. Other therapies include inhaled nitric oxide for pulmonary hypertension, cardiopulmonary bypass.

Coagulopathy and major obstetric haemorrhage

Development of coagulopathy and major obstetric haemorrhage should be anticipated. In the event of bleeding, a massive transfusion protocol should be activated.

1) Baseline bloods should be taken to assess the presence and degree of coagulopathy and a group and antibody screen taken to allow blood for transfusion. Baseline bloods required:

   i) Blood for group and antibody screen/crossmatch (pink tube)

   ii) FBC in edta tube (purple top)

   iii) Coagulopathy screen in citrate tube (blue top).

2) Management of coagulopathy: disseminated intravascular coagulation with rapid consumption of blood clotting proteins, especially fibrinogen and also platelets, is very common and develops very rapidly in AFE compared to other causes of major haemorrhage (McLintock 2009). Aggressive pre-emptive replacement of platelets and clotting factors with fresh frozen plasma (FFP) and cryoprecipitate (to replace fibrinogen) is recommended in addition to transfusion of red blood cells.

3) Haemorrhage should be aggressively managed with uterotonic agents, uterine tamponade and examination to exclude co-existent genital tract trauma that may exacerbate blood loss. Severe ongoing uterine bleeding that does not respond to first-line measures requires rapid recourse to more invasive techniques, such as bracing suture (B-Lynch suture), uterine artery ligation, peripartum hysterectomy. Recombinant FVIIa has been used in management of severe obstetric haemorrhage that is unresponsive to standard treatment (Phillips et al 2009). Options for second line treatment will be dependent on the expertise and resources available locally.

Prevention of AFE

While prediction and prevention of AFE is not possible based on our current understanding of this rare complication, the Perinatal and Maternal Mortality Review Committee has made two recommendations that assist in improving outcomes for patients who develop AFE.

- The Minister of Health note that all staff involved in care of pregnant women should undertake regular training in management of obstetric emergencies.
- The Ministry of Health encourages each acute obstetric unit to develop a massive transfusion protocol to respond to major obstetric haemorrhage. It is possible that this be developed as a national process to support local processes.

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Appendix F: PMMRC DHB Local Coordinators June 2010

DHB	Local coordinator	Work role
Northland	Yvonne Morgan	Clinical Charge Midwife
	Dr Deralie Flower	Obstetrician
	Chris Cullen	Quality/Risk Facilitator
Waitemata	Dr Sue Belgrave	Clinical Director of Obstetrics,
	Claire Shears	Midwife
	Lucy Casey	Midwife
Auckland	Professor Lesley McCowan	Obstetrician
	Claire McLintock	Obstetric Physician
Counties Manukau	Dr Sarah Wadsworth	Consultant Obstetrician
	Dr Nerida Titchiner	Consultant Obstetrician
Waikato	Dr Alastair Haslam	Obstetrician and Gynaecologist
	Dr Sarah Waymouth	Obstetrician and Gynaecologist
	Dr Phil Weston	Paediatrician
	Pauline Martyn	Midwife
Bay of Plenty	Margret Norris	Midwife Leader
Lakes	Amanda Griffiths	Midwife
Tairawhiti	Estelle Mulligan	Midwife
	Robyn Blakely	Midwife
Taranaki	Amanda Hinks	Clinical Midwife Leader
Hawke's Bay	Dr Lynda Croft	Obstetrician and Gynaecologist
	Sara Paley	Midwifery Educator
Whanganui	Lucy Pettit	Midwife
MidCentral	Billie Clayton	Midwifery Educator
	Dr Digby Ngan Kee	Consultant Obstetrician
Wairarapa	Donna Thompson	Team Leader Midwifery
Capital & Coast	Dr Dawn Elder	Paediatrician
	Dr Rose Elder	Obstetrician and Gynaecologist
Hutt Valley	Joanne McMullan	Midwife
Nelson Marlborough	Lois McTaggart	Clinical Midwife Leader
	Dr Kevin Hill	Consultant Obstetrician/Gynaecologist
West Coast	Jude Bruce	Midwife
	Mary McGrane	Midwife
Canterbury	Dianne Leishman	Midwife
	Sonya Matthews	Midwife

DHB	Local coordinator	Work role
South Canterbury	Dianne Keeman	Clinical Leader Maternity Services
	Dr John Weir	Consultant Obstetrician/Gynaecologist
Otago	Helen Flockton	Charge Midwife
Southland	Jenny Humphries	Associate Director of Nursing and Midwifery, Maternal & Child

List of Abbreviations

CEMACH . . . .Confidential Enquiry into Maternal and Child Health

CEMACH . . . .Centre for Maternal and Child Enquiries

DHB . . . . . .District Health Board

LMC . . . . . .Lead maternity carer

MMRWG . . . .Maternal Mortality Review Working Group

MRI . . . . . .Magnetic resonance imaging

NEWG . . . . . .Neonatal Encephalopathy Working Group

NHI . . . . . .National Health Index

NZDep . . . . . .New Zealand Index of Deprivation score

NZHIS . . . . . .New Zealand Health Information Service (now known as the Information Directorate)

PMMRC . . . . .Perinatal and Maternal Mortality Review Committee

PSANZ . . . . . .Perinatal Society of Australia and New Zealand

PSANZ-PDC PSANZ perinatal death classification

PSANZ-NDC PSANZ neonatal death classification

PSU . . . . . .Paediatric Surveillance Unit

SGA . . . . . .Small for gestational age

SUDI . . . . . .Sudden unexpected death in infancy

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He matenga ohorere, he wairua uiui, wairua mutunga-kore

The grief of a sudden, untimely death will never be forgotten

Perinatal and Maternal Mortality Review Committee

He matenga ohorere, he wairua uiui, wairua mutungakore