Perinatal and Maternal Mortality Review Committee

He matenga ohorere, he wairua uiui, wairua mutungakore

Fifth Annual Report of the Perinatal and Maternal Mortality Review Committee

Reporting mortality 2009

INAUGURAL REPORT TO THE HEALTH QUALITY & SAFETY COMMISSION NEW ZEALAND

July 2011

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

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

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- The Health Quality & Safety Commission, including Deon York, who have been involved in all stages of the development of this report.

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Perinatal and Maternal Mortality Review Committee

The Perinatal and Maternal Mortality Review Committee (PMMRC) members in 2011 are:

- Professor Cynthia Farquhar (Chair), obstetrician and gynaecologist and clinical epidemiologist, The University of Auckland
- Ms Sue Bree, midwife, Bay of Islands
- Dr Vicki Culling, Stillbirth and Newborn Death Support (Sands New Zealand), Wellington
- Dr Alec Ekeroma, obstetrician, Counties Manukau DHB
- Ms Anja Hale, neonatal nurse specialist, Waikato DHB
- Dr Beverley Lawton, GP, researcher and Director of Women's Health Research Centre, Wellington
- Professor Lesley McCowan, obstetrician and maternal fetal medicine specialist, The University of Auckland
- Dr Maggie Meeks, neonatologist, Canterbury DHB
- Dr Stephanie Palmer, Māori health researcher
- Dr Graeme Sharpe, anaesthetist, Capital & Coast DHB.

Maternal Mortality Review Working Group

The Maternal Mortality Review Working Group (MMRWG) members in 2011 are:

- Dr Alastair Haslam (Chair), obstetrician and gynaecologist, Waikato DHB
- Dr Claire McLintock, obstetric physician and haematologist, Auckland DHB
- Ms Jacqui Anderson, midwife, Christchurch
- Ms Alison Eddy, midwife, Christchurch
- Professor Cynthia Farquhar, obstetrician and gynaecologist and clinical epidemiologist, The University of Auckland
- Dr Cathy Hapgood, perinatal psychiatrist, Waitemata DHB
- Dr Jeanette McFarlane, pathologist, Auckland DHB
- Dr John Walker, anaesthetist, Auckland DHB
- Ms Mollie Wilson, health manager, Hawke's Bay DHB.

Neonatal Encephalopathy Working Group

The Neonatal Encephalopathy Working Group (NEWG) members in 2011 are:

- Dr Malcolm Battin, (Chair) neonatal paediatrician, Auckland DHB
- Professor Cynthia Farquhar, obstetrician and gynaecologist and clinical epidemiologist, The University of Auckland
- Ms Anja Hale, neonatal nurse specialist, Waikato DHB
- Deborah Harris, neonatal nurse practitioner, Waikato DHB
- Dr Astrid Budden, obstetrician and gynaecologist, Auckland DHB
- Ms Tomasina Stacey, midwife, University of Auckland
- Dr Thorsten Stanley, paediatrician, Capital & Coast DHB
- Ms Rachel Taylor, team manager for the Accident Compensation Corporation
- Dr Alex Wallace, paediatrician, University of Auckland.

Australasian Maternity Outcomes Surveillance System Working Group

The Australasian Maternity Outcomes Surveillance System Working Group (AMOSSWG) members in 2011 are:

- Dr Claire McLintock (Chair), obstetric physician and haematologist, Auckland DHB
- Dr Sarah Wadsworth, obstetrician and gynaecologist, Counties Manukau DHB
- Ms Alison Eddy, midwife, Christchurch
- Professor Cynthia Farquhar, obstetrician and gynaecologist and clinical epidemiologist, The University of Auckland
- Dr Ted Hughes, anaesthetist, ICU consultant, Waitemata DHB
- Dr Beverley Lawton, GP, researcher and Director of Women's Health Research Centre, Wellington
- Ms Jo McMullan, midwife and local coordinator PMMRC, Hutt Valley DHB
- Ms Estelle Mulligan, midwife and local coordinator PMMRC, Tairawhiti DHB
- Ms Kathleen Williamson, midwife, Hawke's Bay DHB.

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FOREWORD

The Health Quality & Safety Commission welcomes the Perinatal and Maternal Mortality Review Committee's report. This is the Committee's fifth report, and deals with perinatal and maternal deaths between 1 January and 31 December 2009. For the first time, contributory factors have been analysed. International comparisons are drawn and emphasis is placed on how to reduce the preventable proportion of these very sad events.

The data in this report tell us how our maternity services are performing, and also provide an objective indication of the overall state of our health services. It is therefore reassuring that our perinatal mortality rates are comparable with those in Australia and the United Kingdom, although it should be noted that our maternal mortality rates are slightly higher than those reported in these two jurisdictions (although the years are not the same and the H1N1 pandemic influenced the figures). There is clearly more to do for teenage mothers and those who are having a baby against a background of deprivation. And although the absolute numbers are very small, it is disconcerting that the leading cause of maternal mortality is suicide. Unsurprisingly, socioeconomic factors have a stong influence on the outcome of pregnancy. Common ground with the other mortality review committees is apparent in the information on sudden unexpected infant deaths and reports of family violence in relation to some of the cases in the report.

There are four mortality committees that are reporting to the Commission from April 2011: the Perinatal and Maternal Mortality Review Committee, the Perioperative Mortality Review Committee, the Child and Youth Mortality Review Committee, and the Family Violence Death Review Committee.

A great deal of careful work has gone into collecting the information in this report, ensuring its accuracy, reviewing the cases and drawing sound conclusions. Local and international peer review is central to the credibility of the report.

The report includes a number of recommendations and the Commission will be working with the Perinatal and Maternal Mortality Review Committee on their implementation. Professor Farquhar and the many people who have worked with her in producing this report are to be congratulated.

Professor Alan Merry, ONZM
Chair of Health Quality & Safety Commission

CHAIR'S INTRODUCTION

I am pleased to present the fifth 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. The purpose of this report is to provide an accurate estimate of the numbers and rates of perinatal and maternal deaths in New Zealand, to describe the risk factors for perinatal and maternal deaths, and to attempt to identify where the attention of maternity and neonatal services might be focused to prevent perinatal and maternal deaths.

This report is the third report with 12 months of both perinatal and maternal data. These data are the result of the collaborative efforts of the PMMRC, lead maternity carers, local coordinators and clinicians of the District Health Boards (DHBs), supported by 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.

In 2009, the maternal mortality ratio was 22 per 100,000 maternities and the perinatal mortality rate was 10.6 per 1000 total births. In 2009 there were four maternal deaths from pandemic influenza (A) H1N1 (2009) which may account for the increase in the maternal mortality rate.

In this year's report we have two new areas of focus. First, we have reported on three years of data which allows us to perform analyses in greater detail. In particular, we have been able to investigate in detail the perinatal deaths of young mothers less than 20 years old. This high-risk group has a significantly increased risk of perinatal related death, particularly stillbirth and neonatal death. They are more likely to have preterm births, bleeding in pregnancy and perinatal infection. Our recommendation is for a national intersectoral working group to consider the best way of providing services to this group of young mothers in order to better meet their needs. Second, we are reporting for the first time an analysis of contributory factors and potentially avoidable deaths. This information for all perinatal deaths was collected in DHBs following review of each death. For maternal deaths, potentially avoidable deaths have been identified following review by the Maternal Mortality Review Working Group (MMRWG) since 2006; in 2009 a formal tool was used to identify contributory factors. Our review shows that almost 14 percent of all perinatal deaths and one-third of maternal deaths were potentially avoidable.

We were able to identify that factors relating to personnel and barriers to accessing and engaging with care are the most common contributory factors reported. It is those factors that our attention will be focused on in the coming years.

In the legislation establishing the PMMRC, we were also asked to review major morbidity. In 2010 we commenced data collection on two new initiatives: the prevalence and risk factors for neonatal encephalopathy, including those infants who survive; and the Australasian Maternity Outcomes Surveillance System (AMOSS) which 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 intensive care unit and peripartum hysterectomy. I am grateful to all those members of the working groups for getting these two projects under way. We will be able to report on those data in next year's report.

We welcomed the publication of *The Lancet* International Series on Stillbirths in April 2011 (*The Lancet* Series 2011). This body of work includes an analysis of rates, inequalities and contributory factors for stillbirth as well as suggestions for future work. Key messages include that in high-income countries there is potential for further reduction in stillbirth, that maternal obesity and smoking are the most important potentially modifiable risk factors for stillbirth, and that factors relating to suboptimum professional care contribute to a substantial proportion of stillbirths.

We note that interventions and strategies to address stillbirth are consistent with our own recommendations and support perinatal mortality audit at a national level.

For the past three years the PMMRC has held a workshop for all stakeholders in maternity care. At these workshops we invite international experts to critique our report and local experts to inform us of the latest New Zealand research. In 2010, 150 people attended our workshop in Christchurch. In 2011 we will hold the workshop in Wellington with a focus on potentially avoidable mortality.

Finally, in the past year the Health Quality & Safety Commission has been established and from April 2011 we have been reporting to the board of the Commission. This step is viewed positively as it is yet another opportunity to build quality improvement activities into our reporting.

Thank you to everyone who has supported the work of the committee in the preparation of the 2009 report. The PMMRC appreciates the efforts of midwives, doctors, consumer groups and the staff of the Ministry of Health 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 Cynthia Farquhar
Chair of the Perinatal and Maternal Mortality Review Committee

> “Our recommendation is for a national intersectoral working group to consider the best way of providing services to this group of young mothers in order to better meet their needs.”

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 from 20 weeks gestation to 28 completed days after birth, or weighing at least 400g 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 400g if gestation was unknown. In 2009, the maternal mortality ratio was calculated per 100,000 maternities.
- Perinatal mortality is fetal and early neonatal deaths, from 20 weeks gestation until less than seven days of age or weighing at least 400g if gestation was unknown.
- The perinatal related mortality rate is fetal deaths (including terminations of pregnancy and stillbirths) and neonatal deaths (up to 28 days) per 1000 total babies born at 20 weeks or beyond, or weighing at least 400g if gestation is unknown.
- Neonatal mortality is all infant deaths from live birth to 27 days of age inclusive.

Key Points: Perinatal related mortality

Perinatal related mortality rates

1. In 2009, the perinatal mortality rate was 10.6 per 1000 births, and the perinatal related mortality rate was 11.3 per 1000 births. The small increase in rate across the three years has been noted but this increase is not statistically significant. The rate is comparable to rates in both Australia in 2008 and the United Kingdom in 2009.

2. The stillbirth rate in 2009 was 6.3 per 1000 births. One-quarter of stillbirths continue to be unexplained, and half of these occur at term. Thirty-five percent of unexplained stillbirths had a post-mortem; 22 percent were not investigated.

Perinatal related mortality and ethnicity

3. Māori and Pacific mothers are more likely to have stillbirths and neonatal deaths compared to New Zealand European and non-Indian Asian mothers.
   a. Sole Māori and sole Pacific mothers have higher rates of perinatal mortality compared to mothers of Māori and Pacific mixed ethnicities.
   b. There is an excess of perinatal death from spontaneous preterm birth among Māori and Pacific mothers.
   c. Neonatal deaths with no obstetric antecedent are considerably more frequent in babies of Māori mothers. The majority of these are Sudden Unexpected Deaths in Infancy (SUDI).
   d. Antepartum haemorrhage is a more common antecedent to death in Māori, possibly related to higher smoking rates among Māori mothers, while hypertension is a more common antecedent among Pacific mothers.

Perinatal related mortality and socioeconomic deprivation

4. There is a significantly increased rate of stillbirth and neonatal death among mothers in the most deprived socioeconomic quintile compared to all less deprived quintiles.
   a. Spontaneous preterm birth and antepartum haemorrhage as primary antecedent causes of stillbirth and neonatal death are associated with increasing socioeconomic deprivation.

Perinatal related mortality and region of residence

5. There are differences in perinatal related mortality rates across regions of residence in keeping with differences in the sociodemographic characteristics of the mothers who live there.

a. The three-year perinatal related mortality rate in the Counties Manukau DHB region (13.70/1000 births) exceeded the national rate (10.75/1000 births).

Perinatal related mortality and age

6. Teenage mothers (<20 years old) are at higher risk of stillbirth and neonatal death compared to mothers aged 20–39 years (14.7/1000 compared to 10.3/1000). Mothers of 40 years and older are at increased risk of fetal loss.

a. Fifty percent of teenage mothers whose babies died from 2007 to 2009 were Māori. The ethnicity of mothers whose babies died is reflective of the population of teenage mothers. The risk of perinatal mortality among teenagers is similar, and increased among all ethnicities.

b. Fifty percent of teenage mothers whose babies died were in the highest deprivation quintile. Again, deprivation is high among teenage mothers, with 45 percent of teenage mothers in the highest deprivation quintile.

c. Forty-five percent of all teenage mothers whose babies died were smokers. Smoking rates among teenage mothers in New Zealand are unknown, but probably are high compared to older mothers.

d. Perinatal related deaths among teenage mothers were more often the result of spontaneous preterm birth, fetal growth restriction, and perinatal infection than among mothers 20–39 years old.

Contributory factors and potential avoidability of perinatal related deaths

7. Fourteen percent of all perinatal deaths were thought to be potentially avoidable deaths; 2 percent of late terminations, 15 percent of stillbirths and 19 percent of neonatal deaths.

8. Contributory factors were identified in 24 percent of all perinatal deaths; 4 percent of late terminations, 25 percent of stillbirths and 19 percent of neonatal deaths.

a. The most common contributory factors were barriers to accessing or engaging with maternity and health services (15%), personnel (7%) and organisational and management factors (5%).

Key Points: Maternal mortality

Maternal mortality ratio

9. The maternal mortality ratio for the four-year interval 2006–2009 is 19.2/100,000 maternities (95% confidence interval 14.2-25.4/100,000).

a. The New Zealand maternal mortality ratio is significantly higher than the ratio reported by the United Kingdom for the triennium 2006–2008 of 11.4/100,000 maternities.

b. There were 14 maternal deaths in 2009. In 2008, there were nine, in 2007 there were 11 and in 2006 there were 15[1]. It is not possible to comment on trends in maternal mortality in New Zealand based on only four years of data.

c. The most frequent causes of maternal death in New Zealand in the years 2006–2009 were suicide (10 cases), maternal pre-existing medical conditions (9 cases) and amniotic fluid embolism (8 cases).

d. Of the 14 deaths in 2009, four died of pandemic influenza (A) H1N1 infection.

Recommendations 2009

The recommendations listed below are those pertaining to the 2009 report. These do not include recommendations made in previous years even though they may still apply. A list of previous recommendations with progress to date in implementing these is included on page 20.

1 This is one more than as stated in previous reports, due to new information becoming available.

Recommendations 2009: Perinatal related mortality

1. **Early booking – all women should commence maternity care before 10 weeks, for the following reasons:**
   a. Opportunity to offer screening for congenital abnormalities, sexually transmitted infections, family violence, and maternal mental health; and to refer as appropriate
   b. Education around nutrition (including appropriate weight gain), smoking, alcohol and drug use, and other at-risk behaviours
   c. Recognition of underlying medical conditions with referral for secondary care as appropriate
   d. Identification of vulnerable women at increased risk of perinatal related mortality (see box).

Clinical flags: the perinatal and maternal mortality report highlights the following 'flags' associated with poor perinatal outcome.

- Maternal age (<20 years and ≥40 years)
- Obesity
- Maternal mental health problems
- Multiple pregnancy
- Socioeconomic deprivation
- Maternal medical conditions

2. **Teenage mothers (less than 20 years old)**
   a. All LMCs should be aware that teenage mothers are at increased risk of stillbirth and neonatal death due to preterm birth, fetal growth restriction and perinatal infection.
   b. Maternity services for teenage mothers need to address this increased risk by the provision of services that specifically meet their needs, paying attention to:
      - commencing maternity care before 10 weeks
      - smoking cessation, prevention of preterm birth (including smoking cessation, sexually transmitted infection screening and treatment, urinary tract infection screening and treatment) and screening for fetal growth restriction using regular fundal height measurement on customised growth charts
      - providing appropriate antenatal education.
   c. Research on the best model of care for teenage pregnant mothers in New Zealand should be undertaken with a view to reducing stillbirth and neonatal death.
   d. Engagement with the Ministry of Education is required regarding appropriate education and maternity care in the school setting.

3. **Contributory factors and potentially avoidable perinatal related deaths**
   a. Key stakeholders in provision of health and social services to women at risk (for eg, due to their age, ethnicity, or socioeconomic deprivation) should work together to identify existing research on:
      - reasons for barriers to accessing maternity care
      - interventions to address barriers to engagement with maternity care.
   b. Clinical services and clinicians have a responsibility to ensure the following:
      - continuing education programmes which focus on knowledge and skills of personnel, including implementation and audit of best practice
      - local review of maternal and perinatal outcomes linked to quality improvement
      - policies and guidelines that are up-to-date, implemented and audited
      - a culture of teamwork including support, mentorship, supervision, communication and documentation
      - a culture of practice reflection on patient outcomes with a link to quality improvement
      - staffing arrangements that ensure timely access to specialist services.

c. The Ministry of Health, in association with DHBs, develops a timely implementation plan to translate these recommendations into clinical practice.

Recommendations 2009: Maternal mortality

1. Maternal mental health

a. At first contact with services women should be asked:

- Are you currently receiving, or have you ever received treatment for a serious mental illness such as severe depression, bipolar disorder, schizophrenia or psychosis?
- Have you had treatment from a psychiatrist or specialist mental health team in the past?
- Do you have a family history of mental illness including perinatal mental illness?

Women with a previous history of serious affective disorder or other psychoses should be referred in pregnancy for psychiatric assessment and management even if they are well. Regular monitoring and support is recommended for at least three months following delivery.

b. At the booking visit and postnatally, possible depression can be identified by asking:

- During the past month, have you often been bothered by feeling down, depressed or hopeless?
- During the past month have you often been bothered by having little interest or pleasure in doing things?

If the answer is 'yes' to either question then ask if this is something the woman would like help with (NICE 2009).

c. Clinicians are reminded that mental illness can deteriorate very rapidly in pregnancy and the postnatal period, and that suicide is the most common cause of maternal death in New Zealand at this time.

d. A working party should be formed of maternity and mental health providers to explore the establishment of a mother and baby unit in the North Island.

2. Obstetric emergencies

All staff involved in care of pregnant women should undertake regular multidisciplinary training in managing obstetric emergencies and in resuscitation, including appropriate use of peri-mortem caesarean section to facilitate adequate resuscitation of the mother.

3. Communication between services

Pregnant women who are admitted to hospital for medical conditions not related to pregnancy need to have specific referral pathways for perinatal care

4. Pandemic influenza (A) H1N1

a. Pregnant women should be immunised against influenza because they are at increased risk of severe outcomes, particularly if they have other risk factors such as obesity or asthma.

b. Pregnant women should consult their midwife, general practitioner or specialist services as soon as symptoms of an influenza-like illness develop or if other family members are unwell to allow:

- referral to hospital for assessment if there are symptoms of respiratory compromise due to influenza, that is, worsening shortness of breath, especially at rest, productive cough, pleuritic chest pain, haemopytsis
- prescription of antiviral medication.

5. Family violence

Family violence screening should be a routine part of maternity care and screening should be documented in clinical notes.

SUMMARY OF PREVIOUS RECOMMENDATIONS (2006–2008)

Below is a summary of progress regarding recommendations from the PMMRC.

Recommendation	Progress
Perinatal Mortality	
1. Birth information	
Accurate, robust and timely clinical data on all pregnancies is important. A national perinatal database needs to be established so that perinatal mortality rates can be calculated and comparisons can be made between babies who die and those who survive the perinatal period.	The Ministry of Health supports national perinatal reporting and is considering a national perinatal epidemiology unit. Further work is required to identify the funding required, potential sources of funding and potential 'hosts' for a unit. The Ministry has funded a rebuild of the current maternity datamart to more accurately report maternity outcomes.
The current birth registration dataset should be required to henceforth include maternity data critical to research (for example, parity, major complications, mode of birth, history of smoking and previous obstetric history).	The Ministry of Health position is that the Births, Deaths and Marriages birth registration process is not an appropriate system for collecting additional obstetric/maternal information, especially as it relies on the parents completing the birth registration form. The Ministry of Health already collects this information from both hospitals and lead maternity carers (LMCs). The Ministry notes that this collected information is not currently available for analysis due to technical difficulties with information systems.
All babies regardless of whether stillborn or liveborn should be assigned a National Health Index (NHI) identification number at the time of birth.	Stillborn babies are given an NHI number in 14 of 20 DHBs.
Continued support and funding is required for DHBs and lead maternity carers (LMCs) for collection of complete perinatal mortality statistics.	The Ministry of Health brought this recommendation to the attention of the DHB Women's Health Managers Network. The Ministry continues to support and fund DHBs and LMCs in their reporting of mortality data and collection of complete perinatal mortality statistics.
The reasons for the difference in rates of optimally investigated perinatal deaths between DHBs needs investigation.	Part of the reason for differences in rates of optimally investigated perinatal deaths between DHBs is regional shortages of perinatal pathologists. Paediatric pathology is one of the services currently being considered by the National Health Board for national planning and funding. Rates of investigated deaths will be considered once planning and funding arrangements for paediatric pathology have been determined.
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. DHB disparities	
Further research is warranted to understand the higher rate of perinatal related mortality in the Counties Manukau region.	The Ministry, as well as representation from the PMMRC, met with Counties Manukau DHB to discuss this rate and develop strategies to improve perinatal related mortality in this region. This is an ongoing process of quality improvement.

3. Ethnicity	
New legislation should enable Births, Deaths and Marriages to accept NHI data and update the routine NHI dataset with regard to ethnicity.	A meeting will be organised between the National Health Board and members of the PMMRC to progress this item.
Clinicians and LMCs should be encouraged to collect accurate ethnicity details at the time of booking.	
4. Access to care	
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 their LMC before 10 weeks gestation. A national media campaign should be considered.	Proceeding with a national media campaign and exploring barriers to early booking have been a low priority for the Ministry. A recommendation for the Ministry's maternity work programme in 2011/12 will be improving information given to consumers about pregnancy, childbirth and the maternity system. The Ministry is investigating ways to purchase primary health and maternity services to ensure multidisciplinary collaboration in the community setting.
Strategies to improve awareness of antenatal care services and increase access among women who are isolated for social, cultural or language reasons should be developed.	Strategies to improve awareness of antenatal care services would be part of the Ministry's proposed 2011/12 work programme on maternity consumer information. The Maternity Quality & Safety Programme will require DHBs to involve consumers.
Clinicians and 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.	
5. Screening for gestational diabetes, smoking and family violence	
LMCs should follow the Ministry of Health pregnancy guidelines for: • diabetes screening • smoking cessation • family violence screening.	Promotion of smoking cessation is a national health priority.
6. Multiple pregnancies	
All women with a multiple pregnancy should be offered an early specialist consultation, including ultrasound diagnosis of chorionicity prior to 14 weeks gestation. Women with high-risk monochorionic multiple pregnancies require fortnightly scans and specialist care.	Advice is available through the newly established New Zealand Fetal Medicine Network.
7. Detection of fetal growth restriction	
Height and weight should be measured at the first antenatal visit and a customised growth chart, GROW (Gestation Network 2007), used to record fundal height to improve the recognition of small for gestational age infants.	Some obstetric databases have included the GROW software program for use by clinicians.

8. Antepartum haemorrhage	
All women with bleeding during pregnancy regardless of the apparent cause should be monitored more closely for fetal growth and preterm birth.	No specific action has been taken to date.
9. Sudden unexpected death in infancy (SUDI)	
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.	The Ministry is considering amendments to the service specifications for DHB-funded maternity services around safe sleeping in hospitals and maternity units.
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.	The Child and Youth Mortality Review Committee (CYMRC) has made a similar recommendation. The Ministry is considering the development of a national SUDI prevention toolkit for DHBs and health practitioners, with a particular focus on supporting vulnerable families at higher risk of SUDI. This has been contracted to Whakawhetu: **www.māorisids.org.nz** The Health Quality and Safety Commission is interested in working with other parts of the Ministry to address high SUDI rates.
10. Access to perinatal investigation and supporting parents	
The Ministry of Health should require DHBs to ensure that all providers of maternity services provide support to parents, families and whānau who have experienced perinatal and maternal loss, including providing access to information, counselling and clinical follow-up.	Funding is secured for the ongoing production of Stillbirth and neonatal death support (Sands) material. The secondary maternity services specification requires funding of 'social work' services, but these are not specified. These specifications are in the final stages of implementation.
The low uptake of post-mortems amongst families who experience perinatal loss should be investigated.	This issue was investigated during the Ministry of Health's Review of the Regulation of Human Tissue and Tissue-based Therapies in 2004. Public opinions about human tissue were explored as part of submissions received on this review. Reasons for low uptake of human tissue investigation among some populations included the need to involve both immediate and wider family in the consent process and the desire to have the body intact for burial.
Maternal Mortality	
11. Maternal information	
Support is required for national reporting of maternal deaths.	A tick box has been added to the death certificate indicating that the deceased was pregnant, or was pregnant within the last 42 days. All maternal deaths must be reported to the coroner.
Improved communication between primary and secondary services is required. A variety of means should be used, such as women-held maternity notes, integrated notes systems and electronic transfer of information.	The Maternity Quality Initiative has resulted in a drive towards a national standardised maternity record.
12. Seat belts during pregnancy	
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 seat belts 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.	A poster is being developed. Endorsement is being sought from other agencies.

13. Maternal mental health	
Maternal mental health services should be integrated into maternity services.	The Ministry supports the recommendation that maternal mental health services be integrated into maternity services. This is in line with best practice. The Ministry has developed a draft Perinatal and Infant Mental Health guidance document that is consistent with this recommendation. It proposes collaboration across maternal health, child health and mental health. The draft document will be the subject of consultation with the National Health Board, DHBs and the Minister.
Access should be provided to a mother and baby unit in the North Island.	The recommendation that there be a mother and baby unit in the North Island requires consideration of availability of capital and service funding, workforce and location.
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.	The Ministry of Health intends to forward this recommendation to the professional colleges and the National Screening Advisory Committee for additional advice.
14. 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.	This recommendation will be considered as part of the development of the revised service specifications for DHB-funded maternity services.
15. 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.	
16. Postpartum haemorrhage	
Acute obstetric units should develop a massive transfusion protocol to respond to major obstetric haemorrhage.	A national guideline is being developed.
17. Emergency obstetric training	
All staff involved in care of pregnant women should undertake regular training in management of obstetric emergencies.	Midwifery Council–requires this occurs every three years. DHBs–skills and drills sessions take place for all practitioners.

1. PERINATAL MORTALITY 2009

1.1 Introduction

In New Zealand, maternity care is funded by the Ministry of Health (the Ministry). It was provided nationally by 21 District Health Boards (DHBs) in 2009 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 2009. 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 and agreement from 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 identify perinatal deaths and oversee the collection of the required data. These data are submitted to the Mortality Review Data Group at the University of Otago. The coordinators are 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 (eg, her past medical and obstetric history and details of the birth), and the other form contains information on the baby. The questions are assessed and adjusted annually to ensure that the data collected remain current and robust.

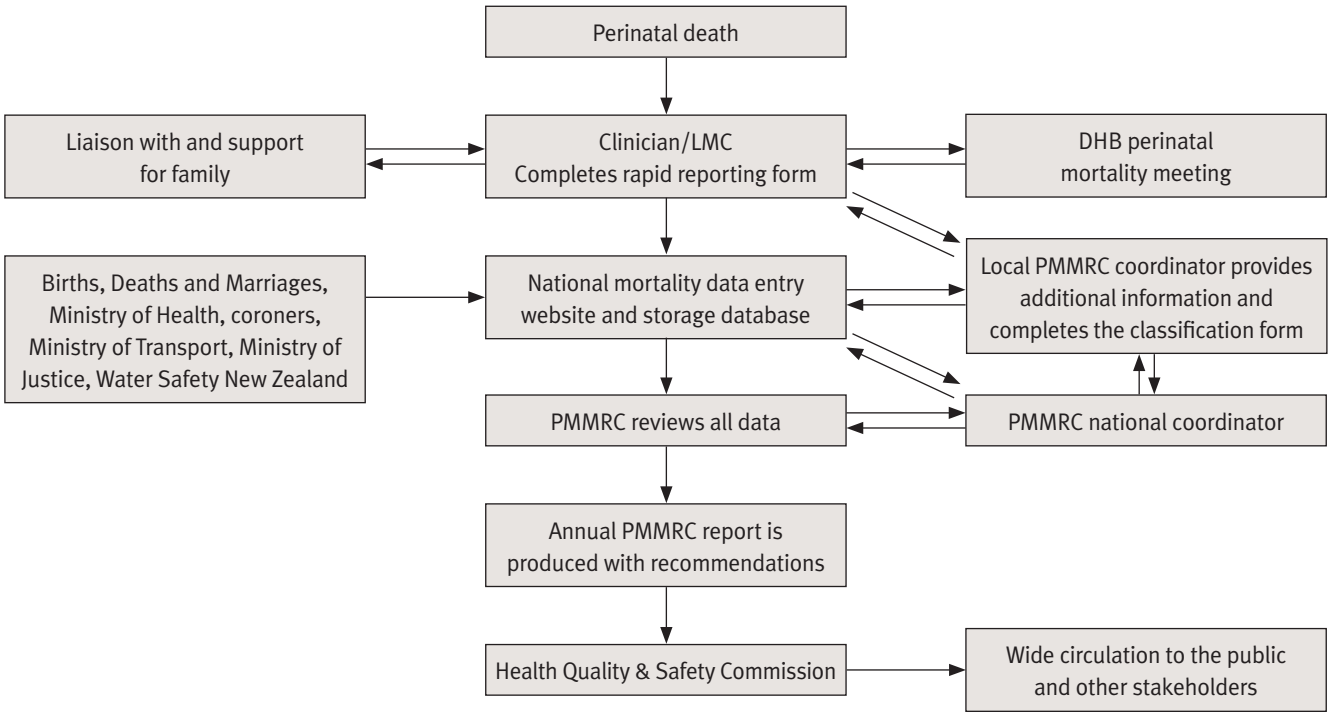
After local review, the local coordinator completes the PMMRC classification form. The classification system that has been adopted is the Perinatal Society of Australia and New Zealand (PSANZ) system of classification (PSANZ 2009). This system includes both perinatal and neonatal classifications (listed in Appendix A). The local coordinator also includes post-mortem and histology reports with the classification form.

Contributory factors and potential avoidability

Contributory factors and potential avoidability of perinatal related mortality have been identified and are included in this 2009 report. The assessment of these was completed by the PMMRC local coordinators following local review and submitted along with the PSANZ classification of perinatal death. The PMMRC classification form was adapted to include questions which identify contributory factors, that is, organisational and/or management, personnel, technology and equipment, environment and barriers to accessing/engaging with care. A death is considered potentially avoidable if the absence of the contributory factors would have prevented the death. A copy of this form can be found in Appendix C. As this is a new process for perinatal mortality, improvements to the process and ongoing training will occur. The first year of perinatal data should be considered as preliminary.

Potentially avoidable deaths were identified by the MMRWG from 2006 to 2008 inclusive. The new system for classifying contributory factors and potentially avoidable deaths was applied to maternal deaths from 2009. A user guide describing the definitions and data elements used by the PMMRC (PMMRC 2009b) is available online: www.pmmrc.health.govt.nz

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



PMMRC data validation

Data are regularly validated, using a standard set of queries, to eliminate duplicate records, to complete missing mother or baby information, to clarify DHB of residence (where this is inconsistent with the given residential address) and to rectify other inconsistencies.

The national coordinator reviews all perinatal death classifications and checks complicated cases with a PMMRC member with expertise in stillbirth 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 2009, there were no cases where the audited and original primary classification varied; in 7 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.

The 2009 audit reviewed family violence screening in detail; 52 percent of women received screening for family violence, 16 percent were not asked, and a further 32 percent had unknown screening status. In only 21 percent of clinical notes reviewed was there a section on the antenatal record for documenting screening.

The assessment of contributory factors and potential avoidability was also included in the audit of perinatal deaths for 2009. There was one death identified where contributory factors were missed. There were eight additional deaths (12% of reviewed cases) that on review were thought to be potentially avoidable. In two of these cases the data were missing.

Denominator data

The denominator in this report consists of New Zealand birth registrations during the 2009 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 includes ethnicity data as notified by parents at birth registration. This source of ethnicity is also used for the numerator where a birth registration has been made. Ethnicity in the hospital discharge dataset (otherwise known as the national minimum dataset, NMDS) is also apparently provided by mothers for themselves and for their babies and becomes part of the National Health Index (NHI) dataset. However, comparisons of maternal and baby ethnicity in the birth registration and NMDS datasets have shown significant differences.

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. 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 fewer 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 the denominator.

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.

Data analysis

Percentages have been displayed with one decimal place, or without decimal places when the denominator is small. 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 perinatal mortality rates have been computed using the methods for vital statistics described by Centres for Disease Control (CDC) (Heron et al 2009). Ninety-five percent confidence intervals (CIs) for maternal mortality ratios have been computed using the Exact method. The CI represents the degree of uncertainty around the point estimate of the rate for the particular 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 25, 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.

At the lower extremes of gestation and birthweight, denominator numbers are small. As the denominator set is registrations rather than births in the relevant year, the denominator is not an exact count of all births in the year. For this reason, perinatal related mortality rates at the lower extremes have not been reported.

In this report, the figures illustrating perinatal related mortality rate include combined data for the three full years that the PMMRC has collected data (2007–2009). This increases the numbers and so improves the confidence around the estimates given. The data for the 2009 year alone are presented in table form in the text and the combined three-year data in table form in Appendix B: Additional Tables.

1.3 Definitions

Ethnicity

Maternal and baby ethnicity for perinatal related deaths was collected from two sources: 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), with information from BDM taking priority over data from rapid reporting forms. In both instances, ethnicity was recorded as that identified by the mother/parents. The ethnicity in the deaths dataset (held by BDM) is 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.

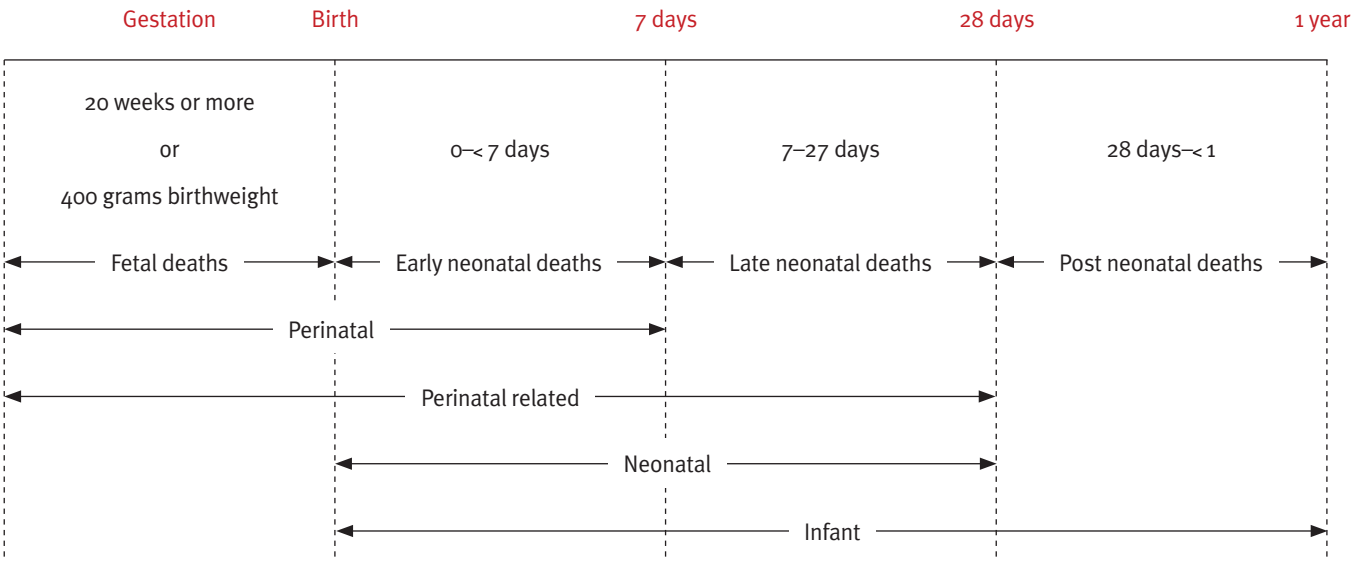
Multiple ethnicities can be identified for both mother and baby. The PMMRC followed the Ethnicity Data Protocols for the New Zealand Health and Disability Sector standards (Ministry of Health 2004) for prioritising ethnicity for the 2006 and 2007 reports. These prioritised ethnicity into the following hierarchy: 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 pregnancies.

In 2008, other methods of outputting ethnicity data were explored, and because this has an effect on perinatal related mortality rates by ethnicity, data for both prioritised and sole/combination ethnicity were reported and discussed. In 2009, prioritised and sole/combination ethnicity have again been reported. 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).

Maternal and baby ethnicity-specific perinatal related mortality rates have again been analysed. Maternal ethnicity-specific mortality rates are presented in the body of the report and baby ethnicity-specific perinatal related mortality rates are given in the appendices.

Mortality rates

Figure 2: Definitions of perinatal and infant mortality



(Adapted from NZHIS 2007 and Ministry of Health 2010)

Fetal death is the death of a fetus at 20 weeks gestation or beyond (≥ 20 weeks), or weighing at least 400g 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 400g if gestation is unknown.

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 400g if gestation is unknown. **Early neonatal death** is a death that occurs up until midnight of the sixth day of life. **Late neonatal death** is a death that occurs between the seventh day and midnight of the 27th day of life.

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

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 400g 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 400g if gestation is unknown.

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 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 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 2006 (NZDep2006) 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). Meshblock unit level data are used throughout this report.

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 2009

Figure 3: Total live birth registrations in New Zealand 1993–2009

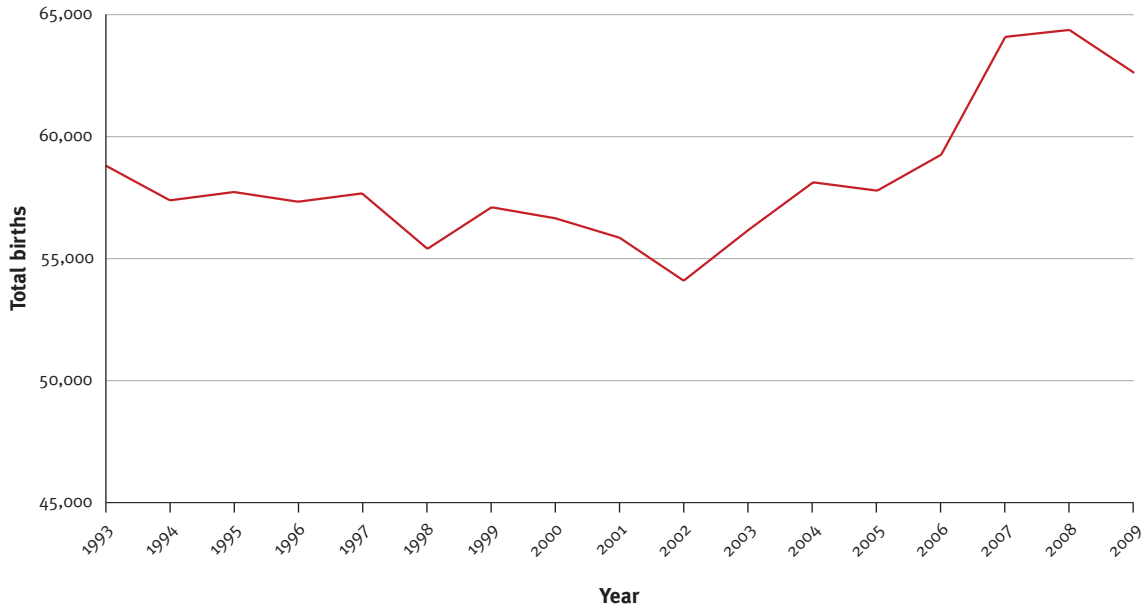
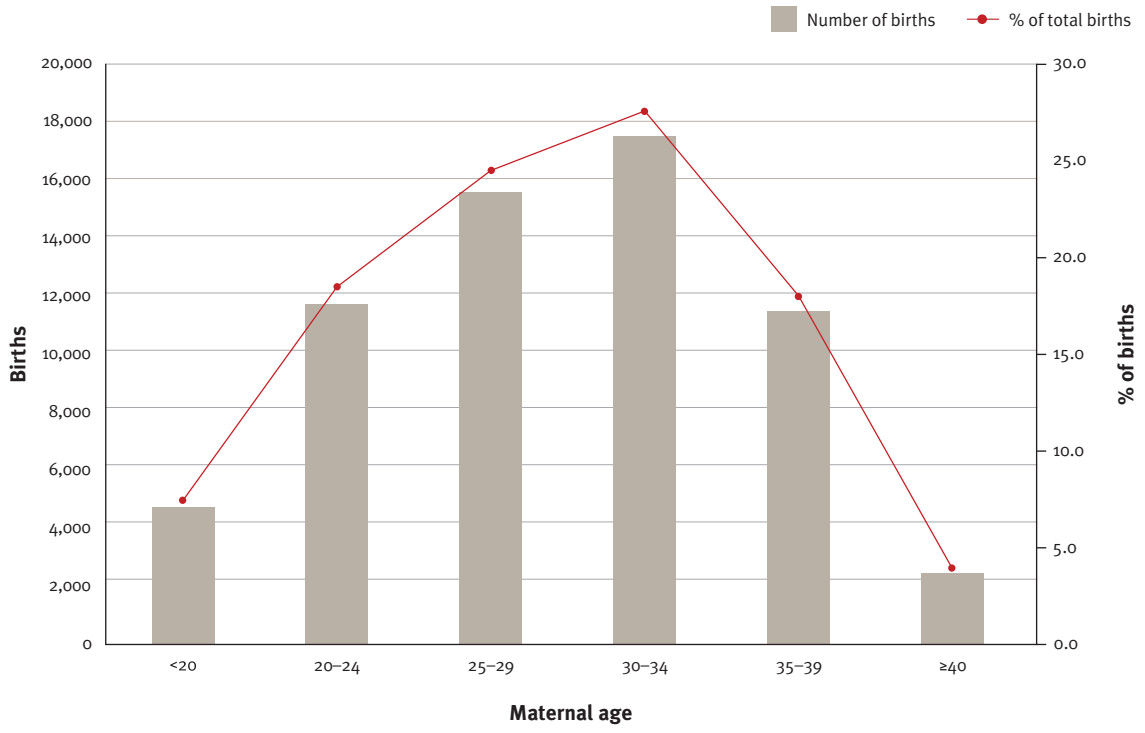


Figure 3 shows a drop in the number of births in 2009.

Maternal age

Figure 4: Distribution of maternal age among birth registrations in 2009 (total births = 63,665)



The greatest number of births in New Zealand occurred among mothers in the five-year age band of 30–34 years (28.0 percent). In 2009 in New Zealand, 7.8 percent of births were to teenage mothers and 3.8 percent to women 40 years or older.

Ethnicity

The process for collection of ethnicity data is outlined in section 1.3. In 2009, the denominator birth registration dataset included two ethnicities for 29.5 percent of all babies registered compared with two ethnicities for 14.9 percent of mothers registered. The set included three ethnicities for 5.7 percent of babies and three ethnicities for 1.4 percent of mothers. This difference in the number of ethnicities a mother reports for herself compared with the number of ethnicities she gives for her baby means mortality rates will be different depending on whether the mother's or the baby's ethnicity is used in analyses. Total responses for maternal and baby ethnicity in the 2009 birth registration set are given in Table 1 below.

Table 1: Total responses for mother and baby ethnicity among birth registrations in 2009

	Ethnicity total response (baby)		Ethnicity total response (mother)	
	n = 63,665		n = 63,665	
	n	%	n	%
Māori	18,593	29.2	14,646	23.0
Pacific peoples	10,302	16.2	7,742	12.2
Indian	2,551	4.0	2,288	3.6
Other Asian	5,015	7.9	4,794	7.5
Other*	5,713	9.0	6,464	10.2
New Zealand European	42,002	66.0	37,480	58.9

* includes not stated or unrecognisable response (n=51 babies, n=244 mothers)

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. Using prioritised ethnicity output, 46.6 percent of mothers identified as New Zealand European, 23.0 percent as Māori, 10.7 percent as Pacific peoples, 3.4 percent as Indian, 7.2 percent as Other Asian, and 9.0 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 and Indian ethnicities rather than New Zealand European, Other Asian or Other ethnicities. The distribution of prioritised ethnicity among mothers and babies in the 2009 birth registration dataset is shown in Figure 5 below (with further information provided later in Table 11 and Table 42).

Figure 5: Distribution of prioritised ethnicity (mother and baby) among birth registrations in 2009 (total births = 63665)

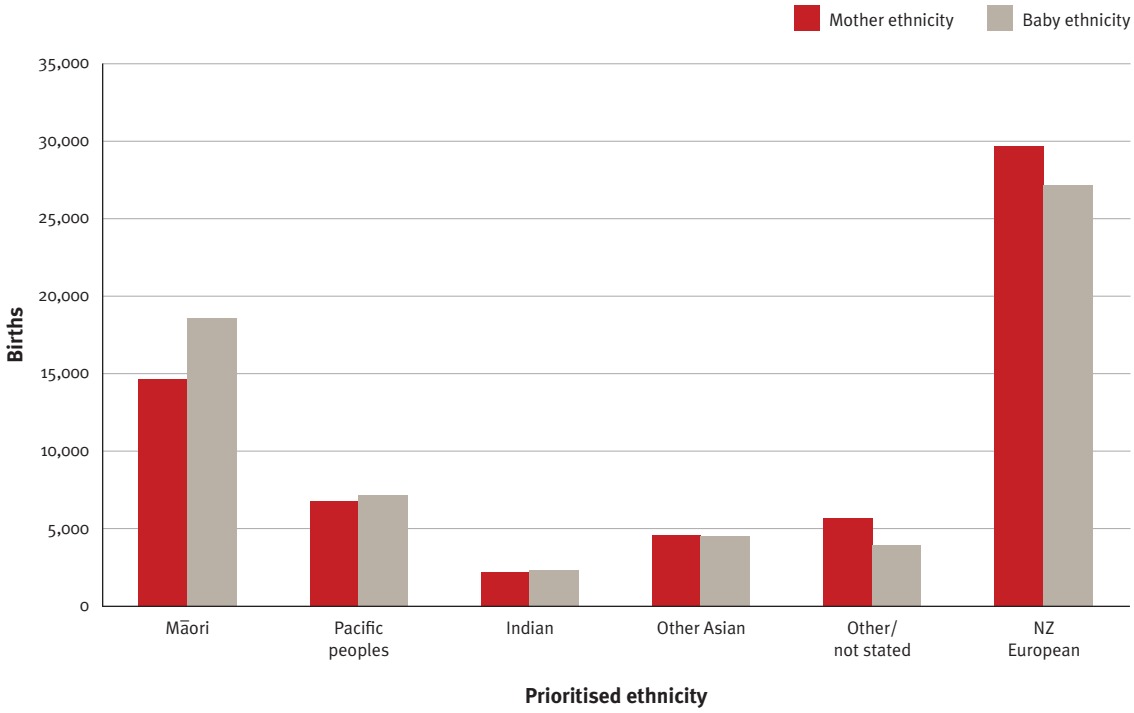


Figure 6: Distribution of sole/combination ethnicity (mother and baby) among birth registrations in 2009 (total births = 63665)

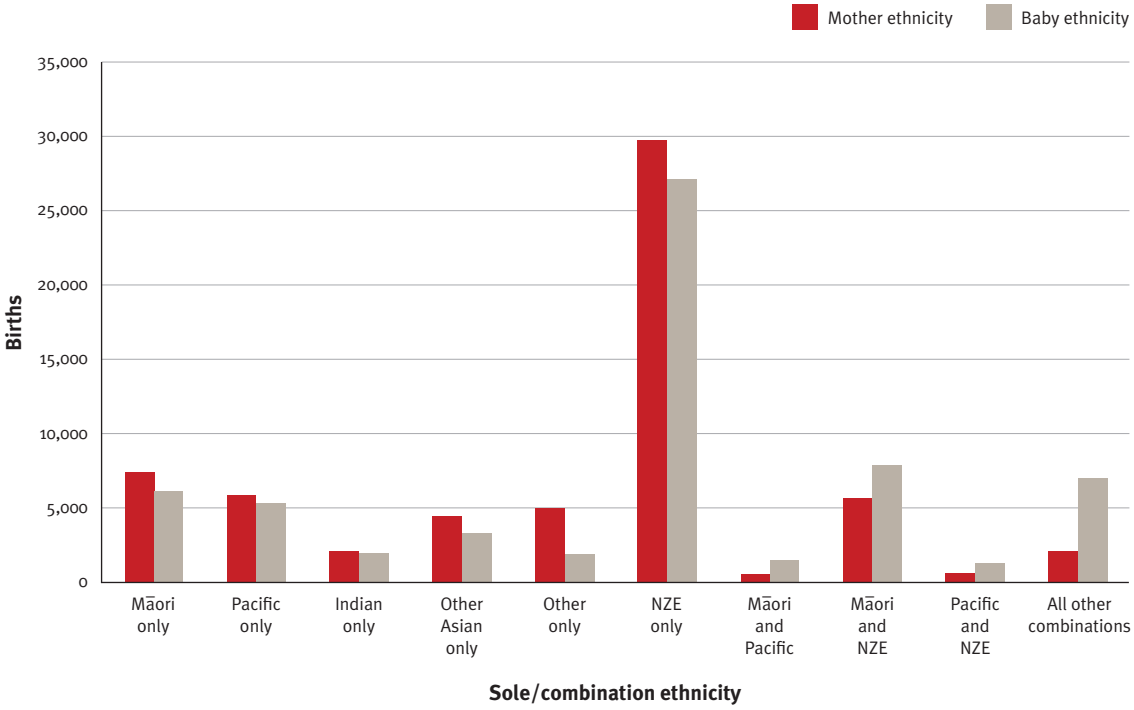
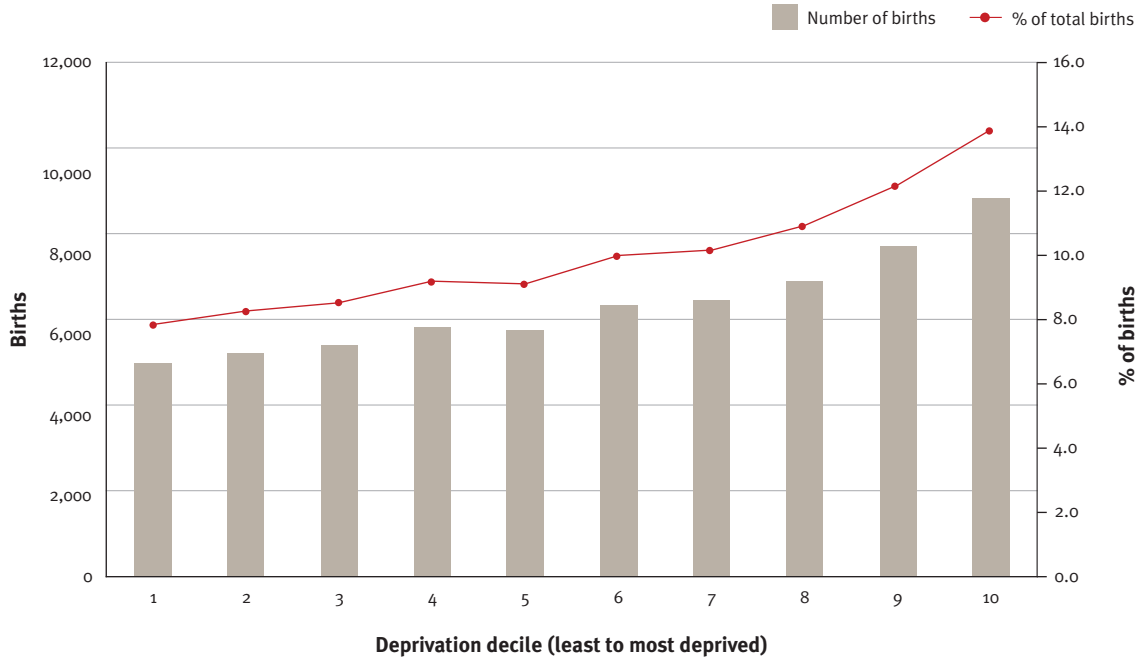


Figure 6 (with further information in Table 12 and Table 44) shows the distribution of sole/combination ethnicity for mothers and babies for all births registered in 2009. In sole/combination, each person is again represented in only one category. All groups described in the prioritised ethnicity variable are represented as sole ethnicity categories, along with the more common combined responses. The remainder are included as 'all other combinations'. Because babies are assigned more than one ethnicity more often than mothers, babies are more likely to be represented in the combined groups than their mothers.

Roughly half of the mothers and babies where Māori was stated as an ethnicity also had 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 identifying which babies are at increased risk of perinatal related mortality.

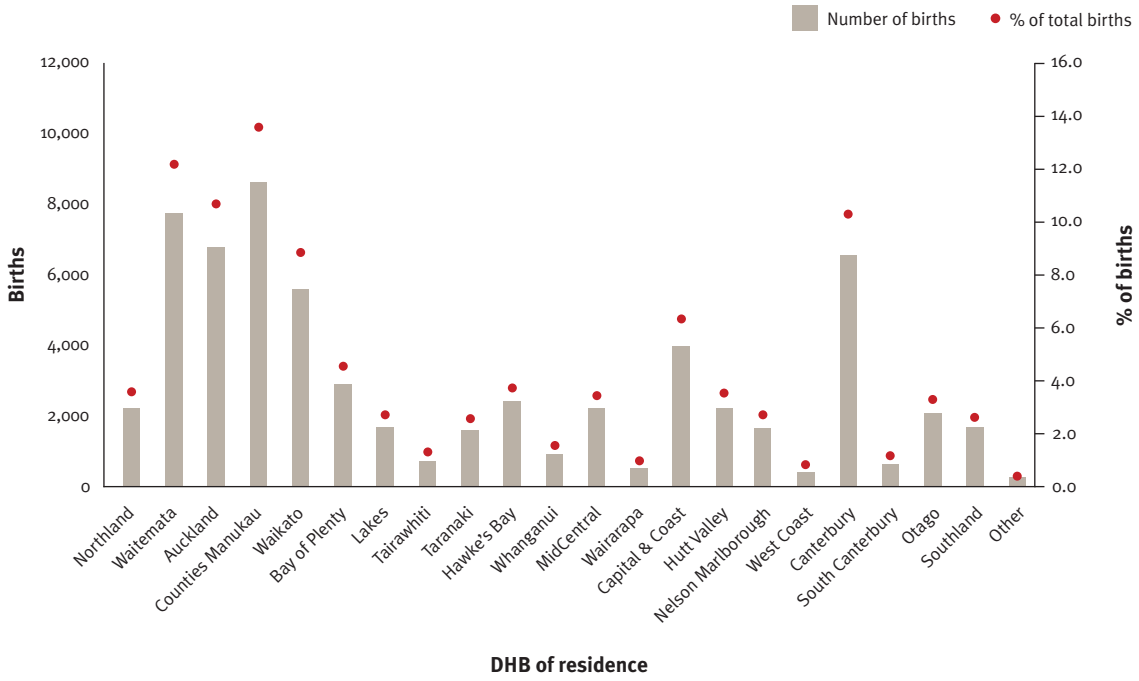
Socioeconomic deprivation and DHB of residence

Figure 7: Distribution of deprivation deciles among birth registrations in 2009 (total births excluding unknown = 63390)



The proportion of babies born in the most deprived decile area in New Zealand (13.8%) is greater than the proportion in any other decile area, and the proportion of births increases fairly consistently with increasing deprivation.

Figure 8: Distribution of births by DHB of maternal residence among birth registrations in 2009 (total births = 63665)



In 2009, 36 percent of babies were born to parents residing in the three Auckland DHB regions of Waitemata, Auckland and Counties Manukau; 20 percent were born to parents residing in the South Island.

Associations between demographic variables

Socioeconomic deprivation and DHB of residence

Figure 9: Distribution of deprivation quintiles by maternal ethnicity (prioritised) among birth registrations in 2009 (total births = 63665)

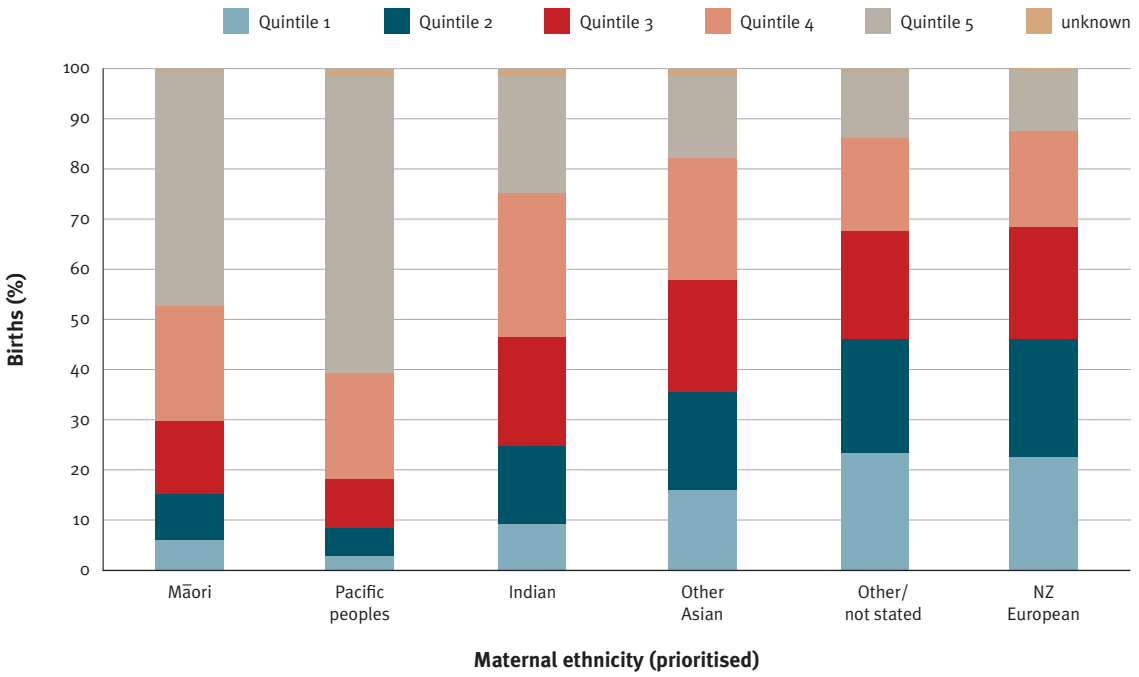


Figure 10: Distribution of deprivation quintiles by maternal ethnicity (sole/combination) among birth registrations in 2009 (total births = 63665)

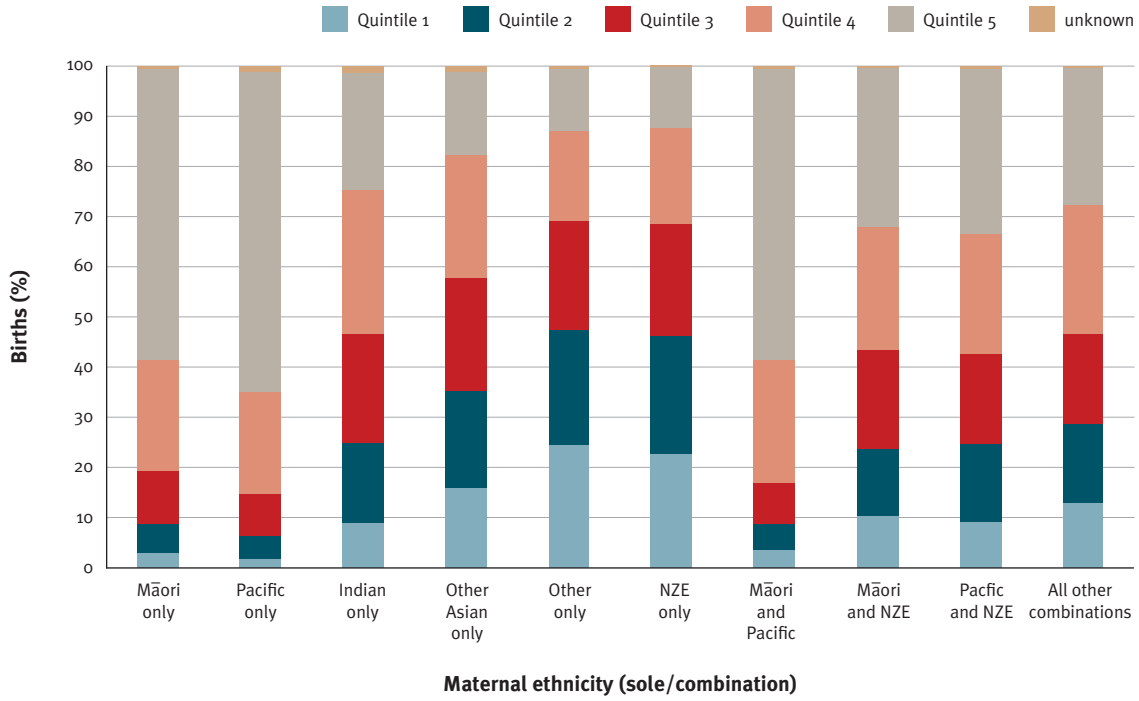


Figure 9 and Figure 10 show the association between maternal ethnicity and deprivation quintiles. Figure 9 demonstrates the distribution of deprivation quintiles across prioritised ethnicity, while Figure 10 uses sole/combination ethnicity. Both figures suggest an unequal distribution of deprivation (NZDep2006) 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 2009 (total births = 63665)

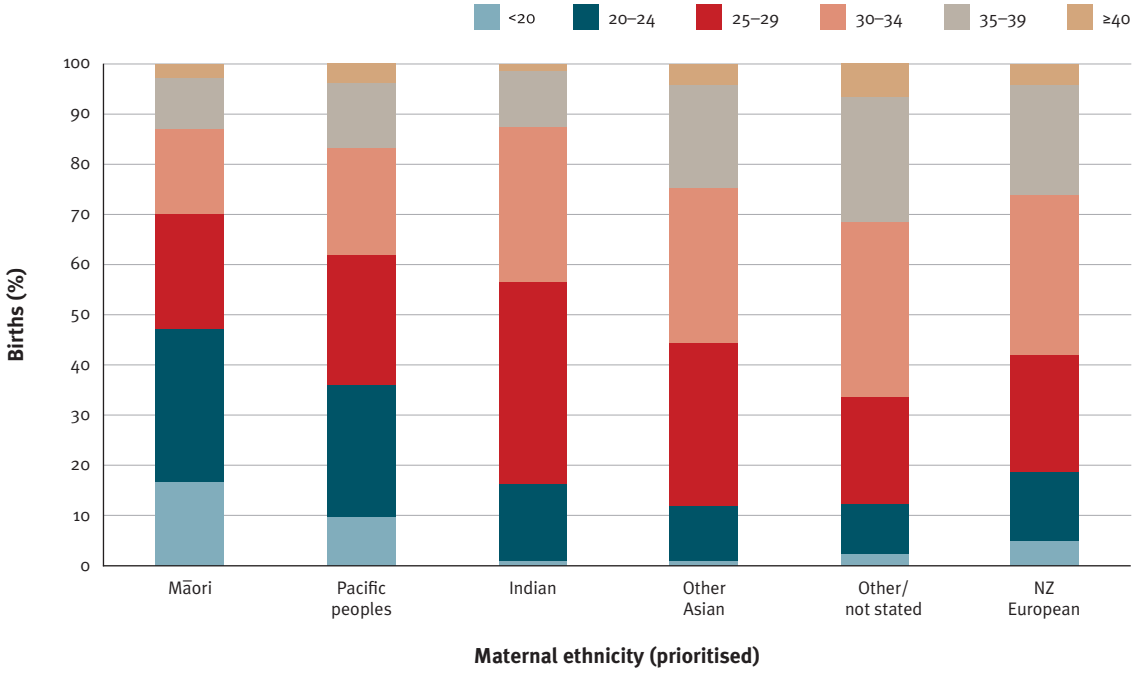


Figure 12: Distribution of maternal age by maternal ethnicity (sole/combination) among birth registrations in 2009 (total births = 63665)

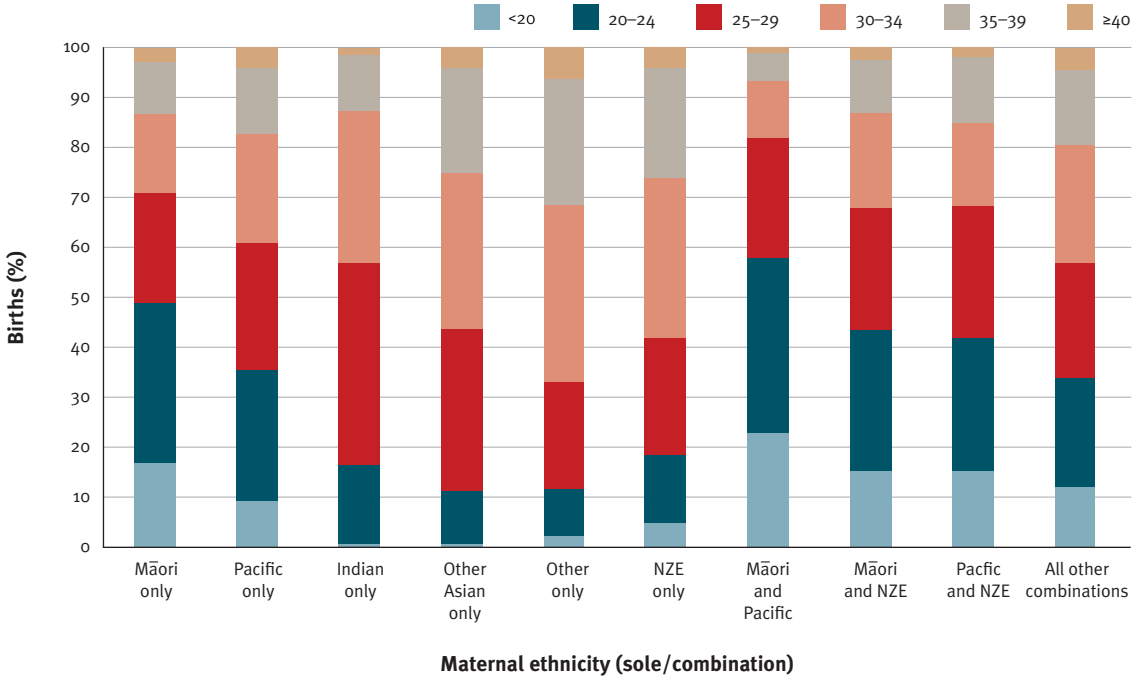
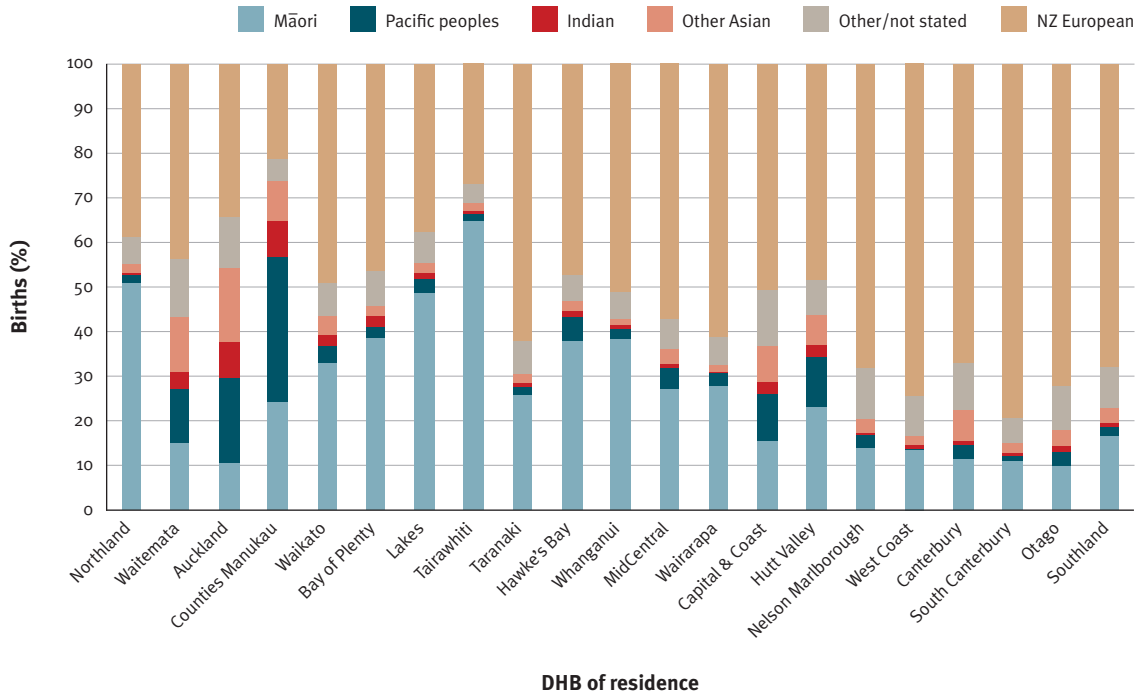


Figure 12 demonstrate the differences in age of mothers according to maternal ethnicity among births registered in New Zealand in 2009. Mothers who identify themselves as combined Māori and Pacific have the youngest age distribution, followed by mothers identifying as sole Māori. The differences in maternal 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 socioeconomic deprivation

DHB and ethnicity

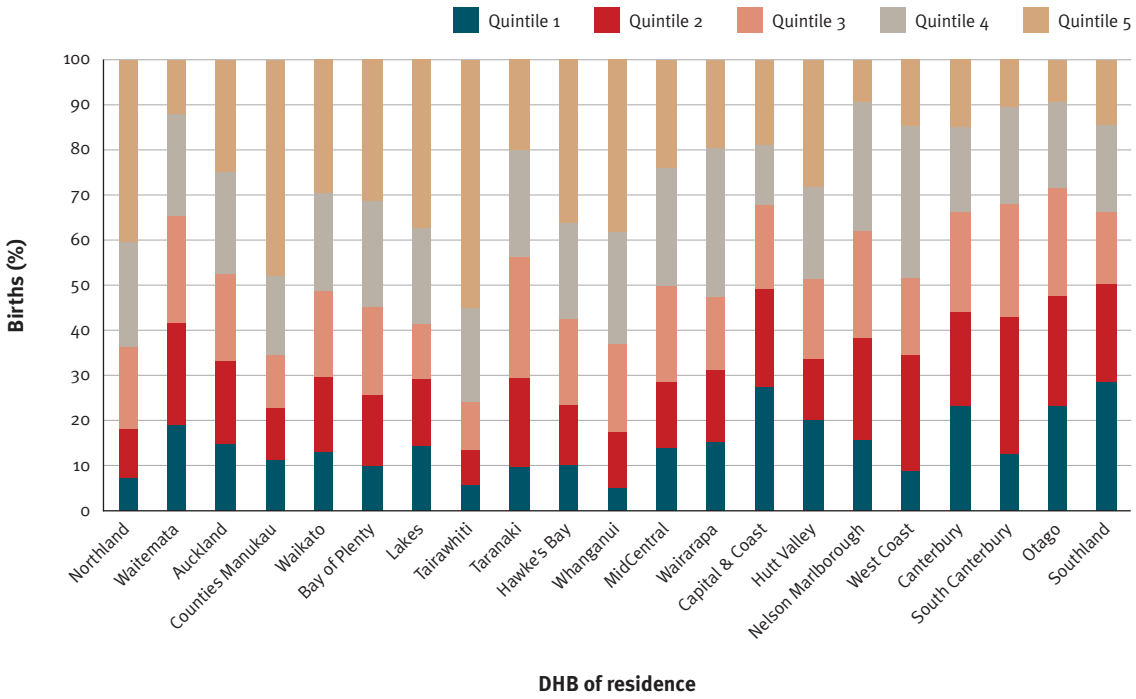
Figure 13: Distribution of maternal ethnicity (prioritised) by DHB of maternal residence among birth registrations in 2009 (total births = 63392)



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

DHB and socioeconomic deprivation

Figure 14: Distribution of deprivation quintile by DHB of maternal residence among birth registrations in 2009 (total births = 63665)



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 2009

Table 2: Summary of New Zealand perinatal mortality rates 2009

	Using NZ definition		Using UK definition[1]	
	n	Rate	n	Rate
Total births	63,665		63,520	
Fetal deaths (terminations of pregnancy and stillbirths)	539[2]	8.5[3]	339	5.3[3]
Terminations of pregnancy	137	2.2	43	
Stillbirths	402[2]	6.3	296	4.7
Early neonatal deaths <7 days	136		136	
Late neonatal deaths 7–27 days	46		46	
Neonatal deaths <28 days	182	2.9[4]	182	2.9[4]
Perinatal mortalities	675	10.6[5]	475	7.5[5]
Perinatal related mortalities	721	11.3[6]	521	8.2[6]
Perinatal mortalities excluding lethal and terminated fetal abnormalities[7]	507	8.0	422	6.6
Perinatal related mortalities excluding lethal and terminated fetal abnormalities[7]	538	8.5	453	7.1

1 Rates calculated using 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

2 Includes one stillbirth registered late (and not included in further analysis)

3 Fetal death rate per 1000 babies born (includes terminations and stillbirths)

4 Neonatal death rate per 1000 live-born babies

5 Fetal deaths and early neonatal deaths per 1000 babies born

6 Fetal deaths and early and late neonatal deaths per 1000 babies born

7 Lethal and terminated fetal abnormalities are all fetal deaths with PSANZ-PDC of congenital abnormality and neonatal deaths with PSANZ-NDC of congenital abnormality

The PMMRC calculate perinatal related mortality rates using numerator data provided by LMCs, reviewed by local perinatal mortality review committees, and collated centrally by a national coordinator, and denominator data from the registration of births in a year. This differs from the methodology used by the Ministry of Health and so the rates presented in this report may differ slightly from those reported in Ministry documents. The PMMRC believe that this report presents as complete a set of perinatal related deaths as can currently be achieved for the 2009 year in NZ.

Table 3: Summary of New Zealand perinatal mortality rates 2007-2009

	2007		2008		2009	
	n	Rate	n	Rate	n	Rate
Total births	65,602		65,872		63,665	
Fetal deaths (terminations of pregnancy and stillbirths)	511	7.8[1]	524	8.0[1]	539	8.5[1]
Terminations of pregnancy	143	2.2	145	2.2	137	2.2
Stillbirths	368	5.6	379	5.8	402	6.3
Early neonatal deaths <7 days	134		134		136	
Late neonatal deaths 7–27 days	33		42		46	
Neonatal deaths <28 days	167	2.6[2]	176	2.7[2]	182	2.9[2]
Perinatal mortalities	645	9.8[3]	658	10.0[3]	675	10.6[3]
Perinatal related mortalities	678	10.3[4]	700	10.6[4]	721	11.3[4]
Perinatal mortalities (excluding lethal and terminated fetal abnormalities)[5]	460	7.0	489	7.4	507	8.0
Perinatal related mortalities (excluding lethal and terminated fetal abnormalities)[5]	479	7.3	516	7.9	538	8.5

1 Fetal death rate per 1000 babies born (includes terminations and stillbirths)

2 Neonatal death rate per 1000 live-born babies

3 Fetal deaths and early neonatal deaths per 1000 babies born

4 Fetal deaths and early and late neonatal deaths per 1000 babies born

5 Lethal and terminated fetal abnormalities are all fetal deaths with PSANZ-PDC of congenital abnormality and neonatal deaths with PSANZ-NDC of congenital abnormality

The perinatal mortality rates for the first three years of data collection are presented in Table 3. There has been a small but statistically insignificant increase in perinatal related mortality from 10.3/1000 births in 2007 to 10.6/1000 births in 2008 to 11.3/1000 births in 2009.

International comparisons

CMACE Perinatal Mortality 2009 reported a perinatal mortality rate of 7.6/1000 total births, a stillbirth rate of 5.2/1000 total births and a neonatal mortality rate of 3.2/1000 live births (CMACE 2011). The comparable New Zealand rates for 2009 are 7.5 per 1000 total births, 4.7 per 1000 total births and 2.9 per 1000 live births respectively.

The 2009 perinatal mortality data from Australia have not been reported. In 2008, Australia reported a perinatal mortality rate (equivalent to our perinatal related mortality rate) of 10.2/1000 births (AIHW National Perinatal Statistics Unit 2010) with rates varying by jurisdiction from 8.7/1000 in New South Wales to 12.7/1000 in Victoria. The comparable New Zealand rate for 2008 is 10.6/1000.

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 4: Perinatal related deaths by primary obstetric antecedent cause (PSANZ-PDC) 2009

Perinatal death classification (PDC)	Fetal deaths				Neonatal deaths		Total perinatal related deaths	
	Termination of pregnancy		Stillbirths					
	n = 137		n = 401		n = 182		n = 720	
	n	%	n	%	n	%	n	%
Congenital abnormality	111	81.0	29	7.2	41	22.5	181	25.1
Perinatal infection	1	0.7	15	3.7	8	4.4	24	3.3
Hypertension	2	1.5	23	5.7	3	1.6	28	3.9
Antepartum haemorrhage	2	1.5	52	13.0	23	12.6	77	10.7
Maternal conditions	5	3.6	25	6.2	7	3.8	37	5.1
Specific perinatal conditions	4	2.9	59	14.7	12	6.6	75	10.4
Hypoxic peripartum death	-	-	11	2.7	17	9.3	28	3.9
Fetal growth restriction	5	3.6	44	11.0	4	2.2	53	7.4
Spontaneous preterm	7	5.1	41	10.2	60	33.0	108	15.0
Unexplained antepartum death	-	-	102	25.4	-	-	102	14.2
No obstetric antecedent	-	-	-	-	7	3.8	7	1.0

Figure 15: Relative distribution of fetal and neonatal deaths by perinatal death classification (PSANZ-PDC) 2009

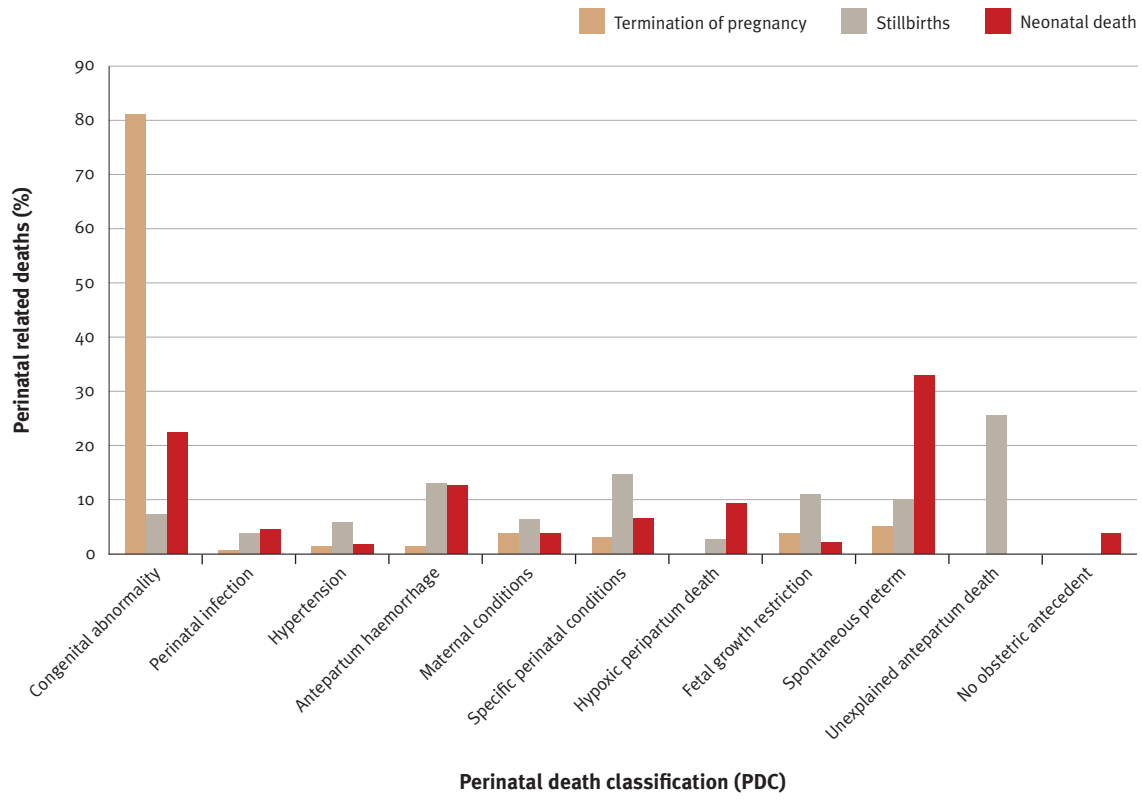
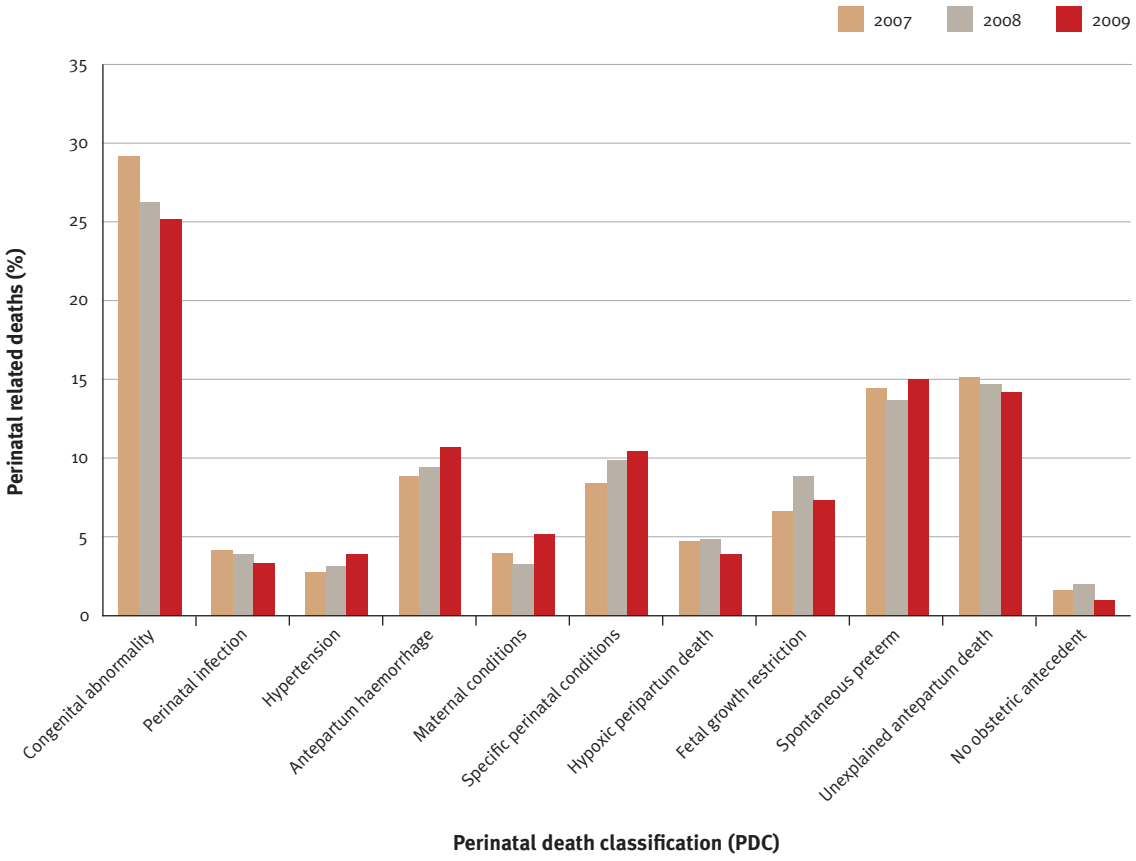


Figure 15 shows the distribution of terminations of pregnancy, stillbirths, and neonatal deaths by PSANZ-PDC cause of death. Figure 16 shows perinatal related deaths combined by PSANZ-PDC cause of death for 2007–2009, demonstrating little change in the distribution over these three years of reporting.

Figure 16: Relative distribution of perinatal death classifications (PSANZ-PDC) among perinatal related deaths by year (2007–2009)



Stillbirth

There were 401 stillbirths in 2009, a rate of 6.3/1000 total births.

The most often used classification for stillbirths continues to be 'unexplained': 25 percent of stillbirths fell into this category in 2009. As in 2007 and 2008, the most frequently identified antecedent causes (PSANZ-PDC) of stillbirth were antepartum haemorrhage, specific perinatal conditions, fetal growth restriction and spontaneous preterm birth, each responsible for 10-15 percent of deaths.

Of stillbirths from 24 weeks, 30 percent fell into the 'unexplained' category. Specific perinatal conditions and fetal growth restriction accounted for 13 and 16 percent respectively.

Of the 102 unexplained stillbirths, 52 were at term. This represents 40 percent of the 130 term stillbirths.

A post-mortem was offered in 88 percent of cases of unexplained stillbirth, and 47 percent declined post-mortem. Post-mortem was completed in only 35 percent of all cases. Partial investigation was undertaken in a further 37 percent (defined as no post-mortem; investigations may have included placental pathology, MRI, ultrasound scan or X-ray). Twenty-two percent of unexplained deaths were uninvestigated, not having a post-mortem, placental histology or karyotype undertaken.

Intrapartum stillbirth

Table 5: Timing of stillbirths relative to labour 2009

Timing of stillbirth	Stillbirths	
	n = 401	
	n	%
Antepartum	285	71.1
Intrapartum – first stage	23	5.7
Intrapartum – second stage	17	4.2
Intrapartum – unknown stage	38	9.5
Unknown	38	9.5

There were at least 78 stillbirths in labour in 2009 (75 in 2008). Timing of stillbirth was unknown in 38 cases.

Of the 78 stillbirths in labour, 34 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 0.54/1000 births (0.44/1000 in 2007, 0.49/1000 in 2008). The majority of these babies born at or beyond 24 weeks without congenital abnormality were term (68% of those who died at 24 or more weeks) and not small for gestational age (SGA) (65 percent).

The primary cause (PDC) in these cases was perinatal infection (3), hypertension (3), antepartum haemorrhage (3), maternal condition (2), hypoxic peripartum death (10), fetal growth restriction (5), spontaneous preterm birth (7) and unexplained (1). Twelve of these deaths (35%) were deemed by a local review committee to have been preventable, including seven of the ten hypoxic peripartum deaths.

A post-mortem was offered in almost all of the 34 cases discussed above (85%), but optimal investigation (post-mortem) was completed in fewer than 50 percent.

The intrapartum stillbirth rate for babies born at term who did not die of congenital abnormality was 0.39/1000 in 2009 (0.40/1000 in 2008). Of 121 term stillbirths without lethal congenital abnormality, 23 (19%) occurred in labour, and nine of these were hypoxic peripartum deaths.

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

Termination of pregnancy

The predominant antecedent cause of death among terminations beyond 20 weeks was congenital abnormality (n = 111, 81%). There were 19 terminations performed after 24 weeks gestation. The primary antecedent classifications for these cases were congenital abnormality in 14, and hypertension, fetal growth restriction and spontaneous preterm in the remainder.

Neonatal deaths

Table 6: Clinical details of neonatal deaths 2009

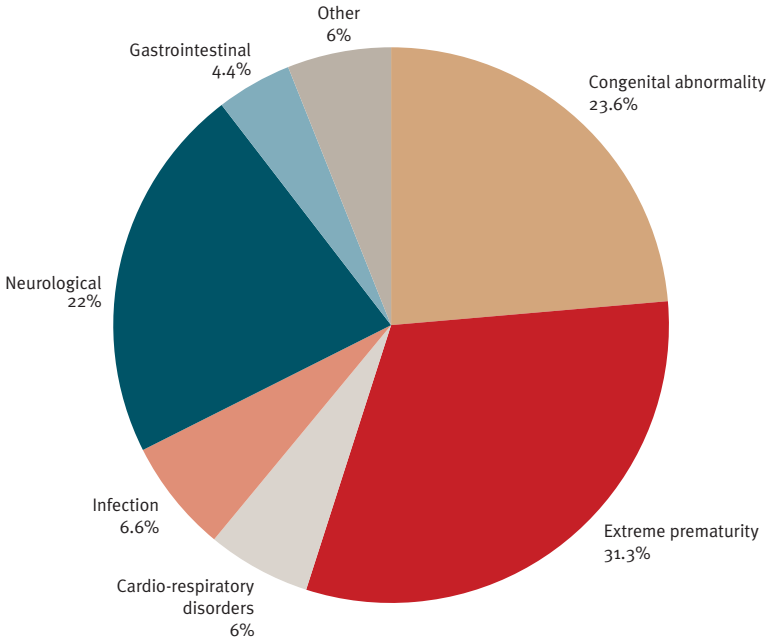
	Neonatal deaths							
	Total		20–23 weeks		24–27 weeks		28+ weeks	
	n = 182		n = 51		= 41		n = 90	
	n	%	n	%	n	%	n	%
Age at death								
≤1 day	101	55.5	48	94.1	18	43.9	35	38.9
2–7 days	41	22.5	1	2.0	13	31.7	27	30.0
8–14 days	20	11.0	2	3.9	3	7.3	15	16.7
15–21 days	9	4.9	-	-	5	12.2	4	4.4
22–28 days	11	6.0	-	-	2	4.9	9	10.0
Place of death								
Home	12	6.6	-	-	-	-	12	13.3
Hospital								
Delivery suite	45	24.7	32	62.7	8	19.5	5	5.6
Neonatal unit	91	50.0	3	5.9	31	75.6	57	63.3
Operating theatre	7	3.8	-	-	1	2.4	6	6.7
Emergency department	5	2.7	3	5.9	1	2.4	1	1.1
Other	17	9.3	11	21.6	-	-	6	6.7
Other	5	2.7	2	3.9	-	-	3	3.3
Apgar 5 minutes								
0–3	73	40.1	36	70.6	13	31.7	24	26.7
4–5	21	11.5	2	3.9	4	9.8	15	16.7
6–7	32	17.6	1	2.0	16	39.0	15	16.7
≥8	38	20.9	-	-	7	17.1	31	34.4
Unknown	18	9.9	12	23.5	1	2.4	5	5.6
Resuscitation at birth								
Yes	104	57.1	5	9.8	35	85.4	64	71.1
No	76	41.8	46	90.2	5	12.2	25	27.8
Unknown	2	1.1	-	-	1	2.4	1	1.1
Outcome of resuscitation								
Baby resuscitated and transferred to another clinical care area	87	83.7	3	60.0	30	85.7	54	84.4
Baby unable to be resuscitated	15	14.4	2	40.0	5	14.3	8	12.5
Unknown	2	1.9	-	-	-	-	2	3.1

Almost half of all neonatal deaths at 24 weeks or beyond occurred at less than one day of age (40%) and 70 percent within the first week. Two-thirds 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, 10 percent (13 babies) could not be resuscitated at birth.

There were seven cases of sudden unexpected death in infancy (SUDI) among the neonatal deaths in 2009 (10 in 2008). Four of these babies had a mother who smoked, and six were co-sleeping.

Figure 17: Primary neonatal death classification (PSANZ-NDC) 2009



Congenital abnormality, extreme prematurity, and neurological continue to be the three most common primary neonatal causes of death.

Table 7: Association between obstetric antecedent cause of death (PDC) and neonatal cause of death (NDC) among all neonatal deaths 2009

Perinatal death classification (PDC)	Total	Neonatal death classification (NDC)						
		Congenital abnormality	Extreme prematurity	Cardio-respiratory disorders	Infection	Neurological	Gastro-intestinal	Other
Congenital abnormality	41	41	-	-	-	-	-	-
Perinatal infection	8	-	4	-	4	-	-	-
Hypertension	3	-	-	1	-	1	1	-
Antepartum haemorrhage	23	-	13	-	1	8	1	-
Maternal conditions	7	2	1	1	3	-	-	-
Specific perinatal conditions	12	-	6	-	-	3	1	2
Hypoxic peripartum death	17	-	-	-	-	17	-	-
Fetal growth restriction	4	-	-	-	-	2	-	2
Spontaneous preterm	60	-	33	9	2	9	5	2
Unexplained antepartum death	-	-	-	-	-	-	-	-
No obstetric antecedent	7	-	-	-	2	-	-	5
Total	**182**	**43**	**57**	**11**	**12**	**40**	**8**	**11**

All neonatal deaths are assigned at least one neonatal death classification (NDC), along with an obstetric antecedent cause (PDC). Table 7 demonstrates how these classification systems relate to each other. For example, neurological causes of neonatal death most often followed peripartum hypoxia (17), or spontaneous preterm birth (9) and antepartum haemorrhage (8). Extreme prematurity was the cause of death following a range of antecedent events.

Demography of perinatal deaths

Gender

Table 8: Perinatal related death rates (per 1000) by gender 2009

	Total births		Fetal deaths: Termination of pregnancy			Fetal deaths: Stillbirths			Neonatal deaths			Total perinatal related deaths		
	n = 63,665		n = 137			n = 401			n = 182			n = 720		
	n	%	n	%	Rate	n	%	Rate	n	%	Rate	n	%	Rate
Gender														
Male	32,677	51.3	69	50.4	2.11	204	50.9	6.24	96	52.7	2.96	369	51.3	11.29
Female	30,988	48.7	68	49.6	2.19	190	47.4	6.13	86	47.3	2.80	344	47.8	11.10
Unknown	-	-	-	-	-	7	1.7	-	-	-	-	7	1.0	-

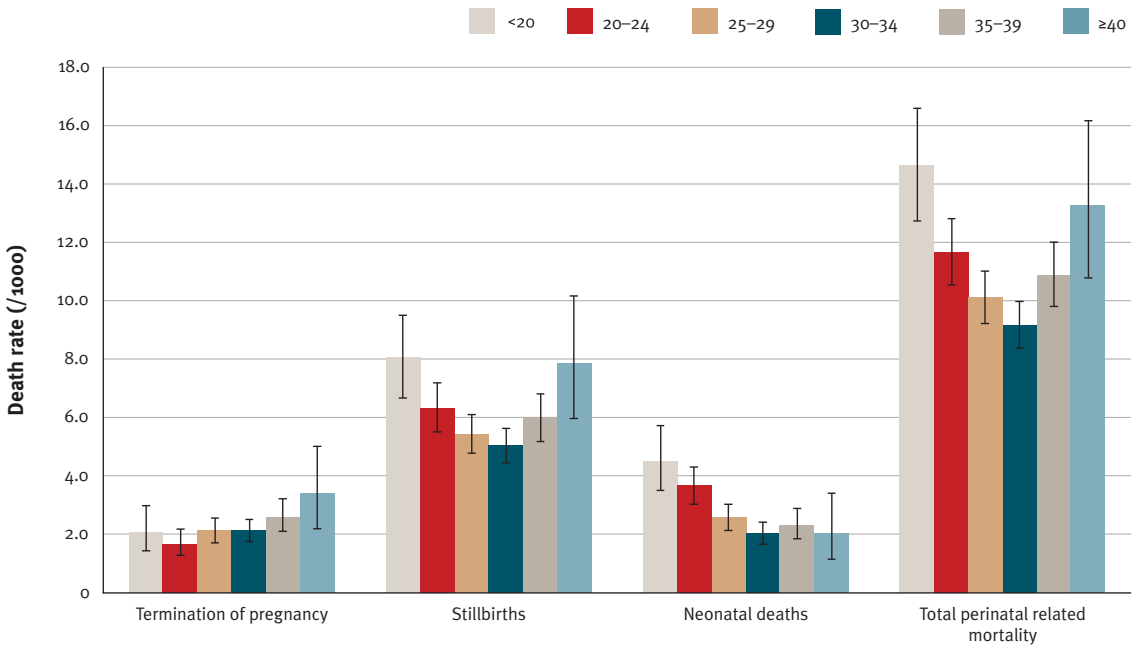
There are no statistically significant differences in perinatal related mortality rates between male and female babies.

Maternal age

Table 9: Perinatal related death rates (per 1000) by maternal age 2009

	Total births		Fetal deaths: Termination of pregnancy			Fetal deaths: Stillbirths			Neonatal deaths			Total perinatal related deaths		
	n = 63,665		n = 137			n = 401			n = 182			n = 720		
	n	%	n	%	Rate	n	%	Rate	n	%	Rate	n	%	Rate
Maternal age														
<20	4,764	7.5	14	10.2	2.94	42	10.5	8.82	22	12.1	4.67	78	10.8	16.37
20–24	11,773	18.5	14	10.2	1.19	74	18.5	6.29	53	29.1	4.54	141	19.6	11.98
25–29	15,600	24.5	33	24.1	2.12	94	23.4	6.03	39	21.4	2.52	166	23.1	10.64
30–34	17,560	27.6	36	26.3	2.05	94	23.4	5.35	37	20.3	2.12	167	23.2	9.51
35–39	11,473	18.0	32	23.4	2.79	79	19.7	6.89	25	13.7	2.20	136	18.9	11.85
≥40	2,495	3.9	8	5.8	3.21	18	4.5	7.21	6	3.3	2.43	32	4.4	12.83

Figure 18: Perinatal related death rates (per 1000) by maternal age (with 95% CIs) 2007–2009



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 18, 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. Further discussion of the association of maternal age with perinatal related mortality can be found in section 1.8.

Ethnicity

Analyses using maternal ethnicity are presented in the body of the report. Similar tables including baby ethnicity data are presented in Appendix B Tables 42–45.

Mothers' ethnicity has been included in the body of the report because of the provision of antenatal care to mothers rather than to babies.

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 2006–2008 PMMRC reports) and as sole/combination categories. Both of these methods of describing ethnicity allocate each individual to a single mutually exclusive ethnicity category. Both of these methods are presented, 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 was used in the PMMRC report for the first time in 2008. The sole/combination groups presented 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 2009 collated by the PMMRC and births registered in the 2009 year. Table 10, showing total ethnicity responses for perinatal related deaths in 2009, has been included for completeness. The figures illustrate rates based on the combined data for 2007–2009.

Table 10: Total responses for mother and baby ethnicity among perinatal related deaths 2009

	Baby ethnicity total response among perinatal related deaths		Mother ethnicity total response among perinatal related deaths	
	n = 720		n = 720	
	n	%	n	%
Māori	250	34.7	206	28.6
Pacific peoples	151	21.0	114	15.8
Indian	35	4.9	34	4.7
Other Asian	48	6.7	44	6.1
Other	44	6.1	56	7.8
New Zealand European	399	55.4	367	51.0

Mothers' ethnicity for the PMMRC set of perinatal related deaths has been extracted, in order of priority, from BDM registration of birth (516) or PMMRC rapid reporting forms (204). Babies' ethnicity for the PMMRC set of perinatal related deaths has been extracted, in order of priority, from BDM registration of birth (515), BDM registration of death (55) or PMMRC rapid reporting forms (150).

Table 11: Perinatal related death rates (per 1000) by maternal ethnicity (prioritised) 2009

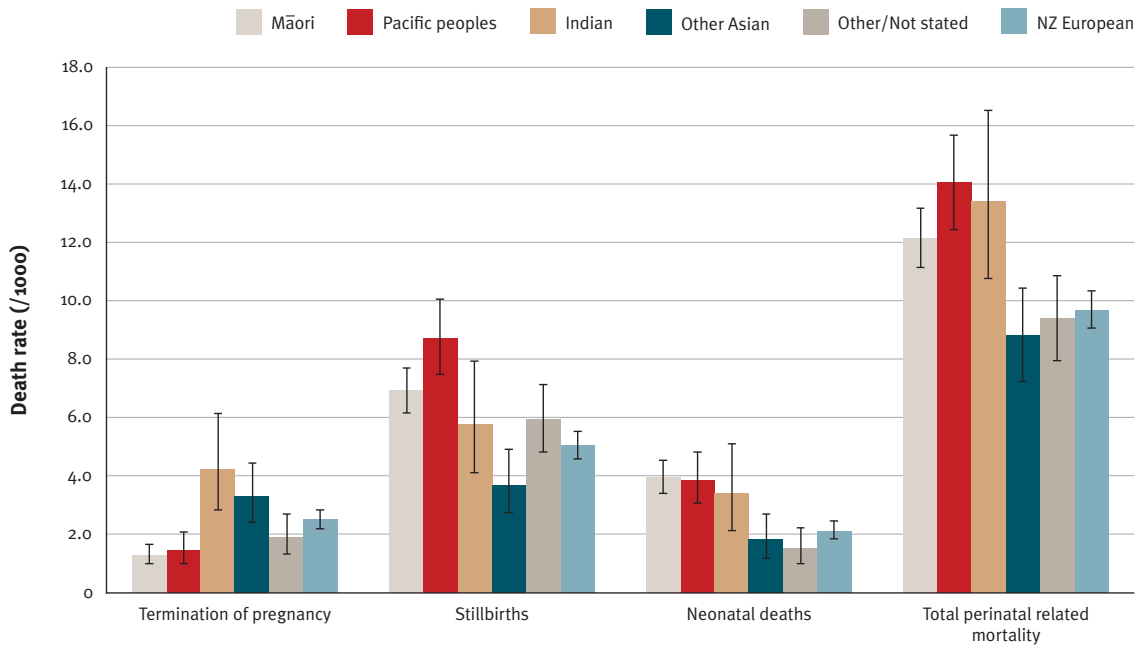
	Total births		Fetal deaths						Neonatal deaths			Total perinatal related deaths		
			Termination of pregnancy			Stillbirths								
	n = 63,665		n = 137			n = 401			n = 182			n = 720		
	n	%	n	%	Rate	n	%	Rate	n	%	Rate	n	%	Rate
Ethnicity (mother)														
Māori	14,646	23.0	28	20.4	1.91	110	27.4	7.51	68	37.4	4.69	206	28.6	14.07
Pacific peoples	6,823	10.7	13	9.5	1.91	63	15.7	9.23	29	15.9	4.30	105	14.6	15.39
Indian	2,190	3.4	9	6.6	4.11	13	3.2	5.94	11	6.0	5.07	33	4.6	15.07
Other Asian	4,590	7.2	14	10.2	3.05	19	4.7	4.14	9	4.9	1.97	42	5.8	9.15
Other/not stated	5,732	9.0	4	2.9	0.70	38	9.5	6.63	8	4.4	1.41	50	6.9	8.72
NZ European	29,684	46.6	69	50.4	2.32	158	39.4	5.32	57	31.3	1.94	284	39.4	9.57

The relationship between ethnicity and perinatal related mortality is complicated, in that the association between ethnicity and mortality varies for each of the modes of perinatal related death. For example, irrespective of how ethnicity is described (prioritised or sole/combination), 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, and in some instances terminations of pregnancy are excluded from analyses.

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 19: Perinatal related death rates (per 1000) by maternal ethnicity (prioritised) (with 95% CIs) 2007–2009



The disparities in perinatal mortality rates by maternal ethnicity are more evident as more data become available for analysis. Prioritised Māori and Pacific maternal ethnicities are associated with increased risk of stillbirth and neonatal death compared with New Zealand European and non-Indian Asian maternal ethnicities. Numbers of Indian mothers are small, but it would appear that these mothers have a higher risk of late termination compared to all non-Asian ethnicity mothers. Māori and Pacific mothers have lower rates of late termination compared to NZ European mothers.

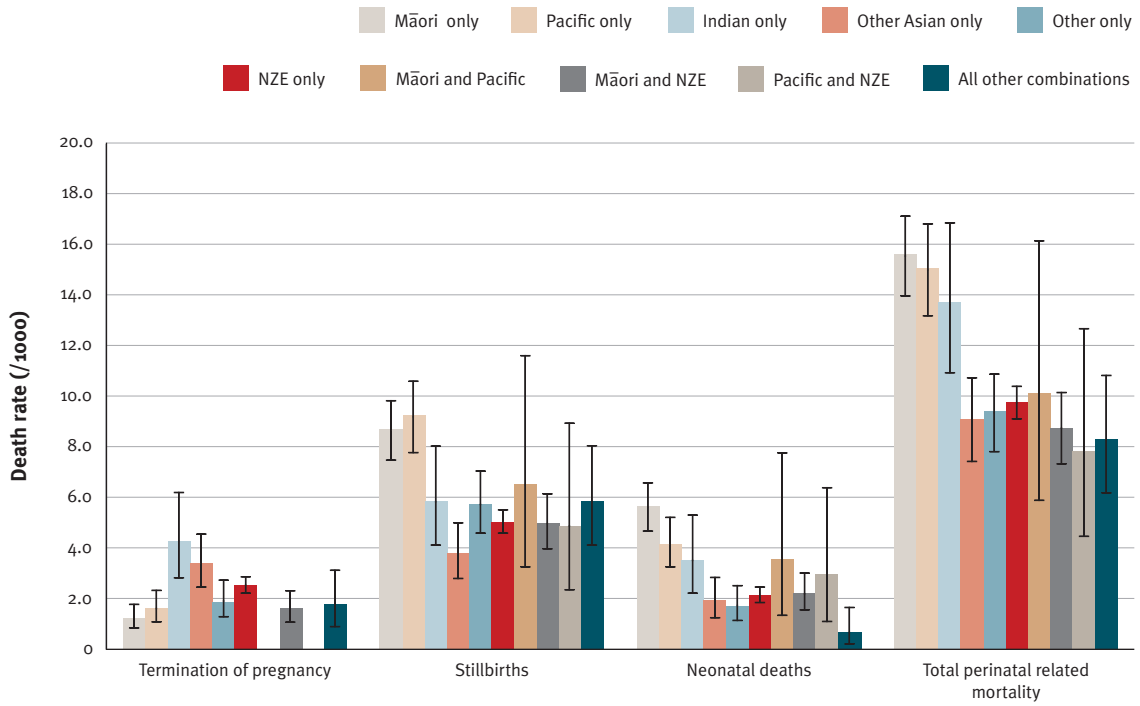
There is no statistically significant difference in the rate of late termination, stillbirth or neonatal death between Māori and Pacific mothers, although it seems likely that stillbirth rates are higher among Pacific mothers.

Table 12: Perinatal related death rates (per 1000) by maternal ethnicity (sole/combination) 2009

	Total births		Fetal deaths						Neonatal deaths			Total perinatal related deaths		
			Termination of pregnancy			Stillbirths								
	n = 63,665		n = 137			n = 401			n = 182			n = 720		
	n	%	n	%	Rate	n	%	Rate	n	%	Rate	n	%	Rate
Sole/combination ethnicity (mother)														
Māori only	7,446	11.7	13	9.5	1.75	70	17.5	9.40	43	23.6	5.84	126	17.5	16.92
Pacific only	5,876	9.2	12	8.8	2.04	57	14.2	9.70	27	14.8	4.65	96	13.3	16.34
Indian only	2,119	3.3	9	6.6	4.25	13	3.2	6.13	11	6.0	5.25	33	4.6	15.57
Other Asian only	4,428	7.0	13	9.5	2.94	19	4.7	4.29	9	4.9	2.05	41	5.7	9.26
Other only[1]	5,083	8.0	4	2.9	0.79	30	7.5	5.90	8	4.4	1.58	42	5.8	8.26
NZE only	29,684	46.6	69	50.4	2.32	158	39.4	5.32	57	31.3	1.94	284	39.4	9.57
Māori and Pacific	545	0.9	-	-	-	4	1.0	7.34	2	1.1	3.70	6	0.8	11.01
Māori and NZE	5,716	9.0	13	9.5	2.27	31	7.7	5.42	21	11.5	3.70	65	9.0	11.37
Pacific and NZE	652	1.0	-	-	-	2	0.5	3.07	2	1.1	3.08	4	0.6	6.13
All other combinations	2,116	3.3	4	2.9	1.89	17	4.2	8.03	2	1.1	0.95	23	3.2	10.87

1 Includes not stated

Figure 20: Perinatal related death rates (per 1000) by maternal ethnicity (sole/combination categories) (with 95% CIs) 2007–2009



The sole/combination method of categorising ethnicity provides further information on the association between ethnicity and perinatal mortality risk, especially for Māori and Pacific mothers. This is because mothers who identify as combined ethnicities (including Māori and Pacific) appear to be at lower risk than those identifying with sole groups. The reasons for this are not evident from these data, but the association between sole/combination ethnicity and socioeconomic deprivation and age, illustrated in the denominator data in Figure 10 and Figure 12, show that ethnicity is a marker for at least these factors. Other markers for perinatal death, which are associated with ethnicity and may be represented by this variable, include obesity and smoking. The Auckland Stillbirth Study (Stacey 2011) has reported that ethnicity is not associated with late stillbirth (≥28 weeks) after adjusting for maternal BMI.

The same excess of stillbirth and neonatal death associated with Māori and Pacific ethnicity compared to Other Asian, Other, and NZ European ethnicity are seen using sole/combination ethnicity as with prioritised ethnicity. The stillbirth and neonatal death rates are higher for sole Māori and sole Pacific than for prioritised Māori and Pacific (Figure 20 compared with Figure 19). 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 theconfidence intervals are wide. These findings may be useful in identifying mothers/babies who require further care in pregnancy.

Figure 21 and Figure 22 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). It is becoming clearer that the higher stillbirth and neonatal death rates for Māori and Pacific mothers are due to an excess of only some causes of perinatal death. There is a clear excess of combined stillbirth and neonatal death from spontaneous preterm birth possibly due in part to higher smoking rates among Māori and Pacific mothers. Other differences are not statistically significant for both Māori and Pacific or consistently among prioritised and sole Māori and Pacific definitions. Specifically, neonatal deaths with no obstetric antecedent are considerably more frequent in babies of Māori mothers. These are most often Sudden Unexpected Deaths in Infancy (SUDI). Antepartum haemorrhage is also a more common antecedent to death in Māori, possibly related to higher smoking rates among Māori mothers, while hypertension is a more common antecedent among Pacific mothers.

Maternal conditions are a more frequent antecedent among sole Māori and sole Pacific mothers and this trend is also evident in the prioritised data.

Congenital abnormality may also be more frequent among stillbirths and neonatal deaths in Māori and Pacific mothers, which probably reflects the lower rates of termination of pregnancy among these mothers, but may also be related to increased obesity among Māori and Pacific mothers.

Figure 21: PDC-specific perinatal related death rates (per 1000) by prioritised maternal ethnicity (excluding termination of pregnancy)(with 95% CIs) 2007–2009

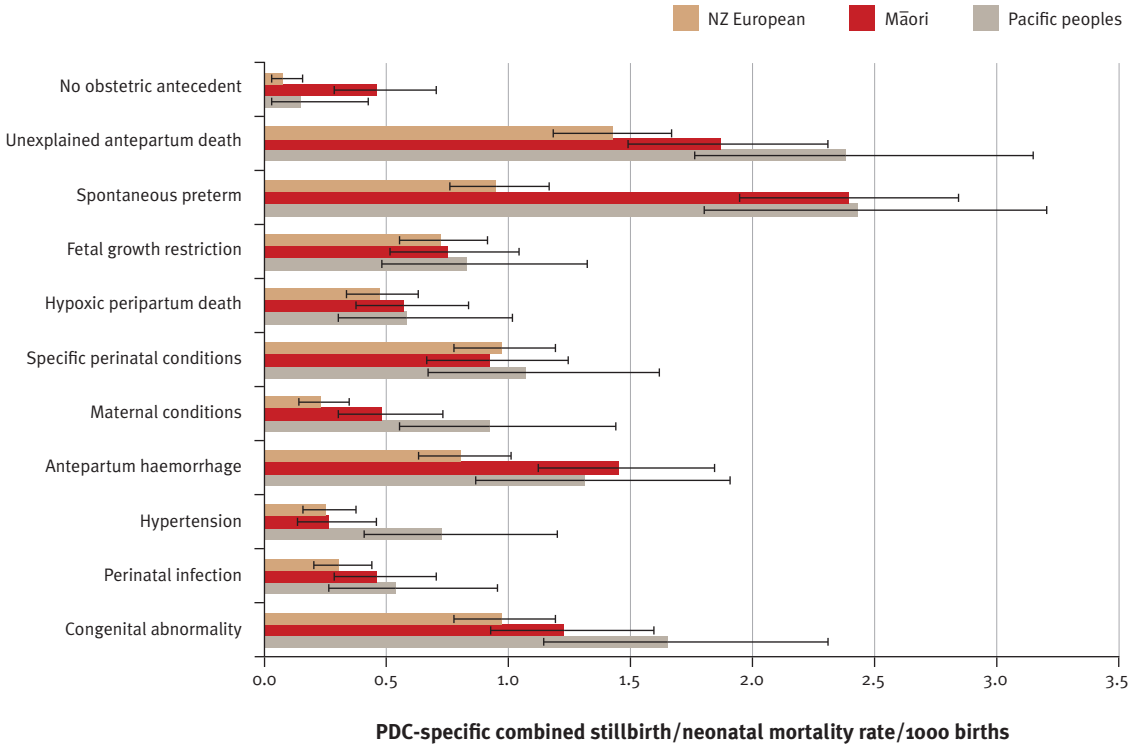
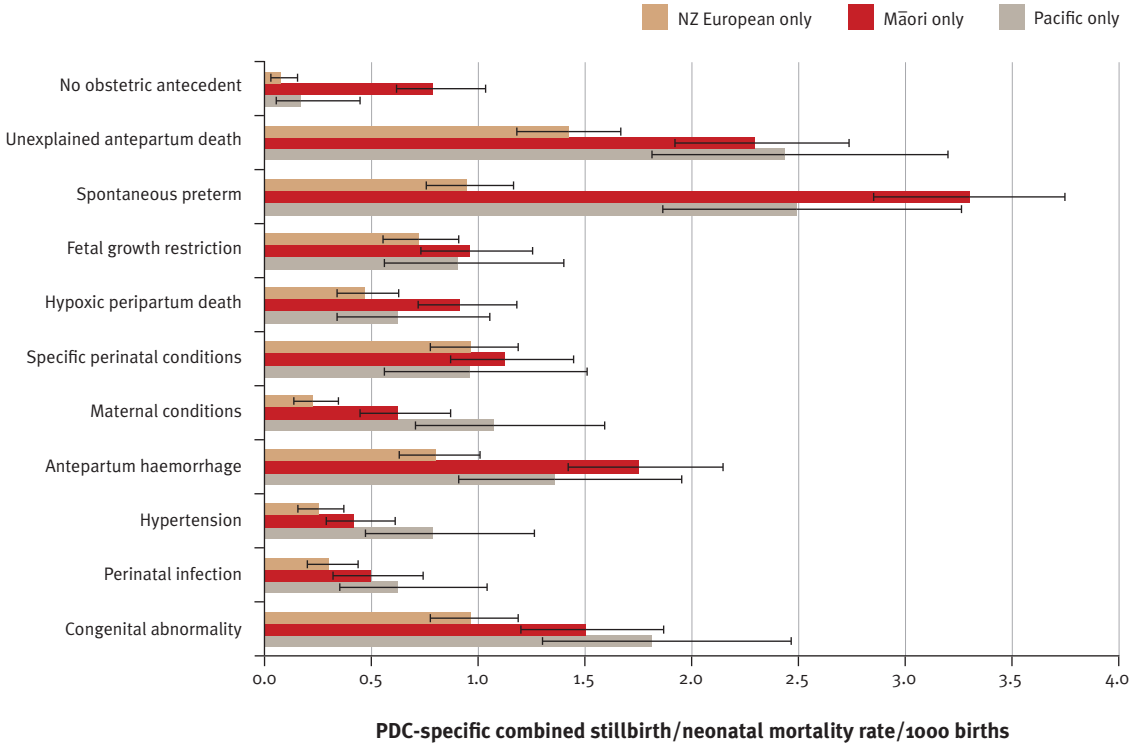


Figure 22: PDC-specific perinatal related mortality rates (per 1000) (excluding termination of pregnancy) by sole/combination maternal ethnicity (with 95% CIs) 2007–2009



Socioeconomic disadvantage

Table 13: Perinatal related death rates (per 1000) by deprivation quintile (NZDep2006) 2009

	Total births		Fetal deaths				Neonatal deaths		Perinatal related deaths		
			Termination of pregnancy		Stillbirths						
	n = 63,665		n = 137		n = 401		n = 182		n = 720		
Deprivation quintile	n	%	n	Rate	n	Rate	n	Rate	n	%	Rate
1	10,177	16.0	25	2.46	44	4.32	14	1.39	83	11.5	8.16
2	11,225	17.6	20	1.78	53	4.72	20	1.79	93	12.9	8.29
3	12,088	19.0	25	2.07	66	5.46	27	2.25	118	16.4	9.76
4	13,342	21.0	31	2.32	94	7.05	40	3.03	165	22.9	12.37
5	16,530	26.0	35	2.12	133	8.05	80	4.89	248	34.4	15.00
Unknown	303	0.5	1	-	11	-	1	-	13	1.8	-

Figure 23: Perinatal related death rates (per 1000) by deprivation quintile (NZDep2006) (with 95% CIs) 2007–2009

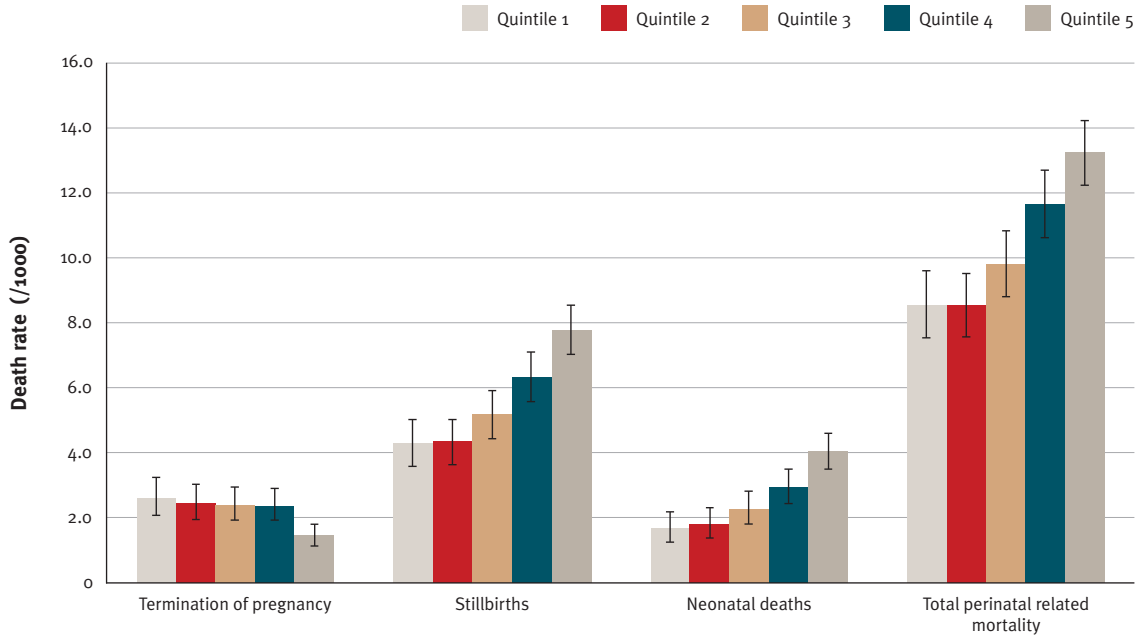
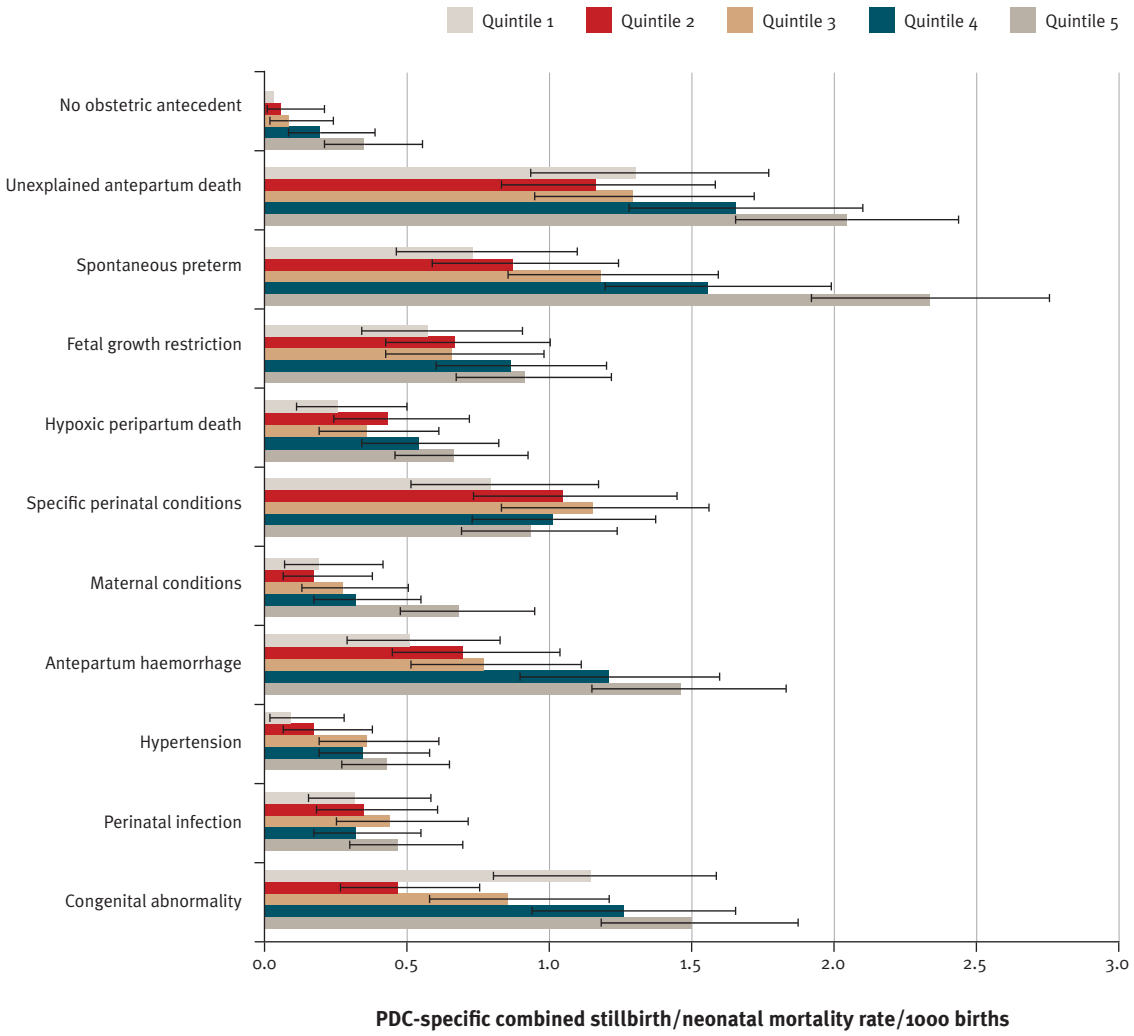


Figure 23 includes combined data from 2007–2009 and shows a significantly lower rate of late termination (≥ 20 weeks) among the most deprived mothers (quintile 5) but a significantly increased rate of stillbirth and neonatal death in this group compared to all less deprived quintiles. The trend towards increasing stillbirth and neonatal death with increasing socioeconomic deprivation becomes more evident as more data are collected. However, it is possible that socioeconomic deprivation is a surrogate for higher BMI, higher parity, and smoking, along with limited antenatal care.

Figure 24: PDC-specific perinatal related death rates (per 1000) (excluding termination of pregnancy) by deprivation quintile (with 95% CIs) 2007–2009



Combined stillbirth and neonatal death rates have been presented for each antecedent cause (PDC) in Figure 24 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. Three years of data have been pooled to increase confidence around the rate estimates. The confidence intervals are often wide but it is becoming apparent that some causes of stillbirth and neonatal death show an association with increasing deprivation, specifically spontaneous preterm birth and antepartum haemorrhage.

The association between deprivation quintile and congenital abnormality as a cause of stillbirth and neonatal death shows a different distribution with significantly higher rates among women in quintile 1 (low deprivation) and quintile 5 (high deprivation) compared with women in quintile 2. The reason for this relationship has not been identified.

Place of residence

Figure 25: Perinatal related death rates (per 1000) by DHB of residence (mother) compared to New Zealand perinatal related mortality (with 95% CIs) 2007–2009

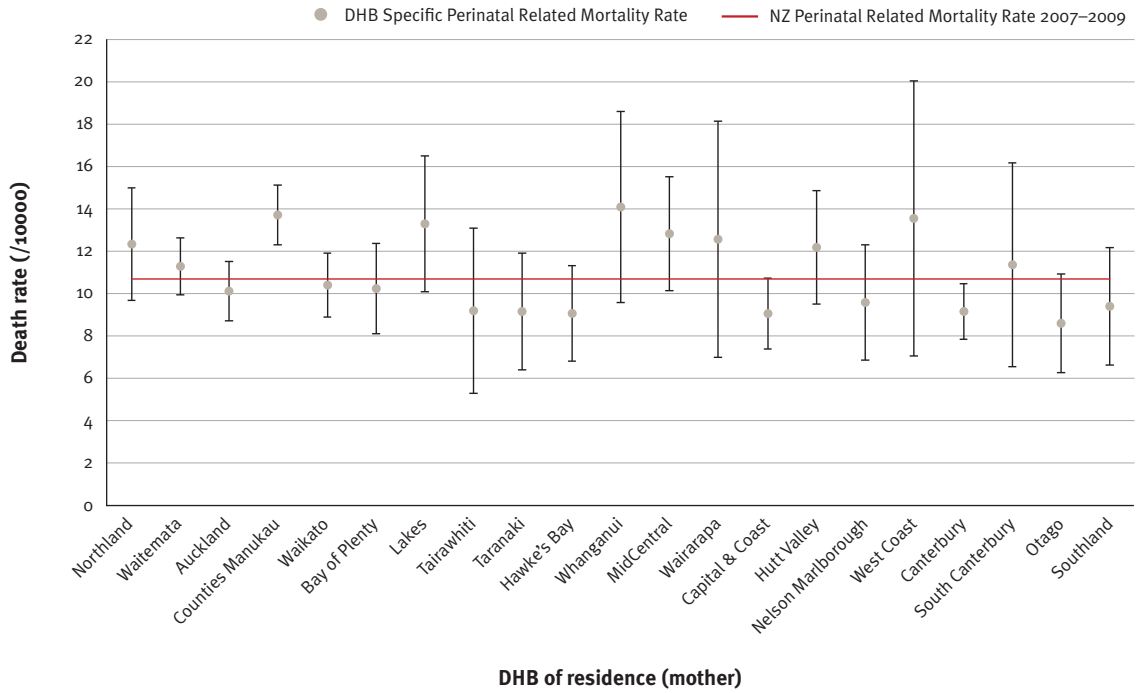


Figure 25 shows the rates of perinatal related mortality per 1000 total births by DHB of residence for 2007–2009. Three-year rates are presented in an attempt to reduce the fluctuations due to small numbers, which are apparent in one-year data.

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 three-year perinatal related mortality rate in the Counties Manukau DHB region (13.7/1000 births) exceeded the national rate (10.8/1000 births), consistent with previous reports. Demographic and socioeconomic characteristics vary by DHB as shown in section 1.4. It is likely that these factors contribute significantly to the excess perinatal related mortality in Counties Manukau DHB region.

Three-year perinatal related mortality rate in the Canterbury (9.2/1000 births) region fell significantly below the national rate.

Independent associations between demographic variables and stillbirth

Multivariate analyses of the associations between ethnicity, age, and socioeconomic status and stillbirth, published in the PMMRC 2008 report, showed that these demographic factors were all independently associated with stillbirth. 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. 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, and may be confounding the associations seen in this analysis, were not able to be tested because of a lack of detailed information about all women who give birth in New Zealand.

Multiple births

Table 14: Perinatal related death rates (per 1000) and multiple births 2009

	Total births		Fetal deaths						Neonatal deaths			Perinatal related deaths		
			Termination of pregnancy			Stillbirths								
	n = 63,665		n = 137			n = 401			n = 182			n = 720		
Type of birth	n	%	n	%	Rate	n	%	Rate	n	%	Rate	n	%	Rate
Singleton	61,862	97.2	131	95.6	2.12	369	92.0	5.96	150	82.4	2.44	650	90.3	10.51
Multiple	1,803	2.8	6	4.4	3.33	32	8.0	17.75	32	17.6	18.13	70	9.7	38.82
Multiples (1/2 died)			2	33.3		16	50.0		9	28.1		27	38.6	
Multiples (2/2 died)			4	66.7		16	50.0		12	37.5		32	45.7	
Multiples (1/3 died)			-	-		-	-		2	6.3		2	2.9	
Multiples (3/3 died)			-	-		-	-		9	28.1		9	12.9	
Dichorionic diamniotic			1	16.7		8	25.0		10	47.6		19	32.2	
Monochorionic diamniotic			4	66.7		21	65.6		6	28.6		31	52.5	
Monoamniotic			-	-		1	3.1		3	14.3		4	6.8	
Unknown chorionicity			1	16.7		2	6.3		2	9.5		5	8.5	

Among perinatal related deaths in 2009, 10 percent were born in a multiple pregnancy. Babies born in multiple pregnancies had a perinatal related mortality rate of 38.8/1000, almost four times the rate of singletons. In twin pregnancies alone, the perinatal mortality rate was 33.8/1000.

It is known 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 2009, of 34 monochorionic multiple pregnancy losses, 28 (82%) were due to 'twin-twin' transfusion syndrome. In 2007 and 2008, the cause of death among monochorionic multiple pregnancies 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. Ten percent (7 out of 70) of perinatal related deaths among babies from multiple pregnancies were conceived with IVF, follicle stimulating hormone (FSH), or clomiphene therapy compared to 3 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 15: Maternal BMI among perinatal related deaths in 2009

	Fetal deaths							
	Termination of pregnancy		Stillbirths		Neonatal deaths		Perinatal related deaths	
	n = 137		n = 401		n = 182		n = 720	
	n	%	n	%	n	%	n	%
Maternal BMI								
<18.50	4	2.9	10	2.5	7	3.8	21	2.9
18.50–24.99	53	38.7	152	37.9	63	34.6	268	37.2
25.00–29.99	30	21.9	85	21.2	31	17.0	146	20.3
30.00–34.99	18	13.1	51	12.7	19	10.4	88	12.2
35.00–39.99	6	4.4	32	8.0	9	4.9	47	6.5
≥40	4	2.9	20	5.0	12	6.6	36	5.0
Unknown	22	16.1	51	12.7	41	22.5	114	15.8

In 2009, BMI data were available for 84 percent of mothers of perinatal related deaths. At least 44 percent of the mothers of perinatal related 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 related death cannot be accurately estimated in our population.

Maternal smoking and drug use

Table 16: Maternal smoking at time of perinatal related death 2009

	Fetal deaths							
	Termination of pregnancy		Stillbirths		Neonatal deaths		Perinatal related deaths	
	n = 137		n = 401		n = 182		n = 720	
	n	%	n	%	n	%	n	%
Maternal smoking (current)								
Yes	34	24.8	107	26.7	69	37.9	210	29.2
No	98	71.5	280	69.8	105	57.7	483	67.1
Unknown	5	3.6	14	3.5	8	4.4	27	3.8

Smoking data at the time of perinatal related death were available for all but 4 percent of mothers in 2009; 27 percent of mothers of stillborn babies and 38 percent of mothers of babies who died after birth were recorded as smoking at the time of their baby's death. As smoking status can change during pregnancy, the PMMRC collect data on smoking in and prior to pregnancy. Smoking cessation support is a priority area for the Ministry of Health and so these data are also collected for mothers of perinatal related deaths. Unfortunately, smoking cessation support data are not provided in approximately 50 percent of cases and so are not currently available for reporting.

Background smoking rates in pregnancy are not available for the total population of mothers in New Zealand. Estimates of smoking during pregnancy in New Zealand from published data and study samples range from 10–23 percent (McCowan et al 2009; NZCOM 2004; National Women's Hospital 2009). 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. Smoking rates are strongly associated with maternal ethnicity (National Women's Hospital 2009, Growing Up in New Zealand 2010).

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

Other drugs

Data were obtained on the use of alcohol and recreational drugs by 84 percent of mothers whose babies died in 2009. Alcohol was reportedly used by 6.8 percent of all mothers and marijuana by 5 percent. No other recreational drug use was reported by more than 1 percent of mothers.

Gestation and birthweight

Table 17: Perinatal related death rates (per 1000) by gestation and birthweight 2009

	Total births		Fetal deaths						Neonatal deaths			Total perinatal related deaths		
			Termination of pregnancy			Stillbirths								
	n = 63,665		n = 137			n = 401			n = 182			n = 720		
	n	%	n	%	Rate	n	%	Rate	n	%	Rate	n	%	Rate
Gestation at birth														
20–23 weeks[1]	200	0.3	110[2]	80.3	*	106	26.4	*	51	28.0	*	267	37.1	*
24–27 weeks	281	0.4	18	13.1	64.06	58	14.5	206.41	41	22.5	200.00	117	16.3	416.37
28–31 weeks	527	0.8	4	2.9	7.59	47	11.7	89.18	14	7.7	29.41	65	9.0	123.34
32–36 weeks	3,930	6.2	5	3.6	1.27	60	15.0	15.27	25	13.7	6.47	90	12.5	22.90
37–40 weeks	46,950	73.7	-	-	-	111	27.7	2.36	38	20.9	0.81	149	20.7	3.19
≥41 weeks	11,721	18.4	-	-	-	18	4.5	1.54	13	7.1	1.11	31	4.3	2.64
Unknown	56	0.1	-	-	-	1	0.2	-	-	-	-	1	0.1	-
Birthweight														
<500g[1]	252	0.40	85	62.0	*	97	24.2	*	31	17.0	*	213	29.6	*
500–999g	317	0.50	43	31.4	135.65	82	20.4	258.68	62	34.1	322.92	187	26.0	589.91
1000–1499g	401	0.63	6	4.4	14.96	31	7.7	77.31	11	6.0	30.22	48	6.7	119.70
1500–1999g	773	1.21	3	2.2	3.88	26	6.5	33.64	10	5.5	13.44	39	5.4	50.45
2000–2499g	2,318	3.64	-	-	-	27	6.7	11.65	11	6.0	4.80	38	5.3	16.39
2500–2999g	8,452	13.28	-	-	-	49	12.2	5.80	10	5.5	1.19	59	8.2	6.98
3000–3499g	21,064	33.09	-	-	-	47	11.7	2.23	18	9.9	0.86	65	9.0	3.09
3500–3999g	20,509	32.21	-	-	-	18	4.5	0.88	14	7.7	0.68	32	4.4	1.56
4000–4499g	7,855	12.34	-	-	-	14	3.5	1.78	12	6.6	1.53	26	3.6	3.31
≥4500g	1,695	2.66	-	-	-	2	0.5	1.18	2	1.1	1.18	4	0.6	2.36
Unknown	29	0.05	-	-	-	8	2.0	-	1	0.5	-	9	1.3	-

1 Denominator data unreliable where asterisk is present, and therefore rates have not been calculated

2 Includes a terminated twin delivered at a later gestation

Table 17 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 500g survive. Some years, such as in 2009, more babies appear to have died in the 20–23 week category than were born. This is in part a consequence of the use of a numerator which is deaths in 2009 and a denominator compiled from birth registrations in 2009.

The majority of perinatal related deaths occur in babies under 28 weeks and under 1000g. Perinatal related death is uncommon after 31 weeks and above 1499g.

Table 18: Perinatal related death rates (per 1000) (or risks per 1000 babies remaining in utero) by gestation and birthweight 2007–2009

	Total births		Fetal deaths: Termination of pregnancy			Fetal deaths: Stillbirths			Neonatal deaths			Total perinatal related deaths		
	n = 195,140		n = 425			n = 1148			n = 525			n = 2098		
	n	%	n	%	Rate	n	%	Risk[2]	N	%	Rate	n	%	Risk[2]
Gestation at birth														
20–23 weeks[1]	762	0.4	335[3]	78.8	*	319	27.8	**1.63**	156	29.7	*	809	38.6	**4.15**
24–27 weeks	864	0.4	60	14.1	69.44	158	13.8	**0.81**	95	18.1	147.06	313	14.9	**1.61**
28–31 weeks	1,640	0.8	17	4.0	10.37	126	11.0	**0.65**	43	8.2	28.72	186	8.9	**0.96**
32–36 weeks	11,917	6.1	13	3.1	1.09	179	15.6	**0.93**	67	12.8	5.71	259	12.3	**1.35**
37–40 weeks	143,367	73.5	-	-	0.01	308	26.8	**1.71**	119	22.7	0.83	427	20.4	**2.38**
≥41 weeks	36,436	18.7	-	-	-	56	4.9	**1.53**	45	8.6	1.24	101	4.8	**2.76**
Unknown	154	0.1	-	-	-	2	0.2	**-**	-	-	-	2	0.1	**-**
Birthweight								**Rate**						**Rate**
<500g[1]	648	0.33	255	60.0	*	299	26.0	*****	87	16.6	*	641	30.6	*****
500–999g	974	0.50	139	32.7	142.71	224	19.5	**229.98**	162	30.9	265.14	525	25.0	**539.01**
1000–1499g	1,249	0.64	15	3.5	12.01	88	7.7	**70.46**	34	6.5	29.67	137	6.5	**109.69**
1500–1999g	2,389	1.22	11	2.6	4.60	83	7.2	**34.74**	27	5.1	11.76	121	5.8	**50.65**
2000–2499g	7,159	3.67	3	0.7	0.42	86	7.5	**12.01**	32	6.1	4.53	121	5.8	**16.90**
2500–2999g	25,975	13.31	-	-	-	126	11.0	**4.85**	43	8.2	1.66	169	8.1	**6.51**
3000–3499g	63,789	32.69	-	-	-	125	10.9	**1.96**	61	11.6	0.96	186	8.9	**2.92**
3500–3999g	62,683	32.12	-	-	-	57	5.0	**0.91**	42	8.0	0.67	99	4.7	**1.58**
4000–4499g	24,634	12.62	-	-	-	36	3.1	**1.46**	27	5.1	1.10	63	3.0	**2.56**
≥4500g	5,403	2.77	-	-	-	10	0.9	**1.85**	7	1.3	1.30	17	0.8	**3.15**
Unknown	237	0.12	2	0.5	-	14	1.2	**-**	3	0.6	-	19	0.9	**-**

1 Denominator data unreliable where asterisk is present, and therefore rates have not been calculated.

2 Risk of stillbirth or perinatal related mortality per 1,000 babies remaining in utero

3 Includes a terminated twin delivered at a later gestation

Table 18 shows three-year data (2007–2009) for perinatal related death rates by gestation and birthweight. Instead of calculating stillbirth and perinatal related death rate as a proportion of births at each gestational age grouping, in this table risks of death are given as a proportion of pregnancies remaining in utero at each gestation. This provides an estimate of the risk of stillbirth or perinatal related death for a continuing pregnancy at that gestation.

These data show that the greatest risk to pregnancy is in the period from 20–23 weeks and again at term. There is no significant increase in risk of stillbirth or perinatal related death for babies in utero at 41+ weeks compared to babies in utero at 37–40 weeks. This may be a reflection of current practice to induce post-term pregnancies.

There is, however, a significant increase in stillbirth, neonatal death and perinatal related mortality for babies with birthweight of 4,000g or greater compared to babies with birthweight of 3500–3999g.

Obstetric antecedent and neonatal cause of death by gestational age

Table 19: Primary obstetric antecedent cause (PDC) of fetal death by gestational age 2007–2009

Perinatal death classification (PDC)	Total	20–23 weeks		24–27 weeks		28–31 weeks		32–36 weeks		37–40 weeks		≥41 weeks	
		n	%	n	%	n	%	n	%	n	%	n	%
Congenital abnormality	442	311	70.4	53	12.0	29	6.6	21	4.8	25	5.7	3	0.7
Perinatal infection	53	15	28.3	7	13.2	5	9.4	7	13.2	13	24.5	6	11.3
Hypertension	58	8	13.8	16	27.6	15	25.9	8	13.8	9	15.5	2	3.4
Antepartum haemorrhage	152	78	51.3	14	9.2	13	8.6	18	11.8	27	17.8	2	1.3
Maternal conditions	75[1]	25	33.3	15	20.0	6	8.0	9	12.0	18	24.0	1	1.3
Specific perinatal conditions	157	55	35.0	24	15.3	19	12.1	25	15.9	32	20.4	2	1.3
Hypoxic peripartum death	43	-	-	-	-	-	-	2	4.7	30	69.8	11	25.6
Fetal growth restriction	149	13	8.7	33	22.1	23	15.4	39	26.2	33	22.1	8	5.4
Spontaneous preterm	136[1]	104	76.5	23	16.9	6	4.4	2	1.5	-	-	-	-
Unexplained antepartum death	308	44	14.3	33	10.7	27	8.8	61	19.8	122	39.6	21	6.8
Total	**1,573**	**653**	**41.5**	**218**	**13.9**	**143**	**9.1**	**192**	**12.2**	**309**	**19.6**	**56**	**3.6**

1 Gestation of one baby unknown

Table 19, Table 20 and Table 21 include 2007–2009 (3-year) data in this report. This provides more stable estimates of the association between PDC and gestation at perinatal related death.

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

Unexplained antepartum death was the assigned PDC in 27 percent of stillbirths. Unexplained stillbirth most commonly occurs near term, accounting for 39 percent of stillbirths at 37–40 weeks.

In the three years 2007–2009, 9 percent of fetal deaths were assigned spontaneous preterm birth as primary obstetric antecedent cause of death. Three-quarters of these deaths occurred before 24 weeks; 59 percent of these cases had clinical or histological evidence of chorioamnionitis.

Table 20: Primary obstetric antecedent cause (PDC) of neonatal death by gestational age 2007–2009

Perinatal death classification (PDC)	Total	20–23 weeks		24–27 weeks		28–31 weeks		32–36 weeks		37–40 weeks		≥41 weeks	
		n	%	n	%	n	%	n	%	n	%	n	%
Congenital abnormality	121	1	0.8	3	2.5	23	19.0	38	31.4	39	32.2	17	14.0
Perinatal infection	26	9	34.6	3	11.5	2	7.7	2	7.7	7	26.9	3	11.5
Hypertension	11	-	-	6	54.5	4	36.4	1	9.1	-	-	-	-
Antepartum haemorrhage	51	33	64.7	7	13.7	1	2.0	7	13.7	2	3.9	1	2.0
Maternal conditions	12	2	16.7	2	16.7	2	16.7	1	8.3	4	33.3	1	8.3
Specific perinatal conditions	44	20	45.5	10	22.7	1	2.3	6	13.6	6	13.6	1	2.3
Hypoxic peripartum death	51	-	-	-	-	-	-	1	2.0	33	64.7	17	33.3
Fetal growth restriction	11	-	-	3	27.3	2	18.2	2	18.2	4	36.4	-	-
Spontaneous preterm	166	91	54.8	61	36.7	8	4.8	6	3.6	-	-	-	-
No obstetric antecedent	32	-	-	-	-	-	-	3	9.4	24	75.0	5	15.6
Total	**525**	**156**	**29.7**	**95**	**18.1**	**43**	**8.2**	**67**	**12.8**	**119**	**22.7**	**45**	**8.6**

Spontaneous preterm birth is the most assigned obstetric cause of neonatal death, identified in almost one-third of cases.

In contrast to fetal death, where congenital abnormality occurs at early gestations associated with termination of pregnancy, congenital abnormality is a common cause of neonatal death among babies born at or near term. Congenital abnormality and hypoxic peripartum death were each responsible for approximately one-third of neonatal deaths among term babies. Hypertension, other maternal conditions, and fetal growth restriction are uncommon obstetric antecedent causes of neonatal death.

Table 21: Primary neonatal cause (NDC) of neonatal death by gestational age 2007–2009

Perinatal death classification (PDC)	Total	20–23 weeks		24–27 weeks		28–31 weeks		32–36 weeks		37–40 weeks		≥41 weeks	
		n	%	n	%	n	%	n	%	n	%	n	%
Congenital abnormality	124	1	0.8	3	2.4	23	18.5	39	31.5	41	33.1	17	13.7
Extreme prematurity	165	144	87.3	20	12.1	1	0.6	-	-	-	-	-	-
Cardio-respiratory disorders	33	7	21.2	22	66.7	2	6.1	1	3.0	1	3.0	-	-
Infection	47	2	4.3	18	38.3	8	17.0	5	10.6	10	21.3	4	8.5
Neurological	104	2	1.9	17	16.3	7	6.7	14	13.5	44	42.3	20	19.2
Gastrointestinal	10	-	-	7	70.0	2	20.0	1	10.0	-	-	-	-
Other	42	-	-	8	19.0	-	-	7	16.7	23	54.8	4	9.5
Total	**525**	**156**	**29.7**	**95**	**18.1**	**43**	**8.2**	**67**	**12.8**	**119**	**22.7**	**45**	**8.6**

Spontaneous preterm birth or extreme prematurity predominate as obstetric/neonatal causes of death in neonates; 87 percent of these deaths from prematurity are in babies born before 24 weeks gestation.

At gestations of 24 weeks or later, congenital abnormality and neurological conditions predominate. Of the neonates dying of neurological disorders, 82 percent died from hypoxic ischaemic encephalopathy.

Maternity care

Antenatal caregiver

Table 22: Perinatal related deaths and maternal booking status 2009

Was the mother booked with a lead maternity carer?	Fetal deaths				Neonatal deaths		Total perinatal related deaths	
	Termination of pregnancy		Stillbirths					
	n = 137		n = 401		n = 182		n = 720	
	n	%	n	%	n	%	n	%
Yes	130	94.9	369	92.0	167	91.8	666	92.5
No	3	2.2	29	7.2	10	5.5	42	5.8
Unknown	4	2.9	3	0.7	5	2.7	12	1.7

Ninety-two percent of mothers were known to have been booked with their 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 total numbers of visits as these data are poorly collected.

Table 23: Lead maternity carer at booking and birth among stillbirths and neonatal deaths 2009

Lead maternity carer at booking	Lead maternity carer at birth											
	Total		Self employed midwife		Hospital		General practitioner		Obstetrician (private)		Unknown	
	n = 536		n = 208		n = 301		n = 5		n = 20		n = 2	
	n	%	n	%	n	%	n	%	n	%	n	%
Self employed midwife	337	62.9	206	61.1	129	38.3	-	-	1	0.3	1	0.3
Hospital	147	27.4	2	1.4	145	98.6	-	-	-	-	-	-
General practitioner	27	5.0	-	-	21	77.8	5	18.5	-	-	1	3.7
Obstetrician (private)	25	4.7	-	-	6	24.0	-	-	19	76.0	-	-
Total	**536**		**208**	**38.8**	**301**	**56.2**	**5**	**0.9**	**20**	**3.7**	**2**	**0.4**

In 2009, among the women booked with their LMC at the time of their baby's death, 58 percent were first booked with a self-employed midwife; 25 percent under a hospital midwife, clinic or obstetrician; 5 percent with a general practitioner, and 4 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. These data on maternity carer will be more helpful when denominator data are available from the national collection.

Screening for diabetes in pregnancy

Table 24: Screening for diabetes among booked women with no pre-existing diabetes and where perinatal related death occurred at or beyond 28 weeks' gestation 2009

Screened for diabetes	n = 300	
	n	%
Yes	198	66.0
No	52	17.3
Unknown	50	16.7

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 Gynacologists (RANZCOG) and the New Zealand College of Midwives (NZCOM). In 2009, 17 percent of mothers of babies who died were not screened for diabetes between 24 and 28 weeks pregnancy. This is fewer than the 25 percent in 2007 and 2008, although missing data of between 17 percent and 21 percent of deaths makes it difficult to be certain that this is a real improvement.

A lack of screening could mask a higher rate of mortality due to diabetes.

Screening for family violence in pregnancy

Table 25: Perinatal related deaths and screening for family violence 2009

	Fetal deaths							
	Termination of pregnancy		Stillbirths		Neonatal deaths		Perinatal related deaths	
	n = 137		n = 401		n = 182		n = 720	
	n	%	n	%	n	%	n	%
Experienced family violence								
Yes	1	0.7	17	4.2	4	2.2	22	3.1
No	60	43.8	179	44.6	65	35.7	304	42.2
Not asked	36	26.3	82	20.4	26	14.3	144	20.0
Unknown	40	29.2	123	30.7	87	47.8	250	34.7
Referral to relevant support								
Yes	1	100.0	9	52.9	3	75.0	13	59.1
No	-	-	2	11.8	1	25.0	3	13.6
Unknown	-	-	6	35.3	-	-	6	27.3

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. More than 30 percent of the data in 2009 were missing or reported as unknown. There were 22 disclosures of family violence in 2009, and of these, almost 60 percent are known to have been referred for support.

Vaginal bleeding in pregnancy

Table 26: Perinatal related deaths and vaginal bleeding during pregnancy 2009

	Fetal deaths							
	Termination of pregnancy		Stillbirths		Neonatal deaths		Perinatal related deaths	
	n = 137		n = 401		n = 182		n = 720	
	n	%	n	%	n	%	n	%
Yes	16	11.7	111	27.7	62	34.1	189	26.3
No	90	65.7	199	49.6	76	41.8	365	50.7
Unknown	31	22.6	91	22.7	44	24.2	166	23.1
Gestation[1]								
<20 weeks	12	8.8	38	9.5	23	12.6	73	10.1
≥20 weeks	7	5.1	95	23.7	56	30.8	158	21.9

[1] Multiple bleeds can occur in pregnancy and can occur both before and after 20 weeks

Bleeding beyond 20 weeks was reported in at least 24 percent of stillbirths and 31 percent of neonatal deaths.

Antenatal corticosteroids

Among neonatal deaths of babies delivered at between 24 and 32 weeks gestation, corticosteroids were given to 42 of 59 babies (71%). Among deaths of babies delivered from 20–23 weeks gestation, a further 9 of 51 babies also received antenatal corticosteroids.

Antenatal identification of small for gestational age (SGA) infants

Table 27: Perinatal related deaths and small for gestational age (SGA) 2009

	Fetal deaths							
	Termination of pregnancy		Stillbirths		Neonatal deaths		Perinatal related deaths	
	n	%	n	%	n	%	n	%
All perinatal related deaths	**n = 137**		**n = 401**		**n = 182**		**n = 720**	
SGA[1]	91	66.4	193	48.1	66	36.3	350	48.6
Perinatal related deaths ≥24 weeks	**n = 28**		**n = 294**		**n = 131**		**n = 453**	
SGA[1]	18	64.3	128	43.5	41	31.3	187	41.3
Perinatal related deaths ≥24 weeks; excluding lethal congenital abnormality	**n = 7**		**n = 271**		**n = 88**		**n = 366**	
SGA[1]	6	85.7	115	42.4	23	26.1	144	39.3

[1] SGA: birthweight less than 10th 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 10th centile.

SGA was evident in 41 percent of perinatal related deaths at 24 weeks or beyond overall and, specifically, in 42 percent of stillborn babies and 26 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, and is consistent across the three years the PMMRC have been collecting data.

Table 28: Antenatal diagnosis of SGA among stillbirths and neonatal deaths at 24 weeks' gestation or more excluding lethal congenital abnormalities 2009

	Total	Suspected growth restriction									
		No		Yes and confirmed by scan		Yes but normal growth on scan		Yes but no scan performed		Unknown	
		n	%	n	%	n	%	n	%	n	%
SGA stillbirths	115	58	50.4	28	24.3	7	6.1	7	6.1	15	13.0
SGA neonatal deaths	23	6	26.1	14	60.9	2	8.7	0	0.0	1	4.3

Twenty-four percent of SGA stillborn babies and 61 percent of SGA neonatal deaths born at 24 weeks or beyond who did not die of congenital abnormality had growth restriction confirmed by scan before birth. Only a few babies suspected to be growth restricted did not have a scan before birth.

Place of birth and antenatal transfer

Table 29: Intended place of birth versus actual place of birth among stillbirths and neonatal deaths 2009

Intended place of birth	Total	Actual place of birth													
		Home		Birthing unit		Hospital level 1		Hospital level 2		Hospital level 3		Other		Unknown	
		n	%	n	%	n	%	n	%	n	%	n	%	n	%
Home	11	4	36.4	-	-	-	-	5	45.5	2	18.2	-	-	-	-
Birthing unit	42	1	2.4	4	9.5	-	-	7	16.7	30	71.4	-	-	-	-
Hospital level 1	35	2	5.7	-	-	3	8.6	9	25.7	20	57.1	1	2.9	-	-
Hospital level 2	204	2	1.0	-	-	-	-	163	79.9	37	18.1	-	-	2	1.0
Hospital level 3	252	-	-	-	-	-	-	4	1.6	246	97.6	1	0.4	1	0.4
Other	2	-	-	-	-	-	-	-	-	2	100	-	-	-	-
Unknown	37	2	5.4	-	-	-	-	9	24.3	21	56.8	3	8.1	2	5.4
Total	**583**	**11**	**1.9**	**4**	**0.7**	**3**	**0.5**	**197**	**33.8**	**358**	**61.4**	**5**	**0.9**	**5**	**0.9**

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, birthing unit, or level 1 hospital to level 2 or 3 hospital facility.

Thirteen neonatal deaths (7%) were transferred in labour, from a birthing unit or level 1 or 2 hospital to a level 3 hospital facility. In seven cases, the obstetric antecedent cause of death was spontaneous preterm birth. Antecedent cause of death in the remainder of cases was antepartum haemorrhage, hypoxic peripartum death, and congenital abnormality. The primary neonatal cause of death was hypoxic ischaemic encephalopathy in five cases.

Overall, 11 stillborn babies or babies who died in the first month of life were born at home. Four of these were intended births at home; all were born at term; two were unexplained stillbirths and two were neonatal deaths from infection. Of the seven unintended home births, the antecedent causes of death were antepartum haemorrhage, hypoxic peripartum death, spontaneous preterm birth and unexplained antepartum death.

Maternal outcome

The table below reports the outcome of the mothers whose babies died in the perinatal period.

Table 30: Perinatal related death and maternal outcome 2009

Maternal outcome	Fetal deaths							
	Termination of pregnancy		Stillbirths		Neonatal deaths		Total perinatal related deaths	
	n = 137		n = 401		n = 182		n = 720	
	n	%	n	%	n	%	n	%
Alive and generally well	134	97.8	389	97.0	178	97.8	701	97.4
Alive but with serious morbidity	3	2.2	8	2.0	4	2.2	15	2.1
Dead	-	-	4	1.0	-	-	4	0.6

There were four maternal mortalities (1 direct and 3 indirect maternal deaths) associated with perinatal related mortality in 2009, and these are discussed in more detail in Section 2: New Zealand Maternal Mortality in 2009. There were 15 serious morbidities among mothers whose babies died; five related to sepsis, three related to obstetric trauma, six related to medical conditions and one to amniotic fluid embolism.

Investigation of perinatal deaths

Table 31: Perinatal related deaths and completeness of perinatal investigations 2009

Perinatal death investigation	Fetal deaths							
	Termination of pregnancy		Stillbirths		Neonatal deaths		Total perinatal related deaths	
	n = 137		n = 401		n = 182		n = 720	
	n	%	n	%	n	%	n	%
Optimum PM/karyotype completed[1]	76	55.5	158	39.4	60	33.0	294	40.8
Partial investigations only[2]	47	34.3	171	42.6	92	50.5	310	43.1
No investigation[3]	12	8.8	59	14.7	27	14.8	98	13.6
Unknown	2	1.5	13	3.2	3	1.6	18	2.5

[1] Optimal investigation or post-mortem was defined as karyotype confirming congenital abnormality or fully completed post-mortem

[2] No post-mortem; investigations may have included placental pathology, MRI, ultrasound scan or X-ray

[3] No post-mortem, placental pathology, MRI, ultrasound scan or X-ray

Overall, 40 percent of perinatal related deaths were optimally investigated in 2009, meaning a post-mortem was performed for all but chromosomal abnormalities (where a karyotype confirming the diagnosis was considered optimum). The rate of optimal investigation was 36 percent in 2006, 46 percent in 2007 and 49 percent in 2008.

In 2009, as in 2007 and 2008, there was considerable variation in the rate of optimal investigation by DHB (Table 56). In DHB areas where low rates of optimal investigation were evident, post-mortem was offered in the majority of cases (although rates were as low as 56%).

Table 32: Perinatal related deaths and rate of offer and decline of post-mortem examination 2009

Post-mortem examination offered	Fetal deaths							
	Termination of pregnancy		Stillbirths		Neonatal deaths		Total perinatal related deaths	
	n = 137		n = 401		n = 182		n = 720	
	n	%	n	%	n	%	n	%
Post-mortem offered and parental consent given	37	27.0	164	40.9	64	35.2	265	36.8
Post-mortem offered and parental consent declined	56	40.9	178	44.4	86	47.3	320	44.4
Post-mortem not offered	37	27.0	39	9.7	26	14.3	102	14.2
Unknown/missing data[1]	7	5.1	20	5.0	6	3.3	33	4.6

[1] In 10 cases, post-mortem was recorded as offered but consent was not recorded

Post-mortem was offered to 81 percent of parents in 2009 (Table 32). Post-mortem was declined following request in 44 percent of cases overall in 2009, consistent with 43 percent in 2008.

In their 2009 report, CMACE recorded a decline of post-mortem following stillbirth from 55 percent in 2000 to 45 percent in 2009 and following neonatal deaths from 29 percent in 2000 to 18 percent in 2009. In the United Kingdom in 2009, post-mortem was not offered following 3 percent of stillbirths and 13 percent of neonatal deaths.

The proportion of parents who were offered post-mortem, and the proportion of those offered who consented did not vary significantly by ethnicity in 2009. In 2009, 57 percent of Māori parents offered post-mortem declined compared with 48 percent of Pacific peoples and 36 percent of New Zealand Europeans.

Data were presented in 2008 on the local PMMRC coordinators' assessment of the usefulness of the post-mortem in cases where it was performed. These data are requested for cases where the cause of death was not chromosomal abnormality. In 2009, this assessment was missing for 34 percent of post-mortem cases, and so this table has not been provided.

In 2008, a post-mortem changed the clinical diagnosis in at least 27 percent of cases, 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 Contributory factors and potential avoidability in perinatal related deaths

Table 33: Contributory factors and potential avoidability in perinatal related deaths 2009

	Fetal deaths							
	Termination of pregnancy		Stillbirths		Neonatal deaths		Perinatal related deaths	
	n = 137		n = 401		n = 182		n = 720	
	n	%	n	%	n	%	n	%
Contributory factors								
Present	6	4.4	102	25.4	61	33.5	169	23.5
Absent	112	81.8	250	62.3	103	56.6	465	64.6
Missing data	19	13.9	49	12.2	18	9.9	82	11.4
Potential avoidability[1]								
Yes	3	2.2	60	15.0	35	19.2	98	13.6
Contributory factors present but avoidability unknown	0		8	2.0	5	2.7	13	1.8
Contributory factors present but not potentially avoidable	3	2.2	34	8.5	21	11.5	58	8.1

[1] In some cases contributory factors were identified but potential avoidability was unknown/missing

In 2009, for the first time, the PMMRC data collection included information on assessment by local perinatal mortality review committees of factors that may have contributed to the perinatal related death. If there were contributory factors, the local reviewing committee was asked whether the perinatal related death was potentially avoidable because of one or some combination of these factors. A description of the process for assessment of contributory factors and potential avoidability is included in section 1.2 and the tool used is included as Appendix C.

The contributory factors the committees were asked to consider are listed in Table 35. Each group of factors includes a list of sub-factors. Assignment of factors was not mutually exclusive either across factors or within a factor.

In some cases, more than one factor was identified, and if the death was deemed to be potentially avoidable, it was not possible within the current database structure to know which factor(s) was (were) the most important.

Data were available for 89 percent of perinatal deaths. Contributory factors were identified in 23.5 percent of perinatal deaths overall, 4.4 percent of late terminations, 25.4 percent of stillbirths, and 33.5 percent of neonatal deaths (Table 33).

Overall, 13.6 percent of perinatal deaths were thought to be potentially avoidable, 15.0 percent of stillbirths and 19.2 percent of neonatal deaths.

More than one contributory factor was present in 33 perinatal related deaths, and the presence of more than one factor was more often associated with a potentially avoidable death (p=0.06) (Table 34).

The audit of 68 records by the national coordinator found eight cases with recognised contributory factors where potential avoidability was not identified. This would suggest that the proportion of potentially avoidable perinatal related deaths may increase with ongoing local support and education.

Table 34: Association between numbers of contributory factors and potential avoidability: 2009 perinatal related deaths

	Contributory factors	Potentially avoidable[1]		Contributory factors BUT NOT considered potentially avoidable or avoidability unknown[1]	
	n=169	n=98		n=71	
	n	n	Row %	n	Row %
No of contributory factors					
1	136	74	54	62	46
2	24	16	67	8	33
3	7	6	86	1	14
4	2	2	100	0	0

[1] In 13 cases with contributory factors, an assessment of potential avoidability was not given

Table 35: Detail of contributory factors among perinatal related deaths 2009

Contributory factors present?	n=720	
	n	%
	169	**23.5**
Organisational/management factors	34	4.7
Delay in procedure eg, caesarean section	2	
Delayed access to test results or inaccurate results	5	
Failure or delay in emergency response	6	
Inadequate education and training	9	
Lack of policies, protocols or guidelines	10	
Poor access to senior clinical staff	2	
Poor organisational arrangements of staff	9	
Other	8	
Personnel factors	50	6.9
Communication between staff was inadequate	10	
Delayed emergency response by staff	9	
Failure to follow recommended best practice	24	
Failure to maintain competence	4	
Failure to seek help/supervision	8	
Knowledge and skills of staff were lacking	16	
Other	9	
Technology and equipment factors	6	0.8
Failure / lack of Information Technology	1	
Lack of maintenance of equipment	1	
Malfunction/failure of equipment	1	
Other	4	
Environmental factors	12	1.7
Geography	12	
Other	1	
Barriers to access or engagement with care	111	15.4
Lack of recognition by woman or family of complexity or seriousness of condition	7	
Cultural	10	
Language	2	
Family violence	6	
Maternal mental illness	3	
Not eligible to access free care	2	
Substance use	23	
Other reason for barriers to access or engagement with care	24	

Organisational/management factors contributed to perinatal related death in almost 5 percent of cases, and the most frequent noted were lack of policies, protocols or guidelines, inadequate education and training, and poor organisational arrangements of staff.

Personnel factors were the second most commonly identified contributory factors (7% of perinatal deaths), the most common being failure to follow recommended best practice and lack of knowledge and skills amongst staff.

Barriers to access or engagement with care were the most commonly cited contributory factors in perinatal related deaths. A specific reason was not always identified from the list given, although cultural issues and substance use were identified in a number of cases.

Technology and environment were infrequent contributory factors in perinatal related death.

Figure 26: Contributory factors and potential avoidability among perinatal related deaths by PDC 2009

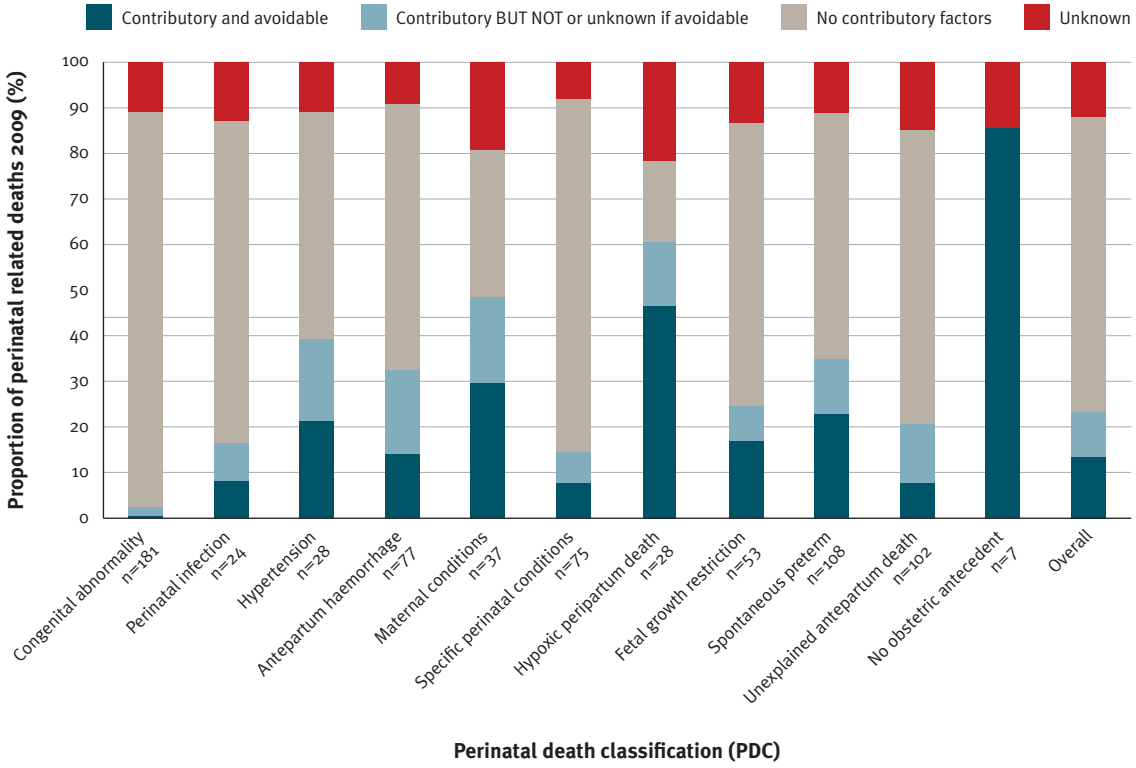


Figure 26 shows the proportion of perinatal related deaths where contributory factors were present (blue bars), whether the death was also potentially avoidable (shown in solid blue), or whether there were no contributory factors identified (maroon) or data were unavailable (cream) by PDC. Numbers within each PDC category are small, so conclusions should be drawn with care.

Case Studies*

Case 1:

A woman experienced reduced fetal movements for two days. She did not advise her LMC until presentation to the birthing unit in early labour.

CTG performed was suboptimal. She was transferred to a tertiary unit, but communication between LMC and hospital did not clearly state the urgency of the transfer. Emergency caesarean section was delayed due to unit workload. This was classified as organisational/management, personnel, environmental factors and barriers to accessing or engaging with care, and the death was potentially avoidable.

Case 2:

A woman with several clinical features of pre-eclampsia was not appropriately investigated or referred. She was sent home after unsuccessful attempts to perform tests. She re-presented following a seizure with an abruption and an intrauterine fetal death. This was classified as organisational/management and personnel contributory factors present, and the death was potentially avoidable.

The pattern for potentially avoidable deaths was similar, although contributory factors did not always signify a potentially avoidable death.

* These examples are formulated from aggregate data for illustration only.

Figure 27: Proportion of perinatal related deaths with contributory factors by PDC 2009

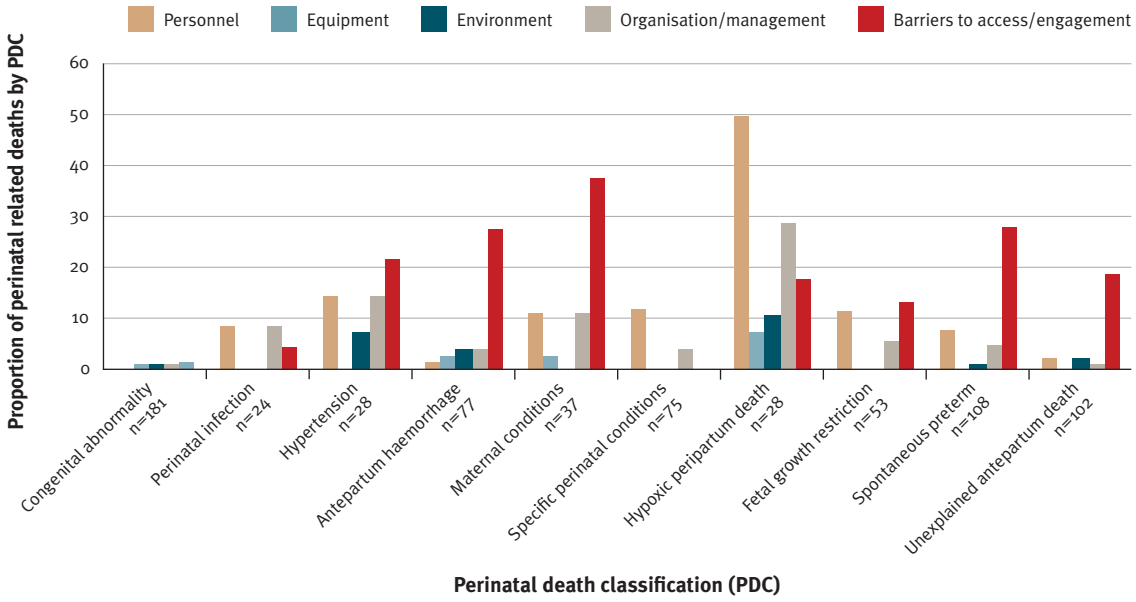


Figure 27 demonstrates the proportion of deaths within each primary antecedent cause of death where a contributory factor was felt to be present, broken down by type of factor (personnel, equipment, environment, organisation or management, and barriers to access or engagement with care).

Among the contributory factors present, personnel factors were prominent in hypertension and hypoxic peripartum deaths. Barriers to access or engagement with care were most evident among hypertension, antepartum haemorrhage, maternal condition deaths, and deaths from spontaneous preterm birth. These findings are preliminary due to small numbers in each PDC category.

Figure 28: Absolute numbers of perinatal related deaths with contributory factors by PDC 2009

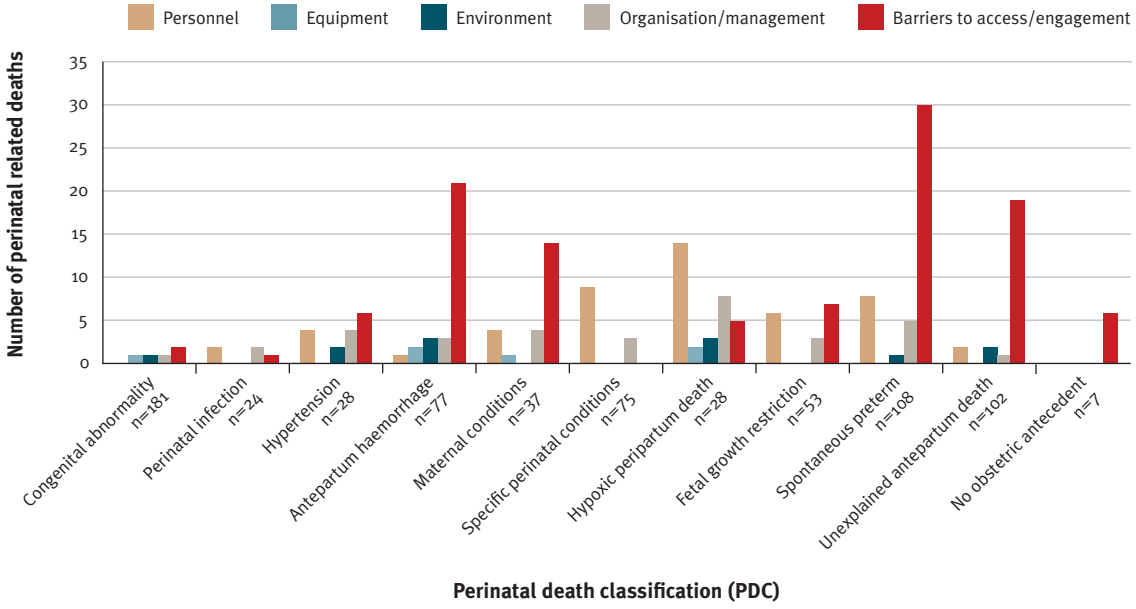


Figure 28 shows absolute numbers of deaths associated with particular contributory factors by primary antecedent cause of death and so identifies barriers to access and engagement with care as the most common contributory factor numerically, with the greatest potential impact on deaths from antepartum haemorrhage, maternal conditions, spontaneous preterm birth, and unexplained antepartum death.

Personnel and organisational/management factors appear less prominent than their percent contribution (Figure 26) would suggest.

Figure 29: Maternal prioritised ethnicity and contributory factors and potential avoidability (95% CIs surround the estimate of proportion of cases within each ethnicity where death was potentially avoidable) 2009

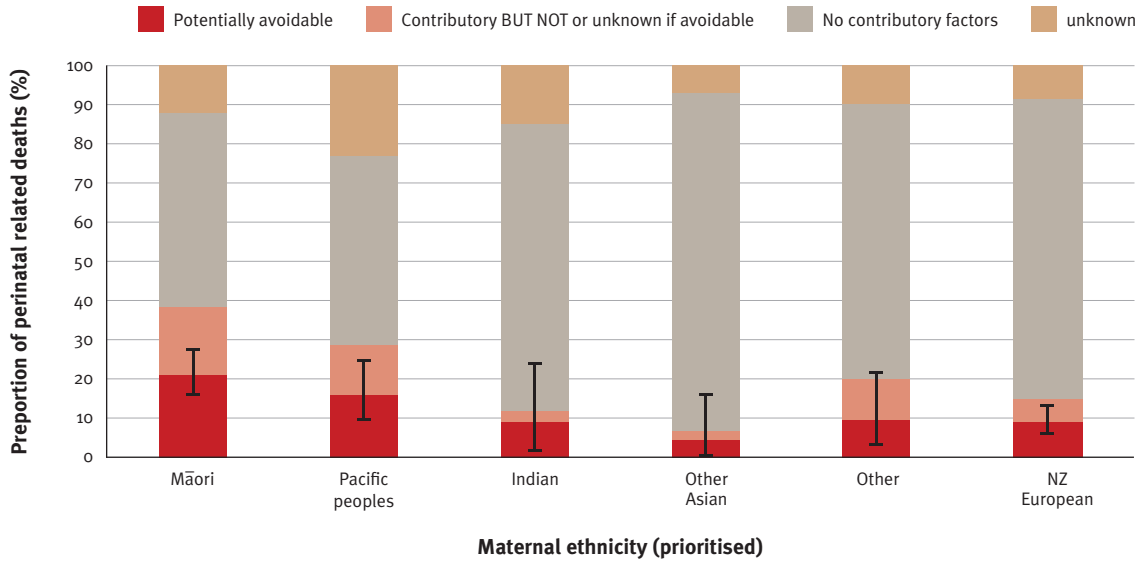


Figure 29 explores whether contributory factors and potential avoidability vary by maternal (prioritised) ethnicity. Ninety-five percent confidence intervals surround the estimate of potentially avoidable perinatal related deaths. This estimate of potential avoidability is highest for Māori mothers (21%) and is significantly higher than the estimate for NZ European (10%). The proportion of potentially avoidable deaths does not vary significantly among any other ethnic groups.

Figure 30: Proportion of perinatal related deaths associated with specific contributory factors by ethnicity 2009

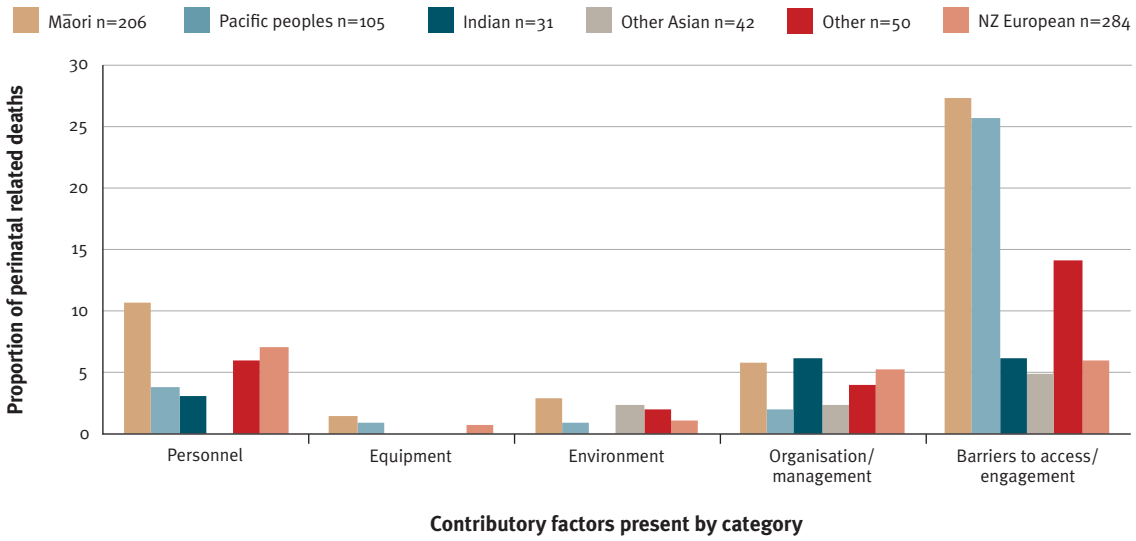


Figure 30 shows the proportion of deaths in each maternal prioritised ethnic group associated with each type of contributory factor. For example, 11 percent of perinatal deaths among Māori women were associated with a contributory personnel factor, compared to 7 percent or fewer for other ethnic groups. A quarter of perinatal related deaths among Māori and Pacific mothers were associated with contributory barriers to access and/or engagement with care.

1.8 Perinatal related mortality among teenage mothers

This section provides further analysis into perinatal related death among teenage mothers, using data collected by the PMMRC from January 2007 to December 2009 (36 months).

The New Zealand PMMRC and birth registration data demonstrate an increase in the rate of perinatal related death among teenage mothers (<20 years of age) compared to mothers aged 20 to 39 years. Maternal age of 40 and above is also associated with an increased risk of perinatal related death (perinatal related mortality rates 14.7, 10.3, and 13.4/1000 births respectively) (see Figure 18). However, the distribution is different for these two age extremes, as seen in Figure 18. Both extremes are associated with increased stillbirth risk. Teenage motherhood is also linked with neonatal death, while older motherhood is linked with termination of pregnancy at or beyond 20 weeks. This difference in distribution would suggest that different co-factors are operating.

Mothers under 20 contributed 7.8 percent of births in New Zealand in the three years 2007–2009. In this same period they were the mothers of a disproportionate 10.6 percent of perinatal deaths. Of these perinatal deaths, 123 (55%) were stillbirths, 68 (31%) neonatal deaths, and 32 (14%) terminations at 20 weeks or beyond.

Table 36: Perinatal related death by maternal age 2007–2009

	Maternal age <20		Maternal age 20–39		Maternal age ≥40	
	n=223		n=1776		n=98	
	n	%	n	%	n	%
Termination of pregnancy	32	14.4	368	20.7	25	25.5
Stillbirth	123	55.2	967	54.5	58	59.2
Neonatal death	68	30.5	441	24.8	15	15.3

Fifty percent of teenage mothers whose babies died from 2007 to 2009 were Māori. The ethnicity of mothers whose babies died (Table 37) is reflective of the population of teenage mothers, with 52.2 percent of teenage mothers being Māori, 13.1 percent Pacific, 29.9 percent NZ European, 0.6 percent Indian, 1.3 percent Other Asian, and 2.3 percent Other ethnicities. This means that risk of perinatal mortality among teenagers is similar and high among all ethnicities.

Fifty percent of teenage mothers whose babies died from 2007 to 2009 were in the highest deprivation quintile. Again, deprivation is high among teenage mothers, with 45 percent of teenage mothers in the highest deprivation quintile.

Almost 50 percent of teenage mothers whose babies died from 2007 to 2009 were current smokers. Smoking among teenage mothers whose babies died was similar across Māori (55%), Pacific (31%) and NZ European (48%) mothers. Smoking rates among teenage mothers in New Zealand is unknown, but probably also high compared to older mothers.

Teenage mothers whose babies died were significantly less likely to be overweight and obese than their older counterparts (data not given).

These analyses suggest that teenage mothers are at increased risk of perinatal death, and that ethnicity and socioeconomic deprivation do not identify a group of teenagers at higher risk.

Table 37: Ethnicity, deprivation quintile and current smoking among perinatal related deaths by maternal age 2007-2009

	Maternal age <20		Maternal age 20–39		Maternal age ≥40	
	n=223		n=1776		n=98	
	n	%	n	%	n	%
Maternal ethnicity (prioritised)						
Māori	112	50.2	418	23.5	23	23.5
Pacific peoples	32	14.3	244	13.7	12	12.2
Indian	4	1.8	81	4.6	3	3.1
Other Asian	8	3.6	100	5.6	9	9.2
Other	6	2.7	143	8.1	13	13.3
NZ European	61	27.4	790	44.5	38	38.8
Deprivation quintile						
1	7	3.1	244	13.7	18	18.8
2	29	13.0	249	14.0	16	16.7
3	30	13.5	309	17.4	18	18.8
4	43	19.3	407	22.9	22	22.9
5	112	50.2	545	30.7	22	22.9
Current smoking	101	45.3	469	26.4	21	21.4

Figure 31: PDC-specific perinatal related death rates by maternal age (<20 20–39 ≥40) (with 95% CIs) 2007–2009

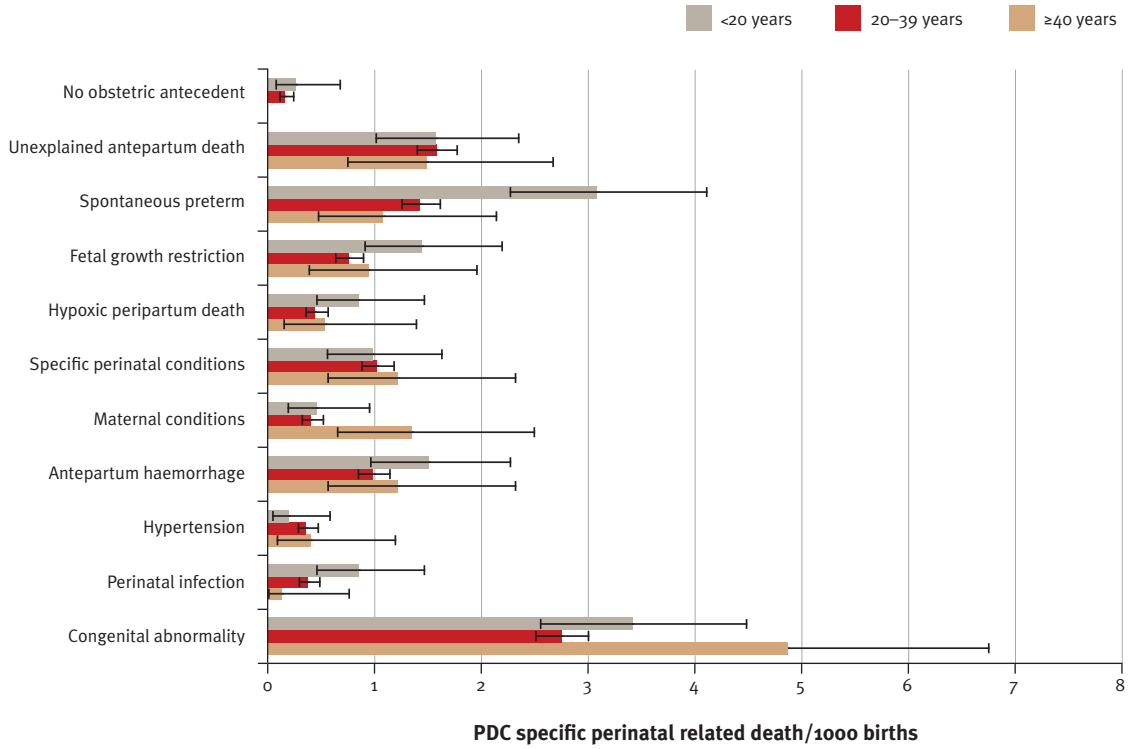


Figure 31 shows the cause of death specific perinatal related mortality rates for teenage mothers compared with mothers 20–39 and mothers 40 and over. This demonstrates that spontaneous pre-term birth, fetal growth restriction and perinatal infection are more common antecedents of perinatal related death in teenagers than women aged 20 to 39. Further, this figure demonstrates that maternal conditions and congenital abnormalities are significantly more common antecedent causes of perinatal death in older mothers compared to women in the 20 to 39 year age bracket. This is not an unexpected finding but is a reminder that the issues facing mothers at opposite ends of the age spectrum are very different and supports education strategies that target the specific needs of at-risk mothers.

There are a number of government and community initiatives under way to support pregnant teenagers in New Zealand. The following are three examples.

- The Ministry of Social Development (MSD) received $15 million increased funding to invest in teenage pregnancy. They have developed a policy programme that includes:
  - 'intensive case workers' in high deprivation, high pregnancy rate areas
  - the establishment of teen parent houses (7 by the end of February) – residential houses (with 24-hour house parents) designed to provide temporary support for teenage mothers.
- A pilot project of extended well child service for teenage mothers in Hawke's Bay, funded by Hawke's Bay DHB, is employing a Well Child specialist nurse who will work specifically with teenage mums.
- The Families Commission will report findings, by 30 June 2011, to Hon Paula Bennett, MSD, of their current work to identify:
  - reasons behind the high rates of parenthood amongst young teens in specific regions of New Zealand
  - support needed to prevent subsequent repeat pregnancies among teenage parents.

2. NEW ZEALAND MATERNAL MORTALITY IN 2009

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 deaths 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.) Other members of the working group are Cynthia Farquhar (PMMRC Chair, obstetrician, gynaecologist and clinical epidemiologist), Claire McLintock (obstetric physician and haematologist), Jeannette McFarlane (pathologist), Jacqui Anderson (midwife), 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 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. 2009 represents the fourth year of maternal death reporting under the auspices of the PMMRC. The previous Maternal Mortality Review Committee issued their final report in 1995 relating to the 1991–1993 triennium.

The Working Group notes the publication of Hospital-based Maternity Events 2006, and Hospital-based Maternity Events 2007, both publications from the Ministry of Health, summarising data stored in the National Minimum Dataset (NMDS) and maternal mortality data sourced from the Mortality Collection. Each publication has a section on maternal deaths. These reports and their predecessors have provided information on maternal deaths since the Maternal Mortality Review Committee ceased to exist in 1995. These publications present deaths by year of death registration rather than year of death and only report maternal deaths identified in the mortality collection. For these reasons the publications report different maternal mortality ratios from those reported by the PMMRC. The PMMRC cross-check cases from these publications to ensure the PMMRC dataset of maternal deaths is as complete as possible. It should be noted that because the PMMRC ascertainment process collects more cases than are found from routine datasets, the PMMRC estimate of the New Zealand maternal mortality ratio is necessarily higher, and a comparable ratio should be used when comparing New Zealand ratios with international ratios. This point is highlighted in The Eighth Report of the Confidential Enquiries into Maternal Deaths in the United Kingdom (CMACE 2011).

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 following 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 400g 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 factors considered are organisational and management factors (eg, delays in procedures or accessing results, lack of policies, protocols or guidelines), personnel factors (eg, failure to maintain competence), technology and equipment factors (eg, lack of maintenance of equipment), environmental factors (eg, inadequate facilities, distance) and barriers to accessing/engaging with care (eg, unbooked pregnancies, language barriers).

A potentially avoidable maternal death is where the absence of the contributory factor(s) would have prevented the death.

> “The group’s aim is to review maternal deaths and identify potentially avoidable causes, with the expectation that this will lead to improvements in care.”

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 the Births Death and Marriages Registry (BDM) to ensure that the collection is complete. Since July 2007, all maternal deaths have been required to be notified to the coroner. In 2009, all cases were referred to the coroner, who required a post-mortem be undertaken in all but 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 assessing the presence of contributory factors and potential avoidability.

2.4 Findings

Table 38: Maternal mortalities and cause of maternal deaths 2006–2009

Classification and cause of maternal death	2006	2007	2008	2009	2006-2009	
					n	Maternal mortality ratio
Direct maternal death	**6**	**5**	**4**	**5**	**20**	**7.9**
Amniotic fluid embolism	3	-	1	4	8	
Postpartum haemorrhage	1	1	1	-	3	
Pulmonary embolism	-	1	1*	-	2	
Peripartum cardiomyopathy	-	1	-	-	1	
Pre-eclampsia/Eclampsia		2	1	1	4	
Sepsis	2	-	-	-	2	
Indirect maternal death (ratio)	**7**	**5**	**5**	**9**	**26**	**8.9**
Pre-existing medical condition	2	4	2	1	9	
Non-obstetric sepsis	-	1	-	5	6	
Intracranial haemorrhage	1	-	-	-	1	
Suicide	4	-	3	3	10	
Unclassifiable	**2**	**1**	**-**	**-**	**3**	
Total	**15**	**11**	**9**	**14**	**49**	
Maternal mortality ratio	**25.1**	**16.8**	**13.7**	**22.0**		**19.2**

* Pulmonary embolism and sepsis

Five direct and nine indirect maternal deaths were reported to the MMRWG in 2009. There were 63,665 maternities in 2009, making the maternal mortality ratio 22.0/100,000. 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 four-year ratio for 2006–2009 was 19.2/100,000 (95% confidence interval 14.2-25.4). In 2009 we did not identify any coincidental deaths.

International comparisons

The UK reported a maternal mortality ratio, based on confidential enquiry data, of 11.4/100,000 maternities (4.7/100,000 direct maternal mortality ratio; 6.7 indirect maternal mortality ratio) for the triennium 2006–2008. The New Zealand maternal mortality ratio for this triennium was 18.3/100,000 maternities (95% CI 12.8-25.5) (7.9/100,000 direct maternal mortality ratio; 8.9/100,000 indirect maternal mortality ratio).

Australia has not reported maternal mortality since 2005.

It is difficult to compare maternal mortality ratios internationally due to differences in definitions and difficulties with ascertainment of cases. For example, a recent publication from Italy estimates an underreporting of 63 percent of maternal deaths (Donati et al 2011) and the Center for Disease Control in the United States only reports on direct maternal deaths due to difficulty with case ascertainment (Xu et al 2010).

Table 39: Details of maternal deaths 2006–2009

	2006	2007	2008	2009	Total n=49	
					n	%
Time of death related to pregnancy						
Antepartum	6	5	3	6	20	41
Postpartum	9	6	6	8	29	59
Place of baby's birth						
Community	1	1	-	1	3	6
Hospital	8	6	8	9	31	63
Not delivered	6	4	1	4	15	31
Place of maternal death						
Hospital	7	7	6	12	32	65
Community	8	4	3	2	17	35
Reported to the coroner						
Yes	13	8	9	14	44	90
No	2	3	-	-	5	10
Was death potentially avoidable?						
Yes	3	5	6	3	17	35
No	10	6	2	11	29	59
Unknown	2	-	1	-	3	6

Pandemic influenza (A) H1N1

In 2009 four women died from influenza, of whom three women had confirmed Pandemic influenza (A) H1N1 and one had suspected but untested H1N1 due to insufficient serum. The group is not aware of fatal H1N1 cases in pregnant women in 2010 and continues to recommend that vaccine be offered to pregnant women, and that Oseltamivir may reduce the severity of illness.

Contributory factors and potentially avoidable maternal deaths

Table 40: Contributory factors in maternal deaths 2009

Were contributory factors present?	2009
	n
Yes	5
No	9
Were contributory factors present relating to:	
Organisation and/or management	4
Personnel	3
Technology and equipment	-
Environment	1
Barriers to access/engagement with care	4

In 2009, the MMRWG determined that there were contributory factors in five of the 14 (36%) maternal deaths and that three of these deaths were potentially avoidable. The CMACE review of maternal deaths for the triennium 2006–2008 reported substandard care in 61 percent of cases overall with this contributing significantly to the death in 36 percent of cases.

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. Three different categories of contributory factors were present in each of the 3 avoidable deaths, relating to organisation/management (3), personnel (2), environment (1), and access/engagement with care (3). Specific factors within these categories are listed in the accompanying box:

Contributory Factors Identified in Avoidable Maternal Deaths 2009

Organisation and/or management

- Poor organisational arrangements of staff
- Inadequate education and training
- Lack of policies, protocols or guidelines
- Poor access to senior staff
- Failure or delay in emergency response
- Inadequate systems/process for sharing of clinical information between services

Personnel

- Failure of communication between staff
- Knowledge and skills of staff were lacking (includes failure to maintain competence)
- Failure to seek help/supervision
- Lack of recognition of complexity or seriousness of condition

Environment

- Geography, that is, distance involved in accessing tertiary centre for care

Barriers to accessing or engaging with care

- Substance use
- Lack of recognition of complexity or seriousness of condition
- Maternal mental illness

2.5 Amniotic fluid embolism

There were a further four cases of maternal death due to amniotic fluid embolism in 2009, a total of eight in the four years from 2006–2009. A report relating to this condition was presented in 2010 to the Minister of Health from the MMRWG. 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 United Kingdom Obstetric Surveillance System (UKOSS) has published a review of 60 cases collected over a four-year period. Twelve of these mothers (20%) and six (10%) newborns died (Knight et al). Early recognition of amniotic fluid embolism and prompt initiation of high quality respiratory and haematological support can result in a good outcome for mothers. Serum tryptase may help in differentiation from other causes of maternal collapse. This report also noted an association between induction of labour and amniotic fluid embolism.

2.6 Conclusion

The MMRWG believe that the collection of maternal deaths from 2006–2009 is complete and forms the basis for a realistic estimate of the maternal mortality ratio in New Zealand. The number of maternal deaths is too small in these four years to measure time trends or for in depth analysis. We will report a more comprehensive analysis of five years of maternal mortality data in 2012.

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.

3. NEONATAL ENCEPHALOPATHY WORKING GROUP REPORT

Compiled by Dr Malcolm Battin

The purpose of this working group is to examine ways of reducing the morbidity associated with neonatal encephalopathy. This task was identified by the PMMRC as an area with the potential to improve outcomes for babies. Accordingly, this led to the establishment of the Neonatal Encephalopathy Working Group (NEWG) in late 2007. The primary task of the NEWG is to collect and review New Zealand data on neonatal encephalopathy.

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.

The data collection includes:

- total number of newborn infants in New Zealand
- spread of cases with moderate to severe neonatal encephalopathy
- distribution of affected infants in terms of geographic location
- Spread between level 2 and level 3 hospital facilities
- possible predictors of the condition
- areas for development and implementation of effective preventative and remedial therapies to improve outcome.

Collection of data on neonatal encephalopathy commenced January 2010. At this time neonatal encephalopathy was included as a condition on Paediatric Surveillance Unit (PSU) reporting cards. 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.

An important milestone for the NEWG in 2010 was the establishment and use of a web-based collection system that will enable easier and more rapid data collection. The plan is for this to eventually replace the paper system. As of April 2011, nearly 100 cases have been notified and work continues to ensure full case ascertainment and complete data capture for this group.

One further area of activity for the NEWG has been to review the literature on sudden unexpected neonatal death, usually occurring in the first hours after birth. DHB guidelines on observation of the newly born infant were also reviewed and a presentation was given on this topic at the PMMRC workshop in 2010. Following this the group wrote a draft set of guidelines on observation of the newly born infant, which highlight ways of improving safety for the baby. The Ministry of Health has received this and work continuing with the professional colleges on the completion and implementation of the guidelines.

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

4. AUSTRALASIAN MATERNITY OUTCOMES SURVEILLANCE SYSTEM WORKING GROUP REPORT

Compiled by Dr Claire McLintock

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 data collection 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 investigate/monitor 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 UK Obstetric Surveillance System (UKOSS) method where specific severe and rare (incidence <1 in 1000) pregnancy complications are studied for a period of time by all participating hospitals.

In New Zealand, AMOSS is run under the PMMRC network and has enjoyed the support of the PMMRC DHB local coordinators and key staff in individual DHBs who are essential for the success of the programme, reporting to the AMOSS system when women have these complications and completing case report forms. What is exciting about the project is that it allows contemporaneous, prospective reporting of these rare events on a bi-national level and should provide information about risk factors and allow development of clinical management plans to identify women at risk and modify clinical care plans.

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 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 closely involved in the running of the study and has recently become a chief investigator for AMOSS, having previously been an associate investigator.

Data collection for the AMOSS conditions commenced in all DHBs across New Zealand in January 2010. To date in Australia, 96 percent of eligible sites (hospitals and birthing units with more than 50 births per year) are up and running. As of the end of 2010, New Zealand had completed a full year of data collection for AMOSS about the following rare and severe pregnancy complications:

- antenatal pulmonary embolism
- amniotic fluid embolism
- eclampsia
- peripartum hysterectomy
- placenta accreta/percreta/increta
- influenza requiring admission to ICU
- BMI >50.

The AMOSS group have now discontinued studying women with BMI >50 and influenza admissions to ICU but will continue to gather data on antenatal pulmonary embolism, amniotic fluid embolism, eclampsia, peripartum hysterectomy and placenta accreta/percreta/increta throughout 2011.

The project team is currently working on the development of three new conditions for surveillance by AMOSS: rheumatic heart disease in pregnancy, selected admission of women to ICU and massive blood transfusion. The latter is being developed with the Australian Red Cross Blood Service.

AMOSS – How it works

In New Zealand the PMMRC DHB local coordinators play a pivotal role in AMOSS data collection using the PMMRC network. Within each DHB, local coordinators determine the optimal way in their hospital to identify women who have had an AMOSS condition; local email notification, AMOSS case report folders and personal notification. Monthly reports of the total number of cases from each DHB are sent via email to the AMOSS in Sydney. Negative reporting is an important aspect of the AMOSS system so that the investigators can be sure they have complete case ascertainment of all eligible cases. So even if a DHB has no cases to report, the local coordinator must reply to the AMOSS investigator's monthly email that 'No cases' were identified.

For all AMOSS cases identified within a DHB, the local coordinator arranges for completion of the online AMOSS case-report forms by the clinical staff involved with the woman's care. Some conditions will be reported as incidence studies but placenta accreta and peripartum hysterectomy are case-control studies, with two control women identified for each 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-regional ethics committee.

NZ AMOSS Working Group

An AMOSS Working Group has been set up by the PMMRC to champion AMOSS in New Zealand, review New Zealand data, represent New Zealand to AMOSS Advisory Group and ultimately help implement learning outcomes across New Zealand. The Working Group membership represents a wide range of health professionals involved in care of women and their families and covers expertise in midwifery, obstetrics & gynaecology, obstetric medicine, haematology, clinical epidemiology and public health research.

AMOSS Advisory Group

New Zealand is well represented on the AMOSS Advisory Group, the body that provides strategic advice to AMOSS on implementation, delivery and development of the project, assists with prioritising conditions to be studied and, ultimately, assist with translation of findings to clinical practice. The Working Group will have four meetings each year, two by teleconference and two face-to-face meetings. Estelle Mulligan and Ted Hughes represent the New Zealand AMOSS Working Group and with Claire McLintock attended the AMOSS Advisory Group meeting in Sydney in November 2010.

AMOSS – International links

A 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. By adopting the UKOSS exemplar we will also have the opportunity to conduct direct international comparisons of quality and safety in maternity care and establish international partnerships. In July 2010, Dr Claire McLintock, attended the inaugural meeting of the International Network of Obstetric Survey Systems (INOSS) with Associate Professor Elizabeth Sullivan, along with clinicians from European countries including the UK, Germany, the Netherlands, France, Spain, Norway, and Finland who are involved with gathering data on maternal morbidity. The founding members of INOSS defined as its mission 'to improve the care given to women, their babies and their families, by advancing knowledge and contributing to the evidence base about serious, rare disorders in pregnancy including near-miss events, through international co-operation and collaborative working.' The work of AMOSS was applauded by the international group who recognised it to be a key organisation that will play a major role in ongoing studies with INOSS.

Publications to date

Homer, C., Kurinczuk, J., Spark, P., Brocklehurst, P. and Knight, M., *Planned vaginal delivery or planned caesarean delivery in women with extreme obesity.* BJOG: An International Journal of Obstetrics & Gynaecology, no. doi: 10.1111/j.1471-0528.2010.02832.x

Knight, M. et al on behalf of the UK's Obstetric Surveillance System, the ANZIC Influenza Investigators, and the Australasian Maternity Outcomes Surveillance System, *Critical illness with AH1N1v influenza in pregnancy: a comparison of two population-based cohorts*, DOI 0.1111/j.1471-0528.2010.02736.x

Homer, C.S.E., et al., Midwifery (2010), *A novel use of a classification system to audit severe maternal morbidity.* doi:10.1016/j.midw.2010.03.010

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5. 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.

As noted earlier, this report is the first in which the PMMRC includes information on local (DHB) assessment of factors that may have contributed to or were causative in the perinatal deaths recorded for 2009. For bereaved parents and families, the inclusion of this data marks a beginning in the ways we might reduce the numbers of perinatal deaths in New Zealand.

Many of us appreciate the importance of collecting the robust and comprehensive data that tell us how many babies have died, what gestation or age they died at, possible maternal conditions, congenital abnormalities, and many other important and telling factors; from a lay perspective it is the causative and potentially avoidable factors that may be the most meaningful in terms of making a difference and reducing a greater number of deaths.

Contributory factors were identified in 23.5 percent of perinatal deaths–4.4 percent in late terminations, 25.4 percent in stillbirths and 33.5 percent in neonatal deaths. Of the 169 perinatal deaths that were considered to have contributory factors, there were 98 considered to be potentially avoidable. That is, there were 98 babies for whom a decision (made by a health professional or parent), some lack of knowledge, or failure within our maternity system, may have contributed to the death.

While this is not the forum in which to become emotive or contentious, from a parent and family perspective it is hard not to consider the enormity of those 98 potentially avoidable losses, that is, babies; the grief that 98 families have experienced and continue to experience; the futility of this retrospective exercise for those particular families; and the impact those potentially avoidable deaths no doubt have had on the health professionals who witnessed and were involved in them.

Within the PMMRC process, the focus is on the learning we can garner from those babies' potentially avoidable deaths rather than the inevitable emotional and life-changing consequences to their parents and families. Indeed, previous chapters on Issues for Parents, Families and Whānau in the PMMRC reports have highlighted the need for more structured and funded support services for such families and that call has not changed. While this report may be focusing on our learning and what we do with it, it is still important to continue to highlight the need for compassion, support and information for our bereaved families following a perinatal death (and any other loss of a baby or infant). They need support on how to navigate their way through a world that now encompasses their baby's birth and death.

At a time when our country has been acutely reminded of the impact of tragedy and trauma, it is timely to state yet again that the need for support for families who are faced with tragedy every day continues. The loss of a little life demands no more and no less sympathy than any other loss of life–and it reflects on us as a community as to what we do for these families.

Providing written information is a start but not nearly enough. Again the call is made for better support for parents, families and whānau who experience the death of a baby.

This new section of the PMMRC report does not identify individual DHBs or staff. In order to encourage our health professionals to embrace the action/reflection model of change, the data must remain generic and non-identifiable. Therefore, any learning to be had applies to all DHBs and is applicable nationwide.

Of the 169 perinatal deaths that featured contributory factors, 111 (15%) were identified as resulting from barriers to access or engagement with care, with cultural issues and substance use being the main factors identified. A further 34 deaths (5%) were attributed to organisational/management factors. The predominant issues were a lack of policies, protocols or guidelines, inadequate education and training, and poor staff organisation.

Finally, personnel factors contributed to 50 (7%) of perinatal deaths, those factors being broken down into categories of inadequate communication, failure to follow best practice and a lack of skills and knowledge.

Those statistics are sobering reading for bereaved parents, families and whānau. In fact they evoke emotion no matter the approach we take. Reading about lack of policies, inadequate training and communication, and failure to follow best practice will be heart-wrenching for many parents.

Let us take this information and do something with it. Let's not focus just on data collection but on the learning and changes we can make in our DHBs to avoid those deaths that are potentially avoidable. In taking meaningful action, we honour the lives of the babies and assure bereaved parents and families that their deaths were not meaningless and futile.

It is beyond the scope of this chapter to explore each of the identified factors and hypothesise about the measures we might take to address these problems. What can be done however is to ask: what can we learn?

And, fittingly: who will be responsible for acknowledging these problems and ensuring that they are addressed within each DHB in order that potentially avoidable deaths are reduced considerably, if not completely?

"Knowing is not enough;

we must apply.

Willing is not enough;

we must do."

~Goethe~

6. NATIONAL COORDINATOR REPORT 2010

The PMMRC national co-ordination services include the following personnel:

Alison Cooper – *Administration support*
Vicki Masson – *National coordinator*
Dr Lynn Sadler – *Perinatal epidemiology services*

The national co-ordination services are provided to facilitate the PMMRC's collection of data on both perinatal and maternal mortality and morbidity. 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.
- Coordinate the collection of information to enable the review of maternal deaths by the MMRWG.
- 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.
- 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. **Co-ordinating 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.
- Visit DHBs and the PMMRC local coordinators and provide support and training for their role.
- Provide resources for local DHB review of perinatal mortality.

4. **Supporting the PMMRC**

- Provide a report from the PMMRC database for each PMMRC meeting; noting issues relating to data quality, new clinical issues and any other concerns that have been raised.
- Assist with planning, preparing and supporting explanations for the analysis of the perinatal and maternal data in this report.
- Assist with planning and preparation for the PMMRC annual workshop.

5. Supporting families and whānau

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

The PMMRC national coordinator services have working relationships with the:

- Ministry of Health secretariat
- University of Otago's Mortality Review Data Group
- Child and Youth Mortality Review Committee (CYMRC)
- Coronial Services of New Zealand
- Perinatal and Reproductive Epidemiology Research Unit (PRERU), The University of New South Wales
- Paediatric Surveillance Unit (PSU).

APPENDICIES

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

7.4 PSANZ Perinatal Mortality Classification

7.4.1 PSANZ 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
  - 1.81 Musculoskeletal
  - 1.82 Respiratory
  - 1.83 Diaphragmatic hernia
  - 1.84 Haematological
  - 1.85 Tumours
  - 1.88 Other specified congenital abnormality
- 1.9 Unspecified congenital abnormality

2. Perinatal infection

- 2.1 Bacterial
  - 2.11 Group B Streptococcus
  - 2.12 E coli
  - 2.13 Listeria monocytogenes
  - 2.14 Spirochaetal eg, syphilis
  - 2.18 Other bacterial
  - 2.19 Unspecified bacterial
- 2.2 Viral
  - 2.21 Cytomegalovirus
  - 2.22 Parvovirus
  - 2.23 Herpes simplex virus
  - 2.24 Rubella virus
  - 2.28 Other viral
  - 2.29 Unspecified viral
- 2.3 Protozoal eg, 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, eg, renal disease
- 3.3 Chronic hypertension: unspecified
- 3.4 Gestational hypertension
- 3.5 Pre-eclampsia
  - 3.51 With laboratory evidence of thrombophilia
- 3.6 Pre-eclampsia superimposed on chronic hypertension
  - 3.61 With laboratory evidence of thrombophilia
- 3.9 Unspecified hypertension

4. Antepartum haemorrhage (APH)

- 4.1 Placental abruption
  - 4.11 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
  - 5.31 Accidental
  - 5.32 Non-accidental
- 5.4 Maternal sepsis
- 5.5 Antiphospholipid syndrome
  - 5.51 Other maternal thrombophilia (if considered cause of death)
- 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
  - 6.31 Cord haemorrhage
  - 6.32 True knot with evidence of occlusion
  - 6.38 Other
  - 6.39 Unspecified
- 6.4 Uterine abnormalities, eg, bicornuate uterus, cervical incompetence

- 6.5 Birth trauma (typically infants of >24 weeks gestation or >600g birthweight)
- 6.6 Alloimmune disease
  - 6.61 Rhesus
  - 6.62 ABO
  - 6.63 Kell
  - 6.64 Alloimmune thrombocytopenia
  - 6.68 Other
  - 6.69 Unspecified
- 6.7 Idiopathic hydrops
- 6.8 Other specific perinatal conditions
  - 6.81 Rupture of membranes after amniocentesis
  - 6.82 Termination of pregnancy for suspected but unconfirmed congenital abnormality.
  - 6.83 Fetal subdural haematoma
  - 6.88 Other
  - 6.89 Unspecified

7. Hypoxic peripartum death (typically infants of >24 weeks gestation or >600g birthweight)

- 7.1 With intrapartum complications
  - 7.11 Uterine rupture
  - 7.12 Cord prolapse
  - 7.13 Shoulder dystocia
  - 7.18 Other
- 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)
- 7.3 No intrapartum 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 (eg, 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
  - 9.11 With chorioamnionitis confirmed on placental histopathology
  - 9.12 Without chorioamnionitis on placental histopathology
  - 9.13 With clinical evidence of chorioamnionitis, no examination of placenta

- 9.17 No clinical signs of chorioamnionitis, no examination of placenta
- 9.19 Unspecified or not known whether placenta examined

9.2 Spontaneous preterm with membrane rupture ≥24 hours before delivery

- 9.21 With chorioamnionitis confirmed on placental histopathology
- 9.22 Without chorioamnionitis on placental histopathology
- 9.23 With clinical evidence of chorioamnionitis, no examination of placenta
- 9.27 No clinical signs of chorioamnionitis, no examination of placenta
- 9.29 Unspecified or not known whether placenta examined

9.3 Spontaneous preterm with membrane rupture of unknown duration before delivery

- 9.31 With chorioamnionitis confirmed on placental histopathology
- 9.32 Without chorioamnionitis on placental histopathology
- 9.33 With clinical evidence of chorioamnionitis, no examination of placenta
- 9.37 No clinical signs of chorioamnionitis, no examination of placenta
- 9.39 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 (eg, significant infarction, acute atherosis, maternal and/or fetal vascular thrombosis or maternal floor infarction)

10.2 With chronic villitis

10.3 No placental pathology

10.4 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)

- 11.11 SIDS Category IA: Classic features of SIDS present and completely documented
- 11.12 SIDS Category IB: Classic features of SIDS present but incompletely documented
- 11.13 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

- 11.91 Unclassified Sudden Infant Death
- 11.92 Other Unknown/Undetermined

7.4.2 PSANZ 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
  - 1.81 Musculoskeletal
  - 1.82 Respiratory
  - 1.83 Diaphragmatic hernia
  - 1.84 Haematological
  - 1.85 Tumours
  - 1.88 Other specified congenital abnormality
  - 1.9 Unspecified congenital abnormality

2. Extreme prematurity (typically infants of ≤24 weeks gestation or ≤600g 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)
- 3.6 Pulmonary haemorrhage
- 3.7 Pneumothorax
- 3.8 Other

4. Infection

- 4.1 Bacterial
  - 4.11 Congenital bacterial
    - 4.111 Group B Streptococcus
    - 4.112 E coli
    - 4.113 Listeria monocytogenes
    - 4.114 Spirochaetal, eg, syphilis
    - 4.118 Other bacterial
    - 4.119 Unspecified bacterial

- 4.12 Acquired bacterial
  - 4.121 Group B Streptococcus
  - 4.122 E coli
  - 4.125 Other Gram negative bacilli (other than E coli)
  - 4.126 Staphyloccus aureus
  - 4.127 Coagulase negative Staphylococcus
  - 4.128 Other specified bacterial
  - 4.129 Unspecified bacterial
- 4.2 Viral
  - 4.21 Congenital viral
    - 4.211 Cytomegalovirus
    - 4.213 Herpes simplex virus
    - 4.214 Rubella virus
    - 4.218 Other specified viral
    - 4.219 Unspecified viral
  - 4.22 Acquired viral
    - 4.221 Cytomegalovirus
    - 4.223 Herpes simplex virus
    - 4.224 Rubella virus
    - 4.228 Other specified viral
    - 4.229 Unspecified viral
- 4.3 Protozoal eg, toxoplasma
- 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 >600g birthweight)
- 5.2 Intracranial haemorrhage
  - 5.21 Intraventricular haemorrhage
  - 5.22 Subgaleal haemorrhage
  - 5.23 Subarachnoid haemorrhage
  - 5.24 Subdural haemorrhage
  - 5.28 Other Intracranial haemorrhage
- 5.8 Other

6. Gastrointestinal

- 6.1 Necrotising enterocolitis
- 6.8 Other

7. Other

- 7.1 Sudden Infant Death Syndrome (SIDS)
  - 7.11 SIDS Category IA: Classic features of SIDS present and completely documented
  - 7.12 SIDS Category IB: Classic features of SIDS present but incompletely documented
  - 7.13 SIDS Category II: Infant deaths that meet category I except for one or more features
- 7.2 Multisystem failure
  - 7.21 Secondary to intrauterine growth restriction
  - 7.28 Other specified
  - 7.29 Unspecified/undetermined primary cause or trigger event
- 7.3 Trauma
  - 7.31 Accidental
  - 7.32 Non accidental
  - 7.39 Unspecified
- 7.4 Treatment complications
  - 7.41 Surgical
  - 7.42 Medical
- 7.8 Other specified
- 7.9 Unknown/Undetermined
  - 7.91 Unclassified Sudden Infant Death
    - 7.911 Bed sharing
    - 7.912 Not bed sharing
  - 7.92 Other Unknown/undetermined

Appendix B: Additional Tables

Table 41: Distribution of births in New Zealand by deprivation decile (NZDep2006) 2009

NZ Deprivation Index (NZDep2006)	Total births	
	n = 63,665	
	n	%
1	4,956	7.8
2	5,221	8.2
3	5,395	8.5
4	5,830	9.2
5	5,756	9.0
6	6,332	9.9
7	6,439	10.1
8	6,903	10.8
9	7,715	12.1
10	8,815	13.8
Unknown	303	0.5

Table 42: Perinatal related deaths (per 1000) by baby ethnicity (prioritised) 2009

	Total births		Fetal deaths						Neonatal deaths			Total perinatal related deaths		
			Termination of pregnancy			Stillbirths								
	n = 63,665		n = 137			n = 401			n = 182			n = 720		
	n	%	n	%	Rate	n	%	Rate	n	%	Rate	n	%	Rate
Ethnicity (baby)														
Māori	18,593	29.2	41	29.9	2.21	135	33.7	7.26	74	40.7	4.02	250	34.7	13.45
Pacific peoples	7,163	11.3	13	9.5	1.81	65	16.2	9.07	31	17.0	4.38	109	15.1	15.22
Indian	2,310	3.6	9	6.6	3.90	15	3.7	6.49	11	6.0	4.81	35	4.9	15.15
Other Asian	4,492	7.1	14	10.2	3.12	22	5.5	4.90	8	4.4	1.80	44	6.1	9.80
Other/not stated	3,924	6.2	4	2.9	1.02	21	5.2	5.35	5	2.7	1.28	30	4.2	7.65
NZ European	27,183	42.7	56	40.9	2.06	143	35.7	5.26	53	29.1	1.96	252	35.0	9.27

Table 43: Perinatal related deaths (per 1000) by maternal and baby ethnicity (prioritised) 2007–2009

	Total births		Fetal deaths: Termination of pregnancy			Fetal deaths: Stillbirths			Neonatal deaths			Total perinatal related deaths		
	n = 195,140		n = 425			n = 1,148			n = 525			n = 2,098		
	n	%	n	%	Rate	n	%	Rate	n	%	Rate	n	%	Rate
Ethnicity (mother)														
Māori	45,560	23.3	59	13.9	1.29	315	27.4	6.91	179	34.1	3.96	553	26.4	12.14
Pacific peoples	20,584	10.5	30	7.1	1.46	180	15.7	8.74	79	15.0	3.88	289	13.8	14.04
Indian	6,577	3.4	28	6.6	4.26	38	3.3	5.78	22	4.2	3.38	88	4.2	13.38
Other Asian	13,255	6.8	44	10.4	3.32	49	4.3	3.70	24	4.6	1.82	117	5.6	8.83
Other/not stated	17,263	8.8	33	7.8	1.91	103	9.0	5.97	26	5.0	1.52	162	7.7	9.38
NZ European	91,901	47.1	231	54.4	2.51	463	40.3	5.04	195	37.1	2.14	889	42.4	9.67
Ethnicity (baby)														
Māori	57,671	29.6	85	20.0	1.47	387	33.7	6.71	199	37.9	3.48	671	32.0	11.63
Pacific peoples	21,519	11.0	33	7.8	1.53	182	15.9	8.46	82	15.6	3.85	297	14.2	13.80
Indian	6,883	3.5	27	6.4	3.92	40	3.5	5.81	25	4.8	3.67	92	4.4	13.37
Other Asian	12,983	6.7	44	10.4	3.39	51	4.4	3.93	21	4.0	1.63	116	5.5	8.93
Other/not stated	11,816	6.1	29	6.8	2.45	74	6.4	6.26	15	2.9	1.28	118	5.6	9.99
NZ European	84,268	43.2	207	48.7	2.46	414	36.1	4.91	183	34.9	2.19	804	38.3	9.54

Table 44: Perinatal related deaths (per 1000) by baby ethnicity (sole/combination) 2009

	Total births		Fetal deaths: Termination of pregnancy			Fetal deaths: Stillbirths			Neonatal deaths			Total perinatal related deaths		
	n = 195,140		n = 425			n = 1,148			n = 525			n = 2,098		
	n	%	n	%	Rate	n	%	Rate	n	%	Rate	n	%	Rate
Sole/combination ethnicity (baby)														
Māori only	6,223	9.8	13	9.5	2.09	57	14.2	9.16	39	21.4	6.34	109	15.1	17.52
Pacific only	5,297	8.3	10	7.3	1.89	53	13.2	10.01	27	14.8	5.16	90	12.5	16.99
Indian only	1,994	3.1	8	5.8	4.01	15	3.7	7.52	10	5.5	5.07	33	4.6	16.55
Other Asian only	3,365	5.3	11	8.0	3.27	16	4.0	4.75	5	2.7	1.50	32	4.4	9.51
Other only	1,945	3.1	4	2.9	2.06	12	3.0	6.17	5	2.7	2.59	21	2.9	10.80
NZE only	27,183	42.7	56	40.9	2.06	143	35.7	5.26	53	29.1	1.96	252	35.0	9.27
Māori and Pacific	1,491	2.3	3	2.2	2.01	16	4.0	10.73	6	3.3	4.08	25	3.5	16.77
Māori and NZE	7,849	12.3	20	14.6	2.55	48	12.0	6.12	22	12.1	2.83	90	12.5	11.47
Pacific and NZE	1,294	2.0	2	1.5	1.55	9	2.2	6.96	4	2.2	3.12	15	2.1	11.59
All other combinations	7,024	11.0	10	7.3	1.42	32	8.0	4.56	11	6.0	1.58	53	7.4	7.55

Table 45: Perinatal related deaths by maternal and baby ethnicity (sole/combination) 2007–2009

	Total births		Fetal deaths						Neonatal deaths			Total perinatal related deaths		
			Termination of pregnancy			Stillbirths								
	n = 195,140		n = 425			n = 1,148			n = 525			n = 2,098		
	n	%	n	%	Rate	n	%	Rate	n	%	Rate	n	%	Rate
Sole/combination ethnicity (mother)														
Māori only	23,930	12.3	29	6.8	1.21	207	18.0	8.65	133	25.3	5.61	369	17.6	15.57
Pacific only	17,631	9.0	28	6.6	1.59	162	14.1	9.19	72	13.7	4.13	262	12.5	15.02
Indian only	6,355	3.3	27	6.4	4.25	37	3.2	5.82	22	4.2	3.50	86	4.1	13.67
Other Asian only	12,759	6.5	43	10.1	3.37	48	4.2	3.76	24	4.6	1.89	115	5.5	9.08
Other only[1]	15,401	7.9	29	6.8	1.88	88	7.7	5.71	26	5.0	1.70	143	6.8	9.36
NZE only	91,829	47.1	231	54.4	2.52	463	40.3	5.04	195	37.1	2.14	889	42.4	9.75
Māori and Pacific	1,695	0.9	-	-	-	11	1.0	6.49	6	1.1	3.56	17	0.8	10.10
Māori and NZE	17,143	8.8	27	6.4	1.57	85	7.4	4.96	37	7.0	2.17	149	7.1	8.75
Pacific and NZE	2,057	1.1	-	-	-	10	0.9	4.86	6	1.1	2.93	16	0.8	7.82
All other combinations	6,340	3.2	11	2.6	1.74	37	3.2	5.84	4	0.8	0.64	52	2.5	8.26
Sole/combination ethnicity (baby)														
Māori only	20,019	10.3	27	6.4	1.35	167	14.5	8.34	125	23.8	6.31	319	15.2	15.93
Pacific only	15,857	8.1	26	6.1	1.64	155	13.5	9.77	72	13.7	4.59	253	12.1	15.96
Indian only	6,015	3.1	24	5.6	3.99	37	3.2	6.15	21	4.0	3.53	82	3.9	13.63
Other Asian only	9,680	5.0	37	8.7	3.82	35	3.0	3.62	15	2.9	1.56	87	4.1	8.99
Other only[1]	6,085	3.1	19	4.5	3.12	48	4.2	7.89	14	2.7	2.33	81	3.9	13.31
NZE only	84,170	43.1	207	48.7	2.46	414	36.1	4.92	183	34.9	2.19	804	38.3	9.55
Māori and Pacific	4,475	2.3	5	1.2	1.12	36	3.1	8.04	14	2.7	3.16	55	2.6	12.29
Māori and NZE	24,157	12.4	45	10.6	1.86	144	12.5	5.96	46	8.8	1.92	235	11.2	9.73
Pacific and NZE	3,931	2.0	5	1.2	1.27	19	1.7	4.83	10	1.9	2.56	34	1.6	8.65
All other combinations	20,751	10.6	30	7.1	1.45	93	8.1	4.48	25	4.8	1.21	148	7.1	7.13

[1] Includes not stated

Table 46: PDC-specific perinatal related death rate (excluding termination of pregnancy) by maternal ethnicity (prioritised Māori, Pacific peoples and NZ European) among births registered in 2007–2009

Perinatal death classification (PDC)	Prioritised Māori			Prioritised Pacific peoples			Prioritised NZ European		
	n = 45,560			n = 20,584			n = 91,901		
	n	%	Rate	n	%	Rate	n	%	Rate
Congenital abnormality	56	11.3	1.23	34	13.1	1.65	89	13.5	0.97
Perinatal infection	21	4.3	0.46	11	4.2	0.53	28	4.3	0.30
Hypertension	12	2.4	0.26	15	5.8	0.73	23	3.5	0.25
Antepartum haemorrhage	66	13.4	1.45	27	10.4	1.31	74	11.2	0.81
Maternal conditions	22	4.5	0.48	19	7.3	0.92	21	3.2	0.23
Specific perinatal conditions	42	8.5	0.92	22	8.5	1.07	89	13.5	0.97
Hypoxic peripartum death	26	5.3	0.57	12	4.6	0.58	43	6.5	0.47
Fetal growth restriction	34	6.9	0.75	17	6.6	0.83	66	10.0	0.72
Spontaneous preterm	109	22.1	2.39	50	19.3	2.43	87	13.2	0.95
Unexplained antepartum death	85	17.2	1.87	49	18.9	2.38	131	19.9	1.43
No obstetric antecedent	21	4.3	0.46	3	1.2	0.15	7	1.1	0.08

Table 47: PDC-specific perinatal related death rate (excluding termination of pregnancy) by maternal ethnicity (sole Māori, sole Pacific peoples, sole NZ European) among births registered in 2007–2009

Perinatal death classification (PDC)	Sole Māori			Sole Pacific peoples			Sole NZ European		
	n = 23,930			n = 17,631			n = 91,829		
	n	%	Rate	n	%	Rate	n	%	Rate
Congenital abnormality	36	10.6	1.50	32	13.7	1.81	89	13.5	0.97
Perinatal infection	12	3.5	0.50	11	4.7	0.62	28	4.3	0.30
Hypertension	10	2.9	0.42	14	6.0	0.79	23	3.5	0.25
Antepartum haemorrhage	42	12.4	1.76	24	10.3	1.36	74	11.2	0.81
Maternal conditions	15	4.4	0.63	19	8.1	1.08	21	3.2	0.23
Specific perinatal conditions	27	7.9	1.13	17	7.3	0.96	89	13.5	0.97
Hypoxic peripartum death	22	6.5	0.92	11	4.7	0.62	43	6.5	0.47
Fetal growth restriction	23	6.8	0.96	16	6.8	0.91	66	10.0	0.72
Spontaneous preterm	79	23.2	3.30	44	18.8	2.50	87	13.2	0.95
Unexplained antepartum death	55	16.2	2.30	43	18.4	2.44	131	19.9	1.43
No obstetric antecedent	19	5.6	0.79	3	1.3	0.17	7	1.1	0.08

Table 48: Perinatal related deaths by deprivation quintile (NZDep2006) 2007–2009

Deprivation quintile	Total births		Fetal deaths						Neonatal deaths			Total perinatal related deaths		
			Termination of pregnancy			Stillbirths								
	n = 195,140		n = 425			n = 1,148			n = 525			n = 2,098		
	n	%	n	%	Rate	n	%	Rate	n	%	Rate	n	%	Rate
1	31,421	16.1	82	19.3	2.61	135	11.8	4.30	52	9.9	1.67	269	12.8	8.56
2	34,416	17.6	84	19.8	2.44	149	13.0	4.33	61	11.6	1.78	294	14.0	8.54
3	36,343	18.6	87	20.5	2.39	188	16.4	5.17	82	15.6	2.27	357	17.0	9.82
4	40,505	20.8	96	22.6	2.37	257	22.4	6.34	119	22.7	2.96	472	22.5	11.65
5	51,329	26.3	74	17.4	1.44	400	34.8	7.79	205	39.0	4.03	679	32.4	13.23
Unknown	1,126	0.6	2	0.5	-	19	1.7	-	6	1.1	-	27	1.3	-

Table 49: PDC-specific perinatal related death rate (excluding termination of pregnancy) by deprivation quintile (NZDep2006) 2007–2009

Perinatal death classification (PDC)	Quintile 1			Quintile 2			Quintile 3			Quintile 4			Quintile 5		
	n = 31,421			n = 34,416			n = 36,343			n = 40,505			n = 51,329		
	n	%	Rate	n	%	Rate	n	%	Rate	n	%	Rate	n	%	Rate
Congenital abnormality	36	19.3	1.15	16	7.6	0.46	31	11.5	0.85	51	31.1	1.26	77	29.9	1.50
Perinatal infection	10	5.3	0.32	12	5.7	0.35	16	5.9	0.44	13	5.0	0.32	24	4.3	0.47
Hypertension	3	1.6	0.10	6	2.9	0.17	13	4.8	0.36	14	1.2	0.35	22	2.4	0.43
Antepartum haemorrhage	16	8.6	0.51	24	11.4	0.70	28	10.4	0.77	49	7.5	1.21	75	9.0	1.46
Maternal conditions	6	3.2	0.19	6	2.9	0.17	10	3.7	0.28	13	2.5	0.32	35	2.8	0.68
Specific perinatal condition	25	13.4	0.80	36	17.1	1.05	42	15.6	1.16	41	9.3	1.01	48	9.0	0.94
Hypoxic peripartum	8	4.3	0.25	15	7.1	0.44	13	4.8	0.36	22	5.6	0.54	34	4.3	0.66
Fetal growth restriction	18	9.6	0.57	23	11.0	0.67	24	8.9	0.66	35	6.2	0.86	47	7.6	0.92
Spontaneous preterm	23	12.3	0.73	30	14.3	0.87	43	15.9	1.18	63	16.1	1.56	120	14.2	2.34
Unexplained antepartum	41	21.9	1.30	40	19.0	1.16	47	17.4	1.29	67	14.9	1.65	105	15.2	2.05
No obstetric antecedent	1	0.5	0.03	2	1.0	0.06	3	1.1	0.08	8	0.6	0.20	18	1.4	0.35

Table 50: Perinatal related deaths by DHB of maternal residence 2009

Maternal domicile	Total births		Fetal deaths						Neonatal deaths			Total perinatal related deaths		
			Termination of pregnancy			Stillbirths								
	n = 63,665		n = 137			n = 401			n = 182			n = 720		
	n	%	n	%	Rate	n	%	Rate	n	%	Rate	n	%	Rate
Northland	2,246	3.5	4	2.9	1.78	11	2.7	4.90	8	4.4	3.59	23	3.2	10.24
Waitemata	7,751	12.2	23	16.8	2.97	49	12.2	6.32	22	12.1	2.86	94	13.1	12.13
Auckland	6,775	10.6	20	14.6	2.95	37	9.2	5.46	18	9.9	2.68	75	10.4	11.07
Counties Manukau	8,646	13.6	18	13.1	2.08	73	18.2	8.44	38	20.9	4.44	129	17.9	14.92
Waikato	5,589	8.8	12	8.8	2.15	33	8.2	5.90	18	9.9	3.25	63	8.8	11.27
Bay of Plenty	2,908	4.6	3	2.2	1.03	14	3.5	4.81	9	4.9	3.11	26	3.6	8.94
Lakes	1,697	2.7	2	1.5	1.18	9	2.2	5.30	8	4.4	4.74	19	2.6	11.20
Tairawhiti	748	1.2	1	0.7	1.34	1	0.2	1.34	4	2.2	5.36	6	0.8	8.02
Taranaki	1,609	2.5	5	3.6	3.11	8	2.0	4.97	3	1.6	1.88	16	2.2	9.94
Hawke's Bay	2,412	3.8	5	3.6	2.07	15	3.7	6.22	7	3.8	2.93	27	3.8	11.19
Whanganui	936	1.5	3	2.2	3.21	7	1.7	7.48	2	1.1	2.16	12	1.7	12.82
MidCentral	2,222	3.5	7	5.1	3.15	16	4.0	7.20	7	3.8	3.18	30	4.2	13.50
Wairarapa	559	0.9	2	1.5	3.58	4	1.0	7.16	5	2.7	9.04	11	1.5	19.68
Capital & Coast	4,008	6.3	10	7.3	2.50	24	6.0	5.99	8	4.4	2.01	42	5.8	10.48
Hutt Valley	2,215	3.5	8	5.8	3.61	14	3.5	6.32	4	2.2	1.82	26	3.6	11.74
Nelson Marlborough	1,669	2.6	4	2.9	2.40	7	1.7	4.19	2	1.1	1.21	13	1.8	7.79
West Coast	432	0.7	1	0.7	2.31	1	0.2	2.31	2	1.1	4.65	4	0.6	9.26
Canterbury	6,561	10.3	5	3.6	0.76	47	11.7	7.16	12	6.6	1.84	64	8.9	9.75
South Canterbury	658	1.0	1	0.7	1.52	7	1.7	10.64	1	0.5	1.54	9	1.3	13.68
Otago	2,077	3.3	2	1.5	0.96	13	3.2	6.26	2	1.1	0.97	17	2.4	8.18
Southland	1,674	2.6	1	0.7	0.60	10	2.5	5.97	2	1.1	1.20	13	1.8	7.77
Other[1]	273	0.4	-	-	-	1	0.2	-	-	-	-	1	0.1	-

[1] Other includes Overseas, Unknown and Other

Table 51: Perinatal related deaths by DHB of maternal residence 2007–2009

Maternal domicile	Total births		Fetal deaths						Neonatal deaths			Total perinatal related deaths		
			Termination of pregnancy			Stillbirths								
	n = 195,140		n = 425			n = 1,148			n = 525			n = 2,098		
	n	%	n	%	Rate	n	%	Rate	n	%	Rate	n	%	Rate
Northland	7,022	3.6	11	2.6	1.57	48	4.2	6.84	26	5.0	3.73	85	4.1	12.10
Waitemata	23,670	12.1	83	19.5	3.51	147	12.8	6.21	37	7.0	1.58	267	12.7	11.28
Auckland	20,198	10.4	61	14.4	3.02	93	8.1	4.60	50	9.5	2.49	204	9.7	10.10
Counties Manukau	26,869	13.8	50	11.8	1.86	209	18.2	7.78	109	20.8	4.10	368	17.5	13.70
Waikato	17,141	8.8	39	9.2	2.28	85	7.4	4.96	54	10.3	3.17	178	8.5	10.38
Bay of Plenty	9,052	4.6	12	2.8	1.33	47	4.1	5.19	32	6.1	3.56	91	4.3	10.05
Lakes	5,148	2.6	5	1.2	0.97	39	3.4	7.58	23	4.4	4.51	67	3.2	13.01
Tairawhiti	2,457	1.3	2	0.5	0.81	12	1.0	4.88	7	1.3	2.87	21	1.0	8.55
Taranaki	4,876	2.5	8	1.9	1.64	23	2.0	4.72	12	2.3	2.48	43	2.0	8.82
Hawke's Bay	7,238	3.7	12	2.8	1.66	35	3.0	4.84	17	3.2	2.36	64	3.1	8.84
Whanganui	2,808	1.4	8	1.9	2.85	22	1.9	7.83	8	1.5	2.88	38	1.8	13.53
MidCentral	7,069	3.6	19	4.5	2.69	49	4.3	6.93	21	4.0	3.00	89	4.2	12.59
Wairarapa	1,638	0.8	6	1.4	3.66	8	0.7	4.88	5	1.0	3.08	19	0.9	11.60
Capital & Coast	12,267	6.3	29	6.8	2.36	65	5.7	5.30	17	3.2	1.40	111	5.3	9.05
Hutt Valley	6,768	3.5	18	4.2	2.66	43	3.7	6.35	20	3.8	2.98	81	3.9	11.97
Nelson Marlborough	5,165	2.6	10	2.4	1.94	25	2.2	4.84	13	2.5	2.53	48	2.3	9.29
West Coast	1,297	0.7	1	0.2	0.77	7	0.6	5.40	8	1.5	6.21	16	0.8	12.34
Canterbury	20,201	10.4	33	7.8	1.63	106	9.2	5.25	46	8.8	2.29	185	8.8	9.16
South Canterbury	1,985	1.0	2	0.5	1.01	15	1.3	7.56	4	0.8	2.03	21	1.0	10.58
Otago	6,341	3.2	9	2.1	1.42	35	3.0	5.52	9	1.7	1.43	53	2.5	8.36
Southland	4,954	2.5	7	1.6	1.41	33	2.9	6.66	5	1.0	1.02	45	2.1	9.08
Other[1]	976	0.5	-	-	-	2	0.2	2.05	2	0.4	2.05	4	0.2	4.10

[1] Other includes Overseas, Unknown and Other

Table 52: Perinatal related deaths by maternal age 2007–2009

Maternal age	Total births		Fetal deaths						Neonatal deaths			Total perinatal related deaths		
			Termination of pregnancy			Stillbirths								
	n = 195,140		n = 425			n = 1,148			n = 525[1]			n = 2,097[1]		
	n	%	n	%	Rate	n	%	Rate	n	%	Rate	n	%	Rate
<20	15,220	7.8	32	7.5	2.10	123	10.7	8.08	68	13.0	4.51	223	10.6	14.65
20–24	35,178	18.0	59	13.9	1.68	223	19.4	6.34	128	24.4	3.67	410	19.5	11.66
25–29	47,554	24.4	101	23.8	2.12	258	22.5	5.43	122	23.2	2.59	481	22.9	10.11
30–34	54,551	28.0	116	27.3	2.13	275	24.0	5.04	110	21.0	2.03	501	23.9	9.18
35–39	35,255	18.1	92	21.6	2.61	211	18.4	5.98	81	15.4	2.32	384	18.3	10.89
≥40	7,382	3.8	25	5.9	3.39	58	5.1	7.86	15	2.9	2.06	98	4.7	13.28

[1] Includes one missing maternal age

Table 53: PDC-specific perinatal related death rates by maternal age (< 20 20-39 ≥40) (95% CIs) 2007–2009

Perinatal death classification (PDC)	Maternal age									Total perinatal related deaths		
	< 20			20–39			≥ 40					
	n = 15,221			n = 172,536			n = 7,382			n = 195,139		
	n	%	Rate	n	%	Rate	n	%	Rate	n	%	Rate
Congenital abnormality[1]	52	23.3	3.42	474	26.7	2.75	36	36.7	4.88	562	26.8	2.88
Perinatal infection	13	5.8	0.85	65	3.7	0.38	1	1.0	0.14	79	3.8	0.40
Hypertension	3	1.3	0.20	63	3.5	0.37	3	3.1	0.41	69	3.3	0.35
Antepartum haemorrhage	23	10.3	1.51	171	9.6	0.99	9	9.2	1.22	203	9.7	1.04
Maternal conditions	7	3.1	0.46	70	3.9	0.41	10	10.2	1.35	87	4.1	0.45
Specific perinatal condition	15	6.7	0.99	177	10.0	1.03	9	9.2	1.22	201	9.6	1.03
Hypoxic peripartum	13	5.8	0.85	77	4.3	0.45	4	4.1	0.54	94	4.5	0.48
Fetal growth restriction	22	9.9	1.45	131	7.4	0.76	7	7.1	0.95	160	7.6	0.82
Spontaneous preterm	47	21.1	3.09	247	13.9	1.43	8	8.2	1.08	302	14.4	1.55
Unexplained antepartum	24	10.8	1.58	273	15.4	1.58	11	11.2	1.49	308	14.7	1.58
No obstetric antecedent	4	1.8	0.26	28	1.6	0.16	-	-	-	32	1.5	0.16

[1] Excludes one maternal age missing

Table 54: Perinatal related deaths by primary and associated obstetric antecedent cause of death (PDC) 2009

Perinatal death classification (PDC)	Primary perinatal death classification		Associated PDC classification 1		Associated PDC classification 2		Assigned PDC classifications	
	n = 720		n = 720		n = 720		n = 720	
	n	%	n	%	n	%	n	%
Congenital abnormality	181	25.1	8	1.1	-	-	189	26.3
Perinatal infection	24	3.3	13	1.8	2	0.3	39	5.4
Hypertension	28	3.9	3	0.4	-	-	31	4.3
Antepartum haemorrhage	77	10.7	19	2.6	-	-	96	13.3
Maternal conditions	37	5.1	9	1.3	3	0.4	49	6.8
Specific perinatal condition	75	10.4	6	0.8	3	0.4	84	11.7
Hypoxic peripartum	28	3.9	5	0.7	-	-	33	4.6
Fetal growth restriction	53	7.4	23	3.2	6	0.8	82	11.4
Spontaneous preterm	108	15.0	51	7.1	4	0.6	163	22.6
Unexplained antepartum	102	14.2	-	-	-	-	102	14.2
No obstetric antecedent	7	1.0	-	-	-	-	7	1.0

Table 55: Neonatal deaths by primary and associated neonatal death classification (NDC) 2009

Neonatal death classification (NDC)	Primary perinatal death classification		Associated NDC classification 1		Associated NDC classification 2		Assigned NDC classifications	
	n = 182		n = 182		n = 182		n = 182	
	n	%	n	%	n	%	n	%
Congenital abnormality	43	23.6	-	-	-	-	43	23.6
Extreme prematurity	57	31.3	-	-	-	-	57	31.3
Cardio-respiratory disorders	11	6.0	15	8.2	1	0.5	27	14.8
Infection	12	6.6	4	2.2	1	0.5	17	9.3
Neurological	40	22.0	5	2.7	1	0.5	46	25.3
Gastrointestinal	8	4.4	1	0.5	-	-	9	4.9
Other	11	6.0	5	2.7	1	0.5	17	9.3

Table 56: Optimal investigation of perinatal related death by DHB of maternal residence 2009

DHB of maternal residence	Perinatal related deaths n = 720	Offered post-mortem		Optimal investigation	
	n	n	%	n	%
Northland	23	17	73.9	5	21.7
Waitemata	92	74	80.4	37	40.2
Auckland	78	74	94.9	42	53.8
Counties Manukau	128	120	93.8	40	31.3
Waikato	61	53	86.9	21	34.4
Bay of Plenty	27	15	55.6	6	22.2
Lakes	20	14	70.0	5	25.0
Tairawhiti	6	5	83.3	4	66.7
Taranaki	16	13	81.3	3	18.8
Hawke's Bay	27	20	74.1	9	33.3
Whanganui	12	8	66.7	6	50.0
MidCentral	31	22	71.0	18	58.1
Wairarapa	11	10	90.9	4	36.4
Capital & Coast	42	34	81.0	25	59.5
Hutt Valley	25	20	80.0	14	56.0
Nelson Marlborough	13	10	76.9	4	30.8
West Coast	4	4	100.0	3	75.0
Canterbury	64	49	76.6	31	48.4
South Canterbury	9	7	77.8	3	33.3
Otago	17	16	94.1	10	58.8
Southland	13	9	69.2	4	30.8
Overseas	1	1	100.0	-	-

Table 57: Complete primary perinatal death classification (PDC) by type of perinatal related death 2009

Perinatal death classification (PDC)		Fetal deaths							
		Termination of pregnancy		Stillbirths		Neonatal deaths		Perinatal related deaths	
		n = 137		n = 401		n = 182		n = 720	
		n	%	n	%	n	%	n	%
	Congenital abnormality								
1.1	Central nervous system	26	19.0	3	0.7	6	3.3	35	4.9
1.2	Cardiovascular system	14	10.2	3	0.7	5	2.7	22	3.1
1.3	Urinary system	5	3.6	-	-	3	1.6	8	1.1
1.4	Gastrointestinal system	1	0.7	3	0.7	-	-	4	0.6
1.5	Chromosomal	42	30.7	12	3.0	8	4.4	62	8.6
1.6	Metabolic	1	0.7	-	-	5	2.7	6	0.8
1.7	Multiple/non chromosomal syndromes	11	8.0	4	1.0	7	3.8	22	3.1
1.8	Other congenital abnormality	-	-	-	-	-	-	-	-
1.81	Musculoskeletal	6	4.4	1	0.2	-	-	7	1.0
1.82	Respiratory	1	0.7	-	-	-	-	1	0.1
1.83	Diaphragmatic hernia	-	-	-	-	7	3.8	7	1.0
1.84	Haematological	-	-	-	-	-	-	-	-
1.85	Tumours	1	0.7	-	-	-	-	1	0.1
1.88	Other specified congenital abnormality	1	0.7	-	-	-	-	1	0.1
1.9	Unspecified congenital abnormality	2	1.5	3	0.7	-	-	5	0.7
	Perinatal infections								
2.1	Bacterial	-	-	-	-	-	-	-	-
2.11	Group B Streptococcus	-	-	7	1.7	1	0.5	8	1.1
2.12	E coli	-	-	1	0.2	3	1.6	4	0.6
2.13	Listeria monocytogenes	-	-	2	0.5	-	-	2	0.3
2.14	Spirochaetal, eg, syphilis	-	-	-	-	-	-	-	-
2.18	Other bacterial	-	-	-	-	1	0.5	1	0.1
2.19	Unspecified bacterial	-	-	-	-	1	0.5	1	0.1
2.2	Viral	-	-	-	-	-	-	-	-
2.21	Cytomegalovirus	1	0.7	3	0.7	-	-	4	0.6
2.22	Parvovirus	-	-	-	-	-	-	-	-
2.23	Herpes simplex virus	-	-	-	-	1	0.5	1	0.1
2.24	Rubella virus	-	-	-	-	-	-	-	-
2.28	Other viral	-	-	-	-	1	0.5	1	0.1
2.29	Unspecified viral	-	-	-	-	-	-	-	-
2.3	Protozoal, eg, Toxoplasma	-	-	-	-	-	-	-	-

Perinatal death classification (PDC)		Fetal deaths							
		Termination of pregnancy		Stillbirths		Neonatal deaths		Perinatal related deaths	
		n = 137		n = 401		n = 182		n = 720	
		n	%	n	%	n	%	n	%
2.5	Fungal	-	-	-	-	-	-	-	-
2.8	Other specified organism	-	-	-	-	-	-	-	-
2.9	Other unspecified organism	-	-	2	0.5	-	-	2	0.3
	Hypertension								
3.1	Chronic hypertension: Essential	1	0.7	-	-	-	-	1	0.1
3.2	Chronic hypertension: Secondary, eg, renal disease	-	-	-	-	-	-	-	-
3.3	Chronic hypertension: Unspecified	-	-	1	0.2	-	-	1	0.1
3.4	Gestational hypertension	-	-	3	0.7	-	-	3	0.4
3.5	Pre-eclampsia	-	-	14	3.5	1	0.5	15	2.1
3.51	Pre-eclampsia: With laboratory evidence of thrombophilia	-	-	1	0.2	1	0.5	2	0.3
3.52	Pre-eclampsia: Without laboratory evidence of thrombophilia	-	-	-	-	-	-	-	-
3.6	Pre-eclampsia superimposed on chronic hypertension	1	0.7	2	0.5	1	0.5	4	0.6
3.61	Pre-eclampsia superimposed on chronic hypertension: With laboratory evidence of thrombophilia	-	-	-	-	-	-	-	-
3.62	Pre-eclampsia superimposed on chronic hypertension: Without laboratory evidence of thrombophilia	-	-	-	-	-	-	-	-
3.9	Unspecified hypertension	-	-	2	0.5	-	-	2	0.3
	Antepartum haemorrhage (APH)								
4.1	Placental abruption	-	-	35	8.7	9	4.9	44	6.1
4.11	Placental abruption: With laboratory evidence of thrombophilia	-	-	2	0.5	-	-	2	0.3
4.12	Placental abruption: Without laboratory evidence of thrombophilia	-	-	-	-	-	-	-	-
4.2	Placenta praevia	1	0.7	2	0.5	1	0.5	4	0.6
4.3	Vasa praevia	-	-	1	0.2	-	-	1	0.1
4.8	Other APH	-	-	2	0.5	7	3.8	9	1.3
4.9	APH of undetermined origin	1	0.7	10	2.5	6	3.3	17	2.4
	Maternal conditions								
5.1	Termination of pregnancy for maternal psychosocial indications	3	2.2	-	-	-	-	3	0.4
5.2	Diabetes/gestational diabetes	-	-	9	2.2	4	2.2	13	1.8
5.3	Maternal injury	-	-	-	-	-	-	-	-
5.31	Maternal injury: Accidental	-	-	1	0.2	-	-	1	0.1

Perinatal death classification (PDC)		Fetal deaths							
		Termination of pregnancy		Stillbirths		Neonatal deaths		Perinatal related deaths	
		n = 137		n = 401		n = 182		n = 720	
		n	%	n	%	n	%	n	%
5.32	Maternal injury: Non-accidental	-	-	1	0.2	-	-	1	0.1
5.39	Maternal injury: Unknown cause	-	-	-	-	-	-	-	-
5.4	Maternal sepsis	-	-	2	0.5	1	0.5	3	0.4
5.5	Antiphospholipid syndrome	1	0.7	4	1.0	1	0.5	6	0.8
5.51	Other maternal thromophilia (if considered cause of death)	-	-	-	-	-	-	-	-
5.6	Obstetric cholestasis	-	-	-	-	-	-	-	-
5.8	Other specified maternal conditions	1	0.7	8	2.0	1	0.5	10	1.4
	Specific perinatal conditions								
6.1	Twin-twin transfusion	4	2.9	22	5.5	6	3.3	32	4.4
6.2	Fetomaternal haemorrhage	-	-	11	2.7	2	1.1	13	1.8
6.3	Antepartum cord complications (eg cord haemorrhage; true knot with evidence of occlusion)	-	-	-	-	-	-	-	-
6.31	Cord haemorrhage	-	-	1	0.2	-	-	1	0.1
6.32	True knot with evidence of occlusion	-	-	2	0.5	-	-	2	0.3
6.38	Other	-	-	7	1.7	-	-	7	1.0
6.39	Unspecified	-	-	-	-	-	-	-	-
6.4	Uterine abnormalities, eg, bicornuate uterus, cervical incompetence	-	-	10	2.5	2	1.1	12	1.7
6.5	Birth trauma (typically infants of >24 weeks gestation or >600g birthweight)	-	-	-	-	1	0.5	1	0.1
6.6	Alloimmune disease	-	-	-	-	-	-	-	-
6.61	Alloimmune disease: Rhesus	-	-	-	-	-	-	-	-
6.62	Alloimmune disease: ABO	-	-	-	-	-	-	-	-
6.63	Alloimmune disease: Kell	-	-	-	-	-	-	-	-
6.64	Alloimmune disease: Alloimmune thrombocytopenia	-	-	-	-	1	0.5	1	0.1
6.68	Alloimmune disease: Other	-	-	-	-	-	-	-	-
6.69	Alloimmune disease: Unspecified	-	-	-	-	-	-	-	-
6.7	Idiopathic hydrops	-	-	2	0.5	-	-	2	0.3
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	-	-	-	-	-	-	-	-
6.81	Rupture of membranes after amnicentesis	-	-	-	-	-	-	-	-
6.82	Termination of pregnancy for suspected but unconfirmed congenital abnormality	-	-	-	-	-	-	-	-

	Perinatal death classification (PDC)	Fetal deaths							
		Termination of pregnancy		Stillbirths		Neonatal deaths		Perinatal related deaths	
		n = 137		n = 401		n = 182		n = 720	
		n	%	n	%	n	%	n	%
6.83	Fetal subdural haematoma	-	-	-	-	-	-	-	-
6.88	Other	-	-	4	1.0	-	-	4	0.6
6.89	Unspecified	-	-	-	-	-	-	-	-
	Hypoxic peripartum death								
7.1	With intrapartum complications	-	-	-	-	-	-	-	-
7.11	With intrapartum complications: Uterine rupture	-	-	1	0.2	1	0.5	2	0.3
7.12	With intrapartum complications: Cord prolapse	-	-	1	0.2	-	-	1	0.1
7.13	With intrapartum complications: Shoulder dystocia	-	-	1	0.2	1	0.5	2	0.3
7.18	With intrapartum complications: Other	-	-	2	0.5	-	-	2	0.3
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)	-	-	4	1.0	9	4.9	13	1.8
7.3	No intrapartum complications and no evidence of non-reassuring fetal status	-	-	-	-	1	0.5	1	0.1
7.9	Unspecified hypoxic peripartum death	-	-	2	0.5	5	2.7	7	1.0
	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)	5	3.6	20	5.0	3	1.6	28	3.9
8.2	With chronic villitis	-	-	1	0.2	-	-	1	0.1
8.3	No placental pathology	-	-	6	1.5	-	-	6	0.8
8.4	No examination of placenta	-	-	3	0.7	-	-	3	0.4
8.8	Other specified placental pathology	-	-	13	3.2	1	0.5	14	1.9
8.9	Unspecified or not known whether placenta examined	-	-	1	0.2	-	-	1	0.1
	Spontaneous preterm								
9.1	Spontaneous preterm with intact membranes, or membrane rupture <24 hours before delivery	-	-	1	0.2	-	-	1	0.1
9.11	Spontaneous preterm with intact membranes, or membrane rupture <24 hours before delivery: With chorioamnionitis	1	0.7	6	1.5	19	10.4	26	3.6
9.12	Spontaneous preterm with intact membranes, or membrane rupture <24 hours before delivery: Without chorioamnionitis	-	-	7	1.7	6	3.3	13	1.8
9.13	Spontaneous preterm with intact membranes, or membrane rupture <24 hours before delivery: No examination of placenta	-	-	-	-	-	-	-	-

Perinatal death classification (PDC)		Fetal deaths							
		Termination of pregnancy		Stillbirths		Neonatal deaths		Perinatal related deaths	
		n = 137		n = 401		n = 182		n = 720	
		n	%	n	%	n	%	n	%
9.17	No clinical signs of chorioamnionitis, no examination of placenta	-	-	2	0.5	12	6.6	14	1.9
9.19	Spontaneous preterm with intact membranes, or membrane rupture <24 hours before delivery: Unspecified or not known whether placenta examined	-	-	5	1.2	4	2.2	9	1.3
9.2	Spontaneous preterm with membrane rupture ≥24 hours before delivery	-	-	-	-	-	-	-	-
9.21	Spontaneous preterm with membrane rupture ≥24 hours before delivery: With chorioamnionitis	2	1.5	14	3.5	10	5.5	26	3.6
9.22	Spontaneous preterm with membrane rupture ≥24 hours before delivery: Without chorioamnionitis	1	0.7	1	0.2	1	0.5	3	0.4
9.23	Spontaneous preterm with membrane rupture ≥24 hours before delivery: With clinical evidence of chorioamnionitis, no examination of placenta	1	0.7	-	-	2	1.1	3	0.4
9.27	No clinical signs of chorioamnionitis, no examination of placenta	-	-	1	0.2	2	1.1	3	0.4
9.29	Spontaneous preterm with membrane rupture ≥24 hours before delivery: Unspecified or not known whether placenta examined	2	1.5	-	-	1	0.5	3	0.4
9.3	Spontaneous preterm with membrane rupture of unknown duration before delivery	-	-	-	-	-	-	-	-
9.31	Spontaneous preterm with membrane rupture of unknown duration before delivery: With chorioamnionitis	-	-	1	0.2	1	0.5	2	0.3
9.32	Spontaneous preterm with membrane rupture of unknown duration before delivery: Without chorioamnionitis	-	-	1	0.2	-	-	1	0.1
9.33	Spontaneous preterm with membrane rupture of unknown duration before delivery: With clinical evidence of chorioamnionitis, no examination of placenta	-	-	-	-	-	-	-	-
9.37	No clinical signs of chorioamnionitis, no examination of placenta	-	-	1	0.2	1	0.5	2	0.3
9.39	Spontaneous preterm with membrane rupture of unknown duration before delivery: Unspecified or not known whether placenta examined	-	-	1	0.2	1	0.5	2	0.3
	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)	-	-	13	3.2	-	-	13	1.8
10.2	With chronic villitis	-	-	1	0.2	-	-	1	0.1

Perinatal death classification (PDC)		Fetal deaths							
		Termination of pregnancy		Stillbirths		Neonatal deaths		Perinatal related deaths	
		n = 137		n = 401		n = 182		n = 720	
		n	%	n	%	n	%	n	%
10.3	No placental pathology	-	-	30	7.5	-	-	30	4.2
10.4	No examination of placenta	-	-	19	4.7	-	-	19	2.6
10.8	Other specified placental pathology	-	-	34	8.5	-	-	34	4.7
10.9	Unspecified or not known whether placenta examined	-	-	5	1.2	-	-	5	0.7
	No obsteric antecedent								
11.1	Sudden Infant Death Syndrome (SIDS)	-	-	-	-	-	-	-	-
11.11	SIDS Category IA: Classic features of SIDS present, completely documented	-	-	-	-	-	-	-	-
11.12	SIDS Category IB: Classic features of SIDS present but incompletely documented	-	-	-	-	-	-	-	-
11.13	SIDS Category II: Infant deaths that meet Category I except for one or more features	-	-	-	-	2	1.1	2	0.3
11.2	Postnatally acquired infection	-	-	-	-	1	0.5	1	0.1
11.3	Accidental asphyxiation	-	-	-	-	-	-	-	-
11.4	Other accident, poisoning or violence (postnatal)	-	-	-	-	-	-	-	-
11.8	Other specified	-	-	-	-	-	-	-	-
11.9	Unknown/Undetermined	-	-	-	-	-	-	-	-
11.91	Unclassified Sudden Infant Death	-	-	-	-	3	1.6	3	0.4
11.92	Other Unknown/Undetermined	-	-	-	-	1	0.5	1	0.1

Table 58: Complete primary neonatal death classification (NDC) for neonatal death 2009

NDC	Neonatal death classification (NDC)	Neonatal deaths	
		n = 182	
		n	%
	Congenital abnormality		
1.1	Central nervous system	6	3.3
1.2	Cardiovascular system	6	3.3
1.3	Urinary system	3	1.6
1.4	Gastrointestinal system	-	-
1.5	Chromosomal	8	4.4
1.6	Metabolic	5	2.7
1.7	Multiple/non chromosomal syndromes	8	4.4
1.8	Other congenital abnormality	-	-
1.81	Musculoskeletal	-	-
1.82	Respiratory	-	-
1.83	Diaphragmatic hernia	7	3.8
1.84	Haematological	-	-
1.85	Tumours	-	-
1.88	Other specified congenital abnormality	-	-
1.9	Unspecified congenital abnormality	-	-
	Extreme prematurity		
2.1	Not resuscitated	51	28.0
2.2	Unsuccessful resuscitation	6	3.3
2.9	Unspecified or not known whether resuscitation attempted	-	-
	Cardio-respiratory disorders		
3.1	Hyaline membrane disease/Respiratory distress syndrome (RDS)	5	2.7
3.2	Meconium aspiration syndrome	-	-
3.3	Primary persistent pulmonary hypertension	-	-
3.4	Pulmonary hypoplasia	2	1.1
3.5	Chronic neonatal lung disease (typically, bronchopulmonary dysplasia)	2	1.1
3.6	Pulmonary haemorrhage	2	1.1
3.7	Pneumothorax	-	-
3.8	Other	-	-
	Infection		
4.1	Bacterial	-	-
4.11	Congenital bacterial	-	-
4.111	Congenital bacterial: Group B Streptococcus	2	1.1
4.112	Congenital bacterial: E coli	-	-

NDC	Neonatal death classification (NDC)	Neonatal deaths	
		n = 182	
		n	%
4.113	Congenital bacterial: Listeria monocytogenes	-	-
4.114	Congenital bacterial: Spirochaetal, eg, syphilis	-	-
4.118	Congenital bacterial: Other bacterial	2	1.1
4.119	Congenital bacterial: Unspecified bacterial	1	0.5
4.12	Acquired bacterial	-	-
4.121	Acquired bacterial: Group B Streptococcus	-	-
4.122	Acquired bacterial: E coli	-	-
4.125	Acquired bacterial: Other Gram negative bacilli (other than E coli)	-	-
4.126	Acquired bacterial: Staphylococcus aureus	-	-
4.127	Acquired bacterial: Coagulase negative Staphylococcus	-	-
4.128	Acquired bacterial: Other specified bacterial	2	1.1
4.129	Acquired bacterial: Unspecified bacterial	-	-
4.2	Viral	-	-
4.21	Congenital viral	-	-
4.211	Congenital viral: Cytomegalovirus	-	-
4.213	Congenital viral: Herpes simplex virus	-	-
4.214	Congenital viral: Rubella virus	-	-
4.218	Congenital viral: Other specified viral	-	-
4.219	Congenital viral: Unspecified viral	-	-
4.22	Acquired viral	-	-
4.221	Acquired viral: Cytomegalovirus	-	-
4.223	Acquired viral: Herpes simplex virus	1	0.5
4.224	Acquired viral: Rubella virus	-	-
4.228	Acquired viral: Other specified viral	-	-
4.229	Acquired viral: Unspecified viral	-	-
4.3	Protozoal, eg, Toxoplasma	-	-
4.5	Fungal	-	-
4.8	Other	-	-
4.9	Unspecified organism	4	2.2
	Neurological		
5.1	Hypoxic ischaemic encephalopathy/Perinatal asphyxia (typically infants of >24 weeks gestation or >600g birthweight)	31	17.0
5.2	Intracranial haemorrhage	1	0.5
5.21	Intraventrical haemorrhage	6	3.3
5.22	Subgaleal haemorrhage	1	0.5

NDC	Neonatal death classification (NDC)	Neonatal deaths n = 182	
		n	%
5.23	Subarachnoid haemorrhage	-	-
5.24	Subdural haemorrhage	-	-
5.28	Other intracranial haemorrhage	1	0.5
5.8	Other	-	-
	Gastrointenstinal		
6.1	Necrotising enterocolitis	6	3.3
6.8	Other	2	1.1
	Other		
7.1	Sudden Infant Death Syndrome (SIDS)	-	-
7.11	SIDS Category IA: Classic features of SIDS present and completely documented	-	-
7.12	SIDS Category IB: Classic features of SIDS present but incompletely documented	-	-
7.13	SIDS Category II: Infant deaths that meet category I except for one or more features	2	1.1
7.2	Multisystem failure	-	-
7.21	Multisystem failure: Secondary to intrauterine growth restriction	3	1.6
7.28	Multisystem failure: Other specified	1	0.5
7.29	Multisystem failure: Unspecified/undetermined primary cause or trigger event	-	-
7.3	Trauma	-	-
7.31	Trauma: Accidental	-	-
7.32	Trauma: Non accidental	-	-
7.39	Trauma: Unspecified	-	-
7.4	Treatment complications	-	-
7.41	Treatment complications: Surgical	-	-
7.42	Treatment complications: Medical	-	-
7.49	Treatment complications: Unspecified	-	-
7.8	Other specified	-	-
7.9	Unknown/undetermined	-	-
7.91	Unclassified Sudden Infant Death	-	-
7.911	Unclassified Sudden Infant Death: Bed sharing	4	2.2
7.912	Unclassified Sudden Infant Death: Not bed sharing	1	0.5
7.92	Other Unknown/undetermined	-	-

Appendix C: PMMRC Classification of Contributory Factors and Potential Avoidability in Perinatal Death

Perinatal and Maternal Mortality Review Committee

He matenga ohorere, he wairua uiui, wairua mutungakore

Systems Review – Contributory Factors

Contributory factors may be highly specific to the death or generalised to the system(s). Identifying contributory factors that occur, and are inherent, in the system is an important part of the review. These factors are commonly sub-classified into organisational and management, personnel, technology/equipment, environmental and those relating to barriers to access and engagement in care.

Please read options below and select if any of the following were present

1. Have any organisational and/or management factors been identified? **Yes** ☐ **No** ☐

(eg, inadequate supervision of staff, lack of appropriate clinical management protocols, lack of communication between services)
(If 'yes' please classify –select ALL relevant)

- Poor organisational arrangements of staff ☐
- Inadequate education and training ☐
- Lack of policies, protocols or guidelines ☐
- Inadequate numbers of staff ☐
- Poor access to senior clinical staff ☐
- Failure or delay in emergency response ☐
- Delay in procedure, eg, caesarean section ☐
- Delayed access to test results or inaccurate results ☐
- Other – if other, please state or provide any comments:

2. Have factors relating to personnel been identified? **Yes** ☐ **No** ☐

(eg, staff factors relating to professional care and service provision)
(If 'yes' please classify –select ALL relevant)

- Knowledge and skills of staff were lacking ☐
- Delayed emergency response by staff ☐
- Failure to maintain competence ☐
- Communication between staff was inadequate ☐
- Failure to seek help/supervision ☐
- Failure to follow recommended best practice ☐
- Lack of recognition of complexity or seriousness of condition by care giver ☐
- Other – If other please state or provide any comments:

3. Have factors relating to technology and equipment been identified? **Yes** ☐ **No** ☐

(eg, faulty equipment, inadequate quantity or inadequate maintenance, no equipment)
(If 'yes' please classify –select ALL relevant)

- Essential equipment not available ☐
- Lack of maintenance of equipment ☐
- Malfunction/failure of equipment ☐
- Failure/lack of Information Technology ☐

Other – if other please state or provide any comments:

4. Have factors relating to the environment been identified? **Yes** ☐ **No** ☐

(eg, administration systems, physical environment–space, privacy, ease of access, lighting, noise power failure, operating theatre in distant location, very preterm baby born outside of level 3 neonatal unit, weather prevented transport)
(If 'yes' please classify – select ALL relevant)

Geography, eg, mother or baby needed long transfer ☐

Building and design functionality limited clinical response ☐

Other – if other please state or provide any comments:

5. Have barriers to accessing/engaging with care been identified? **Yes** ☐ **No** ☐

(eg, no, infrequent or late booking for antenatal care, woman declined treatment/advice)
(If 'yes' please classify – select ALL relevant)

Substance use ☐

Family violence ☐

Lack of recognition by the woman or family of the complexity or seriousness of condition ☐

Maternal mental illness ☐

Cultural barriers ☐

Language barriers ☐

Not eligible to access free care ☐

Other – if other, please state or provide any comments:

6. Was the death potentially avoidable? **Yes** ☐ **No** ☐

Complete this after considering the ticked boxes above.

Comments:

Name of person completing this form:

Contact person for additional information:

Phone number:

Signed:

Date:

Appendix D: PMMRC DHB Local Coordinators

DHB	Local Coordinator	Contact Details
Northland	**Yvonne Morgan** *Clinical Charge Midwife* **Kristy Wolff** *Consultant Obstetrician* **Chris Cullen** *Quality/Risk Facilitator*	Whangarei Hospital
Waitemata	**Dr Sue Belgrave** *Clinical Director of Obstetrics* **Claire Shears** *Midwife* **Lucy Casey** *Midwife (AMOSS)*	North Shore Hospital
Auckland	**Lesley McCowan** *Professor* **Claire McLintock** *Obstetric Physician (AMOSS)*	Auckland City Hospital
Counties Manukau	**Dr Sarah Wadsworth** *Consultant Obstetrician* **Dr Nerida Titchiner** *Consultant Obstetrician*	Middlemore Hospital
Waikato	**Dr Alastair Haslam** *Consultant Obstetrician* **Sarah Waymouth** *Consultant Obstetrician* **Phil Weston** *Paediatrician* **Pauline Martyn** *Midwife*	Waikato Hospital
Bay of Plenty	**Margret Norris** *Midwife Leader*	Tauranga Hospital
Lakes	**Amanda Griffiths** *Midwife*	Rotorua Hospital
Tairawhiti	**Estelle Mulligan** *Midwife* **Robyn Blakely** *Midwife*	Gisborne Hospital
Taranaki	**Susan Shands** *Midwife* **Belinda Chapman** *Midwife*	Taranaki Base Hospital
Hawke's Bay	**Dr Lynda Croft** *Consultant Obstetrician* **Sara Paley** *Midwifery Educator*	Hawke's Bay Hospital
Whanganui	**Lucy Pettit** *Midwife* **Robyn McDougal** *Midwife*	Whanganui Hospital
Midcentral	**Billie Clayton** *Midwife Educator* **Dr Digby Ngan Kee** *Consultant Obstetrician*	Palmerston North Hospital
Wairarapa	**Donna Thompson** *Team Leader Midwifery*	Masterton Hospital
Capital & Coast	**Dawn Elder** *Senior Lecturer, Paediatrics* **Dr Rose Elder** *Consultant Obstetrician* **Madeline Dymond-Cate** *Midwife*	Wellington Hospital
Hutt Valley	**Joanne McMullan** *Midwife*	Hutt Hospital
Nelson Marlborough	**Lois McTaggart** *Clinical Midwife Leader* **Kevin Hill** *Consultant Obstetrician*	Nelson Hospital
West Coast	**Jude Bruce** *Midwife* **Mary McGrane** *Midwife*	Grey Base Hospital
Canterbury	**Dianne Leishman** *Midwife* **Sonya Matthews** *Midwife*	Christchurch Women's Hospital
South Canterbury	**Dianne Keeman** *Clinical Leader Maternity Services* **Dr John Weir** *Consultant Obstetrician*	Timaru Hospital
Otago	**Helen Flockton** *Charge Midwife*	Dunedin Hospital
Southland	**Jenny Humphries** *Associate Director of Nursing and Midwifery, Maternal & Child*	Southland Hospital

List of Abbreviations

AMOSS	Australasian Maternity Outcomes Surveillance System
CEMACH	Confidential Enquiry into Maternal and Child Health
CEMACE	Centre for Maternal and Child Enquiries
DHB	District Health Board
HQSC	Health Quality & Safety Commission
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
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 mutungakore

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