Perinatal and Maternal Mortality Review Committee

He matenga ohorere, he wairua uiui, wairua mutungakore

Health Quality & Safety Commission New Zealand
Kupu Taurangi Hauora o Aotearoa

Te Pūrongo ā-Tau Tekau mā Toru o te Komiti Arotake Mate Pēpi, Mate Whaea Hoki | Thirteenth Annual Report of the Perinatal and Maternal Mortality Review Committee

Te tuku pūrongo mō te mate me te whakamate 2017 | Reporting mortality and morbidity 2017

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- the lead maternity carers and district health board (DHB) clinicians throughout New Zealand and local coordinators[1] within each DHB who assisted with the collection of data within this report
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Perinatal and Maternal Mortality Review Committee

The PMMRC members in 2019 are:

- Mr John Tait (Chair), obstetrician and gynaecologist, Chief Medical Officer, Capital & Coast DHB
- Dr Max Berry, neonatologist, University of Otago, Wellington
- Dr Donna Cormack (Kāti Māmoe, Kāi Tahu), senior researcher and lecturer with joint positions at Te Kupenga Hauora Māori, Faculty of Medical and Health Sciences, University of Auckland, and Te Rōpū Rangahau Hauora a Eru Pōmare, Department of Public Health, University of Otago, Wellington
- Ms Robin Cronin, midwife, Auckland
- Dr Rose Elder (Deputy Chair), obstetrician and gynaecologist, Capital & Coast DHB
- Ms Louise Kuraia (Ngāpuhi, Ngāti Manu, Kōhatu Taka me Ngāi Tai ki Tainui), Māori health leader, Manaia Health Primary Health Organisation
- Ms Lisa Paraku (Ngāti Tamaterā, Ngāti Porou), Friends of Sands member, Wellington Hutt Valley; Māori Strategy Lead, Spark NZ; Board Member, Spark Foundation; Sleep on Side project member; and Death of a Child project member

[1] www.hqsc.govt.nz/our-programmes/mrc/pmmrc/about-us/local-coordinators

- Dr Sarah Tout, obstetrician and gynaecologist, Clinical Director Women's Health, Counties Manukau Health.

Maternal Mortality Review Working Group

The Maternal Mortality Review Working Group members in 2019 are:

- Dr Sarah Wadsworth (Chair), obstetrician, Counties Manukau DHB
- Dr Eileen Bass, physician, Hutt Valley DHB
- Mr John Tait (Chair, PMMRC)
- Dr Rose Elder (Deputy Chair, PMMRC)
- Dr Lesley Dixon, midwife, Christchurch
- Dr Anne Hart, anaesthetist, Counties Manukau DHB
- Dr Liz MacDonald, perinatal psychiatrist, Canterbury DHB
- Dr Catherine Marnoch, physician, Waitematā DHB
- Jo McMullan, midwife, Capital & Coast DHB
- Dr Susan Tutty, general practitioner and GP liaison women's health, Counties Manukau DHB
- Dr Kate White, pathologist, MidCentral DHB
- Ms Karen Whiterod, clinical nurse specialist, Mental Health and Addiction Service, MidCentral Health.

Neonatal Encephalopathy Working Group

The Neonatal Encephalopathy Working Group members in 2019 are:

- Dr Jutta van den Boom (Chair), neonatal paediatrician, Waitematā DHB
- Dr Malcolm Battin, neonatal paediatrician, Auckland DHB
- Dr Kitty Bach, neonatal paediatrician, Auckland DHB
- Dr David Bailey, obstetrician and gynaecologist, Northland DHB
- Ms Karen Bennington, neonatal nurse practitioner, Capital & Coast DHB
- Ms Robin Cronin, midwife, Auckland
- Ms Anne Jackson, neonatal nurse practitioner, Canterbury DHB
- Ms Suzanne Miller, midwife, Wellington
- Mr John Tait (Chair, PMMRC)
- Dr Kristy Wolff, obstetrician and gynaecologist, Northland DHB.

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Kupu whakataki | Foreword

The Health Quality & Safety Commission (the Commission) welcomes the 13th report of the Perinatal and Maternal Mortality Review Committee (the PMMRC). This report focuses on the epidemiology of perinatal mortality from 2007 to 2017, maternal mortality from 2006 to 2016, babies with neonatal encephalopathy from 2010 to 2017, and perinatal and maternal mortality and morbidity for the 2017 calendar year.

The PMMRC has again provided us with a rigorous and carefully considered report. I would like to acknowledge the substantial amount of work by the Chair, Mr John Tait, and the PMMRC, and their determination to improve the quality of maternal and perinatal care.

I am pleased to learn that the rate of stillbirth has significantly decreased for the period 2007–2017 for babies of both New Zealand European and Māori mothers. Unfortunately, this decrease has not occurred in people of other ethnicities. Rates of perinatal mortality, perinatal related mortality and fetal death have reduced since 2007 for babies of New Zealand European mothers, but there has been no change in these measures for other ethnic groups.

All of us who work in the health sector are responsible for addressing this gap in equity. We need first to understand the differences and the various reasons for these, and then work to redesign our systems to eliminate preventable harm in ways that prioritise the most vulnerable. The Commission's priority is to shine a light on potential opportunities to advance Māori health outcomes in particular, and outcomes that are both excellent and equitable for everyone, more generally.

I fully support the PMMRC's vision to promote the recommendations of this report and to follow up and better understand the impact of its previous recommendations. We owe this to the women, babies and their whānau at the centre of this report.

This report would not be possible with the substantial contribution of a dedicated team of people: the local coordinators across Aotearoa/New Zealand who provide the data; Mr John Tait and the PMMRC members; the National Coordination Service at Auckland UniServices; the New Zealand Mortality Review Data Group, the epidemiology team at Otago University; and the mortality review committees' secretariat staff at the Health Quality & Safety Commission. My sincere thanks goes to you all as you influence system change and improvement across our perinatal and maternity services.

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

Te kupu whakataki a te manukura | Chair's introduction – Mr John Tait

I am honoured to present the 13th Annual Report of the Perinatal and Maternal Mortality Review Committee (the PMMRC).

I would firstly like to acknowledge the mothers and babies whose lives have been lost, and the families and whānau who bear the grief of losing their loved ones. It is their stories that allow us to strive for and promote system change to reduce preventable death and deliver greater equity in perinatal and maternal outcomes. Our data show that systems change for Māori mothers and babies and their whānau is urgent.

Therefore, it is my privilege to be the new Chair of the PMMRC and lead this incredibly vital work.

I would like to thank the members of the PMMRC for their ongoing valuable contribution and commitment to improving the outcomes of mothers and babies here in Aotearoa/New Zealand. With three new members, we have increased our expertise in maternity services, Māori health, racial inequality and racism in health, and the importance of data governance and sovereignty. Equally, I would like to acknowledge the monumental work of local coordinators who work with the families and whānau and bring together their experiences. Without your dedication, the work of the PMMRC would not be possible.

With a new Chair and new members, the PMMRC has taken this opportunity to re-establish ourselves and further examine areas where change might be required. It is central to the approach of the PMMRC to highlight inequities evident in maternity services and provide recommendations that can be implemented by the people who are able to directly effect change.

Our new vision and approach for working together across the system prioritises working with bereaved families and whānau, health professionals, policy makers and researchers, with the aim to have greater influence on policy decisions.

> *Te mahi tahi puta noa i te pūnaha*
> *kia kore rawa ai e mate, e whara ngā māmā me ā rātau*
> *pēpi, whānau hoki mai i ngā mate, wharanga rānei ka taea te ārai.*
>
> *Working together across the system towards zero preventable deaths or harm for all mothers and babies, families and whānau.*

The 13th PMMRC report investigates the epidemiology of perinatal mortality, maternal mortality and neonatal encephalopathy. The rate of stillbirth in Aotearoa/New Zealand has reduced significantly since 2007. There has been a reduction of stillborn babies of Māori and New Zealand European mothers; however, this is not the case for other ethnic groups, particularly for babies of Indian women.

There was also some evidence of a decrease in the rate of perinatal mortality, yet this was driven by a decrease in deaths in babies of New Zealand European mothers, with no changes in any other ethnic groups.

Disproportionately, babies of mothers under 20 years of age have higher mortality than most other age groups, as well as Māori women living in New Zealand Index of Deprivation 2013 (NZDep2013) decile 10 areas (the most deprived tenth of the population) experiencing the greatest loss from perinatal related deaths.

The leading cause of perinatal related death continues to be congenital abnormality, followed by spontaneous preterm delivery. It is also unacceptable that suicide is the leading cause of maternal death and is substantially higher than the United Kingdom rate.

We therefore believe the implementation of our recommendations, alongside the monitoring of previous report recommendations, warrant the system changes required to ensure high quality, appropriate and equitable care for all.

This report clearly demonstrates the need to increase our understanding, and research, of the reasons for adverse outcomes in certain groups. The PMMRC recognises the need to co-develop and implement models of care that meet the needs of mothers, through information, support and care, that are acceptable to her. It is important that DHBs monitor key indicators by ethnicity to identify variations in outcome and develop national guidelines for the provision of care of mothers and infants. As a matter of urgency, improvement to the quality of ethnicity data in the National Maternity Collection is needed.

The PMMRC is also delighted to now include the Maternal Morbidity Working Group as a new morbidity subcommittee under the PMMRC. In achieving our vision, it was important to the PMMRC to continue the work of the Maternal Morbidity Working Group following the end of its time-limited contract with the Ministry of Health. The new subcommittee will continue to address systemic factors that may contribute to the severity of the illness, and opportunities for improvement.

It is a privilege to present this report to you.

John Tait
Chair, Perinatal and Maternal Mortality Review Committee

Ngā mātua, ngā whānau me ngā hapori | Parents, whānau, families, communities

Tuia i runga, tuia i raro, tuia i roto, tuia i waho, tuia te here tāngata e pae nei, tēnā koutou, tēnā koutou, tēnā koutou katoa – I thread together the forces from above, from below, from within and from what surrounds us, to bind all of us together – I greet you all.

Once again it is my honour to stand on behalf of bereaved parents, families and whānau as a member of the PMMRC. My name is Lisa Paraku, and I hail from the beautiful Coromandel. My daughter Jasmine Lee, born beautiful and still, her five siblings who died in early pregnancy and their two brothers who live bring me to the PMMRC so that together we can work towards our purpose, working together across the system towards zero preventable deaths or harm for all mothers and babies, families and whānau. Te mahi tahi puta noa i te pūnaha kia kore rawa ai e mate, e whara ngā māmā me ā rātau pēpi, whānau hoki mai i ngā mate, wharanga rānei ka taea te ārai.

To my fellow bereaved parents and whānau, can I offer the following mihi (greeting) to you:

> *Me mihi aroha nui ki a koe me to whānau whānui, my love to you and to your entire family.*
> *E ngā pēpē, moe mai rā. Ki ngā huia kaimanawa kua ngaro ki te pō, moe mai koutou.*
> *To our precious ones who have disappeared into the night, rest in peace. I acknowledge our precious babies, our grief and our journey.*

As a proud wāhine Māori māmā I stand strong in support of **equitable outcomes for all**, a key focus for us at the PMMRC and for our recommendations to our health system. It is time for all of us to be brave and create a system that can serve all peoples, where, when and how they need it.

I am heartened by the mahi (work) being done, and there is more to be done. You will see in our recommendations a consistent message for equitable outcomes for all. It remains a priority that we continue to educate ourselves in the ways of our priority populations – Māori, Pacific, Indian peoples and our young mothers – so that where we sit is not what we see but in fact we can move seats and see and serve a different worldview.

For our bereaved parents, families and whānau we are pleading for **national perinatal bereavement pathways** in the hope that our grief journey can be as gentle as it can be. Within our report you will see our challenge to provide the same level of care, anywhere, anytime, for anyone as the driver for a number of specific recommendations.

I would also like to take this opportunity to acknowledge my Sands NZ and Baby Loss NZ rōpū (groups). These peer-to-peer support groups are often the only service available to parents and families in their communities when our babies have died. Health professionals regularly refer bereaved parents to Sands, a voluntary, non-funded group (as is Baby Loss NZ) who are doing their best to provide as much support to an under-supported section of our population. In a recent survey of Sands bereaved parents, it was noted that overall support from health professionals was good – however, it is important to note that midwives are often not trained nor funded to provide support following the death of a baby, and many provide care in their own time as an extra service to our bereaved parents, families and whānau. To all of those who serve us, I thank you and I extend the wero (challenge) to our health system to recognise and provide more support to these rōpū, which are so very needed.

Mahi is being done between these groups and government at an inter-agency level to work towards better outcomes based upon a ‘whānau pani model’, placing parents at the centre and having levels of care emulating from there. In essence, focusing on a wrap-around of aroha (love) to our bereaved parents. For all those involved, I salute you. The PMMRC mahi has identified improvements needed, and these are some of the groups standing up to do the mahi. After all, ‘he waka eke noa’ – we are all in this together!

E hoa mā, he kaupapa nui tēnei. My friends, this is such an important kaupapa for us all. To my fellow PMMRC whānau, e mihi nunui ki a koutou, many thanks for what you do. This is heavy mahi and mahi that must be done to improve our system, prevent our babies and mothers dying where we can, and create a gentle path when we must walk the path that nobody ever wants to walk, when our loved ones do die. You do this mahi with grace – I acknowledge you and on behalf, I thank you.

Let me share my wish to us all in a section of karakia from my people:

> *E whakamoemiti ana mō tēnei rā*
> *Hei tiritiri mō tātou katoa, mō tātou wairua te hanga tangata kotahi, kia mahitahi ai mō te ao hou tino pai rawa.*
>
> *We give thanks for this day, we will share our views without anger, build our friendships and work together for a better world.*

Ahakoa he mihi poto tēnei, he mihi aroha. Nō reira, tēnā koutou, tēnā koutou, tēnā tātou katoa – Although this greeting is short, it is from the heart with love. Therefore, greetings to us all.

Nāku iti noa, nā,

Lisa Paraku

Ngā kitenga matua mai i te pūrongo ā-tau 13 o te PMMRC | Key findings from the PMMRC's 13th annual report

Stillbirths

The rate of stillbirths is decreasing, largely driven by a reduction in stillbirths in babies of Māori and New Zealand European women; there was no significant change in any other ethnic group.

Perinatal death prevention

In 2017, nearly

600

babies died from 20 weeks of pregnancy until 27 days of age

20 weeks | ◄——► | 27 days

Congenital abnormalities are the leading cause of death in babies.

We are asking for mandatory fortification of bread and flour with **folic acid**, as occurs in many other countries around the world.

This has been shown to reduce the number of neural tube defects (a type of congenital abnormality).

Many deaths could be prevented

Early engagement with high-quality, equitable care could prevent many deaths. We need to provide care that is accessible, facilitates all women booking early, and meets the individual needs of the woman and her whānau and family. Groups whose needs are not being met by our current services include Māori, Pacific and Indian women, and mothers under the age of 20 years.

Women who become smokefree prior to 16 weeks gestation are shown to have the same outcomes of spontaneous premature birth and small for gestational age, as non-smokers. **Smoking cessation programmes with incentives have been shown to be effective in pregnancy and should be widely utilised.**[1]

After-death care

Me mihi aroha nui ki a koe me to whānau whānui,
my love to you and to your entire family.

E ngāpēpē, moe mai rā. Ki ngā huia kaimanawa kua ngaro ki te pō moe mai koutou

To our precious ones who have disappeared into the night, rest in peace. I acknowledge our precious babies, our grief and our journey.

- Lisa Paraku, bereaved māmā

About half of the babies who died had a post-mortem or karyotype performed to see why they died.

A New Zealand study reported on interviews with 169 mothers who gave birth to a stillborn baby after 28 weeks of pregnancy.

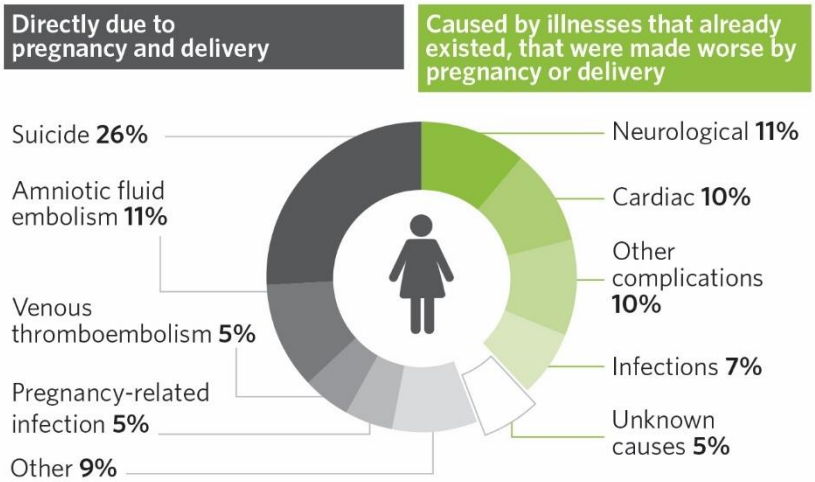
0% **No mother (0 of 99) who agreed to a post-mortem regretted her decision.**[2]

We are working with other organisations to make the grief journey as gentle as it can be through the development of a national bereavement care pathway.

Maternal death

On average nearly 10 women die each year either during pregnancy, or soon after the baby is born.

Causes of death in 2006 to 2017



We are asking for better support for mothers at all stages of pregnancy and afterwards, to make care better and easier to access.

We are also asking for better support if things don't go to plan.

1. McCowan L, Dekker GA, Chan E, et al. 2009. Spontaneous preterm birth and small for gestational age infants in women who stop smoking early in pregnancy: prospective cohort study. *BMJ* 338: b1081 doi: 10.1136/bmj.b1081.

2. Cronin R, Li M, Wise M, et al. 2018. Late stillbirth post mortem examination in New Zealand: maternal decision-making. *Aust NZ J Obstet Gyn* 58(6): 667–73.

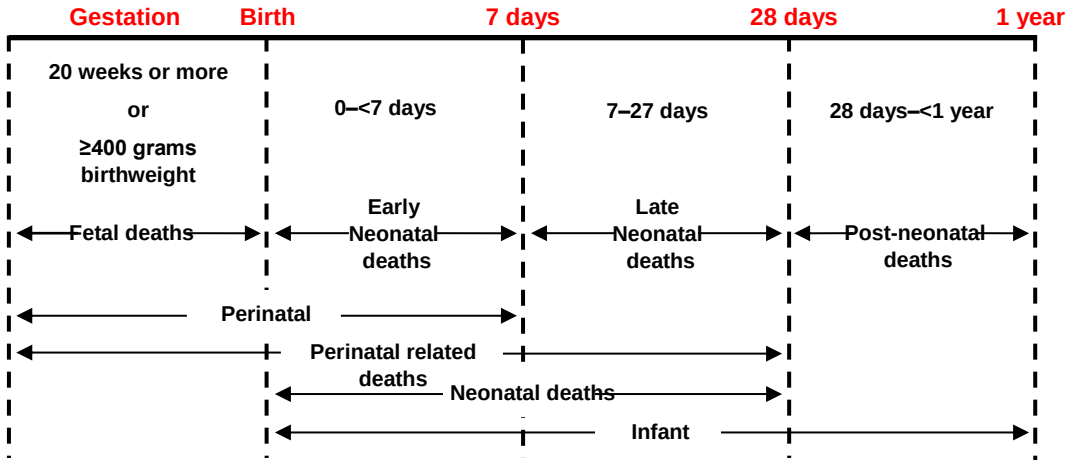
Health Quality & Safety Commission New Zealand
Kupu Taurangi Hauora o Aotearoa

New Zealand Government

Whakarāpopototanga matua | Executive summary

This report outlines some of the trends in mortality in babies and mothers, and serious morbidity from neonatal encephalopathy. Deaths are usually multifactorial in nature – usually not just one thing causes a death. The aim of this work is to monitor trends and look at systems issues that could be modified to prevent future deaths. To do this, good information is vital. For this reason, the PMMRC is recommending that our routinely collected data systems are improved to better capture information on risk factors for all pregnant women and to ensure that our ethnicity data are accurate and complete. The PMMRC is also recommending some areas for further research, as there are still many unanswered questions about factors that might contribute to a death, particularly for some population groups. In addition, we need to develop models of care that better meet the needs of the mothers, babies, and whānau, families and communities that we serve.

Definitions used by the PMMRC



(Adapted from New Zealand Health Information Service 2007 and Ministry of Health 2010.)

Perinatal mortality

Since 2007, when the PMMRC began collecting data, there has not been a significant reduction in deaths overall. However, there was a decrease in the rate of stillbirths. This was largely driven by a reduction in stillbirths in babies of Māori and New Zealand European women; there was no significant change in any other ethnic group.

There was a significant decrease in perinatal mortalities (fetal and early neonatal deaths) seen in babies of New Zealand European mothers, but not for any other ethnic group.

There were no statistically significant changes in rates for neonatal mortality overall; however, there was a significant increase in deaths in babies of Pacific women.

Deaths due to congenital abnormalities remain the leading cause of death overall.

Our results show that there are groups at higher risk of serious adverse outcomes; these include babies of Māori, Pacific and Indian mothers, and babies of mothers aged less than 20 years, with some increase in mortality for those aged 40 years and over.

Mortality rates varied significantly by area deprivation, as measured by the New Zealand Index of Deprivation 2013 (NZDep2013). Those mothers living in the most deprived areas (quintile 5) were statistically significantly more likely to lose a baby from stillbirth, neonatal death, and overall, compared with those living in any other quintile. This variation in mortality rates by deprivation was most marked for deaths due to spontaneous preterm delivery.

Our data suggest that the National Maternity Collection (MAT) data set[2] provides an underestimate of maternal body mass index (BMI). However, regardless of whether MAT or PMMRC data are used, there is a clear increase in mortality from stillbirths, neonatal deaths and perinatal related deaths overall with increasing maternal BMI.

Mortality from stillbirths, neonatal deaths and perinatal related deaths (total) were higher in women who were smoking at the time of registration with a lead maternity carer (LMC) compared with those who were not. Given the significance of smoking as a risk factor, the clear improvement in outcomes when women are able to quit, and that effective smoking cessation programmes do exist, resource should be invested in reducing this modifiable risk factor.

Small for gestational age babies have higher mortality than those who are appropriate, or large for gestational age. In particular, babies with a birthweight in the 5th customised centile or below have substantially higher mortality rates than all other groups.

Overall, approximately half of babies who died had optimal investigation into the cause(s) of their death, defined here as post-mortem or karyotype confirming chromosomal abnormality or clinical examination/investigation confirming the diagnosis. This was higher for terminations of pregnancy and stillbirths, and less for neonatal deaths. There were some variations in both the rate of offering of post-mortem and the rate of uptake if offered, by prioritised ethnic group.

Local review of cases showed there were a number of deaths that had potentially avoidable aspects. Contributory factors were thought to be present in just under one third of perinatal related deaths (excluding termination of pregnancy). Contributory factors were characterised by organisational and/or management factors, personnel factors, and barriers to access. Of these, barriers to access was the most common contributory factor cited.

Neontal encephalopathy

Neonatal encephalopathy (NE) is a clinically defined syndrome of disturbed neurological function within the first week after birth in an infant born from 35 weeks' gestation, manifested by difficulty in initiating and maintaining respiration, depression of tone and reflexes, subnormal level of consciousness and often seizures.

The rate of NE cases per 1,000 term births fluctuated from year to year, with a high of 1.38 per 1,000 live births in 2012 and a low of 1.00 in 2014. However, between the years 2010 and 2017, the rate has not shown a statistically significant trend up or down.

Babies of primiparous women had the highest rates of NE, being statistically significantly higher than women with one, two, three or four or more babies. There was variation in the rates of NE by gestational age at birth, with those at the extreme ends of term pregnancies having higher rates.

Overall, 77% of babies were cooled,[3] with a slightly higher proportion of babies with moderate NE being cooled. The rates of cooling for babies of Māori mothers were the same as for babies of New Zealand European mothers. Mortality was much higher in babies with severe NE, with 61% of babies dying, compared with 2% of babies with moderate NE. Of those babies with NE who survived, nearly half of those with moderate NE had a normal physical examination on discharge or transfer, compared with 15% of those with severe NE.

[2] The MAT data set is the primary source of information for publicly funded maternity care in Aotearoa/New Zealand

[3] Cooling refers to therapeutic hypothermia (33.0–35.0ºC) used for hypoxic ischaemic encephalopathy (HIE) of term or near-term newborns to reduce possible neurological handicap. (Definition taken from: Ergenekon E. 2016. Therapeutic hypothermia in neonatal intensive care unit: Challenges and practical points. *Journal of Clinical Neurology* 5(1): 8–17).

Maternal mortality

Maternal death is the death of a woman while pregnant or within 42 days of termination of pregnancy (miscarriage, termination[4] or birth), 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 number of maternal deaths has fluctuated substantially over the time period 2006–2017, with a range from 3.3 deaths per 100,000 to 24.4 deaths per 100,000 maternities. There is some evidence of a reduction in the total number of maternal deaths over the time period.

The incidence of maternal death increased with age, with those aged 40 years and over having the highest rate (42.2 per 100,000 maternities). Women residing in the most deprived areas (NZDep2013 quintile 5) had the highest rate of mortality; there was some evidence of a statistically significant association between risk of death and increasing deprivation (p=0.02). When examined by prioritised ethnicity, Māori women, until recently, had higher mortality rates than New Zealand European women. However, over the past four years their mortality rate has reduced and is currently similar to that for New Zealand European women. Over the time period 2006–2017 there is some evidence of a statistically significant reduction in deaths for wāhine Māori (p=0.04).

There were 66 direct maternal and 44 indirect maternal deaths over the 12-year study period 2006–2017 inclusive. The single largest cause of maternal death in Aotearoa/New Zealand is suicide, with 30 deaths during this time (45%). The next leading causes were amniotic fluid embolism and neurological conditions, which caused 13 deaths (11.2%) each.

Given that suicide is the leading cause of maternal death, it is imperative that comprehensive action is taken. There are currently screening guidelines during the antenatal and post-natal period; however, their use is variable. Difficulties arise when mild to moderate illness is diagnosed, as maternal mental health service provision is variable within Aotearoa/New Zealand, with particularly limited resources for women with mild to moderate illness. A previous review of maternal suicide in wāhine Māori made a number of recommendations around early recognition of risk factors, comprehensive assessment and active follow-up.[5]

While some gains have been made since 2007, further improvements must be made. PMMRC's vision is to work together with mothers, families and whānau, health professionals, policymakers and researchers to ensure that all women have access to high quality care that meets their needs.

[4] Termination of pregnancy is the interruption of an ongoing pregnancy (whether the baby was stillborn or live born). This report only includes termination of pregnancy from 20 weeks' gestation.

[5] PMMRC. 2017. *Eleventh Annual Report of the Perinatal and Maternal Mortality Review Committee: Reporting mortality 2015*. URL: https://www.hqsc.govt.nz/assets/PMMRC/Publications/2017_PMMRC_Eleventh_Annual_Report.pdf (accessed 2 September 2019).

1 Ngā tūtohinga | Recommendations

Research recommendation

1. Collectively, we need to increase our understanding of the reasons for adverse outcomes in certain groups. For example, within Aotearoa/New Zealand and internationally, we have an incomplete understanding of what puts women and babies of Indian ethnicity at increased risk.

   Evidence

   There is evidence that Indian women are at higher risk of gestational diabetes than women of other ethnic groups. However, this does not explain all the variation in mortality for babies of Indian women.

   Justification

   In Aotearoa/New Zealand, babies of Indian women have the highest mortality rates for perinatal related death and stillbirths.

Delivery of care recommendations

2. District health boards (DHBs) should demonstrate that they have co-developed and implemented models of care that meet the needs of mothers of Indian ethnicity.

   Evidence

   Babies of women of Indian ethnicity have increased mortality from stillbirth and perinatal related mortality.

   Justification

   Models of care that increase acceptability of and access to services should be investigated to reduce avoidable mortality.

3. DHBs should monitor key maternity indicators by ethnic group to identify variations in outcomes. They should then improve areas where there are differences in outcome.

   Justification

   Subgroups, particularly minority groups, of the population are likely to experience worse outcomes than others. If their outcomes are not specifically monitored, poor outcomes can go unnoticed.

Perinatal mortality and morbidity

4. The Ministry of Health should resource, support and facilitate the development of a national guideline for the provision of care of mothers and infants facing delivery at <25 weeks gestational age to ensure high-quality, appropriate and equitable care for all.

   Justification

   Babies born at the cusp of human viability (<25 weeks gestational age) represent a unique and complex patient group. The provision of high-quality care to mother and baby needs to be tailored to their specific individual needs: best practice includes recognition of both palliative care and intensive care support of the newborn.

5. The Ministry of Health should resource, support and facilitate the development of a national perinatal bereavement pathway with key stakeholders, including governmental and non-governmental organisations, to ensure high-quality, appropriate and equitable care for all.

   Justification

   Provision of bereavement care across DHBs is inconsistent for bereaved families and whānau.

Neonatal encephalopathy

6. The PMMRC recommends that DHBs provide interdisciplinary fetal surveillance education for all clinicians involved in intrapartum care on a triennial basis. This is to be provided free for staff and at no cost to lead maternity carers (LMCs). The PMMRC encourages the Midwifery Council, the New Zealand

College of Midwives (NZCOM) and Royal Australian and New Zealand College of Obstetricians and Gynaecologists (RANZCOG) to work with DHBs in the implementation of this recommendation.

   a. This education includes risk assessment for babies throughout pregnancy as well as intrapartum observations.

   b. The aims include strengthening of supervision and support to promote professional judgement, interdisciplinary conversations and reflective practice.

7. All neonatal encephalopathy (NE) cases need to be considered for a Severity Assessment Code (SAC) rating. Neonatal hypoxic brain injury resulting in permanent brain damage (or permanent and severe loss of function) should be rated as SAC 1. Those who received cooling with as yet undetermined outcome should be rated as SAC 3.[6]

   Justification

   SAC reviews can be a useful tool for identifying systems issues that can be modified to reduce the chance of further harm. Having a third-party assessment of the quality of the review will help DHBs to fully utilise this opportunity for improvement.

8. All babies with NE, regardless of severity, should have a multidisciplinary discussion about whether to refer to the Accident Compensation Corporation (ACC) for consideration for cover as a treatment injury, using ACC's *Treatment Injury Claim Lodgement Guide*.[7] Parents should be advised that not all treatment claims are accepted.

   Evidence

   Currently there is little consistency as to which babies with NE are notified to ACC for assessment of a treatment injury claim.

   Justification

   Quality of life for the baby and their family or whānau may differ considerably depending on whether their condition is covered by ACC.

Maternal

9. For the management of suspected ectopic pregnancies, the Perinatal and Maternal Mortality Review Committee (the PMMRC) recommends:

   a. DHB gynaecology services have:

      i. clear pathways/processes for primary care regarding early pregnancy management

      ii. clear hospital guidelines for assessment of the collapsed woman of reproductive age that include the differential diagnosis of ectopic pregnancy. Collapse due to ectopic pregnancy requires rapid assessment and surgical management.

   b. the Royal Australian and New Zealand College of Radiologists endorse and promote the New Zealand Obstetric Ultrasound Guidelines being published by the Ministry of Health that suggest reporting wording to include the following information:

      An ectopic pregnancy cannot be excluded on this ultrasound alone. Please interpret scan with βhCG [beta human chorionic gonadotropin] using advice from gynaecology service or based on gynaecological protocols for PUL [pregnancy of unknown location].[8]

[6] Health Quality & Safety Commission. 2019. *Maternity Severity Assessment Code (SAC) examples 2018–19*. URL: https://www.hqsc.govt.nz/our-programmes/adverse-events/publications-and-resources/publication/2938/ (accessed 6 August 2019).

[7] Accident Compensation Corporation. 2019. *Treatment Injury Claim Lodgement Guide*. URL: https://www.acc.co.nz/assets/provider/405074f420/treatment-injury-claim-lodgement-guide.pdf (accessed 12 August 2019).

[8] Ministry of Health. 2019. *New Zealand Obstetric Ultrasound Guidelines: consultation document*. URL: https://consult.health.govt.nz/nsu/obstetric-ultrasound-guidelines/ (accessed 14 August 2019).

c. primary care use gynaecology pathways and consult with gynaecology services when an ultrasound cannot confirm an intrauterine pregnancy to help interpret beta human chorionic gonadotropin (βhCG) results and scan findings and guide ongoing management.

Justification

Deaths due to ruptured ectopic pregnancy are highly preventable. Deaths have occurred in the 10-day interval between scans, and therefore current practice needs to be improved.

Previous recommendations yet to be fully implemented

1. As a matter of urgency, the Ministry of Health improves the completion and quality of the ethnicity data in the National Maternity Collection (MAT), through consistent transfer of baby ethnicity from the birth certificate, and the transfer of mother ethnicity from the baby's birth certificate into MAT.

   Evidence

   During the years 2007–2017, 51% of babies in the MAT data set did not have an ethnic group recorded. In addition to the use of MAT for reports such as this, MAT is the primary data source used for the Ministry of Health's Annual Report of Maternity.[9]

   Justification

   a. Ethnicity as recorded on the birth certificate is most likely to be accurate for both the baby and parents, as it is completed by parents. It is therefore more likely to reflect the parental self-identified ethnicity, and provide the best information about the baby's ethnicity.

   b. This is consistent with the Ministry of Health's Ethnicity Data Protocols,[10] which outline the importance of collecting high-quality ethnicity data, the need to collect data regularly, and the requirement for ethnicity data to be collected directly from individuals. This is vital for the current government goals of reducing inequity and improving child wellbeing.

2. As a matter of urgency, the Ministry of Health requires DHBs to provide data for women who receive DHB-led antenatal care, and for this to be uploaded into MAT in its entirety.

   Evidence

   Women who receive antenatal care from their DHB can differ considerably from those who receive non-DHB LMC care.

   Justification

   In order to accurately calculate mortality rates for risk factors for different population groups, precise denominator data are required.

3. Government should fund the provision of specific maternal mental health services in order to provide holistic screening for maternal mental illness, intimate partner violence and family violence, and provide appropriate services and support.

   a. For terminations of pregnancy, written discharge information should include contact information for support services and inform women that a follow-up visit is funded.

   Evidence

   Suicide is the leading cause of maternal death in Aotearoa/New Zealand.

   Justification

   Review of suicide deaths showed mental illness, intimate partner violence and family violence were frequent experiences in those women who died by suicide.[11]

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[9] Ministry of Health. 2019. National Maternity Collection. URL: https://www.health.govt.nz/nz-health-statistics/national-collections-and-surveys/collections/national-maternity-collection (accessed 2 September 2019).

[10] Ministry of Health. 2017. *HISO 10001:2017 Ethnicity Data Protocols*. URL: https://www.health.govt.nz/publication/hiso-100012017-ethnicity-data-protocols (accessed 5 July 2019).

[11] PMMRC. 2017. *Eleventh Annual Report of the Perinatal and Maternal Mortality Review Committee: Reporting mortality 2015*. URL: https://www.hqsc.govt.nz/assets/PMMRC/Publications/2017_PMMRC_Eleventh_Annual_Report.pdf (accessed 2 September 2019).

4. We strongly recommend to the Government/Ministry for Primary Industries that folic acid fortification of bread be mandatory to reduce both mortality and serious morbidity from neural tube defects.

   Evidence

   There is strong and convincing evidence that mandatory fortification of food with folic acid unequivocally reduces the prevalence of neural tube defects, and the benefits of this outweigh any potential adverse effects.[12]

   Justification

   a. Congenital abnormalities, particularly neural tube defects, are a significant contributor to terminations of pregnancy.

   b. There is significant lifelong morbidity and mortality risk to babies from neural tube defects.

5. Until bread and flour fortification is implemented, and as an interim measure, folic acid should be provided free. This is not a suitable long-term measure. Fifty percent of pregnancies are unplanned; therefore, this method is less effective than fortification of bread and flour.

6. DHBs should demonstrate that they have co-developed and implemented models of care that meet the needs of mothers under 20 years of age.

   Evidence

   Babies of women under 20 years of age have increased mortality from stillbirth and neonatal mortality.

   Justification

   Models of care that increase acceptability of and access to services should be investigated to reduce avoidable mortality.

[12] Office of the Prime Minister's Chief Science Advisor and the Royal Society Te Apārangi. 2018. *The health benefits and risks of folic acid fortification of food.* URL: https://www.pmcsa.org.nz/wp-content/uploads/The-health-benefits-and-risks-of-folic-acid-fortification-of-food.pdf (accessed 14 August 2018).

2 Te tikanga | Methods

See *Methods and definitions for Perinatal and Maternal Mortality Review Committee (PMMRC) reporting* document, available at: www.hqsc.govt.nz/our-programmes/mrc/pmmrc/publications-and-resources/publication/3823.

Definitions used by the PMMRC

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 termination of pregnancy.

Termination of pregnancy is the interruption of an ongoing pregnancy (whether the baby was stillborn or live born). This report only includes termination of pregnancy from 20 weeks' gestation.

Neonatal death is the death of any baby showing signs of life at 20 weeks' gestation or beyond or weighing at least 400g if gestation is unknown that occurs up until midnight of the 27th day of life. **Early neonatal death** is a death that occurs up until midnight on 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.

Perinatal mortality is fetal and early neonatal death from 20 weeks' gestation (or weighing at least 400g if gestation is unknown) until midnight of the sixth day of life.

Perinatal related mortality is fetal deaths (including terminations of pregnancy and stillbirths) and neonatal deaths (up to midnight of the 27th day of life) per 1,000 total babies born at 20 weeks' gestation or beyond, and weighing at least 400g if gestation was unknown.

A **maternal death** is the death of a woman while pregnant or within 42 days of termination of pregnancy (miscarriage, termination or birth), 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' gestation or beyond or weighing at least 400g if gestation is unknown. The maternal mortality ratio is calculated per 100,000 maternities.

Neonatal encephalopathy (NE) is a clinically defined syndrome of disturbed neurological function within the first week of life, manifested by difficulty in initiating and maintaining respiration, depression of tone and reflexes, subnormal level of consciousness and often seizures.

Equity analyses

Throughout the report, comparisons are made between prioritised ethnic groups. At times, outcomes for babies of Māori women are compared with outcomes for babies of New Zealand European women. This is not to provide commentary on the deficits of a group, rather to highlight the deficits of a society that creates, maintains and tolerates these differences.

Comparison between mother and baby ethnicity

Both mother and baby ethnicity are important for reporting on mortality. As many of the determinants of health for a baby relate to their mother, in many instances it is appropriate to examine maternal ethnicity to explore areas for improvement and intervention. In addition, to examine the burden of mortality for different ethnic groups, it is necessary to also examine mortality by baby ethnicity, which may be different to

maternal ethnicity. Table 2.1 and Table 2.2 show the differences in ethnicity by different data sources. 'PMMRC' data are those that are collected directly by PMMRC, through their Rapid Reporting Forms, following the death of a baby. Therefore, these data relate only to babies who have died (numerator). 'MAT' data are those data that are in the National Maternity Collection, which contain data on pregnancy, delivery and babies. This source includes data on most babies born in Aotearoa/New Zealand (denominator population). Table 2.1 shows that for maternal ethnicity, there are no substantial differences between the two data sources. However, Table 2.2 shows that for baby ethnicity, substantial amounts of data are missing from MAT, with the overall effect being there is a large proportion (51%) of missing cases. This unfortunately makes the baby ethnicity data in MAT too unreliable to use.

Table 2.1: Prioritised maternal ethnic group by PMMRC and MAT data sources for perinatal related deaths, 2007–2017

2007–2017	PMMRC	MAT	Unmatched
Prioritised maternal ethnic group			
Māori	1,888	1,889	191,408
Pacific peoples	966	979	73,861
Indian	430	378	29,506
Other Asian	550	521	60,536
MELAA	140	161	13,400
NZ European	2,794	2,472	251,943
Other European	423	543	55,626
Other	1	-	-
Unknown	2	7	5,809
Total	**7,194**	**6,950**	**682,089**

MELAA = Middle Eastern, Latin American, or African.

Sources: Numerator: PMMRC's perinatal data extract 2007–2017; Denominator: MAT data 2007–2017.

Table 2.2: Prioritised baby ethnic group by PMMRC and MAT data sources for perinatal related deaths, 2007–2017

2007–2017	PMMRC	MAT
Prioritised baby ethnic group		
Māori	2,251	998
Pacific peoples	978	496
Indian	443	232
Other Asian	544	260
MELAA	144	72
NZ European	2,599	1,195
Other European	226	186
Other	-	-
Unknown	9	3,511
Total	**7,194**	**6,950**

MELAA = Middle Eastern, Latin American, or African.

Sources: Numerator: PMMRC's perinatal data extract 2007–2017; Denominator: MAT data 2007–2017.

The National Maternity Collection (MAT)

MAT is based upon two sources:

- primary maternity services provided under Section 88 of the New Zealand Public Health and Disability Act 2000, which is sourced from LMC claims for payment
- the National Minimum Dataset (NMDS), which contains information on inpatient and day patient health event data during pregnancy, birth and the postnatal period for the mother and baby.

While MAT should have a record of most births that occur in New Zealand, either through the NMDS for those who give birth in hospital, or through LMC claims, antenatal data are not routinely uploaded for women who are receiving care from providers other than LMC midwives, general practitioners (GPs), or

obstetricians. In particular, women whose antenatal care is provided through their DHB will not have their antenatal data entered into MAT. Some DHBs, such as Counties Manukau, routinely provide antenatal care. Due to a technical issue, data from DHBs cannot be uploaded into MAT, even when they are provided.

To approximate the effect of this, we have compared the details of women receiving LMC care through Counties Manukau DHB, with women in MAT (Table 2.3).

Table 2.3: Demographic characteristics of women in MAT compared with women from Counties Manukau DHB whose antenatal information is not in MAT

Category	MAT		Counties Manukau DHB non-MAT	
	n	%	n	%
Maternal BMI (kg/m^2)				
<18.50	3,124	2.6	75	1.6
18.50–24.99	53,419	44.2	1,192	25.0
25.00–29.99	29,794	24.6	1,081	22.7
30.00–34.99	15,930	13.2	939	19.7
35.00–39.99	7,745	6.4	629	13.2
≥40	4,616	3.8	635	13.3
Unknown	6,287	5.2	210	4.4
Total	**120,915**	**100.0**	**4,761**	**100.0**
Maternal smoking at registration				
Yes	15,402	12.7	1,040	21.8
No	99,392	82.2	3,438	72.2
Unknown	6,121	5.1	283	5.9
Total	**120,915**	**100.0**	**4,761**	**100.0**

BMI = body mass index.

Sources: MAT data 2016–2017; Counties Manukau data provided by Counties Manukau DHB 2016–2017.

Table 2.3 shows there are substantial differences in those women whose antenatal records are in MAT compared with those whose records are not. Compared with women in MAT, women from Counties Manukau whose antenatal records were not in MAT had a higher proportion of women with a higher BMI, and had a higher proportion of women who are more likely to smoke.

3 Te mate pēpi | Perinatal mortality

Aotearoa/New Zealand overview and key findings

Since 2007, when the PMMRC started collecting data, there has been a statistically significant decrease in the rate of stillbirths (chi-squared test for trend p<0.001) but no reduction in neonatal mortality. Overall, there is some evidence of a statistically significant decrease in the rates of perinatal (fetal and early neonatal) mortalities, and in deaths overall (perinatal related mortality) (Figure 3.1 and Table 3.1).

To examine the populations that benefitted, further analyses by prioritised ethnic group were undertaken (data not shown). Over the time period 2007–2017, for stillbirths, there was a statistically significant decrease in stillbirths in babies of both Māori and New Zealand European mothers, and no change in other groups.

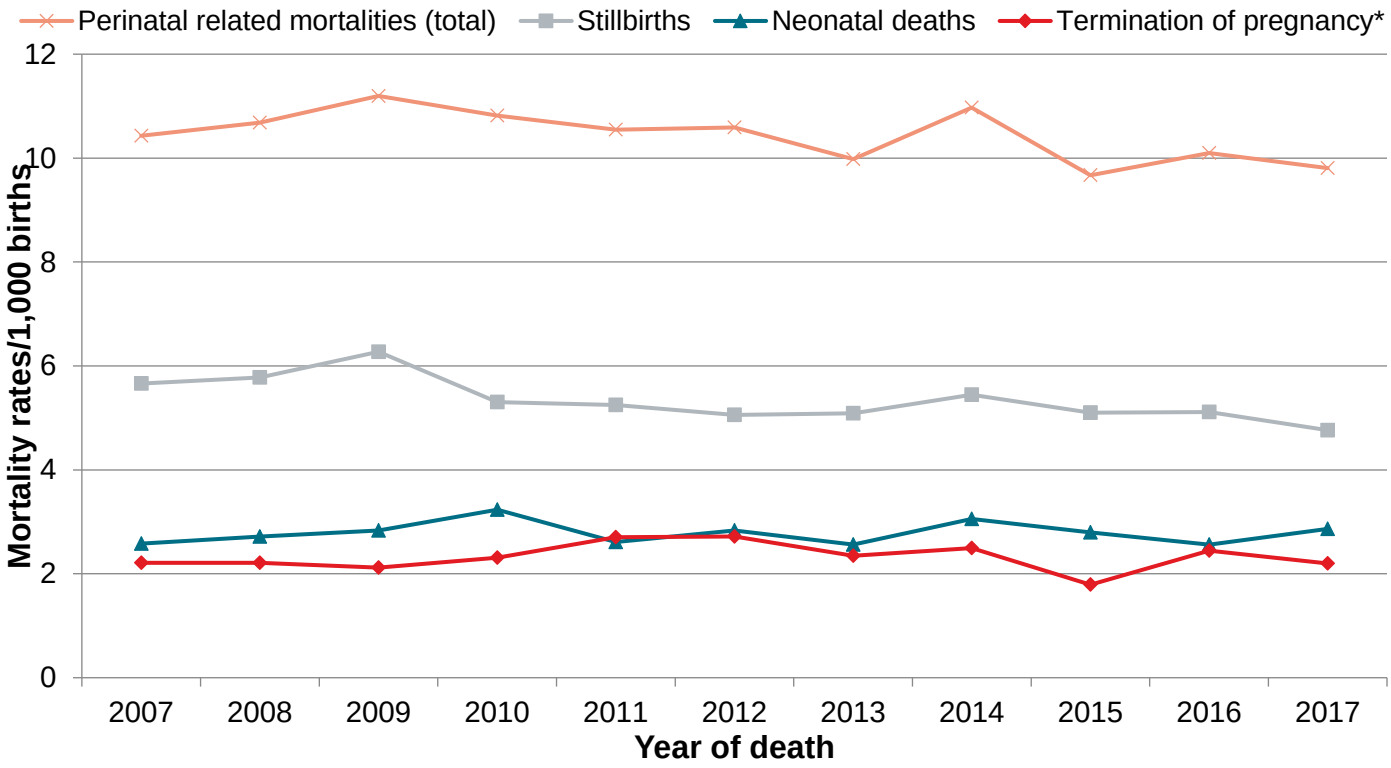
The reduction in perinatal mortalities was driven by a statistically significant reduction in babies of New Zealand European mothers, with no change in other ethnic groups. Similarly, there was a statistically significant decrease in fetal deaths and perinatal related mortalities for New Zealand European mothers, but not for any other ethnic groups.

There was a statistically significant increase in terminations of pregnancy for Māori mothers, but no significant change for other ethnic groups.

Between the years 2007 and 2017, there was a statistically significant increase in neonatal deaths for babies of Pacific women, but no significant change for other groups.

There were no statistically significant changes in any of the above mortality rates for babies of women of Indian; Other Asian; Middle Eastern, Latin American, or African (MELAA); or Other European groups (data not shown).

Figure 3.1: Perinatal related mortality rates (per 1,000 births) using New Zealand definitions 2007–2017



* In this report, 'Termination of pregnancy' refers to the interruption of an ongoing pregnancy from 20 weeks' gestation onwards.
Sources: Numerator: PMMRC's perinatal data extract 2007–2017; Denominator: MAT births 2007–2017.

Table 3.1: Summary of New Zealand perinatal related mortality rates using New Zealand definition (≥20 weeks or ≥400g if gestation is unknown) 2007–2017

	n											
	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	
Total births	65,200	65,623	65,202	65,449	63,242	63,280	60,133	60,079	59,777	60,600	60,454	
Fetal deaths (terminations of pregnancy and stillbirths)*	513	524	547	498	503	492	447	477	412	458	421§	
Terminations of pregnancy	144	145	138	151	171	172	141	150	107	148	133	
Stillbirths	369	379	409	347	332	320	306	327	305	310	288§	
Early neonatal deaths <7 days	133	134	137	165	139	142	122	150	131	123‡	137§	
Late neonatal deaths 7–27 days	34	43	46	45	25	36	31	32	35	31	35	
Neonatal deaths <28 days#	167	177	183	210	164	178	153	182	166	154‡	172§	
Perinatal mortalities+	646	658	684	663	642	634	569	627	543	581‡	558§	
Perinatal related mortalities^	680	701	730	708	667	670	600	659	578	612‡	593§	
Perinatal mortalities excluding lethal and terminated fetal abnormalities•	462	488	515	466	446	445	417	449	402	416‡	409	
Perinatal related mortalities excluding lethal and terminated fetal abnormalities•	482	516	546	497	462	467	436	468	420	437‡	434	
	Rate											Chi-squared test for trend (p)
	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	
Total births												
Fetal deaths (terminations of pregnancy and stillbirths)*	7.9	8.0	8.4	7.6	8.0	7.8	7.4	7.9	6.9	7.6	7.0	0.004
Terminations of pregnancy	2.2	2.2	2.1	2.3	2.7	2.7	2.3	2.5	1.8	2.4	2.2	0.98
Stillbirths	5.7	5.8	6.3	5.3	5.2	5.1	5.1	5.4	5.1	5.1	4.8	<0.001
Early neonatal deaths <7 days												
Late neonatal deaths 7–27 days												
Neonatal deaths <28 days#	2.6	2.7	2.8	3.2	2.6	2.8	2.6	3.1	2.8	2.6	2.9	0.90
Perinatal mortalities+	9.9	10.0	10.5	10.1	10.2	10.0	9.5	10.4	9.1	9.6	9.2	0.024
Perinatal related mortalities^	10.4	10.7	11.2	10.8	10.5	10.6	10.0	11.0	9.7	10.1	9.8	0.017
Perinatal mortalities excluding lethal and terminated fetal abnormalities•	7.1	7.4	7.9	7.1	7.1	7.0	6.9	7.5	6.7	6.9	6.8	0.053
Perinatal related mortalities excluding lethal and terminated fetal abnormalities•	7.4	7.9	8.4	7.6	7.3	7.4	7.3	7.8	7.0	7.2	7.2	0.041

* Fetal death rate per 1,000 babies born (includes terminations and stillbirths).

Neonatal death rate per 1,000 live born babies.

+ Fetal deaths and early neonatal deaths per 1,000 babies born.

^ Fetal deaths and early and late neonatal deaths per 1,000 babies born.

• Lethal and terminated fetal abnormalities are all perinatal related deaths with Perinatal Society of Australia and New Zealand Perinatal Death Classification (PSANZ-PDC) of congenital abnormality, and neonatal deaths with PSANZ Neonatal Death Classification (PSANZ-NDC) of congenital abnormality.

‡ Included two late notifications.

§ Included two late notifications.

Sources: Numerator: PMMRC's perinatal data extract 2007–2017; Denominator: MAT births 2007–2017.

Using international definitions, there is strong evidence of a statistically significant decrease in fetal deaths, stillbirths, perinatal mortalities and perinatal related mortalities since 2007 (Table 3.2 and Figure 3.2).

Table 3.2: New Zealand perinatal related mortality rates (per 1,000 births) using the international definition (≥1,000g or ≥28 weeks if birthweight unknown) 2007–2017

	n										
	2007	**2008**	**2009**	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**	**2016**	**2017**
Total births	64,650	65,076	64,629	64,885	62,694	62,717	59,600	59,513	59,316	60,090	59,928
Fetal deaths (terminations of pregnancy and stillbirths)*	212	207	231	199	191	166	155	162	164	171	158
Terminations of pregnancy	6	14	9	17	24	13	12	13	7	15	16
Stillbirths	206	193	222	182	167	153	143	149	157	156	142
Early neonatal deaths <7 days	57	67	59	68	65	54	45	59	57	53	46
Late neonatal deaths 7–27 days	28	35	30	31	18	24	24	23	28	23	22
Neonatal deaths <28 days#	85	102	89	99	83	78	69	82	85	76	68
Perinatal mortalities+	269	274	290	267	256	220	200	221	221	224	204
Perinatal related mortalities^	297	309	320	298	274	244	224	244	249	247	226
Perinatal mortalities excluding lethal and terminated fetal abnormalities•	224	220	238	204	180	169	158	168	177	170	159
Perinatal related mortalities excluding lethal and terminated fetal abnormalities•	238	240	254	221	189	179	170	178	188	183	172

	Rate											**Chi-squared test for trend (p)**
	2007	**2008**	**2009**	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**	**2016**	**2017**	
Total births												
Fetal deaths (terminations of pregnancy and stillbirths)*	3.3	3.2	3.6	3.1	3.0	2.6	2.6	2.7	2.8	2.8	2.6	<0.001
Terminations of pregnancy	0.1	0.2	0.1	0.3	0.4	0.2	0.2	0.2	0.1	0.2	0.3	0.25
Stillbirths	3.2	3.0	3.4	2.8	2.7	2.4	2.4	2.5	2.6	2.6	2.4	<0.001
Early neonatal deaths <7 days												
Late neonatal deaths 7–27 days												
Neonatal deaths <28 days#	1.3	1.6	1.4	1.5	1.3	1.2	1.2	1.4	1.4	1.3	1.1	0.11
Perinatal mortalities+	4.2	4.2	4.5	4.1	4.1	3.5	3.4	3.7	3.7	3.7	3.4	<0.001
Perinatal related mortalities^	4.6	4.7	5.0	4.6	4.4	3.9	3.8	4.1	4.2	4.1	3.8	<0.001
Perinatal mortalities excluding lethal and terminated fetal abnormalities•	3.5	3.4	3.7	3.1	2.9	2.7	2.7	2.8	3.0	2.8	2.7	<0.001
Perinatal related mortalities excluding lethal and terminated fetal abnormalities•	3.7	3.7	3.9	3.4	3.0	2.9	2.9	3.0	3.2	3.0	2.9	<0.001

* Fetal death rate per 1,000 babies born (includes terminations and stillbirths).

Neonatal death rate per 1,000 live born babies.

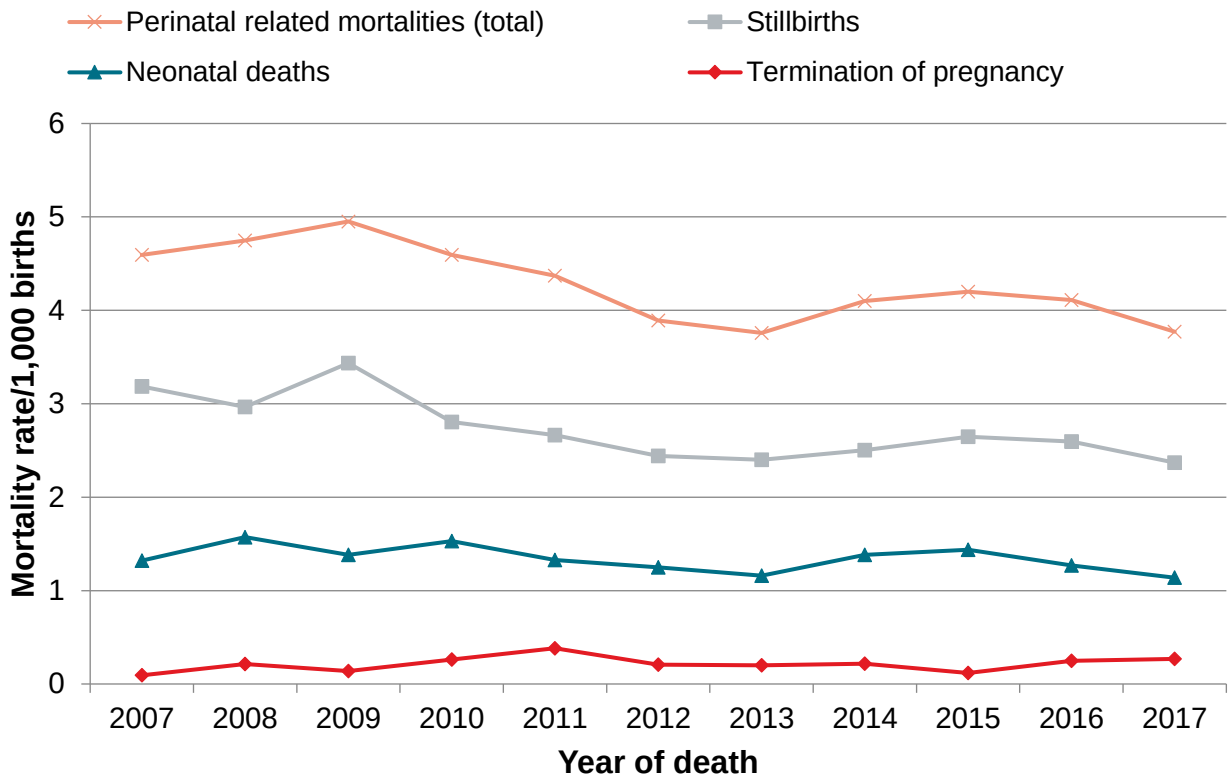
\+ Fetal deaths and early neonatal deaths per 1,000 babies born.

^ Fetal deaths and early and late neonatal deaths per 1,000 babies born.

• Lethal and terminated fetal abnormalities are all perinatal related deaths with PSANZ-PDC of congenital abnormality, and neonatal deaths with PSANZ-NDC of congenital abnormality.

Sources: Numerator: PMMRC's perinatal data extract using the international definition (≥1,000g or ≥28 weeks if birthweight unknown) 2007–2017; Denominator: MAT births using the international definition (≥1,000g or ≥28 weeks if birthweight unknown) 2007–2017.

Figure 3.2: Perinatal related mortality annual rates (per 1,000 births) using international definitions* 2007–2017



* Rates of fetal death, neonatal death, perinatal mortality and perinatal related mortality of babies weighing ≥1,000g, or ≥28 weeks if birthweight is unknown, per 1,000 total births of babies weighing ≥1,000g, or ≥28 weeks if birthweight is unknown. Babies without birthweight or gestation are included if they have been registered.

Sources: Numerator: PMMRC's perinatal data extract using the international definition (≥1,000g or ≥28 weeks if birthweight unknown) 2007–2017; Denominator: MAT births using the international definition (≥1,000g or ≥28 weeks if birthweight unknown) 2007–2017.

In 2017, from 20 weeks' gestation onwards, 75% of terminations of pregnancy were classified as Perinatal Society of Australia and New Zealand (PSANZ) Perinatal Death Classification (PDC) congenital abnormality, with 8.3% classified as PSANZ-PDC for maternal conditions. Nearly 30% of stillbirths were classified as PSANZ-PDC unexplained antepartum death (for unknown reasons). There were no statistically significant differences between rates of unexplained stillbirth between Māori and New Zealand European women. Sixteen percent of stillbirths were due to specific perinatal conditions, and 13% due to antepartum haemorrhage. The leading PSANZ PDC category of neonatal death was spontaneous preterm birth (27.5%), followed by antepartum haemorrhage (22.8%) (Table 3.3).

During the period 2007–2017, congenital abnormalities were the most frequent cause of death. Published research shows there is good evidence that folic acid supplementation prior to and in the first weeks of pregnancy prevents neural tube defects,[13] and we should consider ways to increase folic acid consumption in the childbearing population.

[13] De-Regil LM, Peña-Rosas JP, Fernández-Gaxiola AC, et al. 2015. Effects and safety of periconceptional oral folate supplementation for preventing birth defects. *Cochrane Database of Systematic Reviews* 2015(12): CD007950. URL: https://doi.org/10.1002/14651858.CD007950.pub3 (accessed 14 August 2019).

Table 3.3: Perinatal related deaths by perinatal death classification (PSANZ-PDC) 2017

Perinatal death classification (PSANZ-PDC)	Fetal deaths				Neonatal deaths		Perinatal related deaths (total)	
	Termination of pregnancy		Stillbirths					
	n=133		n=287		n=171		n=591	
	n	%	n	%	n	%	n	%
Congenital abnormality	100	75.2	26	9.1	31	18.1	157	26.6
Perinatal infection	4	3.0	17	5.9	7	4.1	28	4.7
Hypertension	<3	x	10	3.5	<3	x	13	2.2
Antepartum haemorrhage	<3	x	37	12.9	39	22.8	78	13.2
Maternal conditions	11	8.3	11	3.8	6	3.5	28	4.7
Specific perinatal conditions	3	2.3	45	15.7	16	9.4	64	10.8
Hypoxic peripartum death	-	-	4	1.4	9	5.3	13	2.2
Fetal growth restriction	<3	x	33	11.5	6	3.5	41	6.9
Spontaneous preterm	10	7.5	20	7.0	47	27.5	77	13.0
Unexplained antepartum death	-	-	84	29.3	-	-	84	14.2
No obstetric antecedent	-	-	-	-	8	4.7	8	1.4

'x' indicates percentage suppressed due to small numbers.

Source: PMMRC's perinatal data extract 2017.

Our data show there is strong evidence that perinatal deaths due to maternal hypertension have statistically significantly reduced over the time period ($p<0.01$). There is some evidence of a reduction in the rate of death from hypoxic peripartum death, fetal growth restriction, and spontaneous preterm births (Table 3.4).

Using the international definition of birth weight greater than or equal to 1,000g, or gestational age 28 weeks or greater, there was some evidence for a statistically significant reduction in deaths due to antepartum haemorrhage. There was strong evidence for a statistically significant decrease in the rate of deaths due to fetal growth restriction, and hypoxic peripartum deaths (Table 3.5).

Table 3.4: Perinatal death classification (PSANZ-PDC) specific perinatal related mortality rates (per 1,000 births) using New Zealand definition 2007–2017

Perinatal death classification (PSANZ-PDC)	2007		2008		2009		2010		2011		2012		2013		2014		2015		2016		2017		Chi-squared test for trend (p)
	N=65,200		N=65,623		N=65,202		N=65,449		N=63,242		N=63,280		N=60,133		N=60,079		N=59,777		N=60,600		N=60,454		
	n	Rate	n	Rate	n	Rate	n	Rate	n	Rate	n	Rate	n	Rate	n	Rate	n	Rate	n	Rate	n	Rate	
Congenital abnormality	197	3.02	185	2.82	182	2.79	211	3.22	203	3.21	201	3.18	160	2.66	189	3.15	158	2.64	174	2.87	157	2.60	0.19
Perinatal infection	29	0.44	28	0.43	25	0.38	28	0.43	21	0.33	19	0.30	20	0.33	24	0.40	22	0.37	26	0.43	28	0.46	0.97
Hypertension	19	0.29	22	0.34	29	0.44	27	0.41	21	0.33	19	0.30	13	0.22	13	0.22	21	0.35	9	0.15	13	0.22	0.0083
Antepartum haemorrhage	64	0.98	66	1.01	79	1.21	78	1.19	78	1.23	60	0.95	75	1.25	69	1.15	79	1.32	72	1.19	78	1.29	0.076
Maternal conditions	27	0.41	23	0.35	38	0.58	32	0.49	26	0.41	36	0.57	34	0.57	39	0.65	29	0.49	37	0.61	28	0.46	0.11
Specific perinatal conditions	57	0.87	71	1.08	76	1.17	69	1.05	73	1.15	70	1.11	63	1.05	70	1.17	60	1.00	69	1.14	64	1.06	0.56
Hypoxic peripartum death	33	0.51	34	0.52	28	0.43	20	0.31	20	0.32	20	0.32	11	0.18	17	0.28	17	0.28	13	0.21	13	0.22	0.038
Fetal growth restriction	48	0.74	62	0.94	53	0.81	48	0.73	44	0.70	49	0.77	48	0.80	35	0.58	33	0.55	41	0.68	41	0.68	0.041
Spontaneous preterm	99	1.52	94	1.43	110	1.69	113	1.73	85	1.34	102	1.61	80	1.33	106	1.76	65	1.09	72	1.19	77	1.27	0.015
Unexplained antepartum death	96	1.47	102	1.55	103	1.58	72	1.10	92	1.45	85	1.34	90	1.50	90	1.50	87	1.46	91	1.50	84	1.39	0.91
No obstetric antecedent	11	0.17	14	0.21	7	0.11	10	0.15	4	0.06	9	0.14	6	0.10	7	0.12	7	0.12	6	0.10	8	0.13	0.17

Sources: Numerator: PMMRC's perinatal data extract 2007–2017; Denominator: MAT births 2007–2017.

Table 3.5: Perinatal death classification (PSANZ-PDC) specific perinatal related mortality rates (per 1,000 births) using international definition (≥1,000g or ≥28 weeks if birthweight unknown) 2007–2017

Perinatal death classification (PSANZ-PDC)	2007		2008		2009		2010		2011		2012		2013		2014		2015		2016		2017		Chi-squared test for trend (p)
	N=64,650		N=65,076		N=64,629		N=64,885		N=62,694		N=62,717		N=59,600		N=59,513		N=59,316		N=60,090		N=59,928		
	n	Rate	n	Rate	n	Rate	n	Rate	n	Rate	n	Rate	n	Rate	n	Rate	n	Rate	n	Rate	n	Rate	
Congenital abnormality	58	0.90	69	1.06	64	0.99	77	1.19	85	1.36	64	1.02	51	0.86	64	1.08	61	1.03	63	1.05	52	0.87	0.58
Perinatal infection	16	0.25	16	0.25	15	0.23	13	0.20	12	0.19	9	0.14	9	0.15	12	0.20	12	0.20	17	0.28	16	0.27	0.88
Hypertension	7	0.11	7	0.11	14	0.22	11	0.17	9	0.14	3	0.05	5	0.08	6	0.10	10	0.17	6	0.10	6	0.10	0.37
Antepartum haemorrhage	23	0.36	25	0.38	24	0.37	23	0.35	17	0.27	13	0.21	18	0.30	11	0.18	17	0.29	12	0.20	19	0.32	0.036
Maternal conditions	14	0.22	9	0.14	19	0.29	19	0.29	7	0.11	17	0.27	22	0.37	14	0.24	15	0.25	16	0.27	8	0.13	0.84
Specific perinatal conditions	29	0.45	23	0.35	32	0.50	30	0.46	32	0.51	21	0.33	24	0.40	25	0.42	32	0.54	27	0.45	25	0.42	0.85
Hypoxic peripartum death	33	0.51	34	0.52	28	0.43	20	0.31	20	0.32	20	0.32	11	0.18	17	0.29	17	0.29	13	0.22	13	0.22	<0.001
Fetal growth restriction	31	0.48	32	0.49	31	0.48	31	0.48	18	0.29	32	0.51	21	0.35	20	0.34	14	0.24	15	0.25	13	0.22	<0.001
Spontaneous preterm	9	0.14	7	0.11	10	0.15	19	0.29	9	0.14	10	0.16	5	0.08	9	0.15	14	0.24	8	0.13	9	0.15	0.91
Unexplained antepartum death	66	1.02	73	1.12	75	1.16	45	0.69	61	0.97	46	0.73	52	0.87	59	0.99	50	0.84	64	1.07	57	0.95	0.40
No obstetric antecedent	11	0.17	14	0.22	7	0.11	10	0.15	4	0.06	9	0.14	6	0.10	7	0.12	7	0.12	6	0.10	8	0.13	0.17

Sources: Numerator: PMMRC's perinatal data extract using the international definition (≥1,000g or ≥28 weeks if birthweight unknown) 2007–2017; Denominator: MAT births using the international definition (≥1,000g or ≥28 weeks if birthweight unknown) 2007–2017.

For stillbirths, there is strong evidence there was a statistically significant reduction in spontaneous preterm and hypoxic peripartum deaths between the years 2007 and 2017. There was some evidence of a reduction in the rate of stillbirths due to fetal growth restriction. For this time period, the largest category of death for stillbirth was unexplained antepartum death (Table 3.6).

Table 3.6: Perinatal death classification (PSANZ-PDC) specific stillbirth rates (per 1,000 births) 2007–2017

Perinatal death classification (PSANZ-PDC)	2007		2008		2009		2010		2011		2012		2013		2014		2015		2016		2017		Chi-squared test for trend (p)
	N=65,200		N=65,623		N=65,202		N=65,449		N=63,242		N=63,280		N=60,133		N=60,079		N=59,777		N=60,600		N=60,454		
	n	Rate	n	Rate	n	Rate	n	Rate	n	Rate	n	Rate	n	Rate	n	Rate	n	Rate	n	Rate	n	Rate	
Congenital abnormality	35	0.54	28	0.43	30	0.46	37	0.57	27	0.43	35	0.55	22	0.37	34	0.57	25	0.42	31	0.51	26	0.43	0.68
Perinatal infection	21	0.32	15	0.23	16	0.25	17	0.26	10	0.16	9	0.14	10	0.17	12	0.20	12	0.20	10	0.17	17	0.28	0.23
Hypertension	13	0.20	12	0.18	24	0.37	18	0.28	12	0.19	9	0.14	8	0.13	9	0.15	16	0.27	8	0.13	10	0.17	0.096
Antepartum haemorrhage	46	0.71	49	0.75	53	0.81	46	0.70	48	0.76	31	0.49	44	0.73	33	0.55	46	0.77	38	0.63	37	0.61	0.19
Maternal conditions	20	0.31	13	0.20	26	0.40	23	0.35	13	0.21	19	0.30	22	0.37	21	0.35	22	0.37	17	0.28	11	0.18	0.76
Specific perinatal condition	38	0.58	53	0.81	60	0.92	45	0.69	51	0.81	42	0.66	39	0.65	43	0.72	42	0.70	53	0.87	45	0.74	0.78
Hypoxic peripartum death	18	0.28	15	0.23	11	0.17	7	0.11	9	0.14	11	0.17	3	0.05	7	0.12	9	0.15	4	0.07	4	0.07	<0.001
Fetal growth restriction	43	0.66	53	0.81	44	0.67	39	0.60	37	0.59	42	0.66	44	0.73	33	0.55	27	0.45	33	0.54	33	0.55	0.032
Spontaneous preterm	39	0.60	39	0.59	42	0.64	43	0.66	33	0.52	37	0.58	24	0.40	45	0.75	19	0.32	25	0.41	20	0.33	0.002
Unexplained antepartum death	96	1.47	102	1.55	103	1.58	72	1.10	92	1.45	85	1.34	90	1.50	90	1.50	87	1.46	91	1.50	84	1.39	0.91
No obstetric antecedent	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Sources: Numerator: PMMRC's perinatal data extract, stillbirths only, 2007–2017; Denominator: MAT births 2007–2017.

Neonatal death

For babies aged 20–28 weeks' gestation, extreme prematurity was the leading cause of neonatal death. The mortality rate from extreme prematurity in babies under 28 weeks' gestation was the same for Māori as for babies of New Zealand European mothers. There was some evidence of increase in deaths due to neurological conditions over the study period in these extremely preterm babies.

For babies aged 28 weeks and over, congenital abnormalities were the leading cause of death, followed by neurological conditions. Unlike babies aged less than 28 weeks, for those aged 28 weeks and over there was strong evidence of a decrease in deaths over the study period. In this age group (28 weeks and over) there was a significant increase in the rate of death from cardio-respiratory disorders but a statistically significant decrease in deaths due to neurological conditions (Table 3.7).

Table 3.7: Neonatal death classification (PSANZ-NDC) specific neonatal death rates (per 1,000 live births) 2007–2017

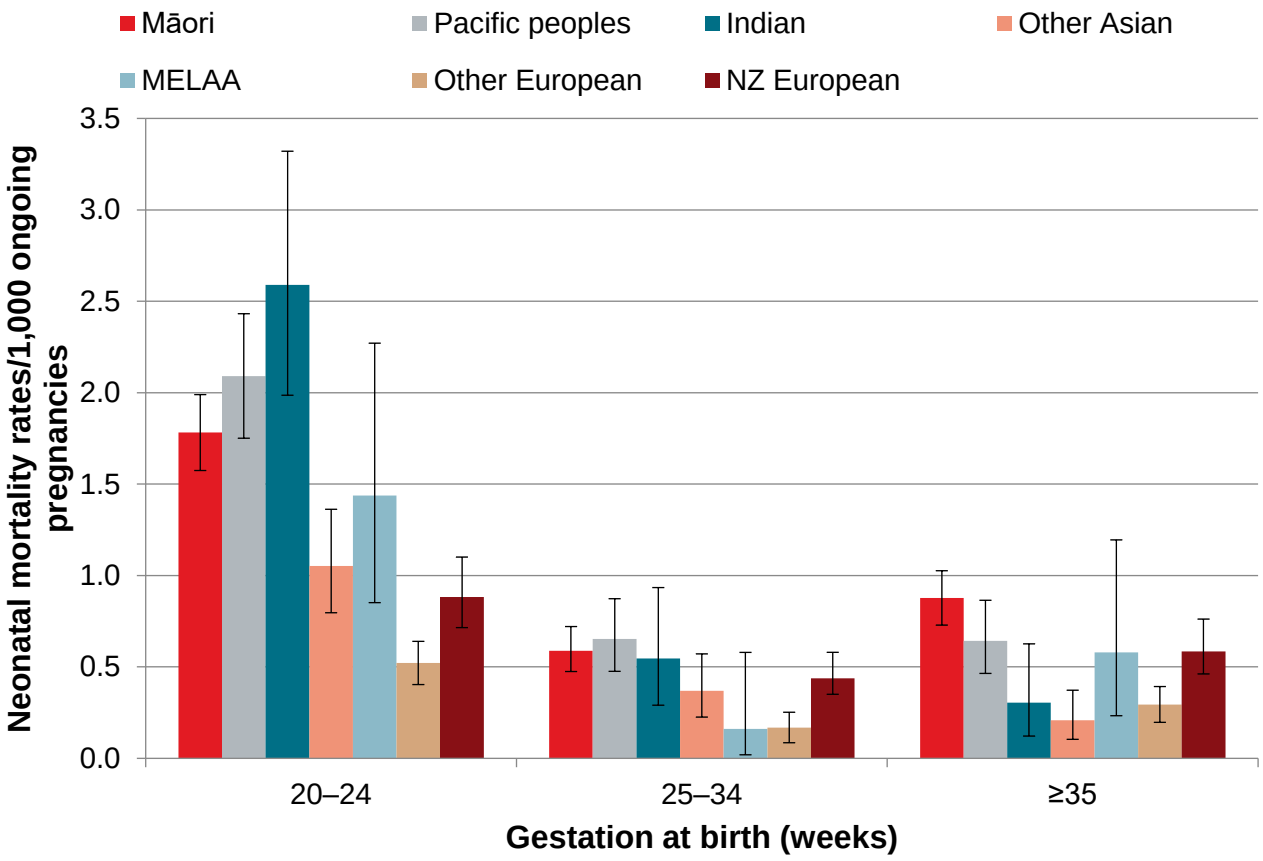
Neonatal death classification (PSANZ-NDC)	2007		2008		2009		2010		2011		2012		2013		2014		2015		2016		2017		Chi-squared test for trend (p)
	n	Rate	n	Rate	n	Rate	n	Rate	n	Rate	n	Rate	n	Rate	n	Rate	n	Rate	n	Rate	n	Rate	
Gestation <28 weeks	**N=275**		**N=277**		**N=286**		**N=292**		**N=242**		**N=256**		**N=257**		**N=274**		**N=255**		**N=249**		**N=281**		
Congenital abnormality	<3	s	-	-	<3	s	-	-	<3	s	<3	s	<3	s	<3	s	3	11.76	<3	s	4	14.23	0.093
Extreme prematurity	57	207.27	52	187.73	57	199.30	84	287.67	54	223.14	67	261.72	63	245.14	69	251.82	51	200.00	53	212.85	69	245.55	0.34
Cardio-respiratory disorders	9	32.73	9	32.49	11	38.46	16	54.79	7	28.93	10	39.06	5	19.46	12	43.80	10	39.22	6	24.10	9	32.03	0.57
Infection	6	21.82	9	32.49	5	17.48	7	23.97	7	28.93	10	39.06	5	19.46	7	25.55	<3	s	4	16.06	8	28.47	0.54
Neurological	6	21.82	3	10.83	10	34.97	<3	s	8	33.06	6	23.44	8	31.13	12	43.80	11	43.14	8	32.13	8	28.47	0.040
Gastrointestinal	<3	s	-	-	5	17.48	4	13.70	<3	s	<3	s	<3	s	<3	s	<3	s	3	12.05	4	14.23	0.68
Other	<3	s	3	10.83	3	10.49	-	-	-	-	<3	s	<3	s	<3	s	4	15.69	<3	s	<3	s	0.98
Gestation ≥28 weeks	**N=63,687**		**N=63,718**		**N=63,784**		**N=64,108**		**N=61,996**		**N=61,609**		**N=59,102**		**N=58,938**		**N=58,727**		**N=59,443**		**N=59,107**		
Congenital abnormality	36	0.57	43	0.67	41	0.64	46	0.72	48	0.77	36	0.58	31	0.52	43	0.73	42	0.72	33	0.56	28	0.47	0.39
Extreme prematurity	-	-	-	-	<3	s	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.36
Cardio-respiratory disorders	<3	s	<3	s	-	-	<3	s	4	0.06	4	0.06	<3	s	4	0.07	6	0.10	5	0.08	7	0.12	0.0019
Infection	8	0.13	12	0.19	7	0.11	12	0.19	8	0.13	7	0.11	7	0.12	8	0.14	5	0.09	10	0.17	7	0.12	0.53
Neurological	25	0.39	30	0.47	30	0.47	26	0.41	15	0.24	19	0.31	17	0.29	12	0.20	20	0.34	16	0.27	14	0.24	0.0023
Gastrointestinal	-	-	-	-	3	0.05	<3	s	-	-	<3	s	-	-	<3	s	<3	s	<3	s	-	-	0.76
Other	12	0.19	14	0.22	8	0.13	10	0.16	9	0.15	13	0.21	13	0.22	9	0.15	10	0.17	8	0.13	12	0.20	0.91

's' indicates rate suppressed due to small numbers.

Sources: Numerator: PMMRC's perinatal data extract, neonatal deaths only, 2007–2017; Denominator: MAT births excluding fetal deaths 2007–2017.

Figure 3.3 shows the neonatal mortality rate by prioritised ethnic group (congenital abnormalities excluded). This shows that the burden of mortality for all ethnic groups is in babies born at 20–24 weeks' gestation. By prioritised ethnic group, neonatal mortality rates are statistically significantly higher in babies born to mothers of Indian, Pacific and Māori ethnicities, compared with mothers of New Zealand European ethnicity. Directing more resource into understanding and preventing preterm delivery is needed to reduce these high mortality rates.

Figure 3.3: Neonatal death rates (per 1,000 ongoing pregnancies) by gestation at birth and maternal ethnicity excluding death with congenital abnormalities 2008–2017*



* Unknown/Other ethnicity not represented.

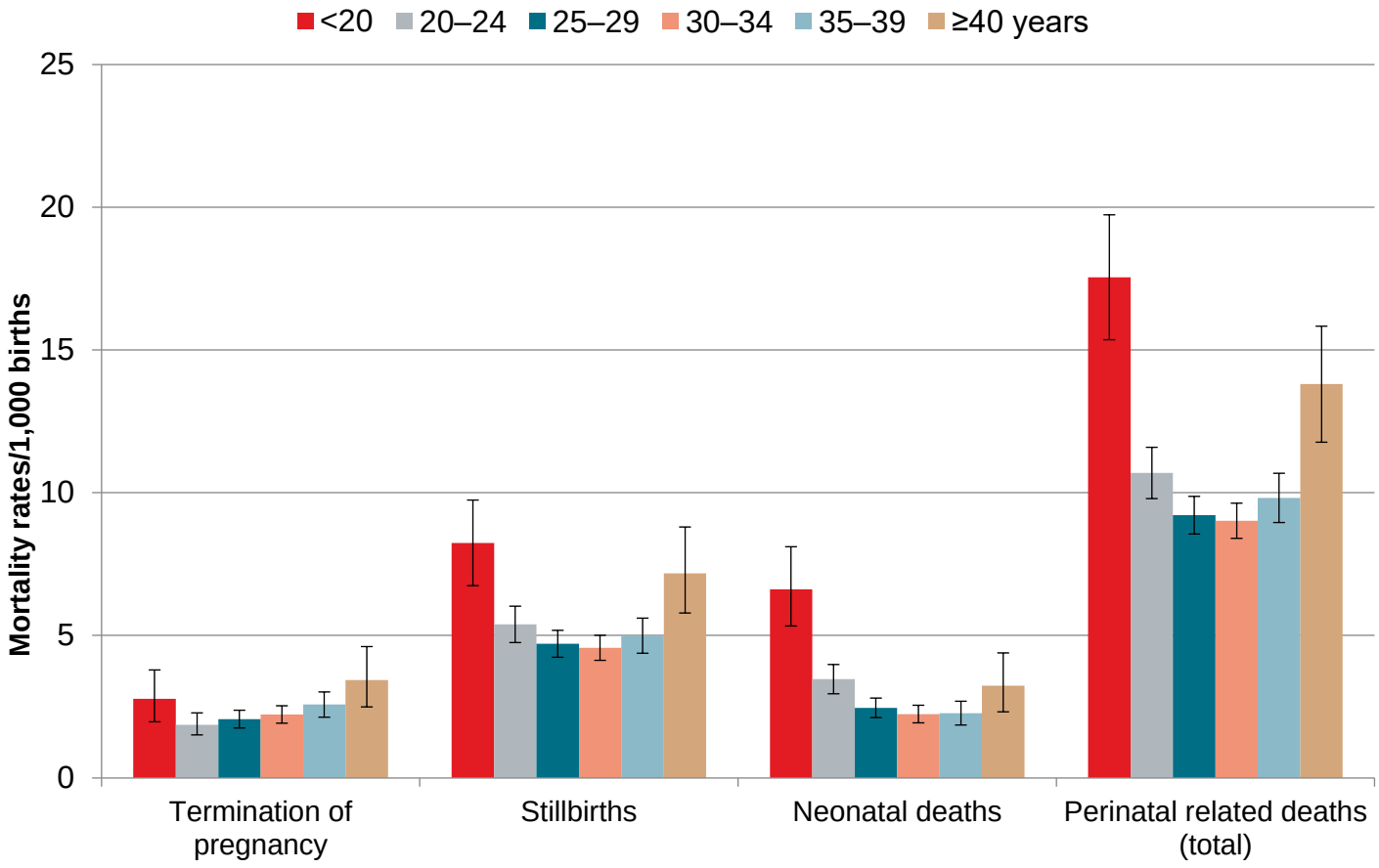
MELAA = Middle Eastern, Latin American, or African.

Sources: Numerator: PMMRC's perinatal data extract excluding congenital abnormalities 2008–2017; Denominator: MAT births 2008–2017.

Maternal age

Perinatal related mortality rates have a U-shaped trend by maternal age, with the highest rates at the extremes of childbearing age. This is particularly evident for stillbirths, with mothers aged under 20 years and 40 years and over having the highest rates of stillbirth. Neonatal deaths were highest in babies of mothers who were under 20 years of age (Figure 3.4 and Table 3.8).

Figure 3.4: Perinatal related mortality rates (per 1,000 births) by maternal age (with 95% confidence intervals (CIs)) 2013–2017



Sources: Numerator: PMMRC's perinatal data extract 2013–2017; Denominator: MAT births 2013–2017.

Table 3.8: Perinatal related mortality rates (per 1,000 births) by maternal age 2013–2017

Maternal age (years)	Total births		Fetal deaths						Neonatal deaths			Perinatal related deaths (total)		
			Termination of pregnancy			Stillbirths								
	N=301,043		n=679			n=1,535			n=824			n=3,038		
	N	%	n	%	Rate	n	%	Rate	n	%	Rate	n	%	Rate
<20	14,077	4.7	39	5.7	2.77	116	7.6	8.24	92	11.2	6.61	247	8.1	17.55
20–24	50,888	16.9	95	14.0	1.87	274	17.9	5.38	175	21.2	3.46	544	17.9	10.69
25–29	81,438	27.1	168	24.7	2.06	383	25.0	4.70	199	24.2	2.46	750	24.7	9.21
30–34	91,189	30.3	203	29.9	2.23	416	27.1	4.56	203	24.6	2.24	822	27.1	9.01
35–39	50,530	16.8	130	19.1	2.57	252	16.4	4.99	114	13.8	2.27	496	16.3	9.82
≥40	12,826	4.3	44	6.5	3.43	92	6.0	7.17	41	5.0	3.23	177	5.8	13.80
Unknown	95	0.0	-	-	-	<3	x	-	-	-	-	<3	x	-

'x' indicates percentage suppressed due to small numbers.

Sources: Numerator: PMMRC's perinatal data extract 2013–2017; Denominator: MAT births 2013–2017.

Over the past 11 years there has been little change in perinatal related mortality rates by maternal age group. There is some evidence of an increase in deaths of babies born to mothers younger than 20 years, and no evidence of any substantial change in any other age group (Table 3.9).

Table 3.9: Perinatal related mortality rates (per 1,000 births) by maternal age and year 2007–2017

Maternal age (years)	2007		2008		2009		2010		2011		2012		2013		2014		2015		2016		2017	
	n	N	n	N	n	N	n	N	n	N	n	N	n	N	n	N	n	N	n	N	n	N
<20	61	5,118	85	5,336	80	4,910	57	4,625	65	4,128	63	3,968	65	3,382	51	3,047	45	2,829	54	2,491	32	2,328
20–24	140	11,371	133	11,868	142	12,086	164	12,258	116	11,939	126	11,697	115	11,007	116	10,477	86	10,137	124	9,776	103	9,491
25–29	161	15,812	153	15,904	169	16,003	162	16,305	147	15,866	149	16,265	139	15,598	165	16,015	150	15,991	143	16,893	153	16,941
30–34	163	18,630	169	18,012	169	17,841	149	18,105	160	17,608	163	17,854	147	17,130	175	17,983	158	18,296	169	18,745	173	19,035
35–39	124	11,778	125	11,977	138	11,765	136	11,396	145	11,028	119	10,676	89	10,317	111	9,940	107	9,976	89	10,199	100	10,098
≥40	31	2,463	35	2,503	32	2,568	40	2,732	34	2,648	50	2,801	45	2,678	40	2,596	32	2,528	30	2,482	30	2,542
Unknown	-	28	<3	23	-	29	-	28	-	25	-	19	-	21	<3	21	-	20	<3	14	-	19

Maternal age (years)	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	Chi-squared test for trend (p)
	Rate	Rate	Rate	Rate	Rate	Rate	Rate	Rate	Rate	Rate	Rate	
<20	11.9	15.9	16.3	12.3	15.7	15.9	19.2	16.7	15.9	21.7	13.7	0.030
20–24	12.3	11.2	11.7	13.4	9.7	10.8	10.4	11.1	8.5	12.7	10.9	0.13
25–29	10.2	9.6	10.6	9.9	9.3	9.2	8.9	10.3	9.4	8.5	9.0	0.088
30–34	8.7	9.4	9.5	8.2	9.1	9.1	8.6	9.7	8.6	9.0	9.1	0.97
35–39	10.5	10.4	11.7	11.9	13.1	11.1	8.6	11.2	10.7	8.7	9.9	0.078
≥40	12.6	14.0	12.5	14.6	12.8	17.9	16.8	15.4	12.7	12.1	11.8	0.83
Unknown	-	-	-	-	-	-	-	-	-	-	-	-

Sources: Numerator: PMMRC's perinatal data extract 2007–2017; Denominator: MAT births 2007–2017.

Spontaneous preterm was the leading cause of perinatal related death in babies born to mothers under 24 years of age. In mothers aged 25–34 years, the leading category of perinatal related death was unexplained antepartum death. However, the rate of unexplained antepartum death was less than that seen in women aged 24 years and less, reflecting the overall lower perinatal related mortality rate in the 25–34-year age group. For mothers aged 35 years and over, the leading classification of death was specific perinatal conditions. Perinatal infection particularly affected mothers under 20 years of age, and hypertension was an uncommon cause of perinatal related death in this age group.

The rate of antepartum haemorrhage was highest in mothers under 20 years of age, and reduced with age until 40 years and over. Deaths due to specific perinatal conditions tended to increase with age. The rates of deaths classified as due to spontaneous preterm and fetal growth restriction were higher in mothers under 20 years of age, compared with other age groups (Table 3.10 and Figure 3.5). See Table 3.11 for further information on women under 20 years of age who were pregnant, and Table 3.12 for information about perinatal related deaths in this age group.

Table 3.10: Perinatal death classification (PSANZ-PDC) specific perinatal related mortality rates (excluding congenital abnormalities) by maternal age 2013–2017

Perinatal death classification (PSANZ-PDC)	Maternal age (years)														
	<20			20–24			25–34			35–39			≥40		
	N=14,026			N=50,768			N=172,204			N=50,369			N=12,751		
	n	%	Rate	n	%	Rate	n	%	Rate	n	%	Rate	n	%	Rate
Perinatal infection	17	8.8	1.21	23	5.5	0.45	63	5.5	0.37	16	4.8	0.32	<3	x	s
Hypertension	<3	x	s	17	4.0	0.33	37	3.2	0.21	8	2.4	0.16	6	5.8	0.47
Antepartum haemorrhage	31	16.0	2.21	70	16.6	1.38	205	18.0	1.19	49	14.8	0.97	18	17.5	1.41
Maternal conditions	17	8.8	1.21	36	8.6	0.71	73	6.4	0.42	22	6.6	0.44	11	10.7	0.86
Specific perinatal condition	10	5.2	0.71	50	11.9	0.98	168	14.7	0.98	74	22.4	1.47	23	22.3	1.80
Hypoxic peripartum death	5	2.6	0.36	12	2.9	0.24	40	3.5	0.23	13	3.9	0.26	<3	x	s
Fetal growth restriction	21	10.8	1.50	30	7.1	0.59	107	9.4	0.62	32	9.7	0.64	8	7.8	0.63
Spontaneous preterm*	58	29.9	4.14	89	21.1	1.75	188	16.5	1.09	50	15.1	0.99	14	13.6	1.10
Unexplained antepartum death*	30	15.5	2.14	82	19.5	1.62	245	21.5	1.42	64	19.3	1.27	20	19.4	1.57
No obstetric antecedent	4	2.1	0.29	12	2.9	0.24	14	1.2	0.08	3	0.9	0.06	<3	x	s

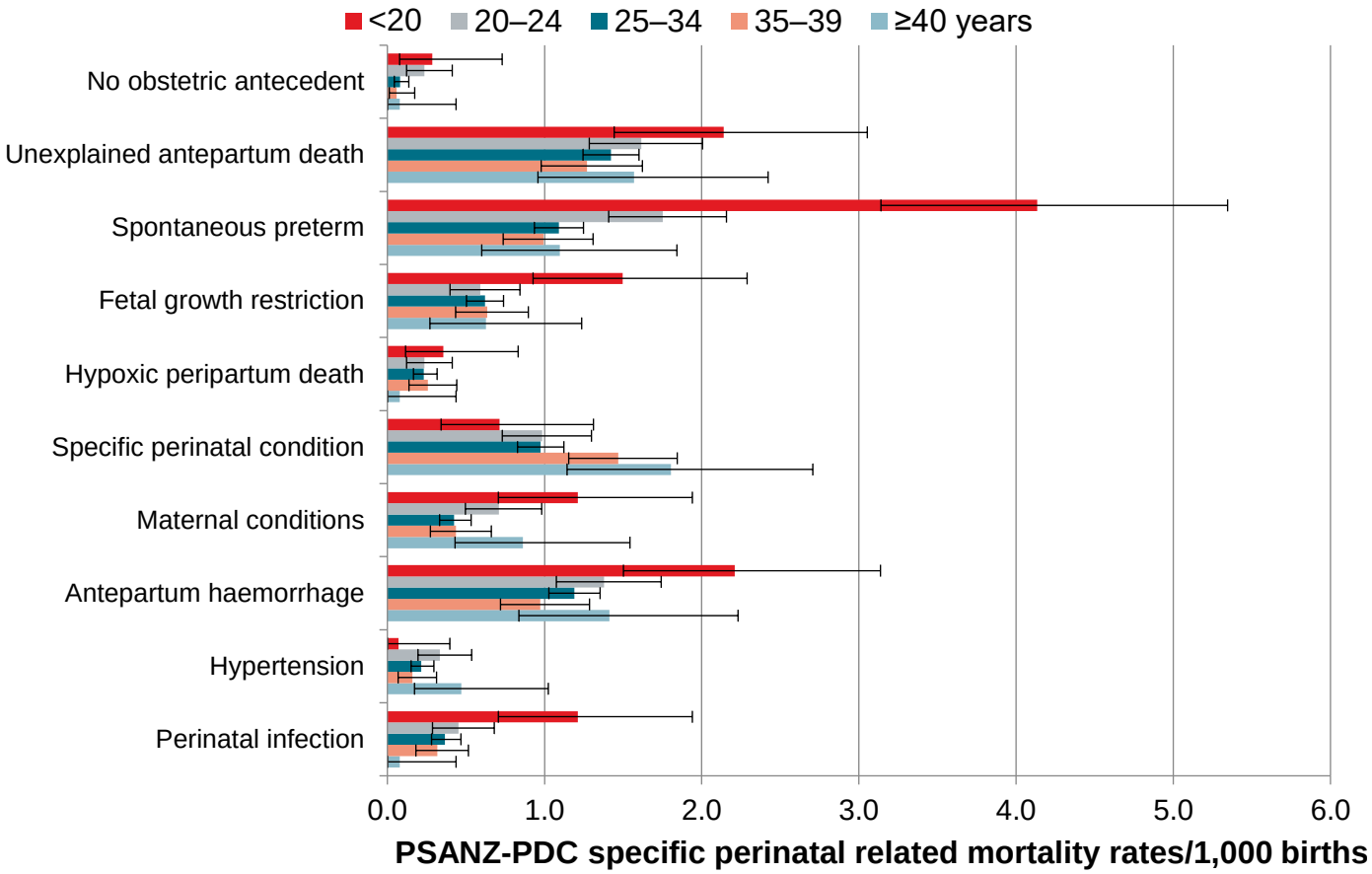
* Excludes two babies where maternal age was unknown.

'x' indicates percentage not calculated due to small numbers.

's' indicates rate not calculated due to small numbers.

Sources: Numerator: PMMRC's perinatal data extract (excluding congenital abnormalities) 2013–2017; Denominator: MAT births 2013–2017.

Figure 3.5: Perinatal death classification (PSANZ-PDC) specific perinatal related mortality rates (excluding congenital abnormalities) by maternal age (with 95% CIs) 2013–2017



Sources: Numerator: PMMRC's perinatal data extract (excluding congenital abnormalities) 2013–2017; Denominator: MAT births 2013–2017.

Mothers under 20 years of age

Of mothers under 20 years of age, over 40% were 19 years of age. There were relatively few women living in the least deprived areas, with the highest proportion living in New Zealand Index of Deprivation 2013 (NZDep2013) quintile 5 (Table 3.11).

Table 3.11: Demographic and other characteristics of all births of mothers under 20 years of age by time period (2008–2012 and 2013–2017)

	2008–2012 N=22,967		2013–2017 N=14,077		2008–2017 N=37,044	
	N	%	N	%	N	%
Age (years)						
<16	764	3.3	471	3.3	1,235	3.3
16	1,956	8.5	1,114	7.9	3,070	8.3
17	4,188	18.2	2,308	16.4	6,496	17.5
18	6,740	29.3	4,040	28.7	10,780	29.1
19	9,319	40.6	6,144	43.6	15,463	41.7
NZDep2013 quintile						
1 (least deprived)	1,181	5.1	644	4.6	1,825	4.9
2	1,884	8.2	1,070	7.6	2,954	8.0
3	3,222	14.0	1,729	12.3	4,951	13.4
4	5,841	25.4	3,363	23.9	9,204	24.8
5 (most deprived)	10,576	46.0	7,151	50.8	17,727	47.9
Missing	263	1.1	120	0.9	383	1.0

Prioritised ethnic group (mother)						
Māori	13,167	57.3	8,483	60.3	21,650	58.4
Pacific peoples	3,064	13.3	1,933	13.7	4,997	13.5
Asian	353	1.5	218	1.5	571	1.5
Indian	107	0.5	60	0.4	167	0.5
Other Asian	246	1.1	158	1.1	404	1.1
MELAA	168	0.7	121	0.9	289	0.8
European	6,204	27.0	3,318	23.6	9,522	25.7
NZ European	5,634	24.5	3,001	21.3	8,635	23.3
Other European	570	2.5	317	2.3	887	2.4
Unknown	11	0.0	4	0.0	15	0.0
Limited to LMC*	**N=18,072**		**N=12,396**		**N=30,468**	
Smoking at registration with LMC						
Yes	6,570	36.4	4,266	34.4	10,836	35.6
No	11,497	63.6	8,130	65.6	19,627	64.4
Missing	5	0.0	-	-	5	0.0
BMI at registration						
<18.50	746	4.1	463	3.7	1,209	4.0
18.50–24.99	9,576	53.0	5,846	47.2	15,422	50.6
25.00–29.99	4,863	26.9	3,497	28.2	8,360	27.4
30.00–34.99	1,972	10.9	1,728	13.9	3,700	12.1
35.00–39.99	630	3.5	601	4.8	1,231	4.0
≥40.00	229	1.3	239	1.9	468	1.5
Unknown	56	0.3	22	0.2	78	0.3
First registration with LMC						
First	7,184	39.8	6,349	51.2	13,533	44.4
Second	9,391	52.0	5,126	41.4	14,517	47.6
Third	1,392	7.7	838	6.8	2,230	7.3
Postpartum	104	0.6	83	0.7	187	0.6
Missing	<3	x	-	-	<3	x

* All data limited to mothers who were registered for care with an LMC (either a midwife, obstetrician or GP) claiming from the Section 88 Primary Maternity Services Notice.

BMI = body mass index.

MELAA = Middle Eastern, Latin American, or African.

LMC = lead maternity carer.

'x' indicates percentage not calculated due to small numbers.

Source: MAT births of babies of mothers <20 years of age 2008–2017.

Of mothers under 20 years of age, 58% were Māori, and overall 65% did not smoke. Half of the mothers had a BMI in the normal range. Ninety-nine percent of the mothers registered with an LMC during their pregnancy. Of the mothers under 20 years of age who were recorded as having registered with an LMC during their pregnancy (between 2008 and 2017), 44% did so in their first trimester. However, because these data are limited to mothers who registered with a midwife, obstetrician or GP LMC, the actual percentages may be lower than this (Table 3.11).

For babies of mothers under 20 years of age, the stillbirth rate was 1.5 times higher than for mothers aged 20 years and over (7.42 per 1,000 births compared with 4.95 per 1,000 births respectively), and the neonatal mortality rate was two times higher (rate 5.4 per 1,000 births compared with 2.58 per 1,000 births). The rate for termination of pregnancy was similar between the two groups (Table 3.12).

Table 3.12: Perinatal death classification (PSANZ-PDC) among babies of mothers <20 years of age and those ≥20 years of age, 2008–2017

Perinatal death classification (PSANZ-PDC)	2008–2017			
	Mothers <20 years old		Mothers ≥20 years old	
	N=37,044		N=586,576	
	n	Rate	n	Rate
Termination of pregnancy (/1,000 births)	96	2.59	1,301	2.22
Stillbirth (/1,000 births)	275	7.42	2,905	4.95
Neonatal death (/1,000 live births)	198	5.34	1,514	2.58
Perinatal death classification (PSANZ-PDC)				
Congenital abnormality	133	3.59	1,632	2.78
Perinatal infection	32	0.86	202	0.34
Hypertension	<3	s	181	0.31
Antepartum haemorrhage	68	1.84	647	1.10
Maternal conditions	29	0.78	254	0.43
Specific perinatal conditions	35	0.94	640	1.09
Hypoxic peripartum death	17	0.46	172	0.29
Fetal growth restriction	46	1.24	397	0.68
Spontaneous preterm birth	126	3.40	743	1.27
Unexplained antepartum death	69	1.86	790	1.35
No obstetric antecedent	12	0.32	62	0.11

's' indicates rate suppressed due to small numbers.

Sources: Numerator: PMMRC's perinatal data extract, where matched to MAT data 2008–2017; Denominator: MAT births 2008–2017.

The 12th report of the PMMRC showed that mothers under 20 years of age had higher risk of perinatal related death (excluding from congenital abnormalities) from spontaneous preterm birth, fetal growth restriction, antepartum haemorrhage, and perinatal infection than any other age group.[14] World-wide, mothers who are pregnant under 20 years of age are viewed as a high-risk group.[15,16] However, there is little strengths-based research involving this group to evaluate their perspectives and develop antenatal care pathways that meet their needs. In Aotearoa/New Zealand, a research study called E Hine was conducted to explore the lived realities of 44 Māori mothers under 20 years of age who were pregnant, and their babies. The study found that mothers in the study generally did not have a delay in diagnosing pregnancy, particularly those who were already engaged with a health service provider, such as a school-based health clinic or youth health provider. However, the research demonstrated that fragmentation of service delivery and poor communication around finding a midwife made accessing antenatal care difficult. This was further complicated by a lack of available midwives in their area for some mothers. Participants were more likely to experience continuous care in their pregnancy when the first health professional they saw ensured that their ongoing needs, particularly in terms of finding an antenatal care provider, were met. This research highlighted the fragmentation between primary non-LMC services and LMC services, which is negatively impacting on women's access to antenatal care.[17]

[14] PMMRC. 2018. *Twelfth Annual Report of the Perinatal and Maternal Mortality Review Committee: Reporting mortality 2016*. URL: https://www.hqsc.govt.nz/assets/PMMRC/Publications/12th-PMMRC-report-final.pdf (accessed 14 August 2019), p 100.

[15] Solivan AE, Wallace ME, Kaplan KC, et al. 2015. Use of a resiliency framework to examine pregnancy and birth outcomes among adolescents: A qualitative study. *Families, Systems and Health* 33(4): 349–55.

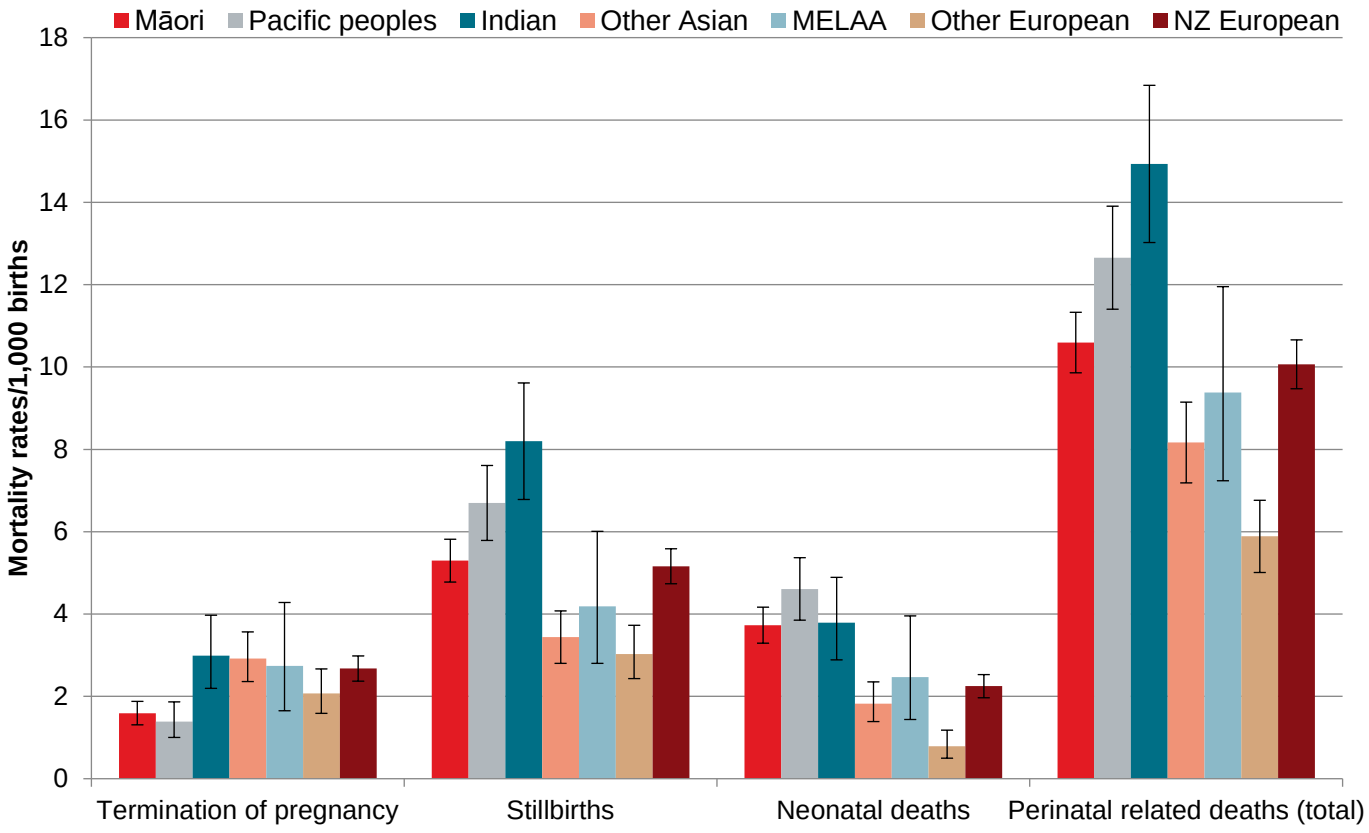
[16] Chen XK, Wen SW, Fleming N, et al. 2007. Teenage pregnancy and adverse birth outcomes: A large population based retrospective cohort study. *International Journal of Epidemiology* 36: 368–73.

[17] Makowharemahihi C, Lawton B, Cram F et al. 2014. Initiation of maternity care for young Māori women under 20 years of age. *New Zealand Medical Journal* 127(1393): 52–61.

Perinatal related mortality by prioritised ethnic group

There were significant differences in perinatal related mortality by both maternal (Figure 3.6 and Table 3.13) and baby (Figure 3.7 and Table 3.14) prioritised ethnic group. These patterns were the same, regardless of whether mother or baby prioritised ethnic group was used.

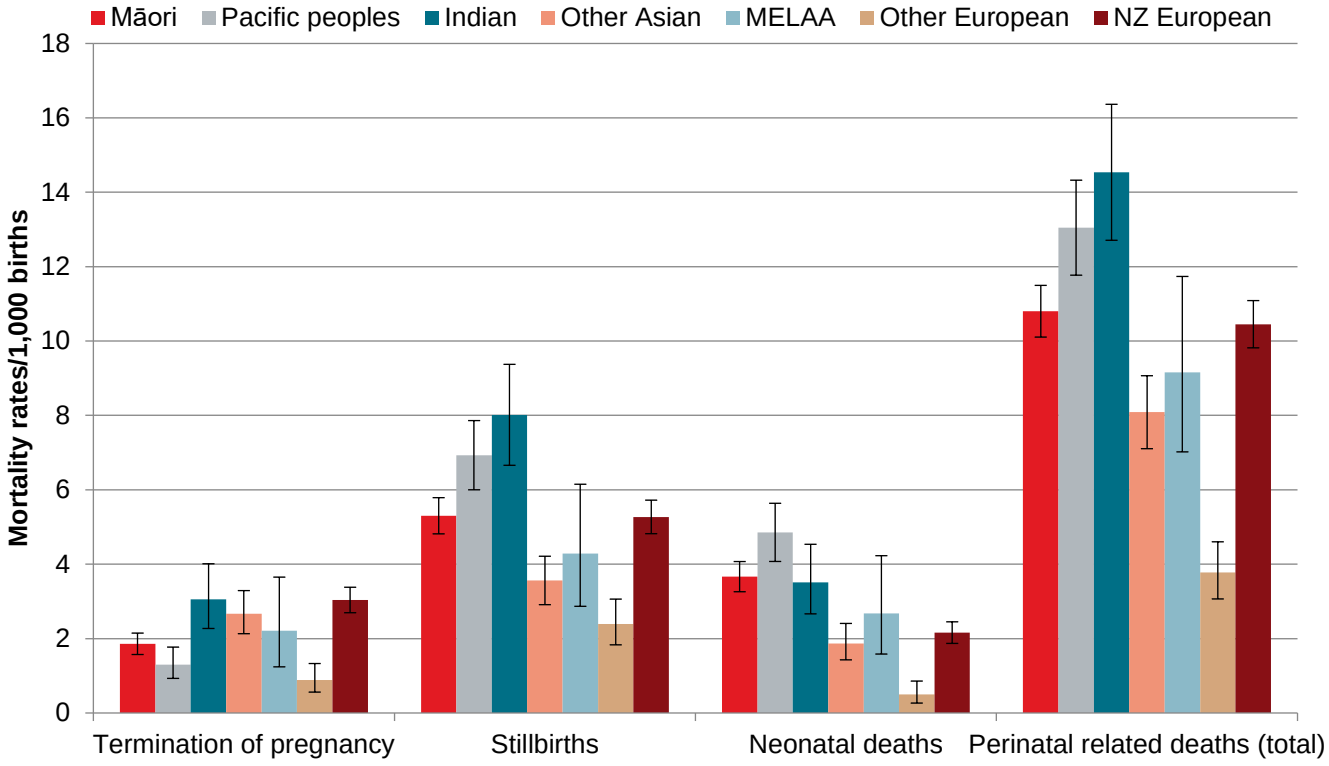
Figure 3.6: Perinatal related mortality rates (per 1,000 births) by maternal prioritised ethnic group (with 95% CIs) 2013–2017



MELAA = Middle Eastern, Latin American, or African.

Sources: Numerator: PMMRC's perinatal data extract 2013–2017; Denominator: MAT births 2013–2017.

Figure 3.7: Perinatal related mortality rates (per 1,000 births) by baby prioritised ethnic group (with 95% CIs) 2013–2017



MELAA = Middle Eastern, Latin American, or African.

Sources: Numerator: PMMRC's perinatal data extract 2013–2017; Denominator: MAT births 2013–2017.

Table 3.13: Perinatal related mortality rates (per 1,000 births) by maternal prioritised ethnic group 2013–2017

Prioritised ethnic group (mother)	Total births		Fetal deaths						Neonatal deaths			Perinatal related deaths (total)		
			Termination of pregnancy			Stillbirths								
	N=301,043*		n=679			n=1,535			n=824			n=3,038		
	n	%	n	%	Rate	n	%	Rate	n	%	Rate	n	%	Rate
Māori	75,328	25.0	120	17.7	1.59	399	26.0	5.30	279	33.9	3.73	798	26.3	10.59
Pacific peoples	31,055	10.3	43	6.3	1.38	208	13.6	6.70	142	17.2	4.61	393	12.9	12.65
Asian	48,313	16.0	142	20.9	2.94	241	15.7	4.99	118	14.3	2.46	501	16.5	10.37
Indian	15,738	5.2	47	6.9	2.99	129	8.4	8.20	59	7.2	3.79	235	7.7	14.93
Other Asian	32,575	10.8	95	14.0	2.92	112	7.3	3.44	59	7.2	1.82	266	8.8	8.17
MELAA	6,932	2.3	19	2.8	2.74	29	1.9	4.18	17	2.1	2.47	65	2.1	9.38
European	139,281	46.3	355	52.3	2.55	656	42.7	4.71	268	32.5	1.94	1,279	42.1	9.18
NZ European	109,887	36.5	294	43.3	2.68	567	36.9	5.16	245	29.7	2.25	1,106	36.4	10.06
Other European	29,394	9.8	61	9.0	2.08	89	5.8	3.03	23	2.8	0.79	173	5.7	5.89

* Includes 134 unknown maternal ethnicity among total births and 2 unknown maternal ethnicity perinatal related deaths (total).

MELAA = Middle Eastern, Latin American, or African.

Sources: Numerator: PMMRC's perinatal data extract 2013–2017; Denominator: MAT births 2013–2017.

Table 3.14: Perinatal related mortality rates (per 1,000 births) by baby prioritised ethnic group 2013–2017

Prioritised ethnic group (baby)	Total births		Fetal deaths						Neonatal deaths			Perinatal related deaths (total)		
			Termination of pregnancy			Stillbirths								
	N=301,043*		n=679			n=1,535			n=824			n=3,038		
	n	%	n	%	Rate	n	%	Rate	n	%	Rate	n	%	Rate
Māori	86,006	28.6	160	23.6	1.86	456	29.7	5.30	313	38.0	3.67	929	30.6	10.80
Pacific peoples	30,732	10.2	40	5.9	1.30	213	13.9	6.93	148	18.0	4.86	401	13.2	13.05
Asian	48,993	16.3	137	20.2	2.80	249	16.2	5.08	118	14.3	2.43	504	16.6	10.29
Indian	16,716	5.6	51	7.5	3.05	134	8.7	8.02	58	7.0	3.51	243	8.0	14.54
Other Asian	32,277	10.7	86	12.7	2.66	115	7.5	3.56	60	7.3	1.87	261	8.6	8.09
MELAA	6,772	2.2	15	2.2	2.22	29	1.9	4.28	18	2.2	2.68	62	2.0	9.16
European	125,362	41.6	325	47.9	2.59	586	38.2	4.67	226	27.4	1.82	1,137	37.4	9.07
NZ European	99,406	33.0	302	44.5	3.04	524	34.1	5.27	213	25.8	2.16	1,039	34.2	10.45
Other European	25,956	8.6	23	3.4	0.89	62	4.0	2.39	13	1.6	0.50	98	3.2	3.78

* Includes 3,178 unknown baby's ethnicity total births and 5 unknown baby's ethnicity perinatal related deaths (total).

MELAA = Middle Eastern, Latin American, or African.

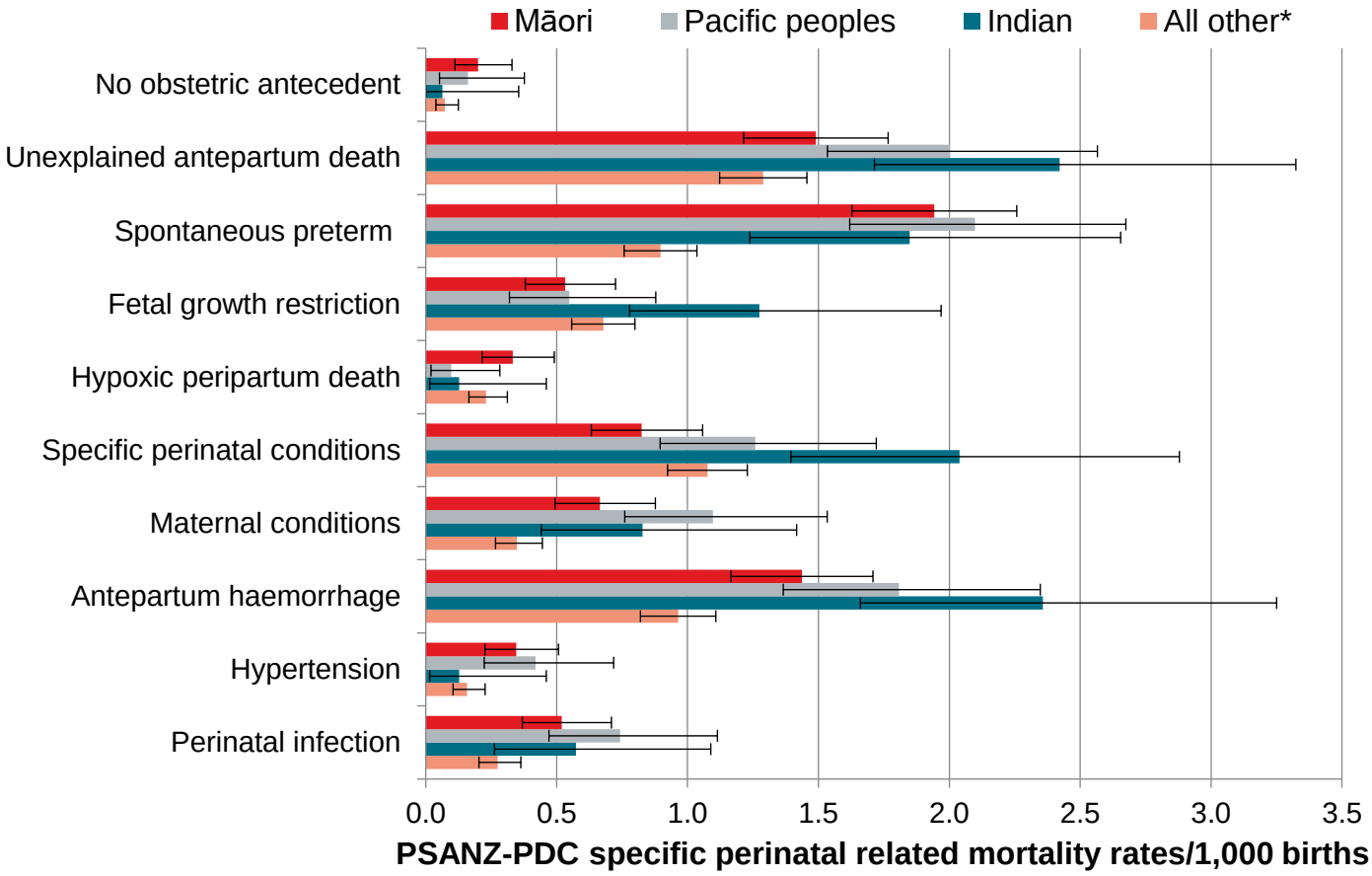
Sources: Numerator: PMMRC's perinatal data extract 2013–2017; Denominator: MAT births 2013–2017.

There was significant variation in the classification of perinatal death by prioritised ethnic group. For deaths due to spontaneous preterm delivery, maternal conditions and antepartum haemorrhage, mortality rates were statistically significantly higher in Indian, Pacific and Māori women, compared with all others ('Other Asian', MELAA, and all European). For unexplained antepartum death, rates were statistically significantly higher in Indian and Pacific mothers than others. There was no significant difference in mortality rates by prioritised ethnic category for deaths due to fetal growth restriction, hypoxic peripartum death, hypertension, and deaths where no obstetric antecedent was identified. Deaths due to perinatal infection were statistically significantly higher in babies of Pacific and Māori mothers than babies of 'Other' mothers (Figure 3.8).

While there is year-to-year variation in perinatal related mortality, there has been little change for most ethnic groups in the past 11 years. There was strong evidence that mortality rates have decreased in babies of New Zealand European mothers – however, there was no change for other ethnic groups. Mortality rates alone do not provide a complete picture of the burden of mortality in specific communities. For communities with high fertility rates, such as Pacific and Māori communities,[18] the burden of perinatal deaths is greater than in communities with lower fertility rates. Therefore, these deaths have a greater impact in the community (Table 3.15).

[18] Statistics New Zealand. 2016. National ethnic population projections. URL: http://archive.stats.govt.nz/browse_for_stats/population/estimates_and_projections/projections-overview/nat-ethnic-pop-proj.aspx (accessed 8 August 2019).

Figure 3.8: Perinatal death classification (PSANZ-PDC) specific perinatal related mortality rates (per 1,000 births) (excluding congenital abnormalities) by maternal prioritised ethnic category (with 95% CIs) 2013–2017



* 'All other' includes Other Asian, Middle Eastern, Latin American, or African (MELAA), Other European, New Zealand European, Unknown/Other.

Sources: Numerator: PMMRC's perinatal data extract (excluding congenital abnormalities) 2013–2017; Denominator: MAT births 2013–2017.

Table 3.15: Perinatal related mortality rates (per 1,000 births) by maternal prioritised ethnic group* and year 2007–2017

Maternal ethnic group	2007		2008		2009		2010		2011		2012		2013		2014		2015		2016		2017	
	n	N	n	N	n	N	n	N	n	N	n	N	n	N	n	N	n	N	n	N	n	N
Māori	179	17,053	170	17,254	209	17,096	193	16,973	176	16,414	163	16,273	156	15,141	166	14,791	143	15,016	181	15,252	152	15,128
Pacific peoples	87	8,007	98	7,843	106	7,568	109	7,650	79	7,250	94	7,069	84	6,526	83	6,294	71	6,179	74	5,969	81	6,087
Asian	61	5,953	69	6,116	75	6,414	88	7,035	86	7,250	100	8,596	83	8,247	95	9,359	96	9,332	106	10,669	121	10,706
Indian	25	1,838	30	1,921	33	1,936	34	2,088	35	2,169	38	2,378	37	2,458	45	2,776	43	3,126	52	3,506	58	3,872
Other Asian	36	4,115	39	4,195	42	4,478	54	4,947	51	5,081	62	6,218	46	5,789	50	6,583	53	6,206	54	7,163	63	6,834
MELAA	17	1,032	12	1,133	12	1,211	5	1,325	13	1,316	16	1,268	10	1,312	15	1,303	15	1,358	8	1,392	17	1,567
European	336	33,113	352	33,216	328	32,866	312	32,424	313	30,958	297	30,034	267	28,873	299	28,290	253	27,871	240	27,296	220	26,951
NZ European	300	27,087	312	27,000	292	26,647	271	26,228	263	24,943	250	24,155	230	22,990	262	22,389	224	21,997	208	21,480	182	21,031
Other European	36	6,026	40	6,216	36	6,219	41	6,196	50	6,015	47	5,879	37	5,883	37	5,901	29	5,874	32	5,816	38	5,920

Maternal ethnic group	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	Chi-squared test for trend (p)
	Rate	Rate	Rate	Rate	Rate	Rate	Rate	Rate	Rate	Rate	Rate	
Māori	10.5	9.9	12.2	11.4	10.7	10.0	10.3	11.2	9.5	11.9	10.0	0.73
Pacific peoples	10.9	12.5	14.0	14.2	10.9	13.3	12.9	13.2	11.5	12.4	13.3	0.73
Asian	10.2	11.3	11.7	12.5	11.9	11.6	10.1	10.2	10.3	9.9	11.3	0.33
Indian	13.6	15.6	17.0	16.3	16.1	16.0	15.1	16.2	13.8	14.8	15.0	0.69
Other Asian	8.7	9.3	9.4	10.9	10.0	10.0	7.9	7.6	8.5	7.5	9.2	0.19
MELAA	16.5	10.6	9.9	3.8	9.9	12.6	7.6	11.5	11.0	5.7	10.8	0.41
European	10.1	10.6	10.0	9.6	10.1	9.9	9.2	10.6	9.1	8.8	8.2	0.002
NZ European	11.1	11.6	11.0	10.3	10.5	10.3	10.0	11.7	10.2	9.7	8.7	0.005
Other European	6.0	6.4	5.8	6.6	8.3	8.0	6.3	6.3	4.9	5.5	6.4	0.55

* Excludes 420 unknown maternal ethnicity total births and 2 unknown maternal ethnicity perinatal related deaths (total).

MELAA = Middle Eastern, Latin American, or African.

Sources: Numerator: PMMRC's perinatal data extract 2007–2017; Denominator: MAT births 2007–2017.

Unexplained antepartum death was a leading classification of cause of death regardless of maternal prioritised ethnic group. However, other leading causes varied by ethnic group. For babies of Māori and Pacific mothers, spontaneous preterm births were the leading cause. For babies of Indian mothers, antepartum haemorrhage was a frequent cause of death. For babies of mothers in the MELAA, New Zealand European and Other European prioritised ethnic groups, specific perinatal conditions were a leading cause of death (Table 3.16).

Table 3.16: Perinatal death classification (PSANZ-PDC) specific perinatal related mortality rates (excluding congenital abnormalities) by maternal prioritised ethnic group* 2013–2017

Perinatal death classification (PSANZ-PDC)	Māori n=75,150			Pacific peoples n=30,976			Asian								
							Indian n=15,690			Other Asian n=32,477			Total Asian n=48,167		
	n	%	Rate	n	%	Rate	n	%	Rate	n	%	Rate	n	%	Rate
Perinatal infection	39	6.3	0.52	23	7.3	0.74	9	4.9	0.57	9	5.6	0.28	18	5.2	0.37
Hypertension	26	4.2	0.35	13	4.1	0.42	<3	x	s	4	2.5	0.12	6	1.7	0.12
Antepartum haemorrhage	108	17.3	1.44	56	17.7	1.81	37	20.2	2.36	30	18.8	0.92	67	19.5	1.39
Maternal conditions	50	8.0	0.67	34	10.7	1.10	13	7.1	0.83	8	5.0	0.25	21	6.1	0.44
Specific perinatal conditions	62	10.0	0.83	39	12.3	1.26	32	17.5	2.04	21	13.1	0.65	53	15.5	1.10
Hypoxic peripartum death	25	4.0	0.33	3	0.9	0.10	<3	x	s	<3	x	s	4	1.2	0.08
Fetal growth restriction	40	6.4	0.53	17	5.4	0.55	20	10.9	1.27	17	10.6	0.52	37	10.8	0.77
Spontaneous preterm	146	23.4	1.94	65	20.5	2.10	29	15.8	1.85	23	14.4	0.71	52	15.2	1.08
Unexplained antepartum death	112	18.0	1.49	62	19.6	2.00	38	20.8	2.42	44	27.5	1.35	82	23.9	1.70
No obstetric antecedent	15	2.4	0.20	5	1.6	0.16	<3	x	s	<3	x	s	3	0.9	0.06

Perinatal death classification (PSANZ-PDC)	MELAA n=6,906			European								
				NZ European n=109,574			Other European n=29,306			Total European n=138,880		
	n	%	Rate	n	%	Rate	n	%	Rate	n	%	Rate
Perinatal infection	<3	x	s	32	4.2	0.29	7	6.9	0.24	39	4.5	0.28
Hypertension	<3	x	s	21	2.8	0.19	<3	x	s	22	2.5	0.16
Antepartum haemorrhage	7	16.7	1.01	120	15.7	1.10	15	14.7	0.51	135	15.6	0.97
Maternal conditions	3	7.1	0.43	46	6.0	0.42	5	4.9	0.17	51	5.9	0.37
Specific perinatal conditions	10	23.8	1.45	137	18.0	1.25	24	23.5	0.82	161	18.6	1.16
Hypoxic peripartum death	3	7.1	0.43	34	4.5	0.31	<3	x	s	36	4.2	0.26
Fetal growth restriction	-	-	-	93	12.2	0.85	11	10.8	0.38	104	12.0	0.75
Spontaneous preterm	6	14.3	0.87	118	15.5	1.08	12	11.8	0.41	130	15.0	0.94
Unexplained antepartum death	10	23.8	1.45	150	19.7	1.37	25	24.5	0.85	175	20.3	1.26
No obstetric antecedent	-	-	-	11	1.4	0.10	-	-	-	11	1.3	0.08

* Excludes 134 unknown maternal ethnicity among total births (denominator) and 2 unknown maternal ethnicity perinatal related deaths (total) (numerator).

'x' indicates percentage suppressed due to small numbers.

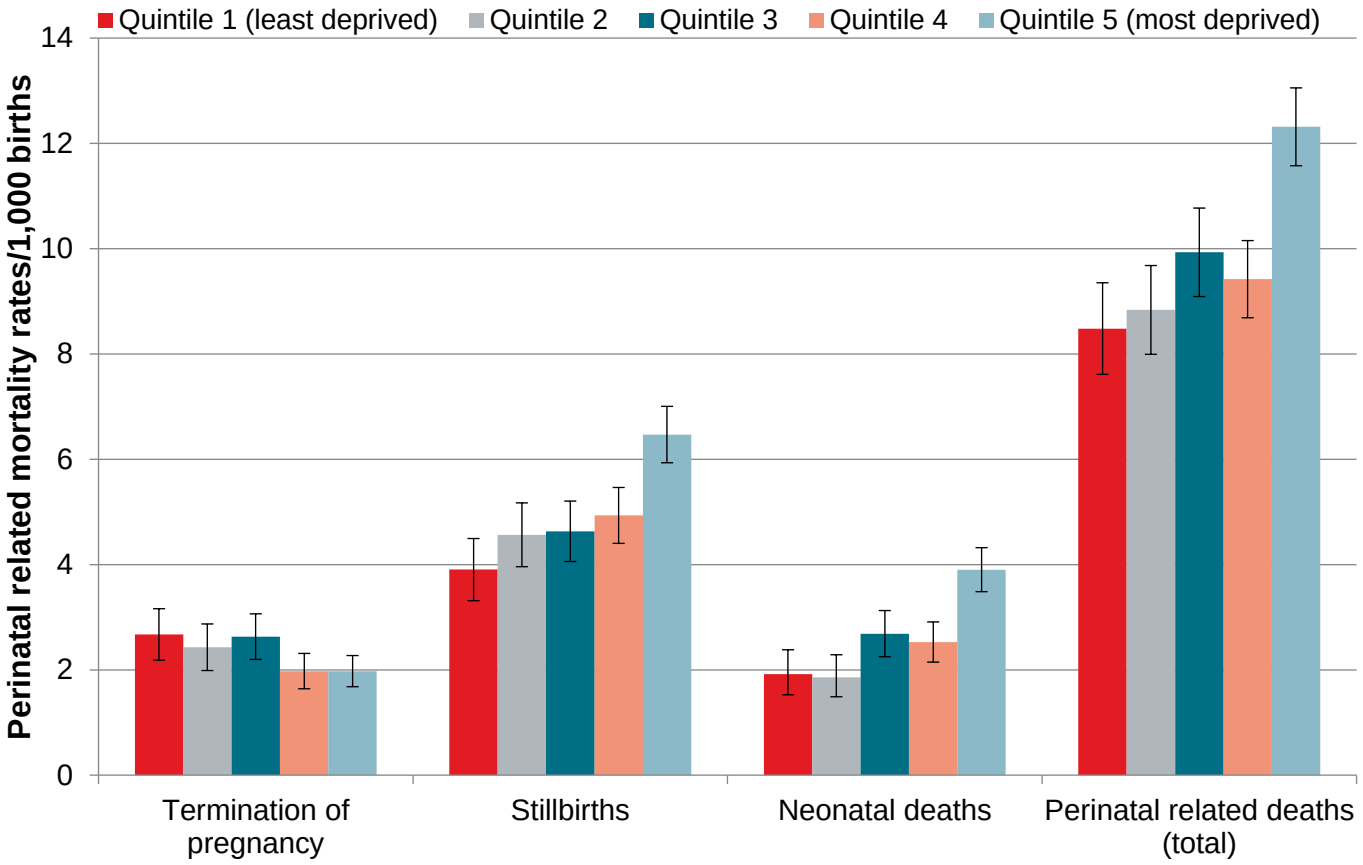
's' indicates rate suppressed due to small numbers.

Sources: Numerator: PMMRC's perinatal data extract (excluding congenital abnormalities) 2013–2017; Denominator: MAT births 2013–2017.

Socioeconomic deprivation

Perinatal related mortality varied significantly by New Zealand Index of Deprivation 2013 (NZDep2013) quintile, with babies of mothers living in quintile 5 (most deprived areas) having statistically significantly higher mortality rates than all others, with the exception of termination of pregnancy (Figure 3.9 and Table 3.17). There was a statistically significantly lower rate of termination of pregnancy in women residing in NZDep2013 quintiles 4 and 5, compared with quintile 1. However, the rate of stillbirth was significantly increased in women residing in NZDep2013 quintiles 4 and 5, compared with quintile 1. The rate of neonatal death was statistically significantly higher in babies of women living in quintiles 3, 4 and 5, compared with quintile 1.

Figure 3.9: Perinatal related mortality rates (per 1,000 births) by NZDep2013 quintile (with 95% CIs) 2013–2017



Sources: Numerator: PMMRC's perinatal data extract 2013–2017; Denominator: MAT births 2013–2017.

Table 3.17: Perinatal related mortality rates (per 1,000 births) by NZDep2013 quintile 2013–2017

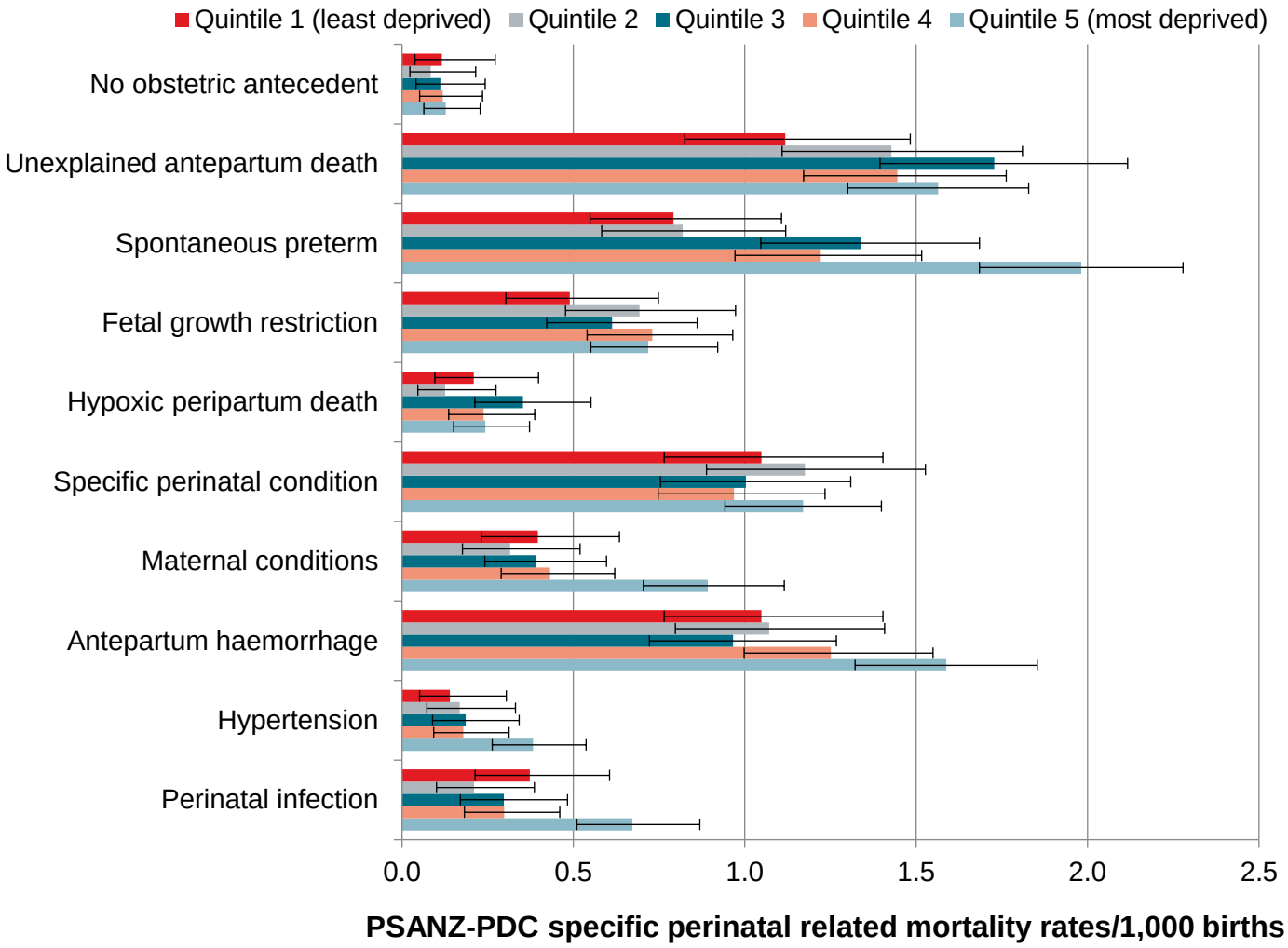
NZDep2013 quintile	Total births		Fetal deaths						Neonatal deaths			Perinatal related deaths (total)		
			Termination of pregnancy			Stillbirths								
	n=301,043		n=679			n=1,535			n=824			n=3,038		
	N	%	n	%	Rate	n	%	Rate	n	%	Rate	n	%	Rate
1 (least deprived)	43,032	14.3	115	16.9	2.67	168	10.9	3.90	82	10.0	1.92	365	12.0	8.48
2	47,755	15.9	116	17.1	2.43	218	14.2	4.56	88	10.7	1.86	422	13.9	8.84
3	53,971	17.9	142	20.9	2.63	250	16.3	4.63	144	17.5	2.69	536	17.6	9.93
4	67,300	22.4	133	19.6	1.98	332	21.6	4.93	169	20.5	2.53	634	20.9	9.42
5 (most deprived)	86,565	28.8	171	25.2	1.98	560	36.5	6.47	335	40.7	3.90	1,066	35.1	12.31
Unknown	2,420	0.8	<3	x	-	7	0.5	-	6	0.7	-	15	0.5	-

'x' indicates percentage not calculated due to small numbers.

Sources: Numerator: PMMRC's perinatal data extract 2013–2017; Denominator: MAT births 2013–2017.

This variation in mortality rates by deprivation was most marked for deaths due to spontaneous preterm delivery, with mortality rates increasing with increasing deprivation. There was little significant variation by deprivation for other causes of death (Figure 3.10 and Table 3.19). This pattern has been stable over time, with no significant changes in mortality rates by deprivation for the 11-year study period (Table 3.18).

Figure 3.10: Perinatal death classification (PSANZ-PDC) specific perinatal related mortality rates (per 1,000 births) (excluding congenital abnormalities) by NZDep2013 quintile (with 95% CIs) 2013–2017



Sources: Numerator: PMMRC's perinatal data extract (excluding congenital abnormalities) 2013–2017; Denominator: MAT births 2013–2017.

Table 3.18: Perinatal related mortality rates (per 1,000 births) by NZDep2013 quintile and year 2007–2017

NZDep2013 quintile	2007		2008		2009		2010		2011		2012		2013		2014		2015		2016		2017	
	n	N	n	N	n	N	n	N	n	N	n	N	n	N	n	N	n	N	n	N	n	N
1 (least deprived)	72	9,124	98	8,783	76	9,105	80	9,028	103	8,833	80	8,969	59	8,321	93	8,600	74	8,370	69	8,821	70	8,920
2	94	9,571	88	9,553	106	9,540	104	9,773	99	9,549	89	9,540	78	9,384	77	9,331	83	9,479	91	9,800	93	9,761
3	131	11,414	134	12,051	120	12,101	117	12,162	116	11,689	106	11,773	126	10,799	118	10,702	90	10,733	99	10,859	103	10,878
4	171	15,619	142	15,395	178	15,168	155	15,200	152	14,794	141	14,717	114	13,575	138	13,464	138	13,437	126	13,460	118	13,364
5 (most deprived)	210	18,801	236	19,117	249	18,595	251	18,645	195	17,780	253	17,751	220	17,570	229	17,446	189	17,257	223	17,188	205	17,104
Unknown	<3	671	3	724	<3	693	<3	641	<3	597	<3	530	3	484	4	536	4	501	<3	472	<3	427

NZDep2013 quintile	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	Chi-squared test for trend (p)
	Rate	Rate	Rate	Rate	Rate	Rate	Rate	Rate	Rate	Rate	Rate	
1 (least deprived)	7.9	11.2	8.3	8.9	11.7	8.9	7.1	10.8	8.8	7.8	7.8	0.24
2	9.8	9.2	11.1	10.6	10.4	9.3	8.3	8.3	8.8	9.3	9.5	0.15
3	11.5	11.1	9.9	9.6	9.9	9.0	11.7	11.0	8.4	9.1	9.5	0.068
4	10.9	9.2	11.7	10.2	10.3	9.6	8.4	10.2	10.3	9.4	8.8	0.061
5 (most deprived)	11.2	12.3	13.4	13.5	11.0	14.3	12.5	13.1	11.0	13.0	12.0	0.96
Unknown	-	-	-	-	-	-	-	-	-	-	-	-

Sources: Numerator: PMMRC's perinatal data extract 2007–2017; Denominator: MAT births 2007–2017.

With regard to specific conditions that show a consistent gradient by deprivation, only deaths due to spontaneous preterm delivery showed a clear increase with increasing deprivation. However, due to the smaller numbers of deaths due to other conditions, any potential gradients will require more years' data to become apparent (Table 3.19).

Table 3.19: Perinatal death classification (PSANZ-PDC) specific perinatal related mortality rates (per 1,000 births) (excluding congenital abnormalities) by NZDep2013 quintile* 2013–2017

Perinatal death classification (PSANZ-PDC)	Quintile 1 (least deprived)			Quintile 2			Quintile 3			Quintile 4			Quintile 5 (most deprived)		
	n=42,919			n=47,625			n=53,822			n=67,134			n=86,301		
	n	%	Rate	n	%	Rate	n	%	Rate	n	%	Rate	n	%	Rate
Perinatal infection	11	4.3	0.26	18	5.9	0.38	26	6.4	0.48	20	4.3	0.30	45	6.0	0.52
Hypertension	6	2.4	0.14	8	2.6	0.17	9	2.2	0.17	22	4.8	0.33	24	3.2	0.28
Antepartum haemorrhage	44	17.3	1.03	47	15.5	0.99	62	15.3	1.15	80	17.4	1.19	135	17.9	1.56
Maternal conditions	18	7.1	0.42	16	5.3	0.34	26	6.4	0.48	27	5.9	0.40	72	9.5	0.83
Specific perinatal condition	46	18.1	1.07	57	18.8	1.20	61	15.1	1.13	75	16.3	1.12	82	10.8	0.95
Hypoxic peripartum death	5	2.0	0.12	10	3.3	0.21	12	3.0	0.22	22	4.8	0.33	22	2.9	0.25
Fetal growth restriction	29	11.4	0.68	26	8.6	0.55	48	11.9	0.89	35	7.6	0.52	60	7.9	0.70
Spontaneous preterm	30	11.8	0.70	55	18.2	1.15	61	15.1	1.13	88	19.1	1.31	164	21.7	1.90
Unexplained antepartum death	59	23.2	1.37	64	21.1	1.34	91	22.5	1.69	86	18.7	1.28	140	18.5	1.62
No obstetric antecedent	6	2.4	0.14	<3	x	s	8	2.0	0.15	6	1.3	0.09	12	1.6	0.14

* Excludes 11 babies with unknown NZDep2013 quintile.

'x' indicates percentage suppressed due to small numbers.

's' indicates rate suppressed due to small numbers.

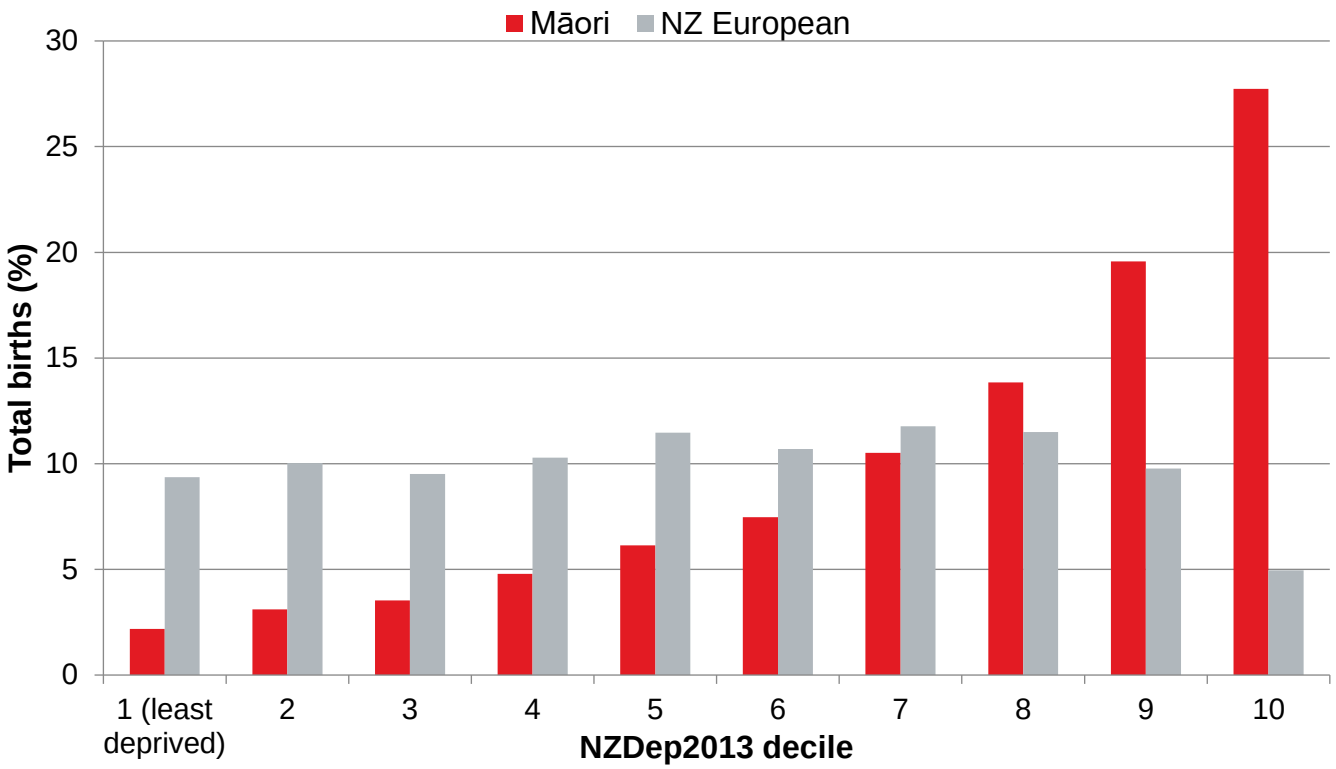
Sources: Numerator: PMMRC's perinatal data extract (excluding congenital abnormalities) 2013–2017; Denominator: MAT births 2013–2017.

When the effect of deprivation is examined for Māori and New Zealand Europeans, it is important to consider the distribution of deprivation in these two groups. Figure 3.11 shows the distribution of all infants under the age of 1 year in Aotearoa/New Zealand by NZDep2013 decile. Deprivation deciles, as the name implies, divide the population of Aotearoa/New Zealand into 10 deciles, with 10% of the population in each one. For babies of New Zealand European mothers, there is approximately 10% of the population in each decile, with the exception of decile 10, in which there is 5%. However, for Māori, there are very few babies born into NZDep2013 deciles 1 to 5, with over half of babies being born into deciles 8 to 10. This shows the unequal distribution of deprivation between babies of Māori and New Zealand European mothers.

Figure 3.12 shows the perinatal related mortality rate by NZDep2013 decile. Overall, mortality rates increase with increasing deprivation for babies of both Māori and New Zealand European mothers, with those in decile 10 having the highest mortality rates.

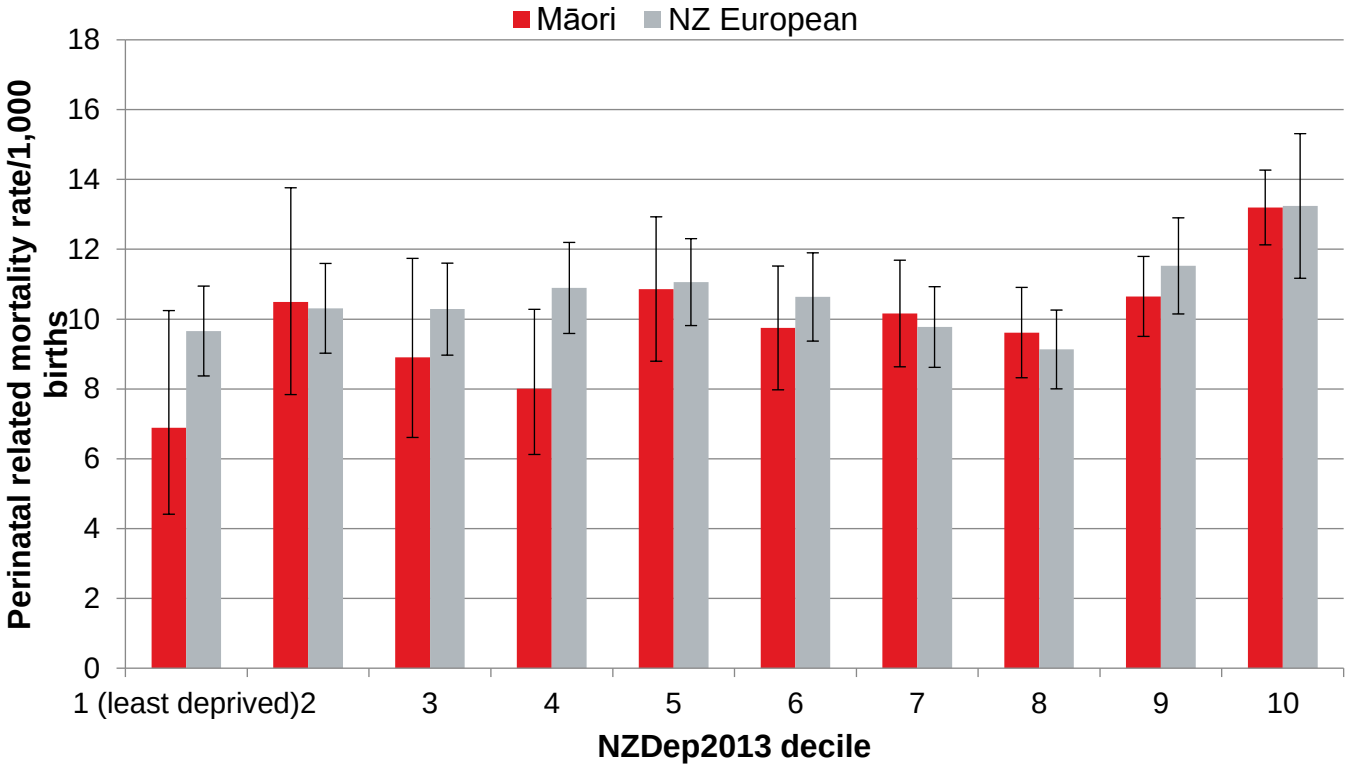
For Māori, because mortality rates are highest in those in decile 10 areas, and there are a larger number of Māori babies born into decile 10 areas, they are disproportionately affected by perinatal related mortality. Figure 3.13 presents the number of deaths by NZDep2013 decile, and shows that the burden of perinatal related mortality is experienced by Māori communities living in decile 10 areas, with nearly twice as many deaths in this group as in any other.

Figure 3.11: All births by NZDep2013 decile, Māori and New Zealand European, 2008–2017



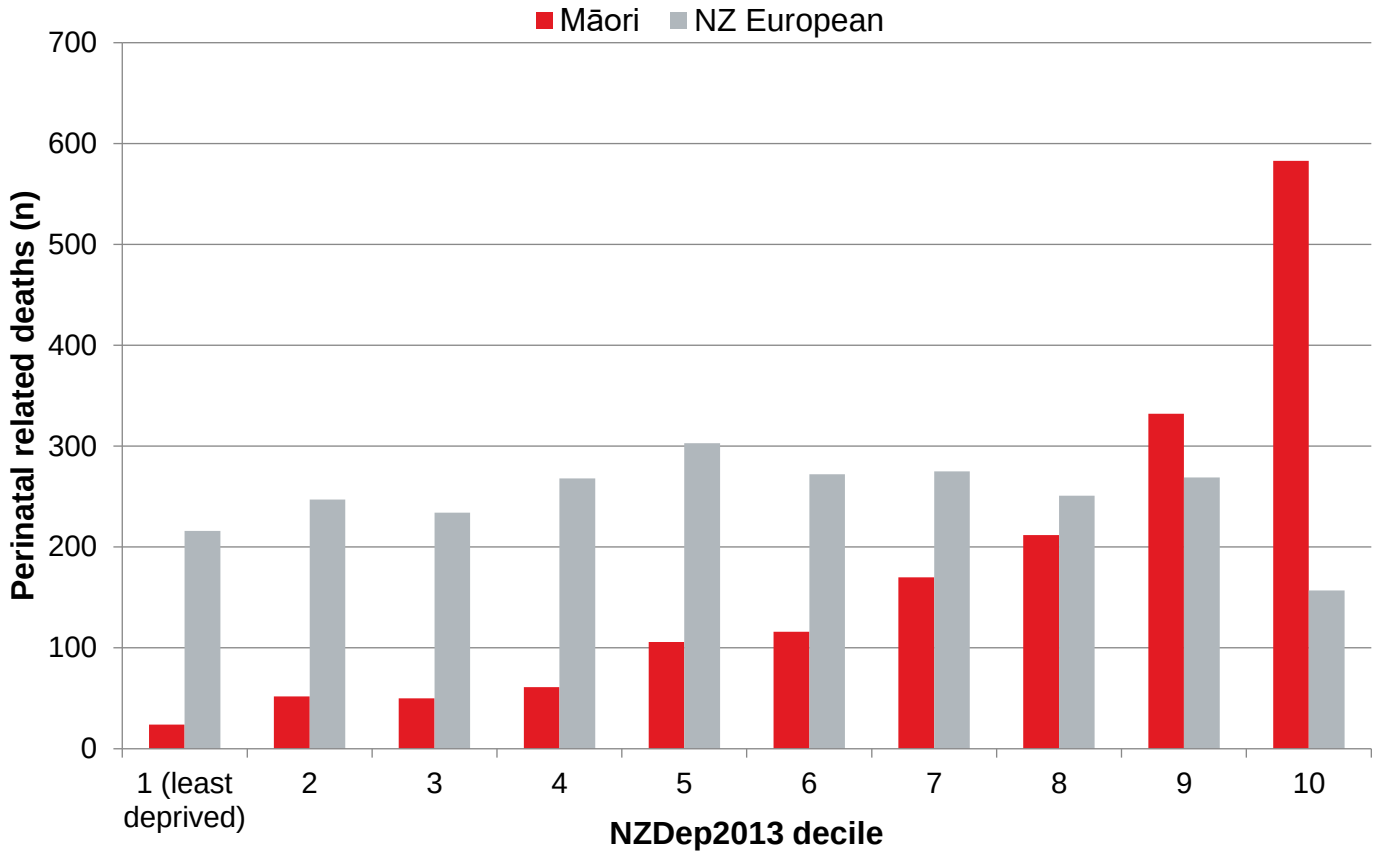
Source: MAT births 2008–2017.

Figure 3.12: Perinatal related mortality rates (per 1,000 births) by NZDep2013 decile, Māori and New Zealand European, 2008–2017



Sources: Numerator: PMMRC's perinatal data extract 2008–2017; Denominator: MAT births 2008–2017.

Figure 3.13: Perinatal related mortality (number of deaths) by NZDep2013 decile, Māori and New Zealand European, 2008–2017



Source: PMMRC's perinatal data extract 2008–2017.

Body mass index (BMI)

BMI is used here as a proxy indicator of risk. Higher BMI has a number of implications for the health of the mother and the baby, as well as implications for care. While not a perfect measure of all these aspects, it is straightforward to calculate, and therefore forms the basis of most risk assessment in studies that help in our understanding of adverse weight-related outcomes.

Women with a high BMI are more likely to have higher amounts of visceral fat, which is associated with a higher risk of gestational diabetes.[19] However, as it is not currently feasible to determine visceral fat on all pregnant women, BMI is used as a proxy, albeit imperfect, indicator of risk. In general, women with a higher BMI have an increased amount of visceral fat.[20] However, distribution of fat does vary by ethnic group. For example, women of Indian ethnicity tend to have higher amounts of total body fat with lower BMI.[21] As well

[19] Bartha JL, Marín-Segura P, González-González NL, et al. 2007. Ultrasound evaluation of visceral fat and metabolic risk factors during early pregnancy. *Obesity* 15: 2233–9.

[20] Carrol JF, Chiapa AL, Rodriquez M, et al. 2008. Visceral fat, waist circumference and BMI: Impact of race/ethnicity. *Obesity* 16: 600–7.

[21] Lear SA, Kohli S, Bondy GP, et al. 2009. Ethnic variation in fat and lean body mass and the association with insulin resistance. *The Journal of Clinical Endocrinology & Metabolism* 94(12): 4696–702.

as the risk from gestational diabetes,[22] obesity as measured by BMI increases the risk of stillbirth,[23, 24] hypertension[25] and pre-eclampsia.[26]

In addition, it is important for providers to consider the care needs of women with higher weight. Increased access to ultrasound may be required, as abdominal palpation can be difficult. Furthermore, different equipment is often needed, such as appropriate-sized blood pressure cuffs, hoists, and suitably weight-rated beds and operating tables. DHBs need to have appropriate equipment to meet the needs of women in their care, in order to provide care in a way that does not cause discomfort or distress to women.

Our data show that regardless of whether data from MAT (Table 3.20 and Figure 3.14) or the PMMRC (Table 3.21) were used, mortality from stillbirths, neonatal deaths and perinatal related deaths overall increased with increasing maternal BMI. Due to incomplete matching between the two data sets, there were some individuals who were in the PMMRC data set but not in MAT, and other situations where individuals in MAT were not able to be matched to the PMMRC records. Using PMMRC data for maternal BMI (numerator) had the net effect of reducing the numbers of women in BMI categories 25.00–29.99 and 30.00–34.99, and increasing the numbers of women in BMI categories 35.00–39.99 and ≥40. This suggests that MAT records provide an underestimate of true maternal BMI.

Table 3.20: Perinatal related mortality rates (per 1,000 births) by maternal BMI at registration with maternity care 2013–2017 using MAT data*

Maternal BMI (kg/m^2)	Total births		Fetal deaths						Neonatal deaths			Perinatal related deaths (total)		
			Termination of pregnancy			Stillbirths								
	N=274,506		n=551			n=1,261			n=655			n=2,467		
	N	%	n	%	Rate	n	%	Rate	n	%	Rate	n	%	Rate
<18.50	7,648	2.8	16	2.9	2.09	21	1.7	2.75	14	2.1	1.84	51	2.1	6.67
18.50–24.99	130,864	47.7	291	52.8	2.22	491	38.9	3.75	247	37.7	1.90	1,029	41.7	7.86
25.00–29.99	71,278	26.0	139	25.2	1.95	371	29.4	5.20	173	26.4	2.44	683	27.7	9.58
30.00–34.99	36,988	13.5	67	12.2	1.81	179	14.2	4.84	122	18.6	3.32	368	14.9	9.95
35.00–39.99	17,290	6.3	24	4.4	1.39	119	9.4	6.88	60	9.2	3.50	203	8.2	11.74
≥40	9,941	3.6	13	2.4	1.31	76	6.0	7.65	38	5.8	3.86	127	5.1	12.78
Unknown	497	0.2	<3	x	-	4	0.3	-	<3	x	-	6	0.2	-
Data not supplied to MAT			18			-			−21			−3		

* All data limited to mothers who were registered for care with an LMC (either a midwife, obstetrician or GP) claiming from the Section 88 Primary Maternity Services Notice.

'x' indicates percentage suppressed due to small numbers.

Sources: Numerator: PMMRC's perinatal data extract where matched to MAT data, 2013–2017; Denominator: MAT births 2013–2017.

[22] Torloni MR, Betrán AP, Horta BL, et al. 2008. Prepregnancy BMI and the risk of gestational diabetes: A systematic review of the literature with meta-analysis. *Obesity Reviews* 10(2): 194–203.

[23] Yao R, Ananth CV, Park BY, et al. 2014. Obesity and the risk of stillbirth: A population-based cohort study. *American Journal of Obstetrics and Gynaecology* 210: 457.e1–9.

[24] Lindam A, Johansson S, Stephansson O, et al. 2016. High maternal body mass index in early pregnancy and risks of stillbirth and infant mortality – a population-based sibling study in Sweden. *American Journal of Epidemiology* 184(2): 98–105.

[25] Weiss JL, Malone FD, Emig D, et al. 2004. Obesity, obstetric complications and cesarean delivery rate – a population-based screening study. *American Journal of Obstetrics & Gynecology* 190: 1091–7.

[26] Anderson N, McCowan L, Fyfe E, et al, on behalf of the SCOPE Consortium. 2012. The impact of maternal body mass index on the phenotype of pre-eclampsia: A prospective cohort study. *British Journal of Obstetrics and Gynaecology* 119: 589–95.

Table 3.21: Perinatal related mortality rates (per 1,000 births) by maternal BMI at registration with maternity care 2013–2017 using PMMRC and MAT data*

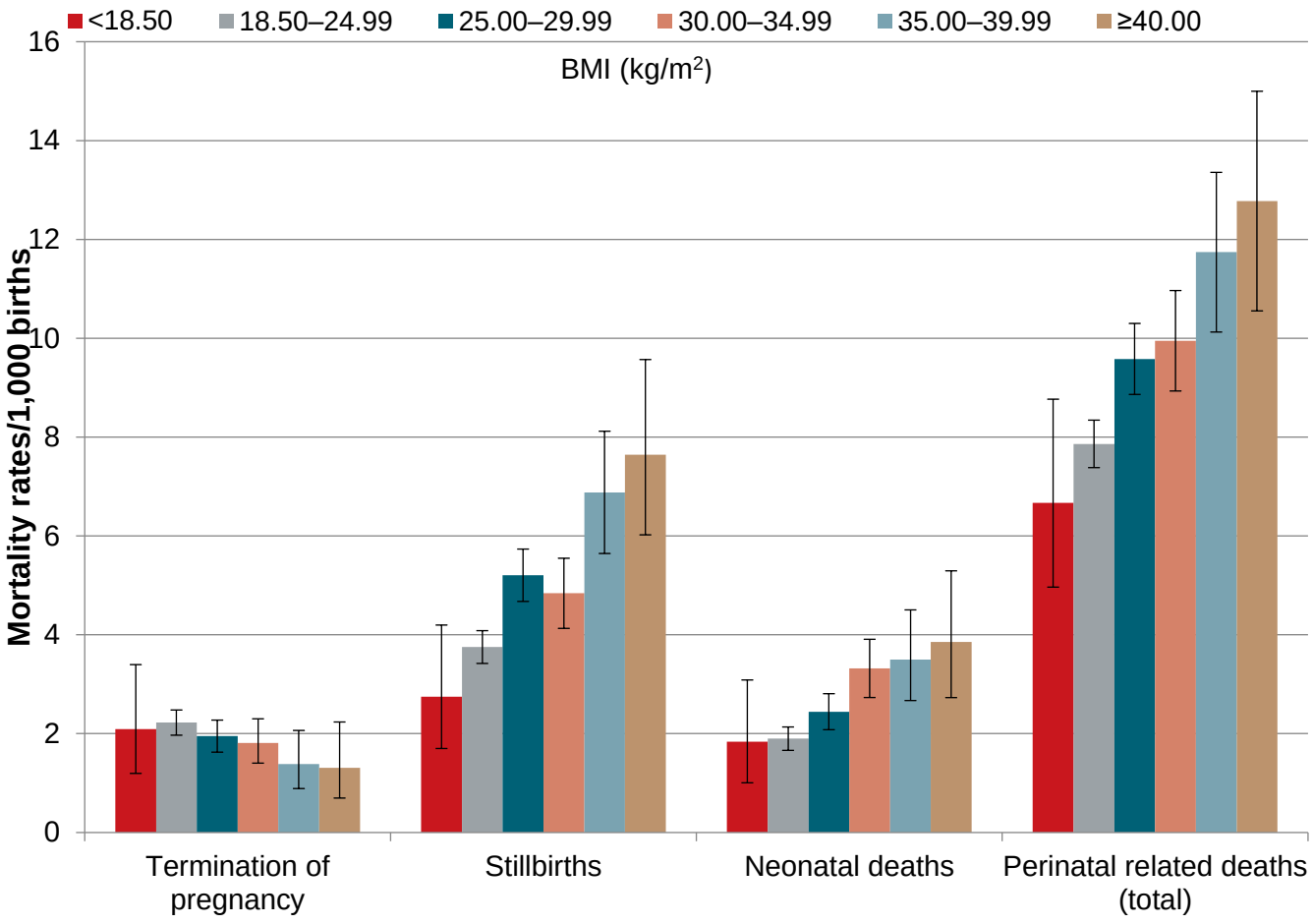
Maternal BMI (kg/m^2)	Total births		Fetal deaths						Neonatal deaths			Perinatal related deaths		
			Termination of pregnancy			Stillbirths								
	N=274,506		n=569			n=1,261			n=634			n=2,464		
	N	%	n	%	Rate	n	%	Rate	n	%	Rate	n	%	Rate
<18.50	7,648	2.8	16	2.8	2.09	22	1.7	2.88	8	1.3	1.05	46	1.9	6.01
18.50–24.99	130,864	47.7	295	51.8	2.25	497	39.4	3.80	240	37.9	1.83	1,032	41.9	7.89
25.00–29.99	71,278	26.0	143	25.1	2.01	354	28.1	4.97	174	27.4	2.44	671	27.2	9.41
30.00–34.99	36,988	13.5	66	11.6	1.78	183	14.5	4.95	106	16.7	2.87	355	14.4	9.60
35.00–39.99	17,290	6.3	26	4.6	1.50	121	9.6	7.00	62	9.8	3.59	209	8.5	12.09
≥40	9,941	3.6	17	3.0	1.71	78	6.2	7.85	40	6.3	4.02	135	5.5	13.58
Unknown	497	0.2	6	1.1	-	6	0.5	-	4	0.6	-	16	0.6	-

* All data limited to mothers who were registered for care with an LMC (either a midwife, obstetrician or GP) claiming from the Section 88 Primary Maternity Services Notice.

BMI = body mass index.

Sources: Numerator: PMMRC's perinatal data extract where matched to MAT data, 2013–2017; Denominator: MAT births 2013–2017.

Figure 3.14: Perinatal related death rates (per 1,000 births) by maternal BMI* (with 95% CIs) 2013–2017



* All data limited to mothers who were registered for care with an LMC (either a midwife, obstetrician or GP) claiming from the Section 88 Primary Maternity Services Notice.

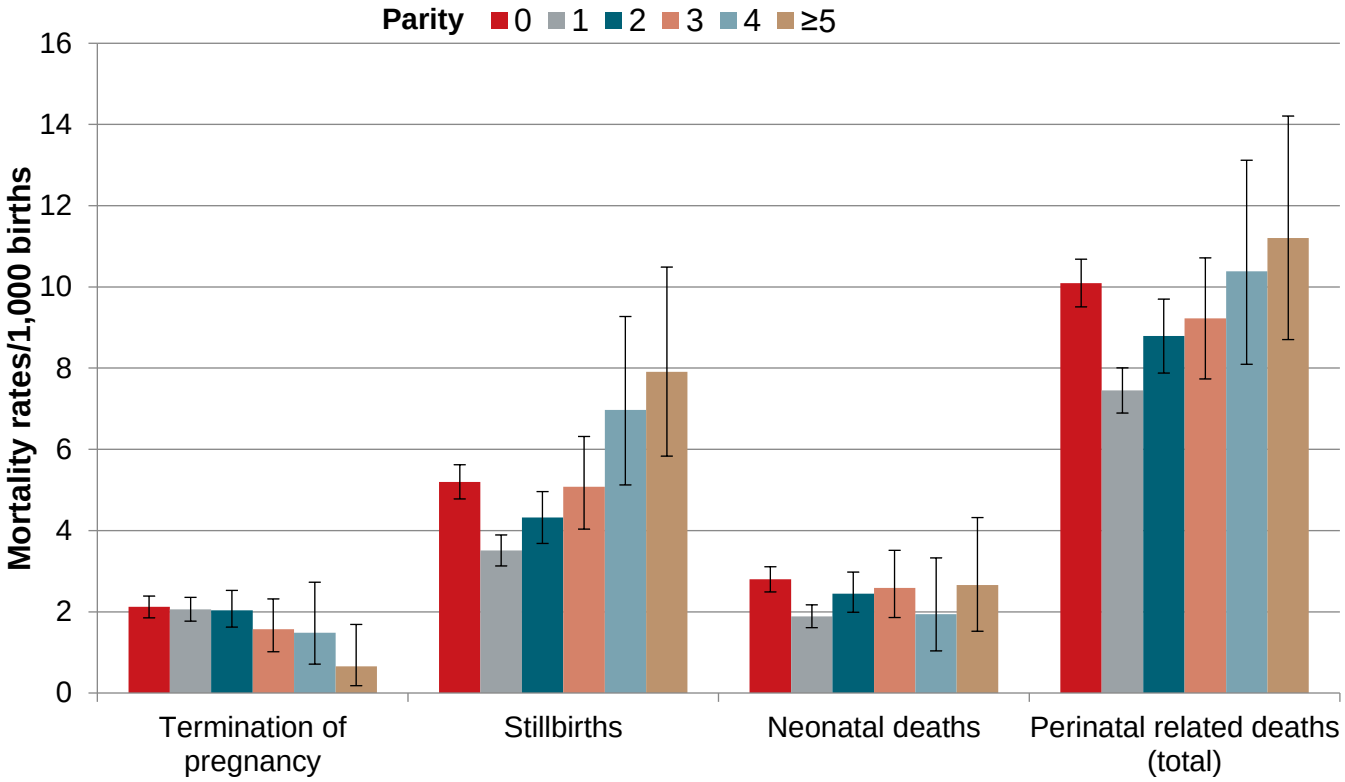
BMI = body mass index.

Sources: Numerator: PMMRC's perinatal data extract where matched to MAT data, 2013–2017; Denominator: MAT births 2013–2017.

Parity

Overall, mortality rates showed a U-shaped curve by parity, with primiparous and multiparous women with four or more previous babies having the highest mortality rate. This was largely driven by the high rate of stillbirths. There is no statistically significant variation in mortality by parity for neonatal deaths or terminations of pregnancy (Figure 3.15 and Table 3.22).

Figure 3.15: Perinatal related mortality rates (per 1,000 births) by maternal parity* (with 95% CIs) 2013–2017



* All data limited to mothers who were registered for care with an LMC (either a midwife, obstetrician or GP) claiming from the Section 88 Primary Maternity Services Notice.

Sources: Numerator: PMMRC's perinatal data extract where matched to MAT data, 2013–2017; Denominator: MAT births 2013–2017.

Table 3.22: Perinatal related mortality rates (per 1,000 births) by parity* 2013–2017

Parity	Total births		Fetal deaths						Neonatal deaths			Perinatal related deaths (total)		
			Termination of pregnancy			Stillbirths								
	N=274,506		n=551			n=1,261			n=655			n=2,467		
	N	%	n	%	Rate	n	%	Rate	n	%	Rate	n	%	Rate
0	112,322	40.9	238	43.2	2.12	584	46.3	5.20	312	47.6	2.80	1,134	46.0	10.10
1	92,610	33.7	191	34.7	2.06	325	25.8	3.51	174	26.6	1.89	690	28.0	7.45
2	40,727	14.8	83	15.1	2.04	176	14.0	4.32	99	15.1	2.45	358	14.5	8.79
3	15,937	5.8	25	4.5	1.57	81	6.4	5.08	41	6.3	2.59	147	6.0	9.22
4	6,741	2.5	10	1.8	1.48	47	3.7	6.97	13	2.0	1.94	70	2.8	10.38
≥5	6,067	2.2	4	0.7	0.66	48	3.8	7.91	16	2.4	2.66	68	2.8	11.21
Unknown	102	0.0	-	-	-	-	-	-	-	-	-	-	-	-
Data not supplied to MAT			18			-			−21			−3		

* All data limited to mothers who were registered for care with an LMC (either a midwife, obstetrician or GP) claiming from the Section 88 Primary Maternity Services Notice.

Sources: Numerator: PMMRC's perinatal data extract where matched to MAT data, 2013–2017; Denominator: MAT births 2013–2017.

Maternal smoking

Data on smoking in pregnancy come from MAT and are based on LMC registration data; specifically, the smoking status of the woman at first LMC registration.[27]

Our data showed mortality rates were statistically significantly higher in babies of mothers who smoked, compared with those who did not smoke, for all types of death, excluding termination of pregnancy (Figure 3.16 and Table 3.23).

There is evidence from the literature that outcomes for babies can be improved where women are supported to stop smoking. In a multi-centre study of nulliparous women, rates of spontaneous preterm birth and small for gestational age babies in women who quit smoking before 15 weeks' gestation were the same as for non-smokers.[28] Furthermore, there is evidence that incentives are effective in reducing smoking rates in pregnancy.[29] For example, Counties Manukau DHB has had the Smokefree Pregnancy Incentives Programme operating since 2013. This programme has a 70% 4-week quit rate, which is similar across all ethnicities.[30] Given the significance of smoking as a risk factor, the clear improvement in outcomes when women are able to quit, and that effective smoking cessation programmes exist, resource should be invested in reducing this modifiable risk factor.

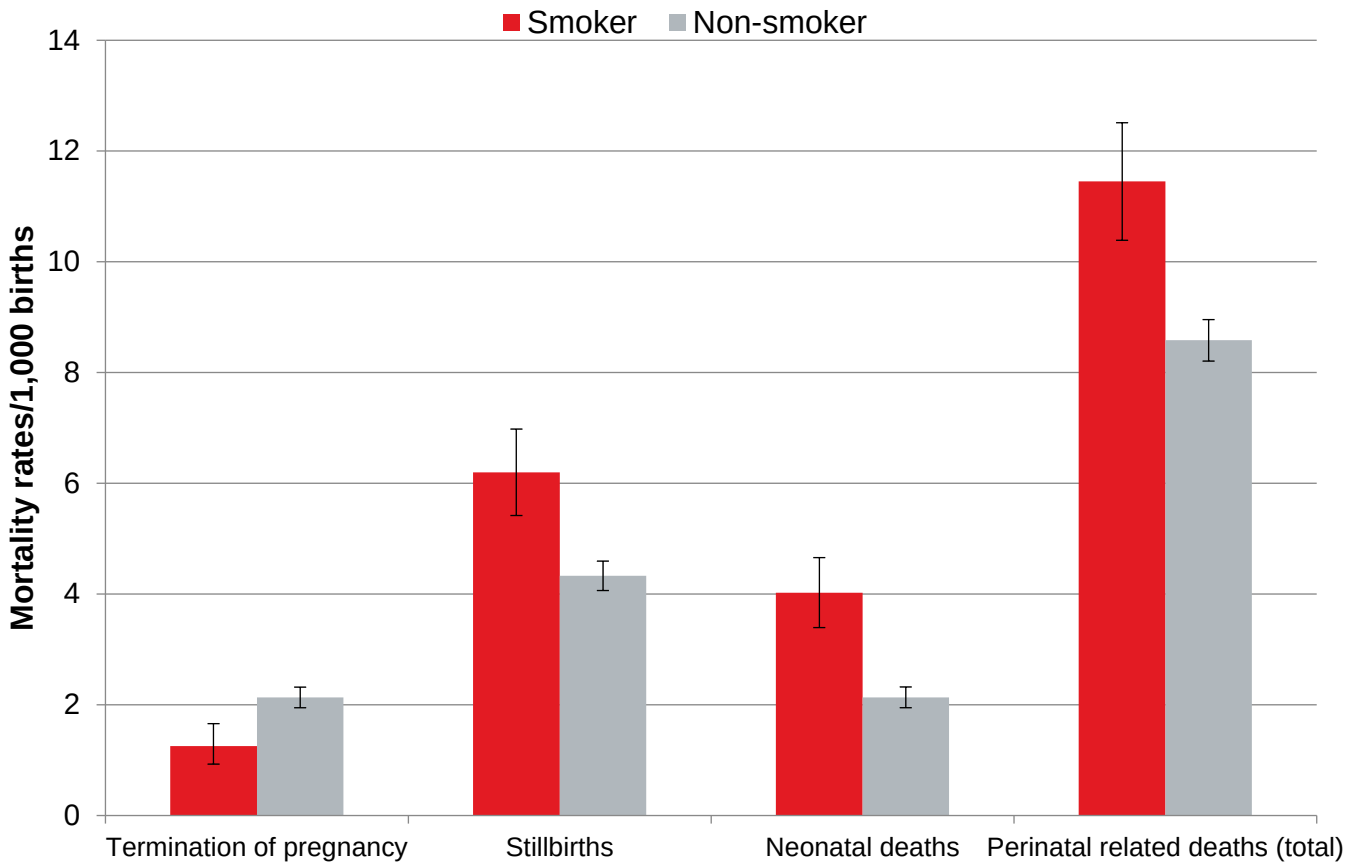
[27] National Health Board Business Unit. 2011. *National Maternity Collection Data Mart Data Dictionary*. URL: https://www.health.govt.nz/system/files/documents/publications/mat-dict-v1-0.pdf (accessed 15 August 2018), p 174.

[28] McCowan L, Dekker GA, Chan E, et al. 2009. Spontaneous preterm birth and small for gestational age infants in women who stop smoking early in pregnancy: prospective cohort study. *BMJ* 338: b1081. URL: https://doi.org/10.1136/bmj.b1081 (accessed 15 August 2019).

[29] Tappin D, Bauld L, Purves D, et al. 2015. Financial incentives for smoking cessation in pregnancy: randomised controlled trial. *BMJ* 350: h134. URL: https://doi.org/10.1136/bmj.h134 (accessed 15 August 2019).

[30] Counties Manukau Health. 2018. *Women's Health and Newborn Annual Report 2017–2018*. URL: https://countiesmanukau.health.nz/our-services/womens-health/maternity-services/womens-health-and-newborn-annual-report/ (accessed 30 August 2019).

Figure 3.16: Perinatal related mortality rates (per 1,000 births) by smoking at registration with maternity care* (with 95% CIs) 2013–2017



* All data limited to mothers who were registered for care with an LMC (either a midwife, obstetrician or GP) claiming from the Section 88 Primary Maternity Services Notice.

Sources: Numerator: PMMRC's perinatal data extract where matched to MAT data, 2013–2017; Denominator: MAT births 2013–2017.

Table 3.23: Perinatal related mortality rates (per 1,000 births) by smoking at registration with maternity care* 2013–2017

Maternal smoking at registration	Total births		Fetal deaths						Neonatal deaths			Perinatal related deaths (total)		
			Termination of pregnancy			Stillbirths								
	N=274,506		n=551			n=1,261			n=655			n=2,467		
	N	%	n	%	Rate	n	%	Rate	n	%	Rate	n	%	Rate
Smoker	39,041	14.2	49	8.9	1.26	242	19.2	6.20	156	23.8	4.03	447	18.1	11.45
Non-smoker	235,385	85.7	502	91.1	2.13	1,019	80.8	4.33	499	76.2	2.13	2,020	81.9	8.58
Unknown	80	0.0	-	-	-	-	-	-	-	-	-	-	-	-
Data not supplied to MAT			18			-			−21			−3		

* All data limited to mothers who were registered for care with an LMC (either a midwife, obstetrician or GP) claiming from the Section 88 Primary Maternity Services Notice.

Sources: Numerator: PMMRC's perinatal data extract where matched to MAT data, 2013–2017; Denominator: MAT births 2013–2017.

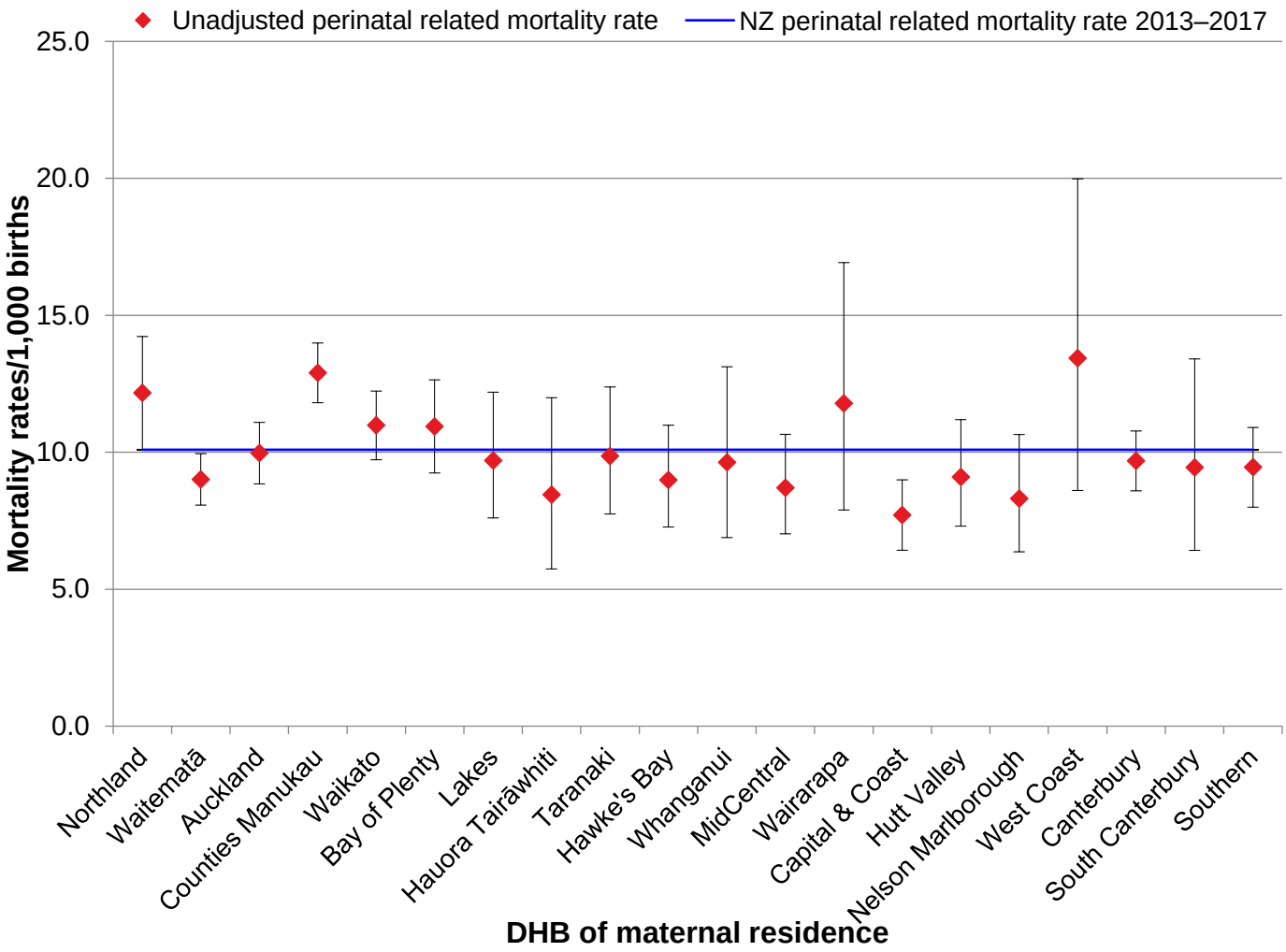
DHB of residence

Variations in rates by DHB may exist for a number of reasons. Mortality rates can be influenced by underlying population characteristics, geographic isolation, resourcing, delivery of care and other factors. Despite this, DHBs are charged with meeting the needs of the population they serve. Furthermore, those DHBs with a rate similar to the national rate may still have groups within their DHBs who do not experience the same level of care and outcomes of others in the DHB region, and a within-DHB assessment of any subgroups that are experiencing worse outcomes could be beneficial.

Perinatal related mortality rates varied by DHB of residence, with Waitematā and Capital & Coast DHBs having rates that were statistically significantly lower than the national rate of 10.09 per 1,000 births. Women living in Northland and Counties Manukau DHBs had perinatal related mortality rates that were statistically significantly higher than the national rate (Figure 3.17 and

Table 3.24).

Figure 3.17: Unadjusted perinatal related mortality rates (per 1,000 births) by DHB of residence (mother) compared with New Zealand perinatal related mortality (with 95% CIs) 2013–2017



Sources: Numerator: PMMRC's perinatal data extract 2013–2017; Denominator: MAT births 2013–2017.

Table 3.24: Perinatal related mortality rates (per 1,000 births) by DHB of maternal residence 2013–2017

DHB of maternal residence	Total births		Fetal deaths						Neonatal deaths			Perinatal related deaths (total)		
			Termination of pregnancy			Stillbirths								
	N=301,043		n=679			n=1,535			n=824			n=3,038		
	N	%	n	%	Rate	n	%	Rate	n	%	Rate	n	%	Rate
Northland	11,016	3.7	26	3.8	2.36	75	4.9	6.81	33	4.0	3.02	134	4.4	12.16
Waitematā	39,286	13.0	113	16.6	2.88	160	10.4	4.07	81	9.8	2.08	354	11.7	9.01
Auckland	30,399	10.1	93	13.7	3.06	135	8.8	4.44	75	9.1	2.49	303	10.0	9.97
Counties Manukau	41,713	13.9	98	14.4	2.35	268	17.5	6.42	172	20.9	4.16	538	17.7	12.90
Waikato	26,774	8.9	60	8.8	2.24	149	9.7	5.57	85	10.3	3.20	294	9.7	10.98
Bay of Plenty	14,529	4.8	28	4.1	1.93	77	5.0	5.30	54	6.6	3.74	159	5.2	10.94
Lakes	7,527	2.5	17	2.5	2.26	41	2.7	5.45	15	1.8	2.01	73	2.4	9.70
Hauora Tairāwhiti	3,669	1.2	4	0.6	1.09	19	1.2	5.18	8	1.0	2.19	31	1.0	8.45
Taranaki	7,502	2.5	13	1.9	1.73	39	2.5	5.20	22	2.7	2.95	74	2.4	9.86
Hawke's Bay	10,571	3.5	19	2.8	1.80	55	3.6	5.20	21	2.5	2.00	95	3.1	8.99
Whanganui	4,151	1.4	6	0.9	1.45	20	1.3	4.82	14	1.7	3.39	40	1.3	9.64
MidCentral	10,693	3.6	20	2.9	1.87	46	3.0	4.30	27	3.3	2.54	93	3.1	8.70
Wairarapa	2,461	0.8	3	0.4	1.22	21	1.4	8.53	5	0.6	2.05	29	1.0	11.78
Capital & Coast	17,901	5.9	24	3.5	1.34	74	4.8	4.13	40	4.9	2.25	138	4.5	7.71
Hutt Valley	9,787	3.3	13	1.9	1.33	48	3.1	4.90	28	3.4	2.88	89	2.9	9.09
Nelson Marlborough	7,465	2.5	14	2.1	1.88	30	2.0	4.02	18	2.2	2.43	62	2.0	8.31
West Coast	1,787	0.6	7	1.0	3.92	12	0.8	6.72	5	0.6	2.83	24	0.8	13.43
Canterbury	31,186	10.4	72	10.6	2.31	165	10.7	5.29	65	7.9	2.10	302	9.9	9.68
South Canterbury	3,282	1.1	4	0.6	1.22	13	0.8	3.96	14	1.7	4.29	31	1.0	9.45
Southern	17,140	5.7	43	6.3	2.51	83	5.4	4.84	36	4.4	2.12	162	5.3	9.45
Other*	2,204	0.7	<3	x	-	5	0.3	-	6	0.7	-	13	0.4	-
Total	**301,043**	**100.0**	**679**	**100.0**	**2.26**	**1,535**	**100.0**	**5.10**	**824**	**100.0**	**2.76**	**3,038**	**100.0**	**10.09**

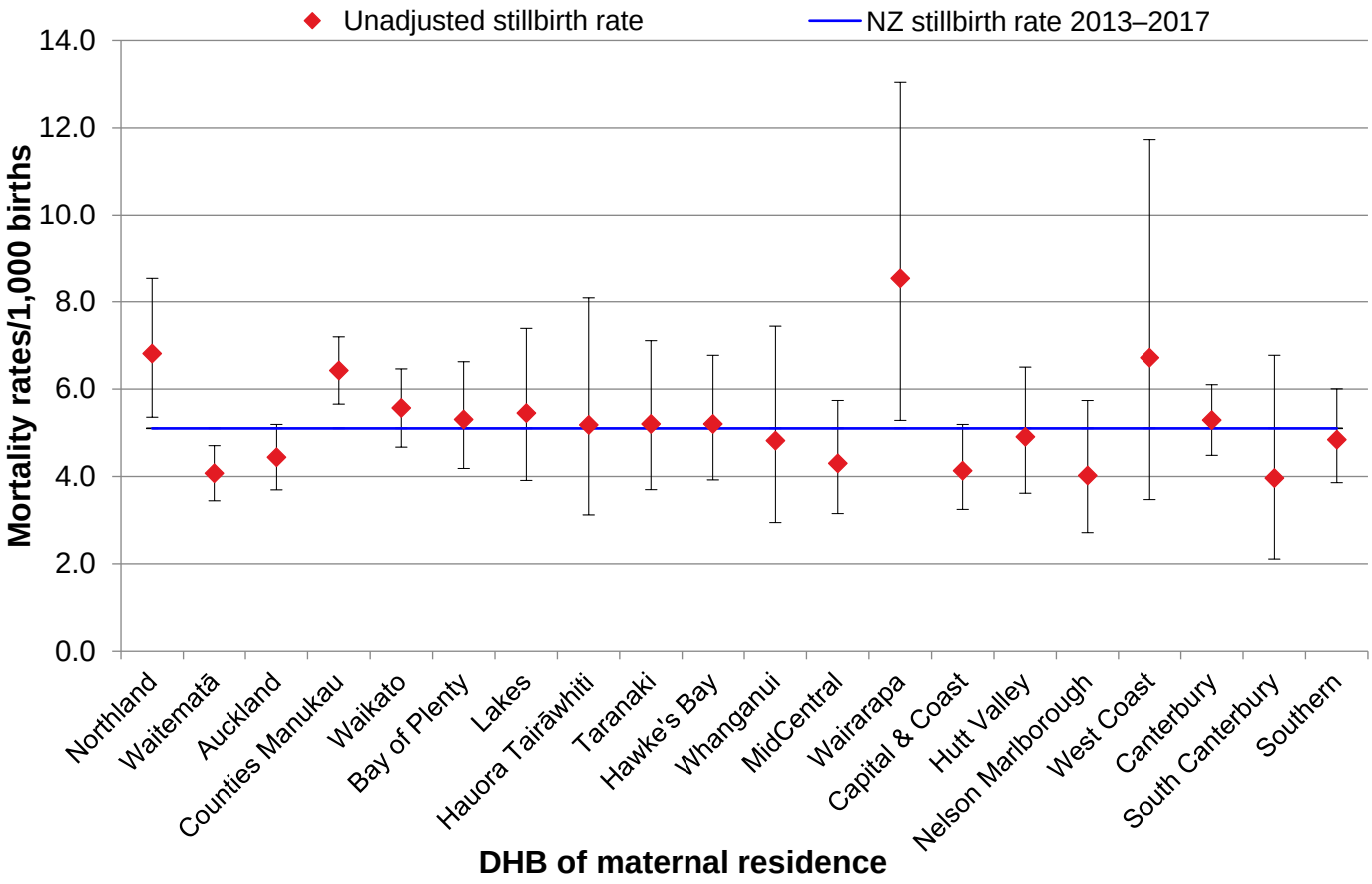
* Other includes Overseas, Unknown and Other.

'x' indicates percentage suppressed due to small numbers.

Sources: Numerator: PMMRC's perinatal data extract 2013–2017; Denominator: MAT births 2013–2017.

There was substantial variation in stillbirth rates by DHB of residence. Compared with the national rate, mothers in Waitematā DHB had a statistically significantly lower rate. Mothers residing in Northland, Counties Manukau and Wairarapa DHBs had a statistically significantly higher rate than the national rate (Figure 3.18).

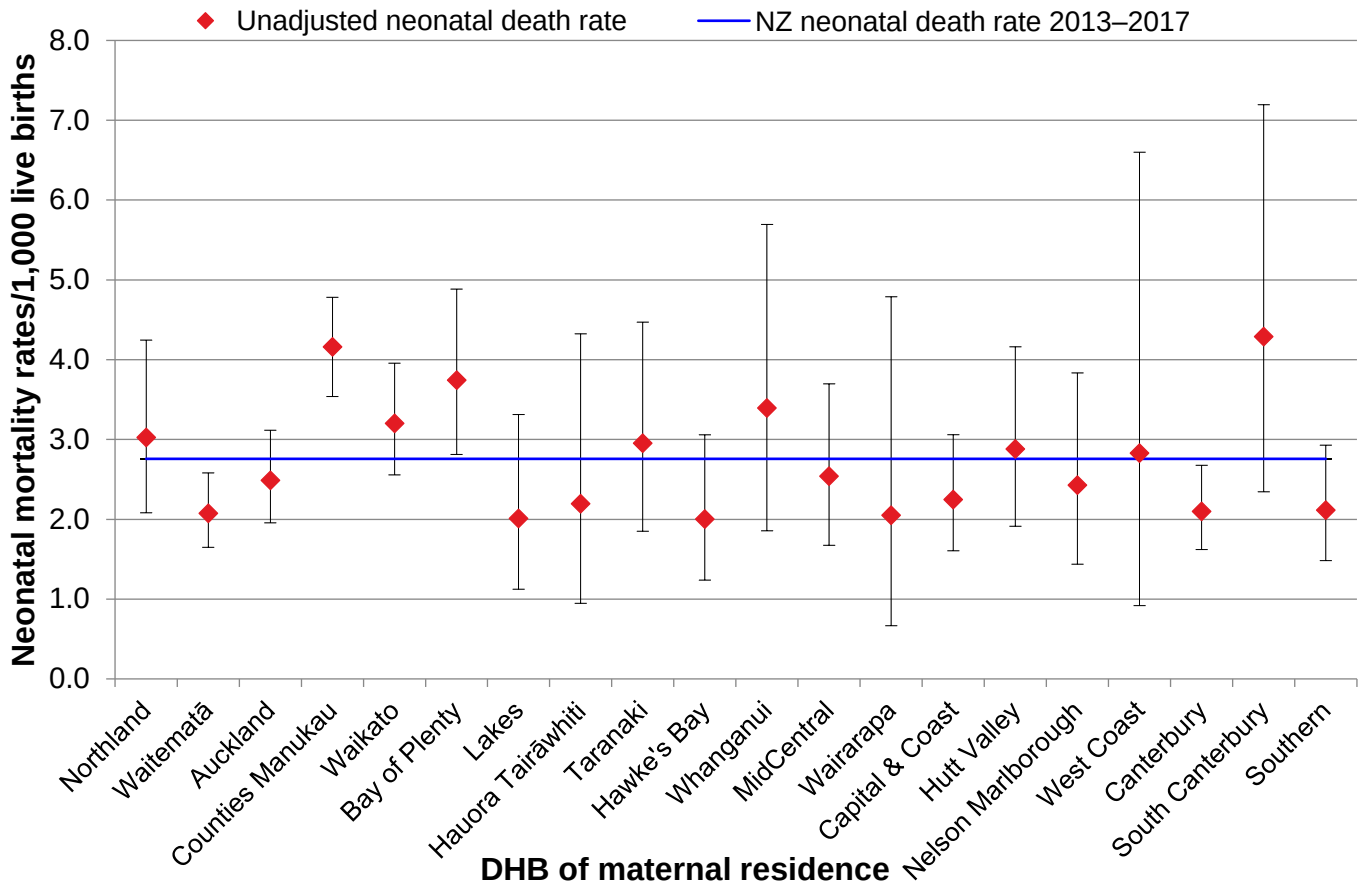
Figure 3.18: Unadjusted stillbirth rates (per 1,000 births) by DHB of residence (mother) compared with average stillbirth rates (with 95% CIs) 2013–2017



Sources: Numerator: PMMRC's perinatal data extract stillbirths only, 2013–2017; Denominator: MAT births 2013–2017.

Due to smaller numbers, the neonatal death rates by DHB of residence are more prone to variation and have wider confidence intervals. When compared with the national rate, Waitematā and Canterbury DHBs had statistically significantly lower rates, while Counties Manukau and Bay of Plenty had statistically significantly higher rates (Figure 3.19).

Figure 3.19: Unadjusted neonatal mortality rates (per 1,000 births) by DHB of residence (mother) compared with New Zealand neonatal mortality (with 95% CIs) 2013–2017

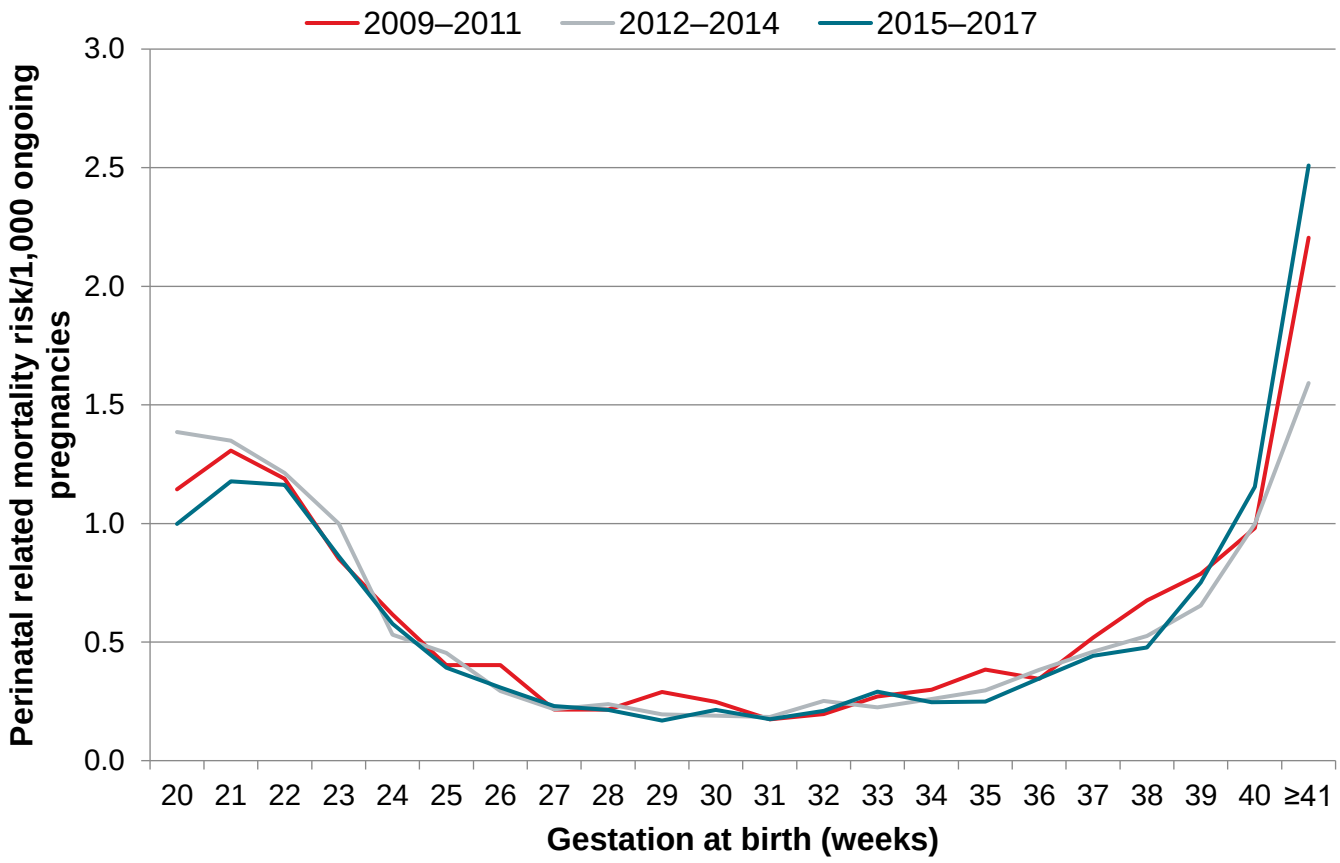


Sources: Numerator: PMMRC's perinatal data extract, neonatal deaths only, 2013–2017; Denominator: MAT births excluding fetal deaths 2013–2017.

Gestational age and birthweight

There has been little change in perinatal related mortality by gestational age over the time period 2009–2017. While the risk of death appears highest from 41 weeks' gestation onwards, this is influenced by the number of ongoing pregnancies (the denominator). As there are fewer ongoing pregnancies at this gestation compared with 23–24 weeks' gestation, the mortality ratio (per 1,000 ongoing pregnancies) is higher from 41 weeks (Figure 3.20). While the rate of death at later gestations is lower (2.01 per 1,000 births at ≥40 weeks' gestation compared with 736.36 per 1,000 births at 23–24 weeks' gestation) (Table 3.25), a higher proportion of pregnancies at this gestation are at risk of adverse outcome.

Figure 3.20: Perinatal related mortality risk (per 1,000 ongoing pregnancies) by gestational age at birth and year 2009–2017



Sources: Numerator: PMMRC's perinatal data extract 2009–2017; Denominator: MAT births 2009–2017.

Table 3.25: Perinatal related mortality rates (per 1,000 births) by gestation and birthweight 2017

	Total births		Fetal deaths						Neonatal deaths			Perinatal related deaths (total)		
			Termination of pregnancy			Stillbirths								
	N=60,454		n=133			n=287			n=171			n=591		
	N	%	n	%	Rate	n	%	Rate	n	%	Rate	n	%	Rate
Gestation at birth (weeks)														
20–22	210	0.3	81	60.9	*	72	25.1	*	56	32.7	*	209	35.4	*
23–24	110	0.2	25	18.8	227.27	27	9.4	245.45	29	17.0	500.00	81	13.7	736.36
25–27	212	0.4	16	12.0	75.47	30	10.5	141.51	18	10.5	108.43	64	10.8	301.89
28–31	474	0.8	5	3.8	10.55	30	10.5	63.29	13	7.6	29.61	48	8.1	101.27
32–36	3,730	6.2	5	3.8	1.34	48	16.7	12.87	23	13.5	6.26	76	12.9	20.38
37–40	46,621	77.1	<3	x	s	68	23.7	1.46	27	15.8	0.58	96	16.2	2.06
≥41	8,451	14.0	-	-	-	12	4.2	1.42	5	2.9	0.59	17	2.9	2.01
Unknown	646	1.1	-	-	-	-	-	-	-	-	-	-	-	-
Birthweight (g)														
<500	206	0.3	69	51.9	*	96	33.4	*	45	26.3	*	210	35.5	*
500–999	314	0.5	47	35.3	149.68	49	17.1	156.05	58	33.9	266.06	154	26.1	490.45
1,000–1,499	364	0.6	13	9.8	35.71	16	5.6	43.96	13	7.6	38.81	42	7.1	115.38
1,500–1,999	659	1.1	<3	x	s	25	8.7	37.94	7	4.1	11.06	33	5.6	50.08
2,000–2,499	2,227	3.7	<3	x	s	18	6.3	8.08	8	4.7	3.62	28	4.7	12.57
2,500–2,999	8,055	13.3	-	-	-	20	7.0	2.48	16	9.4	1.99	36	6.1	4.47
3,000–3,499	19,517	32.3	-	-	-	43	15.0	2.20	12	7.0	0.62	55	9.3	2.82
3,500–3,999	18,037	29.8	-	-	-	14	4.9	0.78	9	5.3	0.50	23	3.9	1.28
4,000–4,499	6,593	10.9	-	-	-	4	1.4	0.61	<3	x	s	6	1.0	0.91
≥4,500	1,359	2.2	-	-	-	<3	x	s	-	-	-	<3	x	s
Unknown	3,123	5.2	<3	x	s	<3	x	s	<3	x	s	3	0.5	-

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

'x' indicates percentage suppressed due to small numbers.

's' indicates rate suppressed due to small numbers.

Sources: Numerator: PMMRC's perinatal data extract 2017; Denominator: MAT births 2017.

Over the time period 2007–2017, there is some evidence of a statistically significant decrease in the risk of death for babies born at 28–31 and 37–38 weeks' gestation (Table 3.26).

Table 3.26: Perinatal related mortality risk (per 1,000 ongoing pregnancies) 2007–2017

	2007		2008		2009		2010		2011		2012		2013		2014		2015		2016		2017	
	Total births	n	Total births	n	Total births	n	Total births	n	Total births	n	Total births	n	Total births	n	Total births	n	Total births	n	Total births	n	Total births	n
Gestation at birth (weeks)																						
20–22	204	217	207	218	210	216	231	248	230	235	231	247	215	217	245	253	169	175	206	214	210	209
23–24	117	81	131	98	137	105	122	81	129	95	119	94	123	85	137	98	117	92	126	84	110	81
25–27	232	64	241	62	237	70	228	73	185	52	219	70	192	55	187	49	206	52	187	50	212	64
28–31	530	57	559	65	539	66	560	52	511	58	503	50	471	49	462	46	458	41	482	48	474	48
32–36	3,842	88	3,959	80	3,978	90	4,004	101	3,909	87	3,931	73	3,723	91	3,727	85	3,648	78	3,817	79	3,730	76
37–38	12,852	65	13,019	59	13,145	78	13,610	62	13,171	64	13,440	65	13,399	38	13,678	56	13,600	42	14,484	59	14,658	45
39–40	34,367	73	34,736	82	34,630	72	34,593	65	33,877	59	33,589	51	32,205	51	32,161	60	32,125	69	32,067	56	31,963	51
≥41	12,330	34	11,667	37	11,740	32	11,550	26	10,729	17	10,325	20	9,478	14	9,092	12	9,071	29	8,781	20	8,451	17
Unknown	726	<3	1,104	-	586	<3	551	-	501	-	923	-	327	-	390	-	383	-	450	-	646	-

	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	Chi-squared test for trend (p)
	Risk	Risk	Risk	Risk	Risk	Risk	Risk	Risk	Risk	Risk	Risk	
Gestation at birth (weeks)												
20–22	3.37	3.38	3.34	3.82	3.75	3.96	3.63	4.24	2.95	3.56	3.49	0.68
23–24	1.26	1.52	1.63	1.25	1.52	1.51	1.43	1.65	1.55	1.40	1.36	0.76
25–27	1.00	0.97	1.09	1.13	0.83	1.13	0.92	0.83	0.88	0.84	1.08	0.33
28–31	0.89	1.02	1.03	0.81	0.93	0.81	0.83	0.78	0.70	0.80	0.81	0.049
32–36	1.39	1.26	1.42	1.58	1.41	1.19	1.55	1.45	1.33	1.34	1.29	0.73
37–38	1.09	0.99	1.31	1.04	1.11	1.13	0.69	1.02	0.77	1.07	0.82	0.023
39–40	1.56	1.77	1.55	1.41	1.32	1.16	1.22	1.45	1.67	1.37	1.26	0.14
≥41	2.76	3.17	2.73	2.25	1.58	1.94	1.48	1.32	3.20	2.28	2.01	0.074
Unknown	-	-	-	-	-	-	-	-	-	-	-	-

Sources: Numerator: PMMRC's perinatal data extract 2007–2017; Denominator: MAT births 2007–2017.

There has been no significant increase in termination of pregnancy rates by gestation (from 20 weeks' gestation onwards) over the study period 2007–2017 (Table 3.27).

Table 3.27: Termination of pregnancy rates (per 1,000 ongoing pregnancies) 2007–2017

Gestation at birth (weeks)	2007		2008		2009		2010		2011		2012		2013		2014		2015		2016		2017	
	Total births	n	Total births	n	Total births	n	Total births	n	Total births	n	Total births	n	Total births	n	Total births	n	Total births	n	Total births	n	Total births	n
Termination of pregnancy																						
20–22	204	103	207	94	210	88	231	92	230	107	231	118	215	83	245	91	169	66	206	87	210	81
23–24	117	22	131	25	137	31	122	20	129	29	119	32	123	32	137	31	117	27	126	32	110	25
25–27	232	10	241	14	237	9	228	20	185	15	219	14	192	16	187	10	206	8	187	13	212	16
28–31	530	6	559	7	539	4	560	6	511	11	503	5	471	5	462	7	458	3	482	14	474	5
≥32	63,391	3	63,381	5	63,493	6	63,757	13	61,686	9	61,285	3	58,805	5	58,658	11	58,444	3	59,149	2	58,802	6
Unknown	726	-	1,104	-	586	-	551	-	501	-	923	-	327	-	390	-	383	-	450	-	646	-

Gestation at birth (weeks)	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	Chi-squared test for trend (p)
	Risk	Risk	Risk	Risk	Risk	Risk	Risk	Risk	Risk	Risk	Risk	
Termination of pregnancy												
20–22	1.60	1.46	1.36	1.42	1.71	1.89	1.39	1.52	1.11	1.45	1.35	0.21
23–24	0.34	0.39	0.48	0.31	0.46	0.52	0.54	0.52	0.46	0.53	0.42	0.11
25–27	0.16	0.22	0.14	0.31	0.24	0.23	0.27	0.17	0.14	0.22	0.27	0.62
28–31	0.09	0.11	0.06	0.09	0.18	0.08	0.08	0.12	0.05	0.23	0.08	0.39
≥32	0.05	0.08	0.09	0.20	0.15	0.05	0.09	0.19	0.05	0.03	0.10	0.78
Unknown	-	-	-	-	-	-	-	-	-	-	-	-

Sources: Numerator: PMMRC's perinatal data extract, terminations of pregnancy only, 2007–2017; Denominator: MAT births 2007–2017.

There is some evidence of a statistically significant decrease in stillbirths at 28–31 weeks' gestation, and at term (37–40 weeks) (Table 3.28). There is also some evidence of a statistically significant reduction in neonatal death in those born at ≥41 weeks' gestation, but a statistically significant increase in deaths at 20–22 weeks' gestation (Table 3.29).

Table 3.28: Stillbirth risk (per 1,000 ongoing pregnancies) 2007–2017

Gestation at birth (weeks)	2007		2008		2009		2010		2011		2012		2013		2014		2015		2016		2017	
	Total births	n	Total births	n	Total births	n	Total births	n	Total births	n	Total births	n	Total births	n	Total births	n	Total births	n	Total births	n	Total births	n
Stillbirths																						
20–22	204	79	207	95	210	88	231	94	230	90	231	85	215	88	245	110	169	73	206	83	210	72
23–24	117	25	131	40	137	43	122	31	129	37	119	28	123	29	137	28	117	32	126	29	110	27
25–27	232	39	241	34	237	39	228	32	185	24	219	36	192	25	187	25	206	31	187	26	212	30
28–31	530	43	559	38	539	48	560	32	511	34	503	30	471	32	462	31	458	29	482	22	474	30
32–36	3,842	64	3,959	54	3,978	60	4,004	66	3,909	55	3,931	54	3,723	63	3,727	58	3,648	48	3,817	60	3,730	48
37–40	47,219	98	47,755	99	47,775	111	48,203	78	47,048	83	47,029	78	45,604	60	45,839	72	45,725	72	46,551	76	46,621	68
≥41	12,330	20	11,667	19	11,740	19	11,550	14	10,729	9	10,325	9	9,478	9	9,092	3	9,071	20	8,781	14	8,451	12
Unknown	726	<3	1,104	-	586	<3	551	-	501	-	923	-	327	-	390	-	383	-	450	-	646	-

Gestation at birth (weeks)	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	Chi-squared test for trend (p)
	Risk	Risk	Risk	Risk	Risk	Risk	Risk	Risk	Risk	Risk	Risk	
Stillbirths												
20–22	1.23	1.47	1.36	1.45	1.43	1.36	1.47	1.84	1.23	1.38	1.20	0.9993
23–24	0.39	0.62	0.67	0.48	0.59	0.45	0.49	0.47	0.54	0.48	0.45	0.44
25–27	0.61	0.53	0.61	0.50	0.38	0.58	0.42	0.42	0.52	0.43	0.50	0.18
28–31	0.67	0.59	0.75	0.50	0.55	0.49	0.54	0.52	0.49	0.37	0.51	0.012
32–36	1.01	0.85	0.94	1.04	0.89	0.88	1.07	0.99	0.82	1.01	0.82	0.65
37–40	1.65	1.67	1.87	1.31	1.44	1.36	1.09	1.31	1.31	1.37	1.23	0.0015
≥41	1.62	1.63	1.62	1.21	0.84	0.87	0.95	0.33	2.20	1.59	1.42	0.60
Unknown	-	-	-	-	-	-	-	-	-	-	-	-

Sources: Numerator: PMMRC's perinatal data extract, stillbirths only, 2007–2017; Denominator: MAT births 2007–2017.

Table 3.29: Neonatal death risk (per 1,000 ongoing pregnancies) 2007–2017

Gestation at birth (weeks)	2007		2008		2009		2010		2011		2012		2013		2014		2015		2016		2017	
	Total births	n	Total births	n	Total births	n	Total births	n	Total births	n	Total births	n	Total births	n	Total births	n	Total births	n	Total births	n	Total births	n
Neonatal deaths																						
20–22	22	35	18	29	34	40	45	62	33	38	28	44	44	46	44	52	30	36	36	44	57	56
23–24	70	34	66	33	63	31	71	30	63	29	59	34	62	24	78	39	58	33	65	23	58	29
25–27	183	15	193	14	189	22	176	21	146	13	169	20	151	14	152	14	167	13	148	11	166	18
28–31	481	8	514	20	487	14	522	14	466	13	468	15	434	12	424	8	426	9	446	12	439	13
32–36	3,775	21	3,900	21	3,913	25	3,929	26	3,846	24	3,874	16	3,656	24	3,664	22	3,597	27	3,755	17	3,677	23
37–40	47,121	40	47,656	42	47,663	38	48,121	45	46,964	39	46,951	38	45,543	28	45,761	38	45,653	39	46,475	39	46,552	27
≥41	12,310	14	11,648	18	11,721	13	11,536	12	10,720	8	10,316	11	9,469	5	9,089	9	9,051	9	8,767	6	8,439	5
Unknown	725	-	1,104	-	585	-	551	-	501	-	923	-	327	-	390	-	383	-	450	-	646	-

Gestation at birth (weeks)	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	Chi-squared test for trend (p)
	Risk	Risk	Risk	Risk	Risk	Risk	Risk	Risk	Risk	Risk	Risk	
Neonatal deaths												
20–22	0.55	0.45	0.62	0.96	0.61	0.71	0.77	0.88	0.61	0.74	0.94	0.006
23–24	0.53	0.52	0.48	0.47	0.47	0.55	0.40	0.66	0.56	0.39	0.49	0.84
25–27	0.23	0.22	0.34	0.33	0.21	0.32	0.24	0.24	0.22	0.18	0.30	0.65
28–31	0.13	0.31	0.22	0.22	0.21	0.24	0.20	0.14	0.15	0.20	0.22	0.57
32–36	0.33	0.33	0.39	0.41	0.39	0.26	0.41	0.38	0.46	0.29	0.39	0.73
37–40	0.67	0.71	0.64	0.75	0.68	0.66	0.51	0.69	0.71	0.71	0.49	0.38
≥41	1.14	1.55	1.11	1.04	0.75	1.07	0.53	0.99	0.99	0.68	0.59	0.033
Unknown	-	-	-	-	-	-	-	-	-	-	-	-

Sources: Numerator: PMMRC's perinatal data extract specific neonatal deaths 2007–2017; Denominator: MAT births excluding fetal deaths 2007–2017.

Over the time period 2007–2017, there was some evidence of a decrease in the mortality rate from intrapartum stillbirth in babies aged 23–27 weeks. There was strong evidence for a reduction in intrapartum stillbirth in babies born at term (37 weeks onwards) (Table 3.30 and Figure 3.21). The reduction in deaths of babies was similar in Māori mothers as in New Zealand European mothers (data not shown).

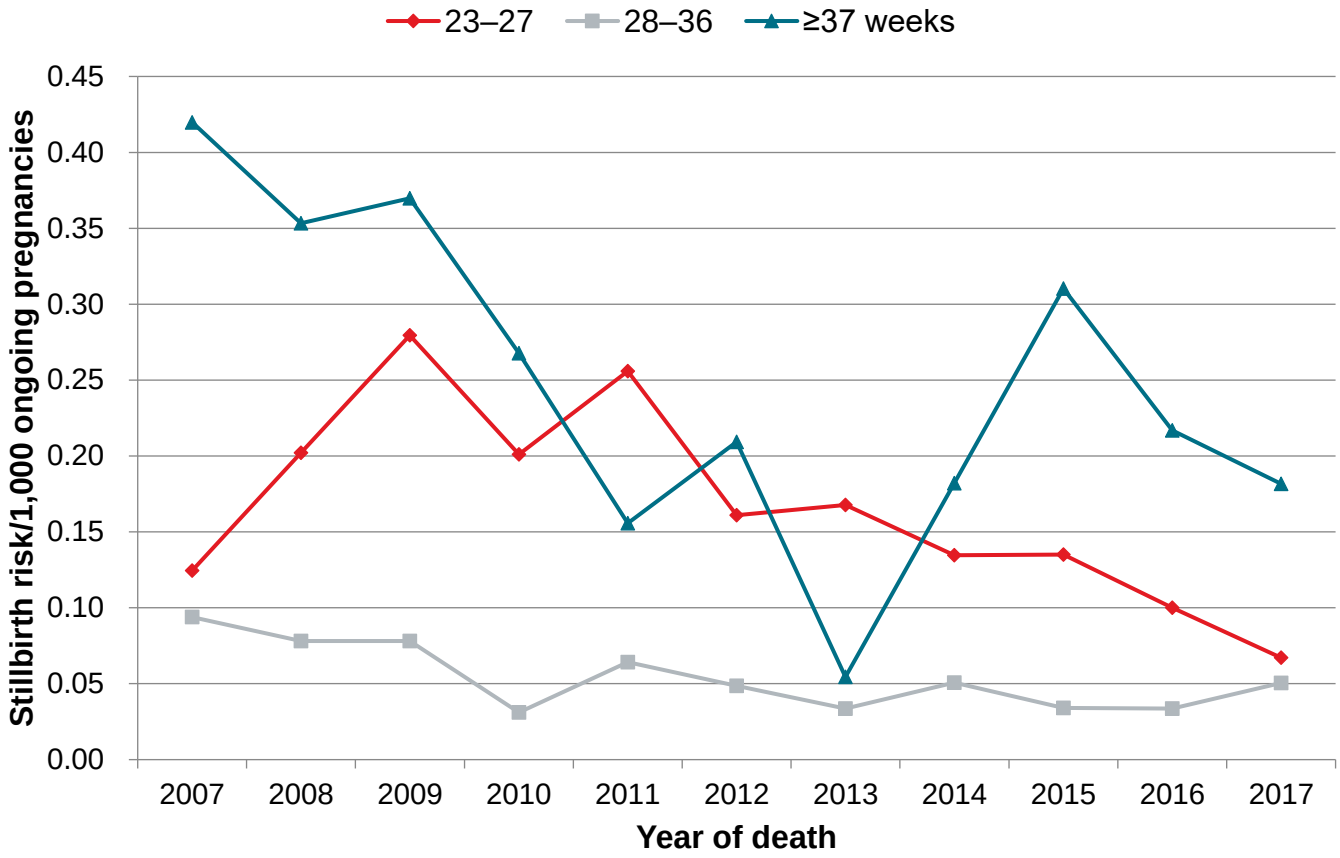
Table 3.30: Intrapartum stillbirth rates (per 1,000 ongoing pregnancies) by gestation excluding congenital abnormalities 2007–2017

Gestation at birth (weeks)	2007		2008		2009		2010		2011		2012		2013		2014		2015		2016		2017	
	n	N	n	N	n	N	n	N	n	N	n	N	n	N	n	N	n	N	n	N	n	N
23–27	8	64,173	13	64,218	18	64,303	13	64,550	16	62,394	10	62,021	10	59,497	8	59,335	8	59,131	6	59,835	4	59,509
28–36	6	63,856	5	63,876	5	63,962	<3	64,243	4	62,115	3	61,725	<3	59,220	3	59,049	<3	58,841	<3	59,565	3	59,228
≥37	25	59,518	21	59,394	22	59,486	16	59,722	9	57,743	12	57,327	3	55,061	10	54,897	17	54,764	12	55,307	10	55,060

Gestation at birth (weeks)	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	Chi-squared test for trend (p)
	Rate	Rate	Rate	Rate	Rate	Rate	Rate	Rate	Rate	Rate	Rate	
23–27	0.12	0.20	0.28	0.20	0.26	0.16	0.17	0.13	0.14	0.10	0.07	0.015
28–36	0.09	0.08	0.08	0.03	0.06	0.05	0.03	0.05	0.03	0.03	0.05	0.094
≥37	0.42	0.35	0.37	0.27	0.16	0.21	0.05	0.18	0.31	0.22	0.18	0.001

Sources: Numerator: PMMRC's perinatal data extract, stillbirths only (excluding congenital abnormalities) 2007–2017; Denominator: MAT births 2007–2017.

Figure 3.21: Intrapartum stillbirth risks (per 1,000 ongoing pregnancies) by gestation at birth (weeks) excluding congenital abnormalities 2007–2017

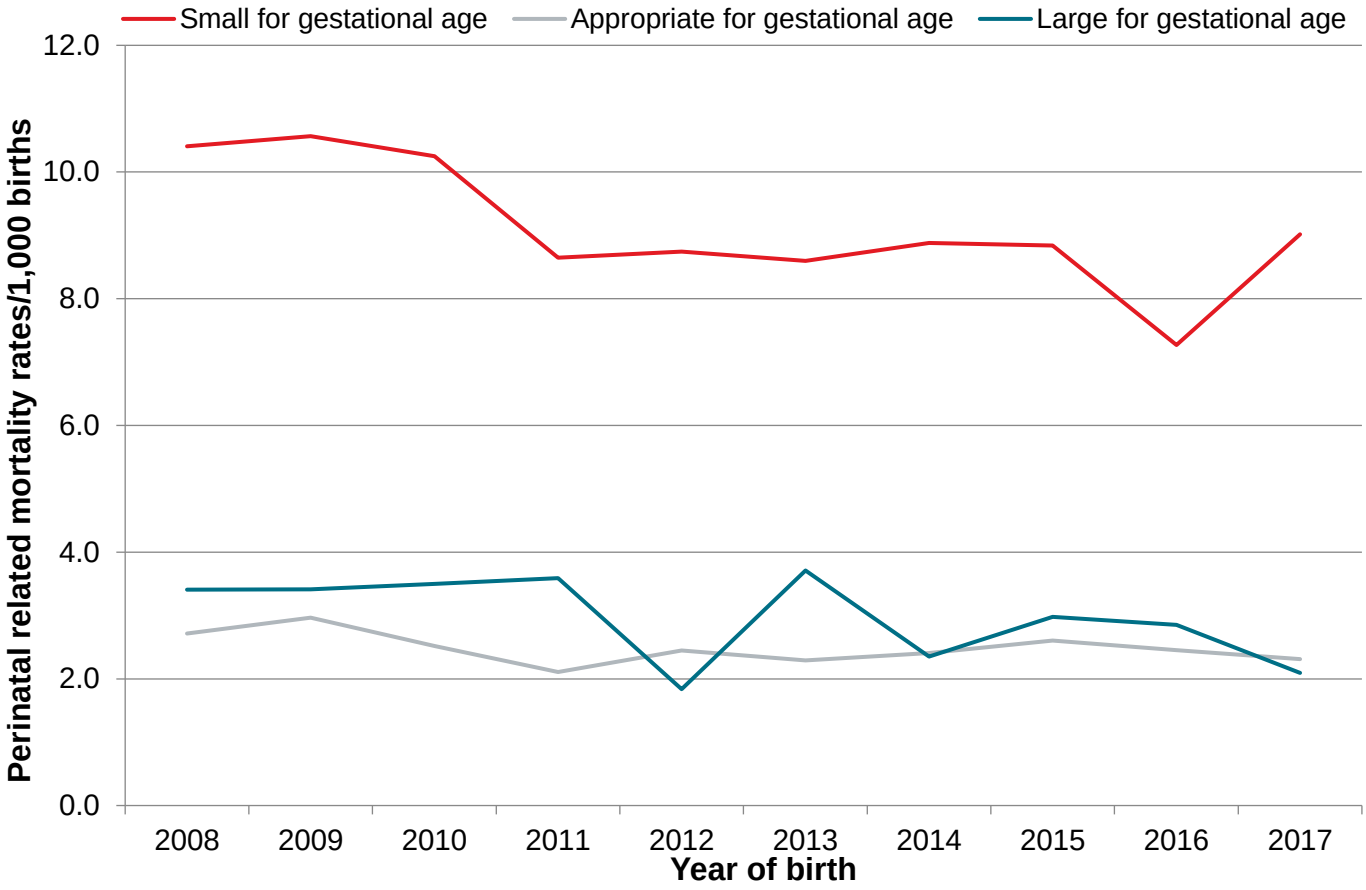


Sources: Numerator: PMMRC's perinatal data extract, stillbirths only (excluding congenital abnormalities), 2007–2017; Denominator: MAT births 2007–2017.

Mortality by customised birthweight centile

There has been very little change in the perinatal related mortality rate in singleton non-anomalous appropriate and large for gestational age babies over the last 10 years. However, deaths in small for gestational age babies are trending down (Figure 3.22 and Table 3.31).

Figure 3.22: Perinatal related mortality rates by customised centile group among singleton births* from 26 weeks' gestation without congenital abnormalities 2008–2017



* All data limited to mothers who were registered for care with an LMC (either a midwife, obstetrician or GP) claiming from the Section 88 Primary Maternity Services Notice.

Sources: Numerator: PMMRC's perinatal data extract where matched to MAT data, from 26 weeks' gestation without congenital abnormalities 2008–2017; Denominator: MAT births among singleton births from 26 weeks' gestation 2008–2017.

Table 3.31: Perinatal related mortality rates by customised birthweight centile group among singleton births* from 26 weeks' gestation without congenital abnormalities 2008–2017

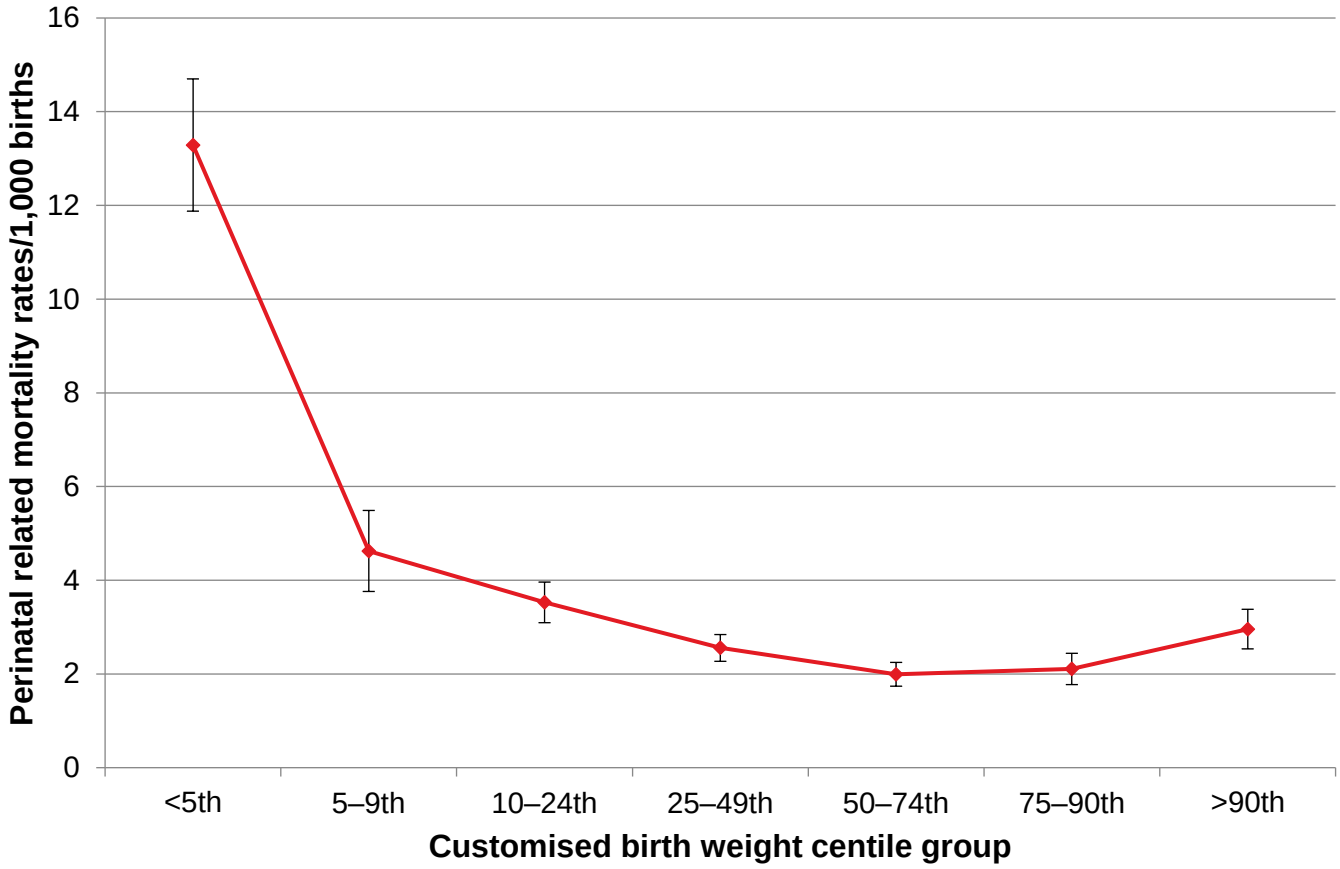
Year of death	Small for gestational age			Appropriate for gestational age			Large for gestational age			Unknown/missing data			Total		
	N=49,441	n=451		N=384,014	n=952		N=63,563	n=188		N=24,740	n=107		N=521,758	n=1,698	
	N	n	Rate	N	n	Rate	N	n	Rate	N	n	Rate	N	n	Rate
2008	4,805	50	10.41	36,473	99	2.71	6,160	21	3.41	2,700	17	6.30	50,138	187	3.73
2009	5,016	53	10.57	37,093	110	2.97	6,149	21	3.42	2,567	19	7.40	50,825	203	3.99
2010	5,074	52	10.25	38,148	96	2.52	6,288	22	3.50	2,678	7	2.61	52,188	177	3.39
2011	5,089	44	8.65	37,956	80	2.11	6,127	22	3.59	2,746	13	4.73	51,918	159	3.06
2012	5,032	44	8.74	39,194	96	2.45	6,533	12	1.84	2,234	6	2.69	52,993	158	2.98
2013	4,885	42	8.60	37,972	87	2.29	6,199	23	3.71	2,367	7	2.96	51,423	159	3.09
2014	4,955	44	8.88	38,655	93	2.41	6,377	15	2.35	2,273	5	2.20	52,260	157	3.00
2015	4,864	43	8.84	39,180	102	2.60	6,381	19	2.98	2,477	7	2.83	52,902	171	3.23
2016	4,952	36	7.27	39,579	97	2.45	6,660	19	2.85	2,407	16	6.65	53,598	168	3.13
2017	4,769	43	9.02	39,764	92	2.31	6,689	14	2.09	2,291	10	4.36	53,513	159	2.97
Data not supplied to MAT		86			−38			−59			5			−6	

* MAT data limited to mothers who were registered for care with an LMC (either a midwife, obstetrician or GP) claiming from the Section 88 Primary Maternity Services Notice.

Sources: Numerator: PMMRC's perinatal data extract where matched to MAT data, among singleton births from 26 weeks' gestation without congenital abnormalities 2008–2017; Denominator: MAT births among singleton births from 26 weeks' gestation 2008–2017.

From 26 weeks' gestation onwards, there was a significant reduction in mortality as baby birthweight approached the 50th–74th customised centile group. Those babies with a customised birthweight under the 5th centile had a substantially higher mortality rate, even compared with those in the 5th–9th centile. Mortality was lowest in those with a birthweight in the 50th–74th centile group. Babies with a birthweight in the customised centile group 90th or above had a statistically significantly higher mortality rate than those in the 50th–74th and 75th–90th centiles (Figure 3.23).

Figure 3.23: Perinatal related mortality rates (with 95% CIs) by customised birthweight centile group among singleton births from 26 weeks' gestation without congenital abnormalities 2008–2017*



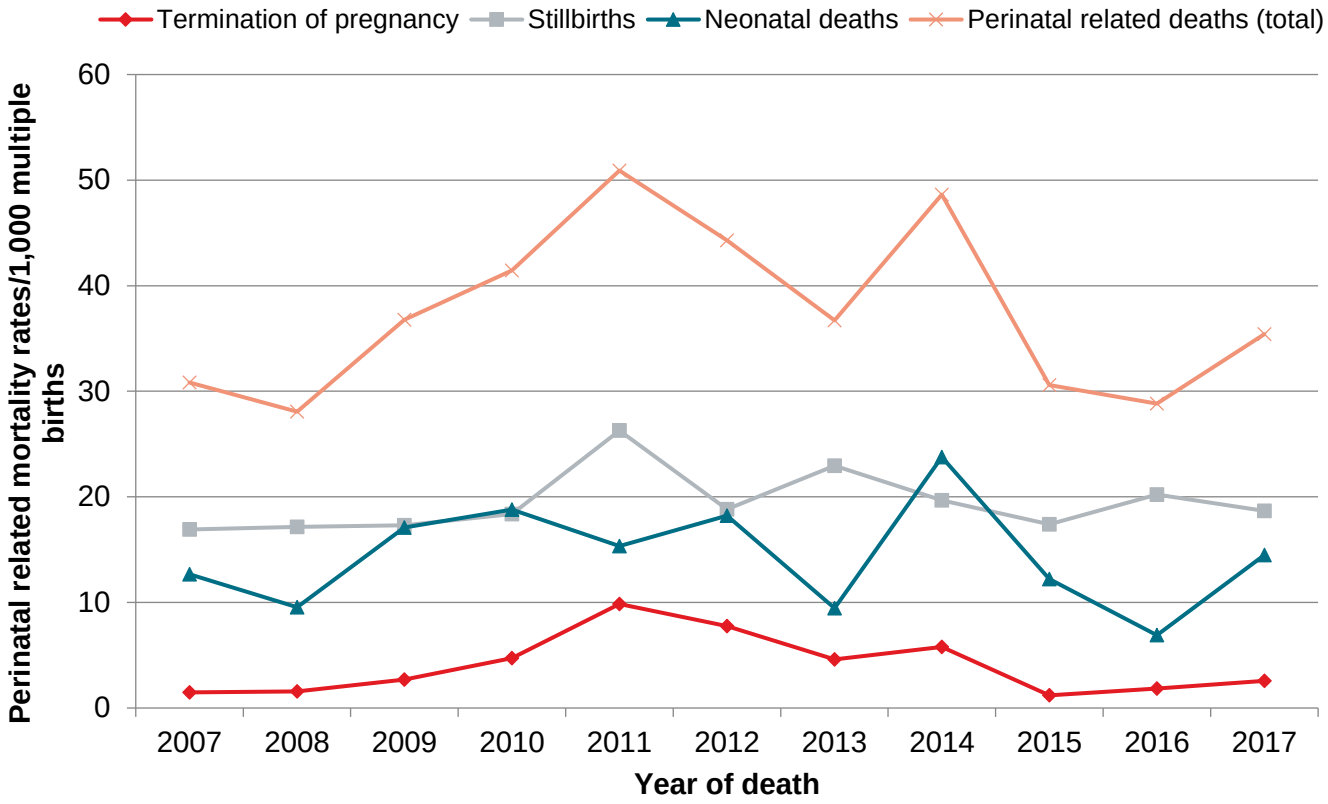
* All data limited to mothers who were registered for care with an LMC (either a midwife, Obstetrician or GP) claiming from the Section 88 Primary Maternity Services Notice.

Sources: Numerator: PMMRC's perinatal data extract where matched to MAT data, among singleton births from 26 weeks' gestation without congenital abnormalities 2008–2017; Denominator: MAT births among singleton births from 26 weeks' gestation 2008–2017.

Multiple pregnancies

Mortality rates in multiple pregnancies were substantially higher than for singletons, for all types of deaths except terminations of pregnancy. There have not been any significant changes in the mortality rates in multiples over the period 2007–2017 (Figure 3.24 and Table 3.32).

Figure 3.24: Perinatal related mortality rates (per 1,000 births) among babies born in multiple pregnancies 2007–2017



Sources: Numerator: PMMRC's perinatal data extract among babies born in multiple pregnancies 2007–2017; Denominator: MAT births among babies born in multiple pregnancies 2007–2017.

Table 3.32: Perinatal related mortality rates among babies born in multiple pregnancies 2007–2017

Year of death	Total multiple births	Fetal deaths				Neonatal deaths		Perinatal related deaths (total)	
		Termination of pregnancy		Stillbirths					
		n=79		n=381		n=277		n=737	
		n	Rate	n	Rate	n	Rate	n	Rate
2007	2,011	3	1.49	34	16.91	25	12.66	62	30.83
2008	1,924	3	1.56	33	17.15	18	9.53	54	28.07
2009	1,849	5	2.70	32	17.31	31	17.11	68	36.78
2010	1,906	9	4.72	35	18.36	35	18.80	79	41.45
2011	1,827	18	9.85	48	26.27	27	15.33	93	50.90
2012	1,806	14	7.75	34	18.83	32	18.20	80	44.30
2013	1,743	8	4.59	40	22.95	16	9.44	64	36.72
2014	1,727	10	5.79	34	19.69	40	23.77	84	48.64
2015	1,667	2	1.20	29	17.40	20	12.22	51	30.59
2016	1,631	3	1.84	33	20.23	11	6.90	47	28.82
2017	1,553	4	2.58	29	18.67	22	14.47	55	35.42
Chi-squared test for trend (p)		**0.83**		**0.49**		**0.79**		**0.69**	

's' indicates rate suppressed due to small numbers.

Sources: Numerator: PMMRC's perinatal data extract among babies born in multiple pregnancies 2007–2017; Denominator: MAT births among babies born in multiple pregnancies 2007–2017.

Death investigation

Overall, approximately half of babies had optimal investigation into the cause(s) of their death. This is defined here as post-mortem or karyotype confirming chromosomal abnormality or clinical examination/investigation confirming the diagnosis. This was higher for terminations of pregnancy and stillbirths, and less for neonatal deaths (Table 3.33).

Table 3.33: Perinatal related deaths and completeness of perinatal death investigations 2017

Perinatal death investigation	Fetal deaths				Neonatal deaths		Perinatal related deaths (total)	
	Termination of pregnancy		Stillbirths					
	n=133		n=287		n=171		n=591	
	n	%	n	%	n	%	n	%
Optimal investigation*	75	56.39	146	50.87	61	35.67	282	47.72
Post-mortem	43	32.33	131	45.64	46	26.90	220	37.23
Karyotype	31	23.31	12	4.18	8	4.68	51	8.63
Clinical examination/investigations confirm diagnosis	4	3.01	11	3.83	9	5.26	24	4.06
Partial investigations only#	49	36.84	104	36.24	97	56.73	250	42.30
Placental pathology performed+	74	55.64	231	80.49	126	73.68	431	72.93
No investigation^	9	6.77	37	12.89	13	7.60	59	9.98
Unknown	-	-	-	-	-	-	-	-

* Optimal investigation is defined as post-mortem or karyotype confirming congenital abnormality or clinical examination/investigation confirming diagnosis. Note: more than 1 option can be selected.

No post-mortem; investigations may have included placental pathology, magnetic resonance imaging (MRI), ultrasound scan or x-ray.

+ Includes both placental histology with post-mortem and as part of partial investigation.

^ No post-mortem, placental pathology, MRI, ultrasound scan or x-ray.

Source: PMMRC's perinatal data extract 2017.

Table 3.34 shows the degree to which perinatal deaths were investigated. There were higher proportions of Māori mothers who were offered post-mortem but declined, and consequently a larger number of Māori babies who did not have any investigation. The proportion of women who were not offered a post-mortem for their babies was reasonably consistent by prioritised ethnic group, with the exception of MELAA, who were not offered a post-mortem more frequently than other groups (Table 3.34).

Table 3.34: Perinatal related deaths and perinatal death investigations by prioritised ethnic group 2013–2017

Post-mortem examination offered	Māori		Pacific peoples		Asian						MELAA		European						Unknown/ Other		Perinatal related deaths (total)	
					Indian		Other Asian		Total Asian				NZ European		Other European		Total European					
	n=798		n=393		n=235		n=266		n=501		n=65		n=1,106		n=173		n=1,279		n=2		n=3,038	
	n	%	n	%	n	%	n	%	n	%	n	%	n	%	n	%	n	%	n	%	n	%
Post-mortem offered and parental consent given	183	22.9	123	31.3	98	41.7	117	44.0	215	42.9	29	44.6	540	48.8	91	52.6	631	49.3	2.0	100.0	1,183	38.9
Post-mortem offered and parents declined	558	69.9	241	61.3	130	55.3	134	50.4	264	52.7	28	43.1	492	44.5	68	39.3	560	43.8	-	-	1,651	54.3
Post-mortem not offered	47	5.9	24	6.1	3	1.3	14	5.3	17	3.4	8	12.3	64	5.8	11	6.4	75	5.9	-	-	171	5.6
Unknown	10	1.3	5	1.3	4	1.7	<3	x	5	1.0	-	-	10	0.9	3	1.7	13	1.0	-	-	33	1.1
Optimal investigation*	252	31.6	156	39.7	113	48.1	162	60.9	275	54.9	38	58.5	655	59.2	112	64.7	767	60.0	2.0	100.0	1,490	49.0
Post-mortem	183	22.9	123	31.3	98	41.7	117	44.0	215	42.9	29	44.6	540	48.8	91	52.6	631	49.3	2.0	100.0	1,183	38.9
Karyotype	46	5.8	24	6.1	15	6.4	45	16.9	60	12.0	9	13.8	110	9.9	20	11.6	130	10.2	-	-	269	8.9
Clinical examination/ investigations confirm diagnosis	38	4.8	15	3.8	5	2.1	11	4.1	16	3.2	<3	x	56	5.1	6	3.5	62	4.8	-	-	133	4.4
Partial investigations only#	362	45.4	194	49.4	111	47.2	90	33.8	201	40.1	23	35.4	397	35.9	51	29.5	448	35.0	-	-	1,228	40.4
No investigation+	182	22.8	42	10.7	10	4.3	13	4.9	23	4.6	4	6.2	49	4.4	10	5.8	59	4.6	-	-	310	10.2
Unknown	<3	x	<3	x	<3	x	<3	x	<3	x	-	-	5	0.5	-	-	5	0.4	-	-	10	0.3

* Optimal investigation is defined as post-mortem or karyotype confirming congenital abnormality or clinical examination/investigation confirming diagnosis. Note: more than 1 option can be selected.

No post-mortem; investigations may have included placental pathology, magnetic resonance imaging (MRI), ultrasound scan or x-ray.

+ No post-mortem, placental pathology, MRI, ultrasound scan or x-ray.

'x' indicates percentage suppressed due to small numbers.

Source: PMMRC's perinatal data extract 2013–2017.

Contributory factors

Local review of cases showed there were a number of deaths that had potentially avoidable aspects. Contributory factors were thought to be present in just under one third of perinatal related deaths (excluding termination of pregnancy) (Table 3.35).

Table 3.35: Contributory factors and potentially avoidable perinatal related deaths 2017

	Fetal deaths				Neonatal deaths		Perinatal related deaths (total)	
	Termination of pregnancy		Stillbirths					
	n=133		n=287		n=171		n=591	
	n	%	n	%	n	%	n	%
Contributory factors								
Present	8	6.0	90	31.4	51	29.8	149	25.2
Absent	124	93.2	194	67.6	114	66.7	432	73.1
Missing data	<3	x	3	1.0	6	3.5	10	1.7
Potentially avoidable								
Yes	<3	x	52	18.1	25	14.6	78	13.2
Contributory factors present but not potentially avoidable	7	5.3	36	12.5	26	15.2	69	11.7
Contributory factors present but avoidability unknown	-	-	<3	x	-	-	<3	x

'x' indicates percentage suppressed due to small numbers.

Source: PMMRC's perinatal data extract 2017, local review data.

Contributory factors were characterised by organisational and/or management factors, personnel factors, and barriers to access. Of these, 'barriers to access and/or engagement with care' was the most common contributory factor cited (Table 3.36).

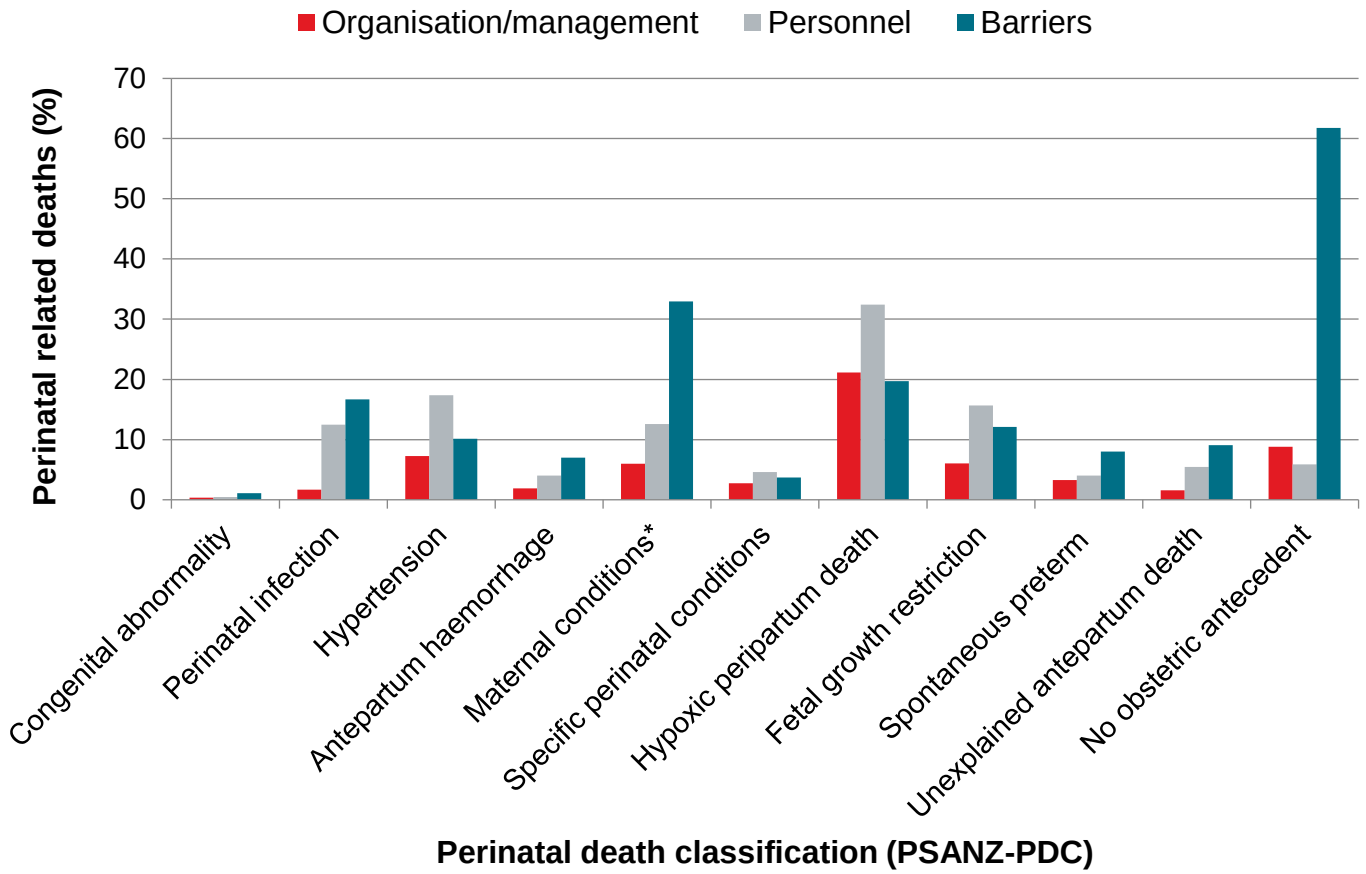
Table 3.36: Details of contributory factors among perinatal related deaths 2009–2017

Contributory factors	2009–2017	
	n	%
Any contributory factor	1,539	26.5
Organisational and/or management factors	296	5.1
Personnel factors	472	8.1
Barriers to access and/or engagement with care	1,105	19.0

Source: PMMRC's perinatal data extract 2009–2017, local review data.

Barriers to care was most notable for perinatal infection, maternal conditions and situations where there was no obstetric antecedent. Personnel factors were more common in hypertension, hypoxic peripartum death and fetal growth restriction (Figure 3.25 and Table 3.37).

Figure 3.25: Main contributory factor(s) in potentially avoidable perinatal related deaths (as a percentage of all deaths in each PSANZ-PDC category) by perinatal death classification (PSANZ-PDC) 2013–2017*



* Excludes two deaths where specific contributory factors were not identified.

Source: PMMRC's perinatal data extract 2013–2017, local review data.

Table 3.37: Main contributory factor(s) in potentially avoidable perinatal related death by perinatal death classification (PSANZ-PDC) 2013–2017

Perinatal death classification (PSANZ-PDC)	Perinatal related deaths	Potentially avoidable					
		Organisation/management		Personnel		Barriers	
	n	n	%	n	%	n	%
Congenital abnormality	838	3	0.4	4	0.5	9	1.1
Perinatal infection	120	<3	x	15	12.5	20	16.7
Hypertension	69	5	7.2	12	17.4	7	10.1
Antepartum haemorrhage	373	7	1.9	15	4.0	26	7.0
Maternal conditions*	167	10	6.0	21	12.6	55	32.9
Specific perinatal conditions	326	9	2.8	15	4.6	12	3.7
Hypoxic peripartum death	71	15	21.1	23	32.4	14	19.7
Fetal growth restriction	198	12	6.1	31	15.7	24	12.1
Spontaneous preterm	400	13	3.3	16	4.0	32	8.0
Unexplained antepartum death	442	7	1.6	24	5.4	40	9.0
No obstetric antecedent	34	3	8.8	<3	x	21	61.8

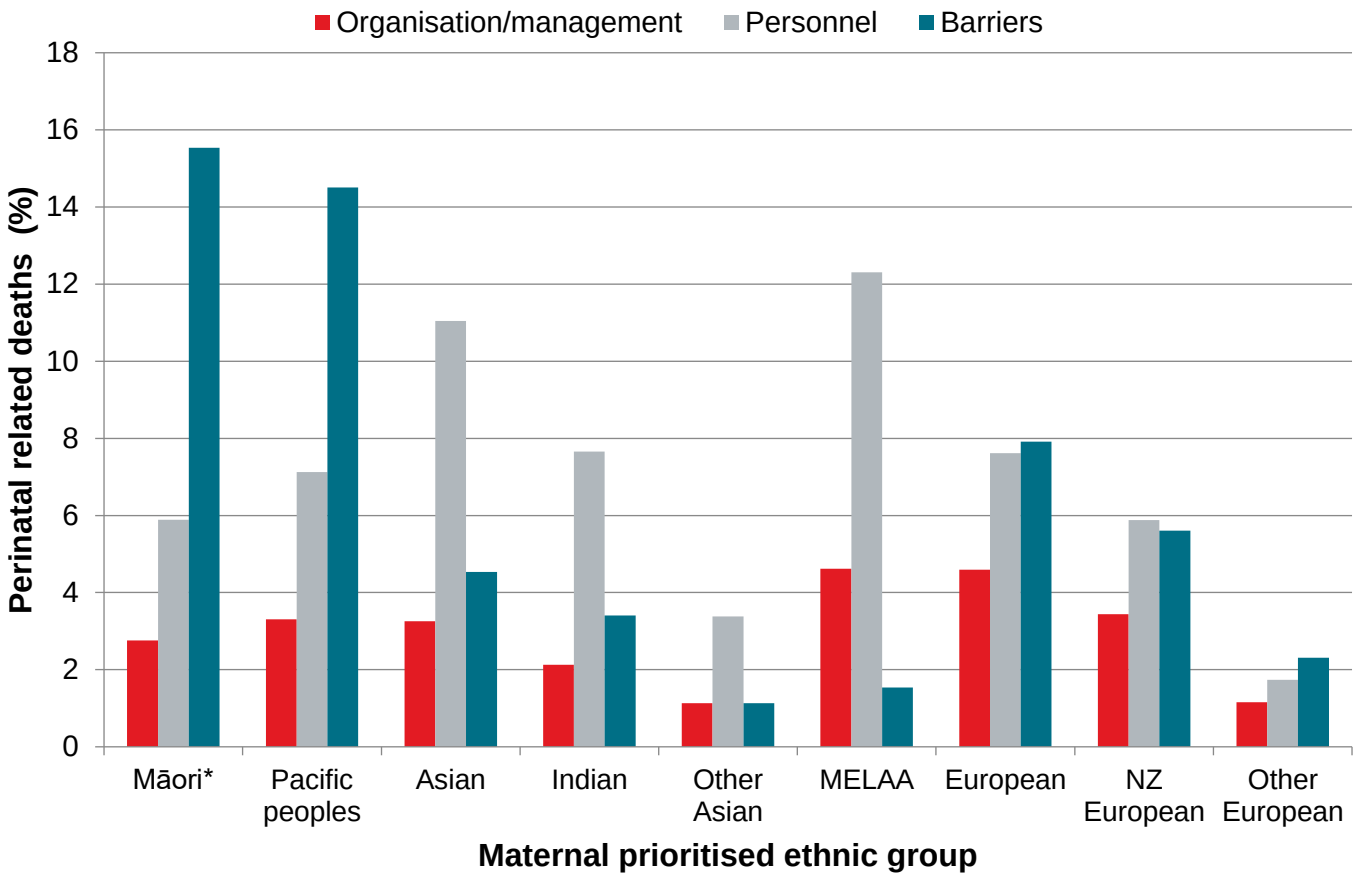
* Excludes two deaths where specific contributory factors were not identified.

'x' indicates percentage suppressed due to small numbers.

Source: PMMRC's perinatal data extract 2013–2017, local review data.

Organisational or management barriers were frequent amongst Māori and Pacific mothers, with personnel being a significant factor for those in Asian and MELAA ethnic groups (Figure 3.26 and Table 3.38).

Figure 3.26: Main contributory factor(s) in potentially avoidable perinatal related deaths (as a percentage of all deaths) by maternal prioritised ethnic group 2013–2017



* Excludes one death where specific contributory factors were not identified.

MELAA = Middle Eastern, Latin American, or African.

Source: PMMRC's perinatal data extract 2013–2017, local review data.

Table 3.38: Main contributory factor(s) in potentially avoidable perinatal related deaths by maternal prioritised ethnic group* (with 95% CIs) 2013–2017

Maternal prioritised ethnic group	Perinatal related deaths	Potentially avoidable					
		Organisation/management		Personnel		Barriers	
	n	n	%	n	%	n	%
Māori#	798	22	2.8	47	5.9	124	15.5
Pacific peoples	393	13	3.3	28	7.1	57	14.5
Asian	501	8	1.6	27	5.4	11	2.2
Indian	235	5	2.1	18	7.7	8	3.4
Other Asian	266	3	1.1	9	3.4	3	1.1
MELAA	65	3	4.6	8	12.3	<3	x
European	1,279	40	3.1	68	5.3	66	5.2
NZ European	1,106	38	3.4	65	5.9	62	5.6
Other European	173	<3	x	3	1.7	4	2.3

* Excludes two unknown maternal ethnicity perinatal related deaths (total).

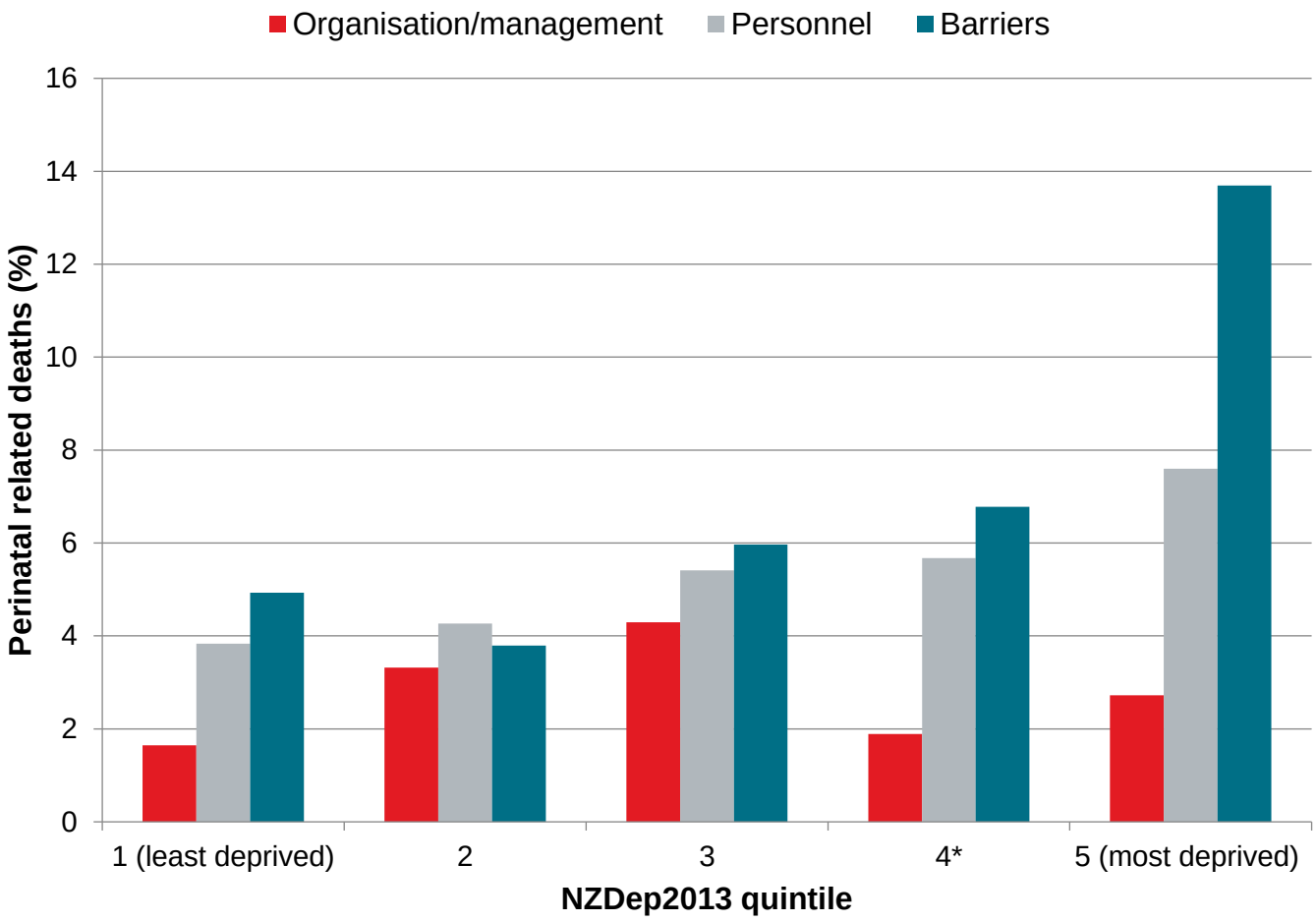
Excludes one death where specific contributory factors were not identified.

'x' indicates percentage suppressed due to small numbers.

Source: PMMRC's perinatal data extract 2013–2017, local review data.

As the level of deprivation increased, barriers to accessing care became more significant, particularly in NZDep2013 quintile 5 (Figure 3.27 and Table 3.39).

Figure 3.27: Main contributory factor(s) in potentially avoidable perinatal related deaths (as a percentage of all deaths) by NZDep2013 quintile 2013–2017



* Excludes two deaths where specific contributory factors were not identified.

Source: PMMRC's perinatal data extract 2013–2017, local review data.

Table 3.39: Main contributory factor(s) in potentially avoidable perinatal related deaths by NZDep2013 quintile (with 95% CIs) 2013–2017

NZDep2013 quintile	Perinatal related deaths	Potentially avoidable					
		Organisation/management		Personnel		Barriers	
	n	n	%	n	%	n	%
1 (least deprived)	365	6	1.6	14	3.8	18	4.9
2	422	14	3.3	18	4.3	16	3.8
3	536	23	4.3	29	5.4	32	6.0
4*	634	12	1.9	36	5.7	43	6.8
5 (most deprived)	1,066	29	2.7	81	7.6	146	13.7
Unknown	15	<3	x	-	-	5	33.3

* Excludes one death where specific contributory factors were not identified.

'x' indicates percentage suppressed due to small numbers.

Source: PMMRC's perinatal data extract 2008–2017, local review data.

Resuscitation

Resuscitation of babies born at 23–26 weeks' gestation requires careful discussion with parents about the implications of resuscitating, or not. We are unable to determine for which babies resuscitation was discussed, offered and declined, and for which babies resuscitation was not discussed or offered. Table 3.40 shows the number of babies for which resuscitation was attempted, by maternal prioritised ethnic group.

Table 3.40: Resuscitation and survival (to 28 days) by maternal prioritised ethnic group for live born babies at 23–26 weeks' gestation without congenital abnormalities 2008–2017

Prioritised ethnic group	Total live births*	Neonatal deaths		
		Resuscitation attempted	Resuscitation not attempted	Total
Māori	573	115	43	158
Pacific peoples	239	44	25	69
Asian	201	36	16	52
Indian	87	14	12	26
Other Asian	114	22	4	26
MELAA	33	6	4	10
European	616	103	28	131
NZ European	501	87	24	111
Other European	115	16	4	20
Unknown/Other	1	1	-	1
Total	**1,663**	**305**	**116**	**421**

* Includes congenital abnormalities

MELAA = Middle Eastern, Latin American, or African.

Sources: Numerator: PMMRC's perinatal data extract where matched to MAT data, 23–26 weeks' gestation, 2008–2017; Live births: MAT data 2008–2017.

Table 3.41: Perinatal related death and perinatal death classification (PSANZ-PDC) 2008–2017

	Perinatal death classification (PSANZ-PDC)	2008–2012 n=3,476		2013–2017 n=3,038	
		n	Rate	n	Rate
	Congenital abnormality				
1.1	Central nervous system	189	0.59	159	0.53
1.2	Cardiovascular system	133	0.41	126	0.42
1.3	Urinary system	70	0.22	59	0.20
1.4	Gastrointestinal system	18	0.06	17	0.06
1.5	Chromosomal	301	0.93	266	0.88
1.6	Metabolic	14	0.04	11	0.04
1.7	Multiple/Non-chromosomal syndromes	124	0.38	100	0.33
1.8	Other congenital abnormality				
1.81	Musculoskeletal	45	0.14	50	0.17
1.82	Respiratory	5	0.02	4	0.01
1.83	Diaphragmatic hernia	30	0.09	14	0.05
1.84	Haematological	6	0.02	3	0.01
1.85	Tumours	11	0.03	7	0.02
1.88	Other specified congenital abnormality	16	0.05	10	0.03
1.9	Unspecified congenital abnormality	20	0.06	12	0.04
	Perinatal infection				
2.1	Bacterial				
2.11	Group B *Streptococcus*	23	0.07	26	0.09
2.12	*E. coli*	12	0.04	10	0.03
2.13	*Listeria monocytogenes*	7	0.02	10	0.03
2.14	Spirochaetal (eg, syphilis)	<3	s	3	0.01
2.18	Other bacterial	13	0.04	22	0.07
2.19	Unspecified bacterial	11	0.03	16	0.05
2.2	Viral				
2.21	*Cytomegalovirus*	23	0.07	12	0.04
2.22	Parvovirus	9	0.03	3	0.01
2.23	Herpes simplex virus	3	0.01	3	0.01
2.28	Other viral	<3	s	-	-
2.29	Unspecified viral	<3	s	-	-
2.3	Protozoal (eg, Toxoplasma)	7	0.02	5	0.02
2.5	Fungal	-	-	<3	s
2.8	Other specified organism	<3	s	-	-
2.9	Other unspecified organism	9	0.03	9	0.03
	Hypertension				
3.1	Chronic hypertension: essential	9	0.03	10	0.03
3.2	Chronic hypertension: secondary (eg, renal disease)	5	0.02	<3	s
3.3	Chronic hypertension: unspecified	4	0.01	<3	s
3.4	Gestational hypertension	10	0.03	4	0.01
3.5	Pre-eclampsia	63	0.20	37	0.12
3.51	Pre-eclampsia: With laboratory evidence of thrombophilia	4	0.01	4	0.01
3.6	Pre-eclampsia superimposed on chronic hypertension	16	0.05	7	0.02
3.61	Pre-eclampsia superimposed on chronic hypertension: With laboratory evidence of thrombophilia	3	0.01	-	-
3.9	Unspecified hypertension	4	0.01	3	0.01
	Antepartum haemorrhage (APH)				
4.1	Placental abruption	188	0.58	129	0.43
4.11	Placental abruption: With laboratory evidence of thrombophilia	16	0.05	4	0.01
4.2	Placenta praevia	10	0.03	9	0.03

4.3	Vasa praevia	3	0.01	<3	s
4.8	Other APH	40	0.12	115	0.38
4.9	APH of undetermined origin	104	0.32	114	0.38
	Maternal conditions				
5.1	Termination of pregnancy for maternal psychosocial indications	19	0.06	23	0.08
5.2	Diabetes/Gestational diabetes	62	0.19	58	0.19
5.3	Maternal injury	-	-	<3	s
5.31	Maternal injury: Accidental	6	0.02	17	0.06
5.32	Maternal injury: Non-accidental	5	0.02	5	0.02
5.4	Maternal sepsis	8	0.02	14	0.05
5.5	Antiphospholipid syndrome	15	0.05	11	0.04
5.51	Other maternal thrombophilia (if considered cause of death)	3	0.01	<3	s
5.6	Obstetric cholestasis	-	-	3	0.01
5.8	Other specified maternal conditions	37	0.11	34	0.11
	Specific perinatal conditions				
6.1	Twin–twin transfusion	110	0.34	73	0.24
6.2	Fetomaternal haemorrhage	45	0.14	34	0.11
6.3	Antepartum cord complications (eg, cord haemorrhage; true knot with evidence of occlusion)	12	0.04	-	-
6.31	Cord haemorrhage	6	0.02	7	0.02
6.32	True knot with evidence of occlusion	13	0.04	13	0.04
6.38	Other	42	0.13	36	0.12
6.4	Uterine abnormalities (eg, bicornuate uterus, cervical incompetence)	61	0.19	65	0.22
6.5	Birth trauma (typically infants of >24 weeks' gestation or >600g birthweight)	<3	s	-	-
6.6	Alloimmune disease				
6.61	Alloimmune disease: Rhesus	<3	s	<3	s
6.64	Alloimmune disease: Alloimmune thrombocytopenia	3	0.01	3	0.01
6.63	Alloimmune disease: Kell	-	-	<3	s
6.68	Alloimmune disease: Other	-	-	<3	s
6.7	Idiopathic hydrops	20	0.06	20	0.07
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 amniocentesis	8	0.02	4	0.01
6.82	Termination of pregnancy for suspected but unconfirmed congenital abnormality	-	-	4	0.01
6.83	Fetal subdural haematoma	4	0.01	4	0.01
6.88	Other	33	0.10	57	0.19
6.89	Unspecified	-	-	<3	s
	Hypoxic peripartum death				
7.1	With intrapartum complications				
7.11	With intrapartum complications: Uterine rupture	6	0.02	5	0.02
7.12	With intrapartum complications: Cord prolapse	13	0.04	6	0.02
7.13	With intrapartum complications: Shoulder dystocia	3	0.01	-	-
7.18	With intrapartum complications: Other	14	0.04	6	0.02
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)	51	0.16	39	0.13
7.3	No intrapartum complications and no evidence of non-reassuring fetal status	7	0.02	10	0.03
7.9	Unspecified hypoxic peripartum death	28	0.09	5	0.02
	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)	161	0.50	129	0.43
8.2	With chronic villitis	<3	s	10	0.03
8.3	No placental pathology	25	0.08	7	0.02
8.4	No examination of placenta	15	0.05	12	0.04
8.8	Other specified placental pathology	51	0.16	38	0.13
8.9	Unspecified or not known whether placenta examined	<3	s	<3	s

	Spontaneous preterm				
9.1	Spontaneous preterm with intact membranes, or membrane rupture <24 hours before delivery	-	-	<3	s
9.11	Spontaneous preterm with intact membranes, or membrane rupture <24 hours before delivery: With chorioamnionitis	112	0.35	113	0.38
9.12	Spontaneous preterm with intact membranes, or membrane rupture <24 hours before delivery: Without chorioamnionitis	61	0.19	36	0.12
9.13	Spontaneous preterm with intact membranes, or membrane rupture <24 hours before delivery: No examination of placenta	7	0.02	11	0.04
9.17	No clinical signs of chorioamnionitis, no examination of placenta	59	0.18	44	0.15
9.19	Spontaneous preterm with intact membranes, or membrane rupture <24 hours before delivery: Unspecified or not known whether placenta examined	33	0.10	5	0.02
9.2	Spontaneous preterm with membrane rupture ≥24 hours before delivery				
9.21	Spontaneous preterm with membrane rupture ≥24 hours before delivery: With chorioamnionitis	130	0.40	121	0.40
9.22	Spontaneous preterm with membrane rupture ≥24 hours before delivery: Without chorioamnionitis	19	0.06	10	0.03
9.23	Spontaneous preterm with membrane rupture ≥24 hours before delivery: With clinical evidence of chorioamnionitis, no examination of placenta	21	0.07	12	0.04
9.27	No clinical signs of chorioamnionitis, no examination of placenta	20	0.06	25	0.08
9.29	Spontaneous preterm with membrane rupture ≥24 hours before delivery: Unspecified or not known whether placenta examined	11	0.03	3	0.01
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	8	0.02	11	0.04
9.32	Spontaneous preterm with membrane rupture of unknown duration before delivery: Without chorioamnionitis	3	0.01	4	0.01
9.33	Spontaneous preterm with membrane rupture of unknown duration before delivery: With clinical evidence of chorioamnionitis, no examination of placenta	4	0.01	-	-
9.37	No clinical signs of chorioamnionitis, no examination of placenta	5	0.02	<3	s
9.39	Spontaneous preterm with membrane rupture of unknown duration before delivery: Unspecified or not known whether placenta examined	11	0.03	<3	s
	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)	65	0.20	34	0.11
10.2	With chronic villitis	6	0.02	10	0.03
10.3	No placental pathology	114	0.35	110	0.37
10.4	No examination of placenta	92	0.29	75	0.25
10.8	Other specified placental pathology	161	0.50	211	0.70
10.9	Unspecified or not known whether placenta examined	16	0.05	<3	s
	No obstetric antecedent				
11.1	Sudden infant death syndrome (SIDS)				
11.11	SIDS Category IA: Classic features of SIDS present, completely documented	-	-	<3	s
11.13	SIDS Category II: Infant deaths that meet Category I except for one or more features	<3	s	-	-
11.2	Postnatally acquired infection	10	0.03	5	0.02
11.3	Accidental asphyxiation	-	-	<3	s
11.4	Other accident, poisoning or violence (postnatal)	3	0.01	-	-
11.8	Other specified	3	0.01	4	0.01
11.9	Unknown/Undetermined	3	0.01	<3	s
11.91	Unclassified sudden infant death	22	0.07	21	0.07
11.92	Other Unknown/Undetermined	<3	s	<3	s

Sources: Numerator: PMMRC's perinatal data extract 2008–2017; Denominator: MAT births 2008–2017.

Table 3.42: Neonatal death and primary neonatal death classification (PSANZ-NDC) 2008–2017

	Neonatal death classification (PSANZ-NDC)	2008–2012 n=912		2013–2017 n=824	
		n	Rate	n	Rate
	Congenital abnormality				
1.1	Central nervous system	23	0.07	18	0.06
1.2	Cardiovascular system	34	0.11	30	0.10
1.3	Urinary system	26	0.08	15	0.05
1.4	Gastrointestinal system	4	0.01	6	0.02
1.5	Chromosomal	52	0.16	45	0.15
1.6	Metabolic	13	0.04	12	0.04
1.7	Multiple/Non-chromosomal syndromes	30	0.09	32	0.11
1.8	Other congenital abnormality				
1.81	Musculoskeletal	6	0.02	10	0.03
1.82	Respiratory	4	0.01	<3	s
1.83	Diaphragmatic hernia	21	0.07	8	0.03
1.84	Haematological	<3	s	<3	s
1.85	Tumours	<3	s	4	0.01
1.88	Other specified congenital abnormality	4	0.01	5	0.02
1.9	Unspecified congenital abnormality	-	-	<3	s
	Extreme prematurity				
2.1	Not resuscitated	261	0.81	281	0.94
2.2	Unsuccessful resuscitation	54	0.17	24	0.08
2.9	Unspecified or not known whether resuscitation attempted	-	-	-	-
	Cardio-respiratory disorders				
3.1	Hyaline membrane disease/Respiratory distress syndrome (RDS)	28	0.09	24	0.08
3.2	Meconium aspiration syndrome	-	-	2	0.01
3.3	Primary persistent pulmonary hypertension	3	0.01	4	0.01
3.4	Pulmonary hypoplasia	15	0.05	19	0.06
3.5	Chronic neonatal lung disease (typically, bronchopulmonary dysplasia)	5	0.02	-	-
3.6	Pulmonary haemorrhage	9	0.03	5	0.02
3.7	Pneumothorax	-	-	<3	s
3.8	Other	5	0.02	10	0.03
	Infection				
4.1	Bacterial				
4.11	Congenital bacterial				
4.111	Congenital bacterial: Group B *Streptococcus*	14	0.04	10	0.03
4.112	Congenital bacterial: *E. coli*	9	0.03	8	0.03
4.113	Congenital bacterial: *Listeria monocytogenes*	<3	s	3	0.01
4.114	Congenital bacterial: Spirochaetal (eg, syphilis)	-	-	<3	s
4.118	Congenital bacterial: Other bacterial	9	0.03	6	0.02
4.119	Congenital bacterial: Unspecified bacterial	6	0.02	8	0.03
4.12	Acquired bacterial				
4.121	Acquired bacterial: Group B *Streptococcus*	4	0.01	<3	s
4.122	Acquired bacterial: *E. coli*	4	0.01	-	-
4.125	Acquired bacterial: Other Gram negative bacilli (other than *E. coli*)	3	0.01	<3	s
4.126	Acquired bacterial: *Staphylococcus aureus*	4	0.01	6	0.02
4.127	Acquired bacterial: Coagulase negative *Staphylococcus*	3	0.01	<3	s
4.128	Acquired bacterial: Other specified bacterial	7	0.02	3	0.01
4.129	Acquired bacterial: Unspecified bacterial	<3	s	<3	s
4.2	Viral				
4.21	Congenital viral				
4.211	Congenital viral: *Cytomegalovirus*	3	0.01	<3	s
4.213	Congenital viral: Herpes simplex virus	<3	s	3	0.01
4.218	Congenital viral: Other specified viral	<3	s	-	-
4.22	Acquired viral				
4.223	Acquired viral: Herpes simplex virus	<3	s	<3	s
4.228	Acquired viral: Other specified viral	3	0.01	<3	s

4.229	Acquired viral: Unspecified viral	<3	s	-	-
4.5	Fungal	-	-	3	0.01
4.9	Unspecified organism	7	0.02	<3	s
	Neurological				
5.1	Hypoxic ischaemic encephalopathy/Perinatal asphyxia (typically infants of >24 weeks' gestation or >600g birthweight)	117	0.37	77	0.26
5.2	Intracranial haemorrhage				
5.21	Intraventrical haemorrhage	24	0.07	43	0.14
5.22	Subgaleal haemorrhage	<3	s	-	-
5.23	Subarachnoid haemorrhage	<3	s	-	-
5.24	Subdural haemorrhage	<3	s	<3	s
5.28	Other intracranial haemorrhage	<3	s	4	0.01
5.8	Other	3	0.01	-	-
	Gastrointestinal				
6.1	Necrotising enterocolitis	15	0.05	14	0.05
6.8	Other	3	0.01	<3	s
	Other				
7.1	Sudden infant death syndrome (SIDS)				
7.11	SIDS Category IA: Classic features of SIDS present and completely documented	-	-	<3	s
7.13	SIDS Category II: Infant deaths that meet category I except for one or more features	<3	s	-	-
7.2	Multisystem failure				
7.21	Multisystem failure: Secondary to intrauterine growth restriction	3	0.01	4	0.01
7.28	Multisystem failure: Other specified	4	0.01	9	0.03
7.29	Multisystem failure: Unspecified/undetermined primary cause or trigger event	<3	s	-	-
7.3	Trauma	-	-	<3	s
7.31	Trauma: Accidental	3	0.01	4	0.01
7.32	Trauma: Non-accidental	<3	s	-	-
7.4	Treatment complications				
7.41	Treatment complications: Surgical	-	-	<3	s
7.42	Treatment complications: Medical	<3	s	<3	s
7.8	Other specified	8	0.02	9	0.03
7.9	Unknown/Undetermined				
7.91	Unclassified sudden infant death	<3	s	3	0.01
7.911	Unclassified sudden infant death: Bed sharing	29	0.09	24	0.08
7.912	Unclassified sudden infant death: Not bed sharing	4	0.01	3	0.01

Sources: Numerator: PMMRC's perinatal data extract, neonatal deaths only, 2008–2017; Denominator: MAT births excluding fetal deaths 2008–2017.

Table 3.43: Perinatal death classification (PSANZ-PDC) of fetal death by gestational age 2013–2017

Perinatal death classification (PSANZ-PDC)	Total	Gestation age (weeks)													
		20–22		23–24		25–27		28–31		32–36		37–40		≥41 weeks	
		n	%	n	%	n	%	n	%	n	%	n	%	n	%
Congenital abnormality	**656**	342	52.1	129	19.7	59	9.0	42	6.4	55	8.4	24	3.7	5	0.8
Perinatal infection	**72**	16	22.2	12	16.7	7	9.7	11	15.3	7	9.7	14	19.4	5	6.9
Hypertension	**56**	6	10.7	6	10.7	13	23.2	8	14.3	14	25.0	8	14.3	<3	x
Antepartum haemorrhage	**226**	128	56.6	25	11.1	8	3.5	10	4.4	32	14.2	21	9.3	<3	x
Maternal conditions	**134**	48	35.8	16	11.9	11	8.2	14	10.4	21	15.7	20	14.9	4	3.0
Specific perinatal conditions	**249**	63	25.3	34	13.7	25	10.0	27	10.8	45	18.1	49	19.7	6	2.4
Hypoxic peripartum death	**27**	-	-	-	-	-	-	-	-	<3	x	20	74.1	6	22.2
Fetal growth restriction	**184**	17	9.2	19	10.3	39	21.2	32	17.4	37	20.1	33	17.9	7	3.8
Spontaneous preterm	**168**	129	76.8	26	15.5	3	1.8	5	3.0	5	3.0	-	-	-	-
Unexplained antepartum death	**442**	85	19.2	25	5.7	35	7.9	29	6.6	79	17.9	167	37.8	22	5.0
No obstetric antecedent	**-**	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Total	**2,214**	**834**	**37.7**	**292**	**13.2**	**200**	**9.0**	**178**	**8.0**	**296**	**13.4**	**356**	**16.1**	**58**	**2.6**

'x' indicates percentage suppressed due to small numbers.

Source: PMMRC's perinatal data extract, fetal deaths only, 2013–2017.

Table 3.44: Perinatal death classification (PSANZ-PDC) and neonatal death classification (PSANZ-NDC) of neonatal deaths by gestational age 2013–2017

Death classification (PSANZ)	Total	Gestation age (weeks)													
		20–22		23–24		25–27		28–31		32–36		37–40		≥41	
		n	%	n	%	n	%	n	%	n	%	n	%	n	%
Perinatal death classification (PSANZ-PDC)															
Congenital abnormality	**182**	7	3.8	1	0.5	5	2.7	16	8.8	61	33.5	79	43.4	13	7.1
Perinatal infection	**48**	12	25.0	4	8.3	5	10.4	3	6.3	4	8.3	15	31.3	5	10.4
Hypertension	**13**	-	-	5	38.5	5	38.5	<3	x	<3	x	-	-	-	-
Antepartum haemorrhage	**147**	79	53.7	39	26.5	17	11.6	4	2.7	7	4.8	<3	x	-	-
Maternal conditions	**33**	9	27.3	4	12.1	3	9.1	3	9.1	9	27.3	5	15.2	-	-
Specific perinatal conditions	**77**	30	39.0	14	18.2	7	9.1	11	14.3	9	11.7	5	6.5	<3	x
Hypoxic peripartum death	**44**	-	-	-	-	-	-	<3	x	<3	x	34	77.3	8	18.2
Fetal growth restriction	**14**	-	-	-	-	<3	x	3	21.4	<3	x	6	42.9	<3	x
Spontaneous preterm	**232**	97	41.8	81	34.9	26	11.2	12	5.2	16	6.9	-	-	-	-
Unexplained antepartum death	**-**	-	-	-	-	-	-	-	-	-	-	-	-	-	-
No obstetric antecedent	**34**	-	-	-	-	-	-	-	-	<3	x	26	76.5	6	17.6
Neonatal death classification (PSANZ-NDC)															
Congenital abnormality	**188**	7	3.7	<3	x	3	1.6	16	8.5	66	35.1	82	43.6	13	6.9
Extreme prematurity	**305**	226	74.1	75	24.6	4	1.3	-	-	-	-	-	-	-	-
Cardio-respiratory disorders	**65**	-	-	26	40.0	16	24.6	12	18.5	6	9.2	4	6.2	<3	x
Infection	**63**	-	-	8	12.7	18	28.6	4	6.3	9	14.3	19	30.2	5	7.9
Neurological	**126**	-	-	27	21.4	20	15.9	10	7.9	23	18.3	37	29.4	9	7.1
Gastrointestinal	**15**	<3	x	3	20.0	7	46.7	4	26.7	-	-	-	-	-	-
Other	**62**	-	-	8	12.9	<3	x	8	12.9	9	14.5	29	46.8	6	9.7
Total	**824**	**234**	**28.4**	**148**	**18.0**	**70**	**8.5**	**54**	**6.6**	**113**	**13.7**	**171**	**20.8**	**34**	**4.1**

'x' indicates percentage suppressed due to small numbers.

Source: PMMRC's perinatal data extract, neonatal deaths only, 2013–2017.

Perinatal mortality appendix: Update on previous neonatal mortality recommendations

1. The PMMRC recommends the Ministry of Health establish a multidisciplinary working group to review current evidence for implementation of a preterm birth prevention programme such as that implemented in Western Australia, taking care to: a. identify and adequately resource evidence-based solutions b. ensure equitable access to screening and/or treatment for priority populations c. ensure that priority populations have a voice in the development of health policy, process and practice in order to achieve equitable health outcomes d. ensure that the outcomes of any implemented programme, including equity of access, are evaluated.	**The Ministry of Health** shares the PMMRC's desire to see progress in reducing preterm birth and reducing inequalities in the maternity system. Over the past 10 months, the Ministry of Health has been working on planning and developing a whole of maternity system action plan that will be considered by Cabinet in the middle of the year. This action plan will direct the transformation of maternity services from 2019–2023 to ensure the maternity system is effective, sustainable and remains a world-class service. While this work is in a planning phase, through the Maternity Quality and Safety Programme (MQSP) every DHB has been asked to undertake and report on the following projects in the 2018/19 work programme: • reducing preterm birth and neonatal mortality • improving care for mothers under 20 years of age • accessing primary mental health services • promoting primary birthing where appropriate.
2. Women with a previous preterm birth at less than 34 weeks are at increased risk of neonatal death. The PMMRC recommends that LMCs and DHBs employ strategies to reduce preterm birth by targeting this high-risk group, including: a. counselling at the time of a preterm birth to outline the strategies likely to be recommended for their next pregnancy, and advice to present for antenatal care as soon as they know they are pregnant b. ensuring that antenatal care is available to allow women to register as early as possible, and ensuring that early antenatal care includes attention to modifiable risk factors such as smoking, sexually transmitted infections, and urinary tract infections c. ensuring referral for specialist consultation in the first trimester to facilitate discussion of treatment options, which might include cervical cerclage or vaginal progesterone treatment and monitoring of cervical length using transvaginal ultrasound	**The Royal Australian and New Zealand College of Obstetricians and Gynaecologists (RANZCOG)** plans to highlight and discuss this recommendation at the Clinical Directors and Midwifery Leaders meeting in August 2019. RANZCOG will also recommend that counselling at the time of preterm birth and strategies for possible future pregnancies be prominent in both DHB and RANZCOG guidelines as a best practice recommendation. **The New Zealand College of Midwives (NZCOM)** notes the expanding evidence base that describes the protective effect of midwifery continuity of care on preterm birth rates with a particularly strong protective effect for women of low socioeconomic position. The New Zealand model of maternity care is premised on continuity from a known midwife, and NZCOM consistently promotes and supports midwives to provide continuity of care as well as advocating for this model to be sustained as part of the New Zealand health system. NZCOM has developed and manages the Find Your Midwife website, which enables women to access up-to-date information on midwives availability and contact details.

d. counselling around signs and symptoms of preterm birth and how to respond to these to optimise outcome.	It is standard midwifery practice as expressed in the competencies for entry to the register of midwives and the standards for practice that all women's antenatal midwifery care includes a comprehensive booking visit, which includes assessment for modifiable risk factors. NZCOM is currently undertaking a review on the consensus statement *Assessment and Promotion of Baby Wellbeing During Pregnancy*, which includes a statement about booking assessment and referral. NZCOM's consensus statement S*exually Transmitted Infections Screening* has just been updated. NZCOM notes that DHBs are addressing the issue of first trimester registration and inequities in access to first trimester care through the MQSP, on which local midwives are contributing members. **DHBs** – The majority of DHBs note the importance of early registration with an LMC, early mid-stream urine screening, sexually transmitted infection screening and referral to specialist care, including counselling at the time of a preterm birth. This counselling should outline strategies likely to be recommended for any future pregnancy. Capital & Coast DHB has systems in place around triaging of appointments and ensuring women come to clinic for appropriate investigations. Through MQSP, the four Northern Region DHBs (Auckland, Counties Manukau, Northland and Waitematā) are working in collaboration to develop written information that can be used to support education of women and their families about the risks, prevention, and management of preterm birth. They are investigating the possibility of a video to support this work. Other DHBs have noted interest in utilising these resources once available. Early registration with an LMC was an area highlighted by multiple DHBs. Canterbury and West Coast DHBs note their early registration rates to be over 78.1% – however, there is an ethnic disparity in early registration. This is noted as a key feature in the formation of their draft strategy. Nelson Marlborough DHB notes their early registration rate to be 89% of women booked in first trimester. Northland DHB reports success of their work on early engagement in pregnancy. Rates of first trimester registration in Northland DHB have increased from 47% to 66% in the last financial year – however, more work needs to be done in the Far North, which has not reflected this increase. Engagement barriers were highlighted in Tairāwhiti and Whanganui DHBs. Whanganui DHB

	has a severe shortage of community-based LMCs. In response, they have started a primary maternity care clinic run by a core midwife. A number of audits relating to preterm birth are underway in Hawke's Bay, Northland, Waitematā, Auckland and Counties Manukau DHBs. Hawke's Bay DHB has highlighted a need for a national approach to preterm birth.
3. Birth in a tertiary centre is associated with improved outcomes for preterm babies at the lower limits of viability (prior to 25 weeks' gestation). The PMMRC recommends the Ministry of Health leads the development of a national consensus pathway for the care of women in preterm labour or requiring delivery prior to 25 weeks' gestation. The PMMRC recommends this pathway includes: a. ensuring that all groups of women (irrespective of ethnicity, age, socioeconomic status or place of residence) are offered and provided the same level of care b. strategies for secondary units for management of women in threatened or early preterm labour, or who require delivery, prior to 25 weeks' gestation, including: i. administration of corticosteroids and magnesium sulphate ii. timely transfer from primary and secondary units to tertiary units iii. management of babies inadvertently born in their units at the lower limits of viability c. ensuring that priority populations have a voice in the development of health policy, process and practice in order to achieve equitable health outcomes d. guidance on monitoring that care provision is equitable by ethnicity, age, socioeconomic status and place of residence.	As mentioned above, **the Ministry of Health** shares the PMMRC's desire to see progress in reducing preterm birth and reducing inequalities in the maternity system. One of the themes mentioned in the whole of maternity system action plan is 'strengthening commissioning and accountability; supporting quality and safety', with the MQSP being central to this theme alongside the PMMRC, the National Maternity Monitoring Group, the Health Quality & Safety Commission and the Health Research Council. Part of this work is the development of a quality assurance framework that includes the above and will oversee the planning and development of: • maternity related reports • clinical indicators • national consensus pathways and guidance/guidelines • the MQSP.
4. The PMMRC recommends DHBs make available appropriate information, including appropriate counselling, for parents, families and whānau about birth outcomes prior to 25 weeks' gestation to enable shared decision-	The New Zealand Newborn Clinical Network has produced a New Zealand Consensus Statement on the Care of Mother and Baby(ies) at Periviable Gestations, which is about to be released. The following bodies have endorsed this consensus statement:

making and planning of active care or palliative care options.	• New Zealand Royal Australian College of Physicians • NZCOM • RANZCOG (formal letter is awaited) • Paediatric Society of New Zealand. This guideline standardises the care provided to mothers and babies. It includes parent information and decision aid for parents and families of babies likely to be born at 23–24 weeks' gestation. **DHBs** – Some DHBs report already using this draft consensus statement, while others have said they will adopt it once finalised. Capital & Coast DHB collaborates with different areas within the hospital to provide women with appropriate information, including Maternal Fetal Medicine Services, Neonatal Intensive Care Unit, the DHB Palliative Care Service (when required) and Te Māhoe Pregnancy Counselling Service inpatient staff and Sands (a support network for bereaved parents if required).
5. The PMMRC recommends that DHB maternity services audit the rates of antenatal corticosteroid administration, including repeat doses when indicated, to mothers of neonates live born at less than 34 weeks' gestation, including auditing whether administration is equitable by ethnicity, DHB of residence, and maternal age.	**DHBs** – Tairāwhiti, Hawke's Bay, Auckland and Waikato DHBs have undertaken an audit of the rates of antenatal corticosteroid administration. Waikato plans to do a further audit in 2019/20 to look at ethnicity, DHB of residence and maternal age. Hawke's Bay DHB reports that 48% of women completed steroids and another 30% started but did not complete. This was mainly due to the short timeframe from presentation of the labouring woman to the birth. Capital & Coast DHB has an audit in progress and Canterbury, West Coast, MidCentral and Hutt Valley DHBs all plan to audit in the 2019/20 financial year. Wairarapa DHB plans to be involved in a project auditing the use of corticosteroid administration and repeat doses through the MQSP. Taranaki DHB notes that they last audited antenatal corticosteroid administration in 2017. Northland, Hawke's Bay and Tairāwhiti DHBs have also recently updated their preterm birth guidelines.
6. The PMMRC recommends that tertiary obstetric and neonatal intensive care units investigate and address the difference between units in survival rates amongst infants born at 23–26 weeks' gestation as part of their benchmarking and quality and safety initiatives.	The Newborn Clinical Network is reviewing data on survival over three years (numbers are small, so annual rates fluctuate widely). This is based on feedback from the Australia and New Zealand Neonatal Network. This review includes survival of all babies born after 22 weeks' gestation but less than 32 weeks' gestation. The review involves multidisciplinary team discussions to assess risk

	factors and makes recommendations for future pregnanc(ies).
7. The PMMRC recommends that regulatory bodies require cultural competency training of all individuals working across all areas of the maternity and neonatal workforce. Training should address awareness of, and strategies to reduce and minimise the impact of, implicit bias and racism.	**RANZCOG** has introduced a mandatory component into the Fellowship of the Royal Australian and New Zealand College of Obstetricians and Gynaecologists training programme. This is an online and kanohi ki te kanohi (face to face) course called 'Application of the Hui Process/Meihana Model to Clinical Practice', which is facilitated by the Māori Indigenous Health Institute (MIHI), Otago University, Christchurch. Standards for doctors as part of the Medical Council of New Zealand statement on cultural competence will place a greater onus on all fellows to complete cultural competence and safety training like the MIHI course mentioned above. **NZCOM** – Although not a regulatory body, NZCOM has put significant focus on developing and providing continuing education in this area. Prior to the release of the PMMRC 12th annual report, NZCOM had initiated strategies to strengthen cultural consciousness within midwifery through the development and provision of the two new workshops for midwives nationally. The overarching aim of both workshops is to support an increased understanding and awareness of cultural consciousness within midwifery to benefit Māori and Pacifica women and whānau. The profession has welcomed the concept of raising cultural consciousness, which supports the development of cultural competency. The two workshops developed are: • Grounding Practice within Te Tiriti/the Treaty relationship (8-hour workshop unpacking the history of Aotearoa/New Zealand in order to understand how to be honourable partners in the Tiriti/Treaty relationship) • Birthing Across Cultures in Aotearoa/New Zealand (8-hour workshop for midwives to consider the inequities in health care outcomes and overall impact on health from a broader perspective).
8. The PMMRC recommends that the Ministry of Health and DHBs have a responsibility to ensure that midwifery staffing ratios and staffing acuity tools:	**DHBs** – All DHBs have the Care Capacity Demand Management programme, which is a set of tools and processes that help DHBs better match the capacity to care with patient demand. Many DHBs also have Trendcare, a planning and workload management system. DHBs that use these include Hawke's Bay, Hutt Valley, Northland, Taranaki,

a. enable active observation of mothers and babies who are undertaking skin-to-skin contact in the postnatal inpatient period b. allow for the identification of, and additional needs of, mothers who have increased risk factors for sudden unexpected death in infancy (SUDI).	Tairāwhiti, Lakes, Nelson Marlborough, Capital & Coast, Waikato and Canterbury. Capital & Coast DHB has recently participated in TrendC (acuity tool) timing studies to better reflect the maternity-specific environment. Wairarapa DHB uses LMC advanced booking to allow for opportunities to plan for periods of increased activity and have the flexibility to increase the staffing on a shift-by-shift basis. While some DHBs do not have a problem with staffing, many do. Hawke's Bay DHB notes that as per the national context the midwifery workforce is experiencing significant shortfalls, and this is a challenge for their DHB. Auckland and Lakes DHBs both also noted this challenge. Many DHBs have prioritised education for midwives, the mother and her family around safe sleeping and SUDI risk factors. This is due partly to the fact that while most often skin-to-skin time is supervised, there are times it is not and so education around safety is key. Hawke's Bay DHB noted that 90–100% of women have been screening for SUDI risk factors, and all women who smoke have been referred to a smoke-free incentive-based programme. Taranaki DHB has appointed a safe sleep, SUDI, smoking cessation coordinator in their DHB.
9. The PMMRC recommends that LMCs and DHBs ensure that every baby will have access to a safe sleep place on discharge from the hospital or birthing unit, or at home, that is their own place of sleep, on their back and with no pillow. If they do not have access to a safe sleep place, then a wahakura or Pēpi-Pod® must be made available for the baby's use prior to discharge from hospital.	**RANZCOG** plans to discuss this at the upcoming Clinical Directors and Midwifery Leaders meeting. **NZCOM** has promoted the National SUDI Prevention Online Training to its members, which includes the mnemonic PEPE, which stands for: • **P**lace to put the baby in their own bed: includes wahakura and Pēpi-Pods • **E**liminate smoking during pregnancy: midwives routinely refer for smoking cessation support • **P**osition baby on their back to sleep • **E**ncourage and support mum to breastfeed. **DHBs** are contracted by the Ministry of Health to distribute about 8,500 safe sleeping devices each year, including wahakura and Pēpi-Pods, with individual DHBs deciding which are most suitable for its population. In the 2018/19 period, Auckland DHB distributed 304 Pēpi-Pods. Many DHBs, including Canterbury, West Coast, Capital & Coast, Tairāwhiti and Hutt Valley, have wahakura for distribution. Canterbury, West Coast, MidCentral, Northland and Wairarapa DHBs also have

	wahakura weaving wānanga (educational seminars) available in their DHB region. Auckland, Taranaki, Nelson Marlborough, Canterbury, West Coast and Tairāwhiti DHBs have appointed a safe sleep coordinator. All DHBs mention education as an important factor in SUDI prevention. This includes education of health professionals and education of mothers. A number of DHBs have mentioned the SUDI online training that they have encouraged staff to complete. Educating the mother and her family on safe sleep is also noted as an important part of SUDI prevention. Northland DHB extends education to a number of people and organisations, including midwives, childbirth educators, iwi health providers, Family Start, and maternal and infant health and pregnancy and parenting services.

Perinatal mortality appendix: Update on perinatal mortality recommendations

11. Maternity and primary care providers need to be aware of the increasing risk of perinatal mortality for mothers under 20 years of age in New Zealand. Inequity in perinatal mortality for babies born to mothers under 20 years of age needs to be actively addressed. The PMMRC recommends the Ministry of Health and DHBs: a. develop, in consultation with young mothers, acceptable and safe methods for mothers under 20 years of age to access and engage with care in order to achieve equitable health outcomes b. identify and adequately resource evidence-based solutions to address risks for mothers under 20 years of age, paying attention to smoking cessation, screening and treatment for infections, screening for fetal growth restriction, and providing adequate information about the causes and symptoms of preterm labour c. consider how they can support LMCs caring for mothers aged under 20 years.	**DHBs** – Through the MQSP, every DHB has been asked to undertake and report on improving care for mothers under 20 years of age in the 2018/19 work programme. The majority of DHBs have noted antenatal (and postnatal) education for youth, tailored to youth, as well as wrap-around services for the young woman. These services are often provided at a place that is familiar to them. For example, in Hutt Valley DHB, antenatal education is provided at Vibe, a health and support youth service. In Lakes DHB, LMCs work in partnership with Rotovegas Youth Health and Anamata Cafe to provide integrated support for the woman. The incidence of unbooked or late-booking young women has decreased since these strategies have been implemented. Nelson Marlborough DHB has provided additional support to LMCs caring for pregnant women under 20 and wrap-around services to support these women. Services include mental health support care, alcohol and other drug addiction services, Māori health services, Well Child Tamariki Ora service providers, Family Start and Oranga Tamariki. GAP (Growth Assessment Protocol) is a tool often used to screen for fetal growth restriction. In Auckland DHB, the number of young mothers under 20 years old continues to slowly decrease (from 431 in 2000 to 137 in 2018, which is the lowest it has been).

12. The PMMRC recommends that DHBs with rates of perinatal related mortality significantly higher than the national rate review, or continue to review, the higher rate of mortality in their area and identify areas for improvement.	**Wairarapa DHB** continues to hold PMMRC meetings annually or biannually depending on how many deaths there have been. The pathologist attends to present the findings of post-mortems that are undertaken. Stillbirths and neonatal deaths that occur in the DHB follow the process of reporting to the PMMRC and are reviewed locally.

4 Te māuiui roro i ngā pēpi whānau hou | Neonatal encephalopathy

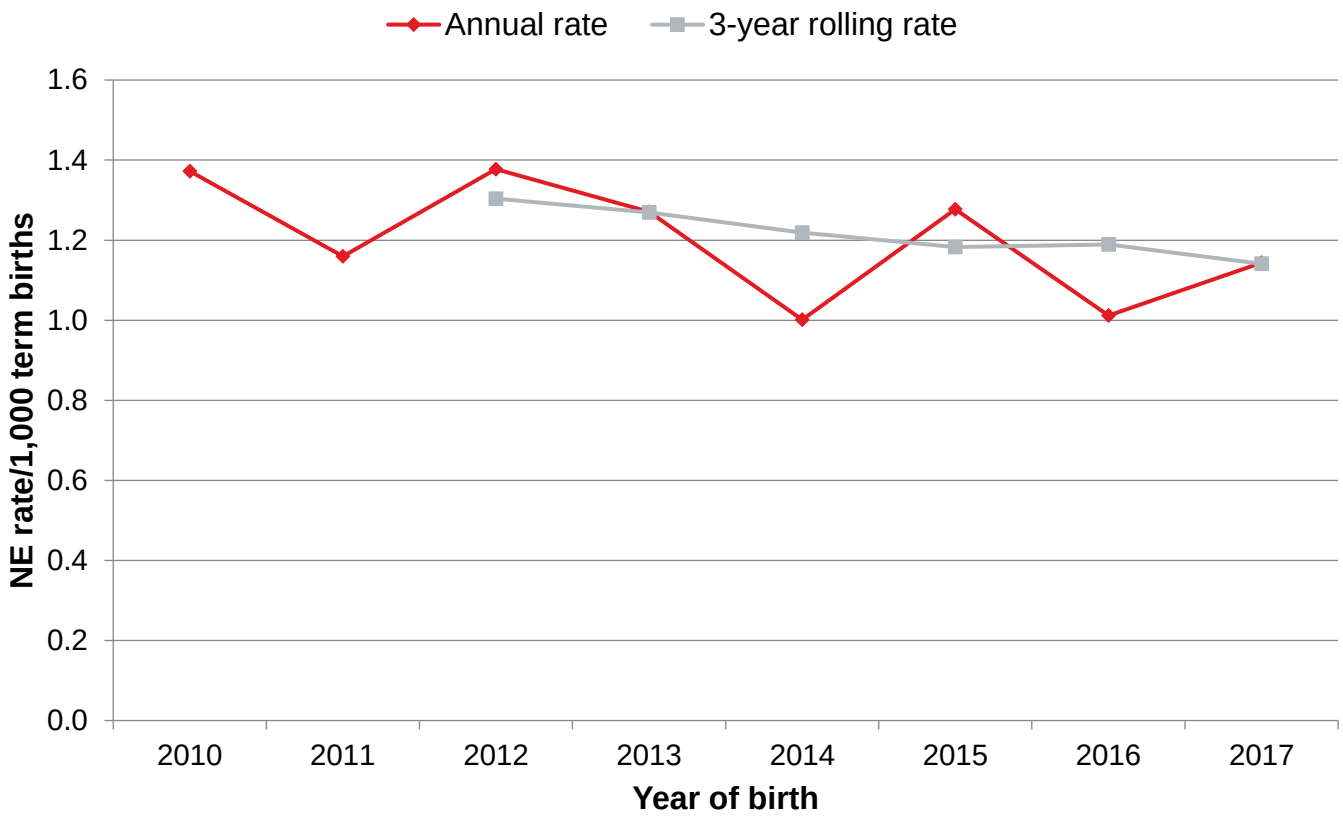
Introduction

Neonatal encephalopathy (NE) is a clinically defined syndrome of disturbed neurological function within the first week after birth in an infant born from 35 weeks' gestation, manifested by difficulty in initiating and maintaining respiration, depression of tone and reflexes, subnormal level of consciousness and often seizures. The severity of the encephalopathy is measured by the Sarnat stages 1, 2, or 3 or as mild, moderate or severe.[31]

The PMMRC collects data on babies who present with moderate or severe NE in the first seven days after birth. Data have been collected on NE babies from 37 weeks onwards since 2010. In 2016, the PMMRC started collecting data on babies from 35 weeks' gestation. Due to the small number of cases in 35–36 weeks' gestation babies collected to date, only data relating to babies born at 37 weeks or later are presented in this chapter. There are about 65 babies each year with moderate to severe NE in Aotearoa/New Zealand who are reported to the PMMRC.

There are a number of risk factors for NE as identified in the peer reviewed literature. These include antenatal risk factors, such as maternal diabetes, obesity, thyroid dysfunction, pre-eclampsia and previous caesarean section, evidence of fetal growth restriction, abnormal amniotic fluid volume and abnormal fetal heart tracing before labour. Intrapartum risk factors include clinical chorioamnionitis and ominous fetal heart tracing,[32] cord prolapse, placental abruption and uterine rupture.[33]

Figure 4.1: NE annual and three-year rolling rates (per 1,000 term births) 2010–2017



Sources: Numerator: PMMRC's NE data extract ≥37 weeks 2010–2017; Denominator: MAT births ≥37 weeks 2010–2017.

[31] Nelson KB, Leviton A. 1991. How much of neonatal encephalopathy is due to birth asphyxia? *American Journal of Diseases of Children* 145(11): 1325–31.

[32] Locatelli A, Incerti M, Paterlini G, et al. 2010. Antepartum and intrapartum risk factors for neonatal encephalopathy at term. *American Journal of Perinatology* 27(8): 649–54.

[33] Martinez-Biarge M, Madero R, González A, et al. 2012. Perinatal morbidity and risk of hypoxic-ischemic encephalopathy associated with intrapartum sentinel events. *American Journal of Obstetrics & Gynecology* 206: 148.e1–7.

International comparisons

It is frequently difficult to compare NE rates with other countries, due to differences in definitions of terms, inclusion and exclusion criteria, and data quality issues. A previous meta-analysis estimated the NE incidence in high-income regions to be 1.6 per 1,000 live births.[34] The New Zealand rate of 1.2 per 1,000 live births over the period 2010–2017 is therefore similar to other comparable countries.

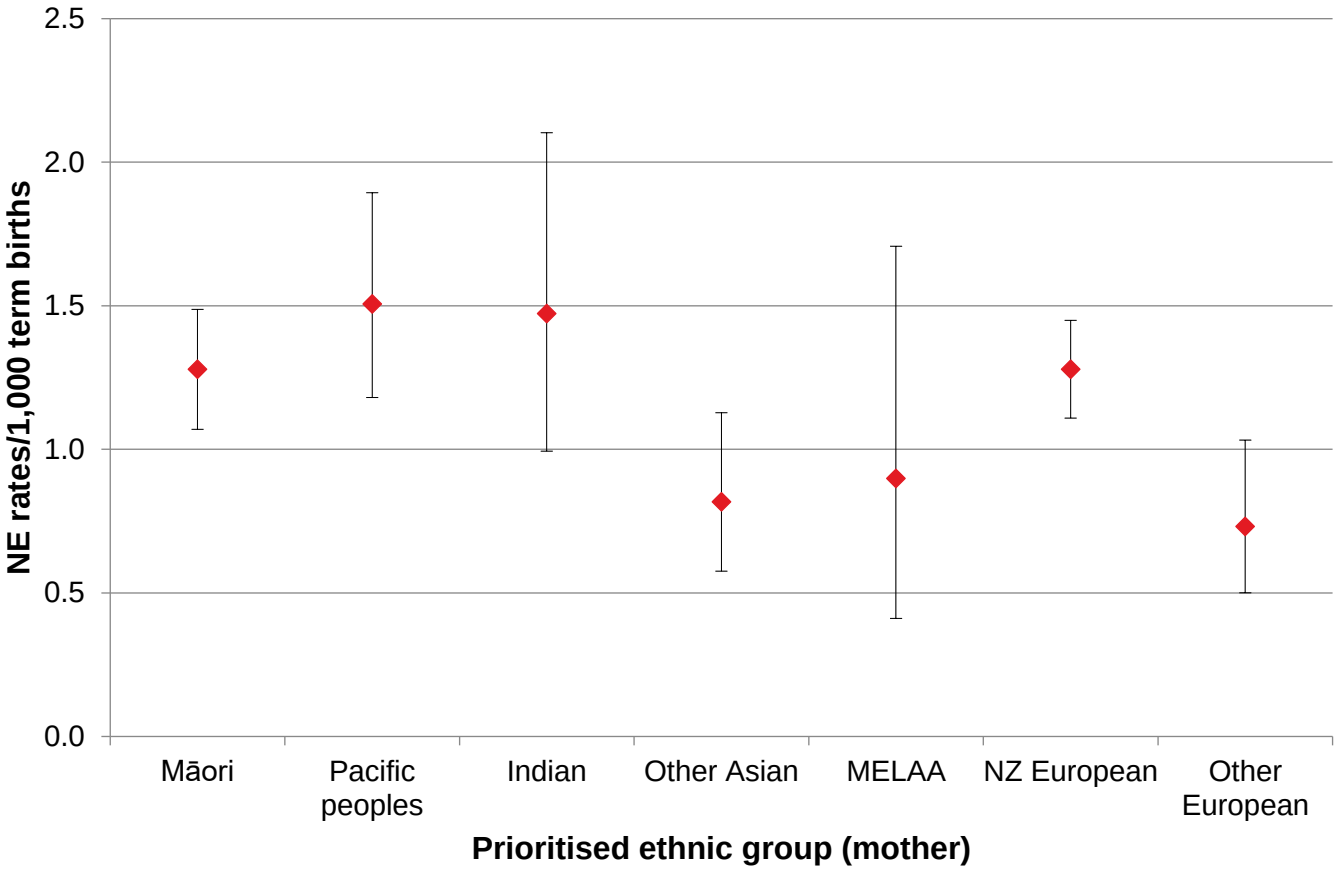
The rate of NE cases per 1,000 term births fluctuated from year to year, with a high of 1.38 per 1,000 live births in 2012 and a low of 1.00 in 2014. However, between the years 2010 and 2017, the rate has not shown a statistically significant trend up or down (chi-squared test for trend=2.41, p=0.12) (Figure 4.1). Over the past eight years there has been an average of 65–70 cases per year (Table 4.1).

There was some variation in rates of NE by maternal prioritised ethnic group, with 'Other European' and 'Other Asian' mothers having the lowest rates (Figure 4.2 and Table 4.11).

Findings

NE rates varied substantially by NZDep2013 quintile. Babies whose mothers lived in quintiles 2 to 5 were statistically significantly more likely to develop NE than those living in quintile 1 (Figure 4.3 and Table 4.11).[35]

Figure 4.2: NE rates (per 1,000 term births) by maternal prioritised ethnic group (with 95% CIs) 2010–2017



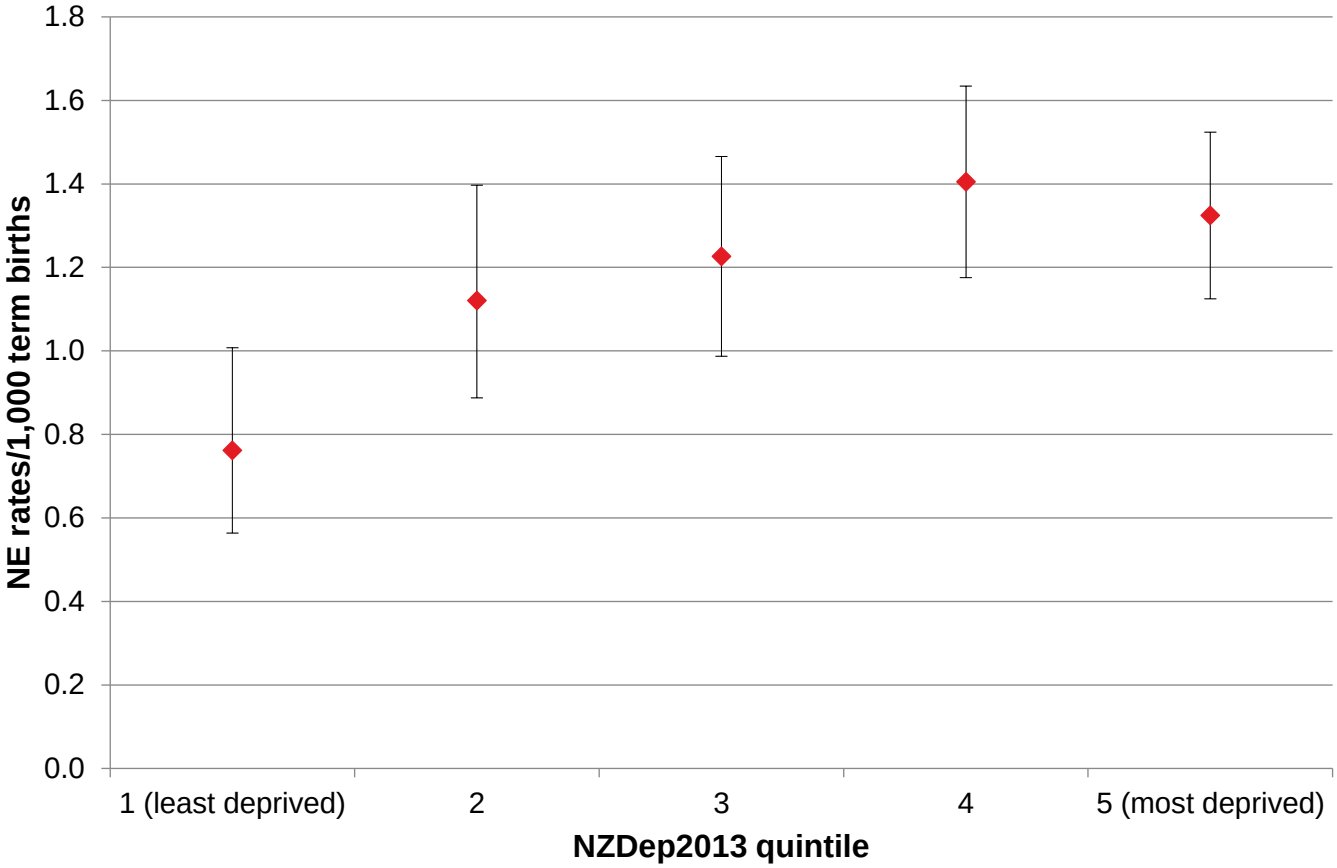
MELAA = Middle Eastern, Latin American, or African.

Sources: Numerator: PMMRC's NE data extract ≥37 weeks 2010–2017; Denominator: MAT births ≥37 weeks 2010–2017.

[34] Lee ACC, Kozuki N, Blencowe H, et al, 2013. Intrapartum-related neonatal encephalopathy incidence and impairment at regional and global levels for 2010 with trends from 1990. *Pediatric Research* 74(a1): 50–72.

[35] The rate ratio comparing quintile 2 with quintile 1 was 1.47, 95% CI 1.03–2.10. For quintile 3 compared with quintile 1 the rate ratio was 1.61, 95% CI 1.14–2.26.

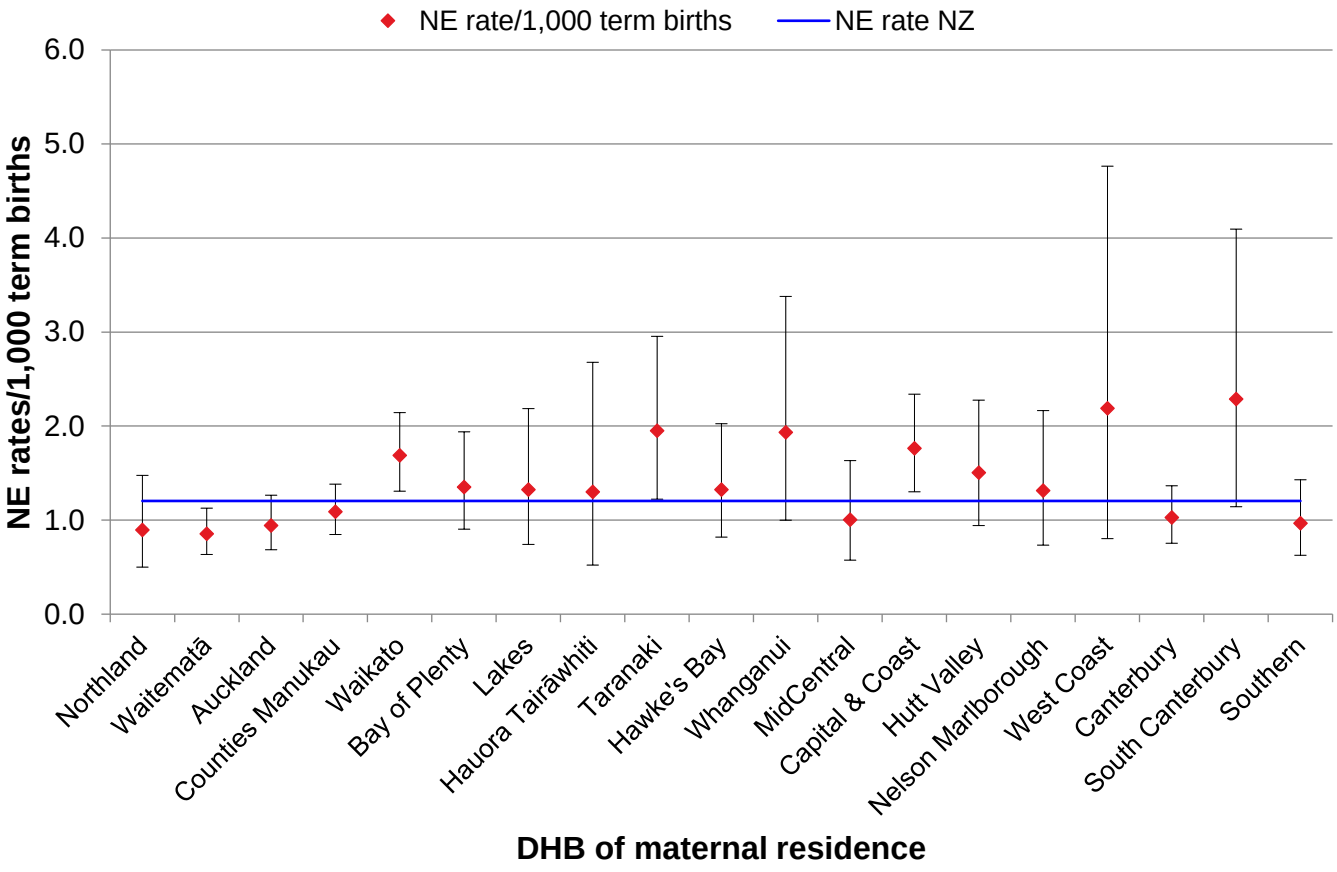
Figure 4.3: NE rates (per 1,000 term births) by NZDep2013 quintile (with 95% CIs) 2010–2017



Sources: Numerator: PMMRC's NE data extract ≥37 weeks 2010–2017; Denominator: MAT births ≥37 weeks 2010–2017.

There was also considerable variation in NE rates by DHB of residence. The rates in most DHBs were not statistically significantly different to the national rate of 1.20 per 1,000 term births. However, over the eight-year reporting period 2010–2017, Waitematā DHB had a rate lower than the national average. Capital & Coast, Waikato and Taranaki DHBs all had rates that were higher than the national average (Figure 4.4 and Table 4.12). Due to the statistically low frequency of cases, it was not possible to determine if there are any trends of an increase or decrease in rates for individual DHBs.

Figure 4.4: NE rates (per 1,000 term births) by DHB of maternal residence* (compared with New Zealand NE rate) (with 95% CIs) 2010–2017



* Excludes Wairarapa DHB, which had fewer than three cases.

Sources: Numerator: PMMRC's NE data extract ≥37 weeks 2010–2017; Denominator: MAT births ≥37 weeks 2010–2017.

Rates of NE varied by gestational age, with higher rates in those at 37 weeks' gestation, and at ≥41 weeks. This is probably due to a number of different factors, and further case review will be required to analyse this in detail. There were no statistically significant differences by infant sex. Babies with lower birthweight had higher rates of NE, with those under 2,500g having the highest rate. While small in number, babies who were multiples were at higher risk than singletons (Table 4.1). Most of the twins who developed NE born from 37 weeks onwards were dichorionic diamniotic, with 75% being delivered by caesarean section. About half of the babies were the second twin to be delivered. Of the second twins who developed NE, most were delivered by caesarean section after a normal vaginal delivery with the first twin (data not shown).

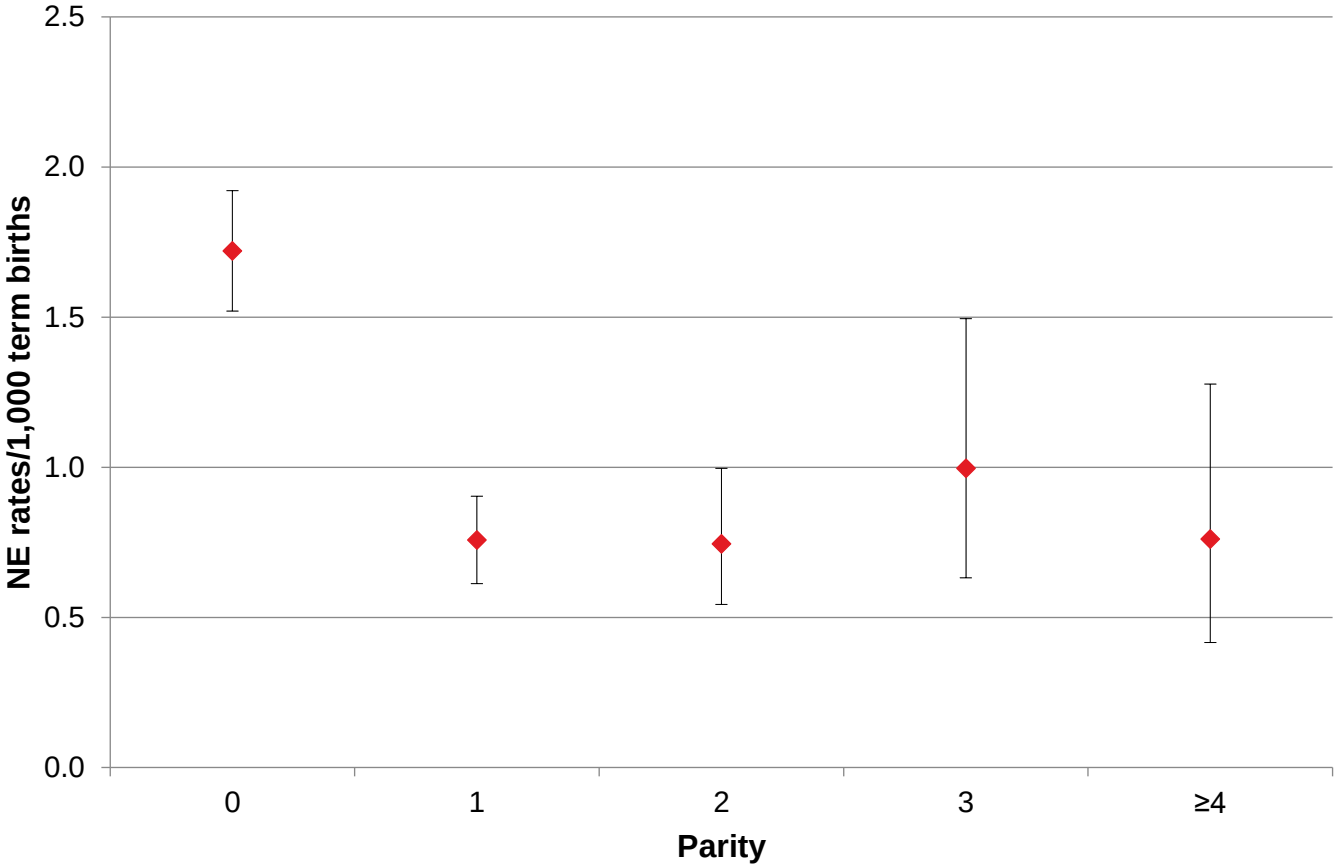
Table 4.1: NE rates (per 1,000 term births) by gestation, sex, birthweight, and plurality 2010–2017

	MAT births ≥37 weeks		NE babies		Rate (/1,000 term births)	
	N=450,097		n=542			
	n	%	n	%	/1,000	95% CI
Gestation at birth (weeks)						
37	31,286	7.0	61	11.3	1.95	1.49–2.50
38	78,754	17.5	83	15.3	1.05	0.84–1.31
39	129,059	28.7	123	22.7	0.95	0.78–1.12
40	133,521	29.7	138	25.5	1.03	0.86–1.21
41	67,704	15.0	122	22.5	1.80	1.48–2.12
≥42	9,773	2.2	15	2.8	1.53	0.86–2.53
Sex						
Male	230,113	51.1	292	53.9	1.27	1.12–1.41
Female	219,964	48.9	250	46.1	1.14	1.00–1.28
Undetermined/unknown	20	0.0	-	-	-	-
Birthweight (g)						
<2,500	8,267	1.8	23	4.2	2.78	1.76–4.17
2,500–3,999	354,814	78.8	451	83.2	1.27	1.15–1.39
4,000–4,499	55,660	12.4	50	9.2	0.90	0.67–1.18
≥4,500	11,272	2.5	18	3.3	1.60	0.95–2.52
Unknown	20,084	4.5	-	-	-	-
Plurality						
Singleton	442,890	98.4	530	97.8	1.20	1.09–1.30
Multiple	5,411	1.2	12	2.2	2.22	1.15–3.87
Unknown	1,796	0.4	-	-	-	-

Sources: Numerator: PMMRC's NE data extract ≥37 weeks 2010–2017; Denominator: MAT births ≥37 weeks 2010–2017.

Babies of primiparous women had the highest rates of NE, being statistically significantly higher than women with one, two, three or four or more babies (Figure 4.5). The rate ratio for NE in babies of primiparous compared with multiparous women was 2.21, 95% CI 1.84–2.66.

Figure 4.5: NE rates (per 1,000 term births) by parity prior to index birth* 2010–2017

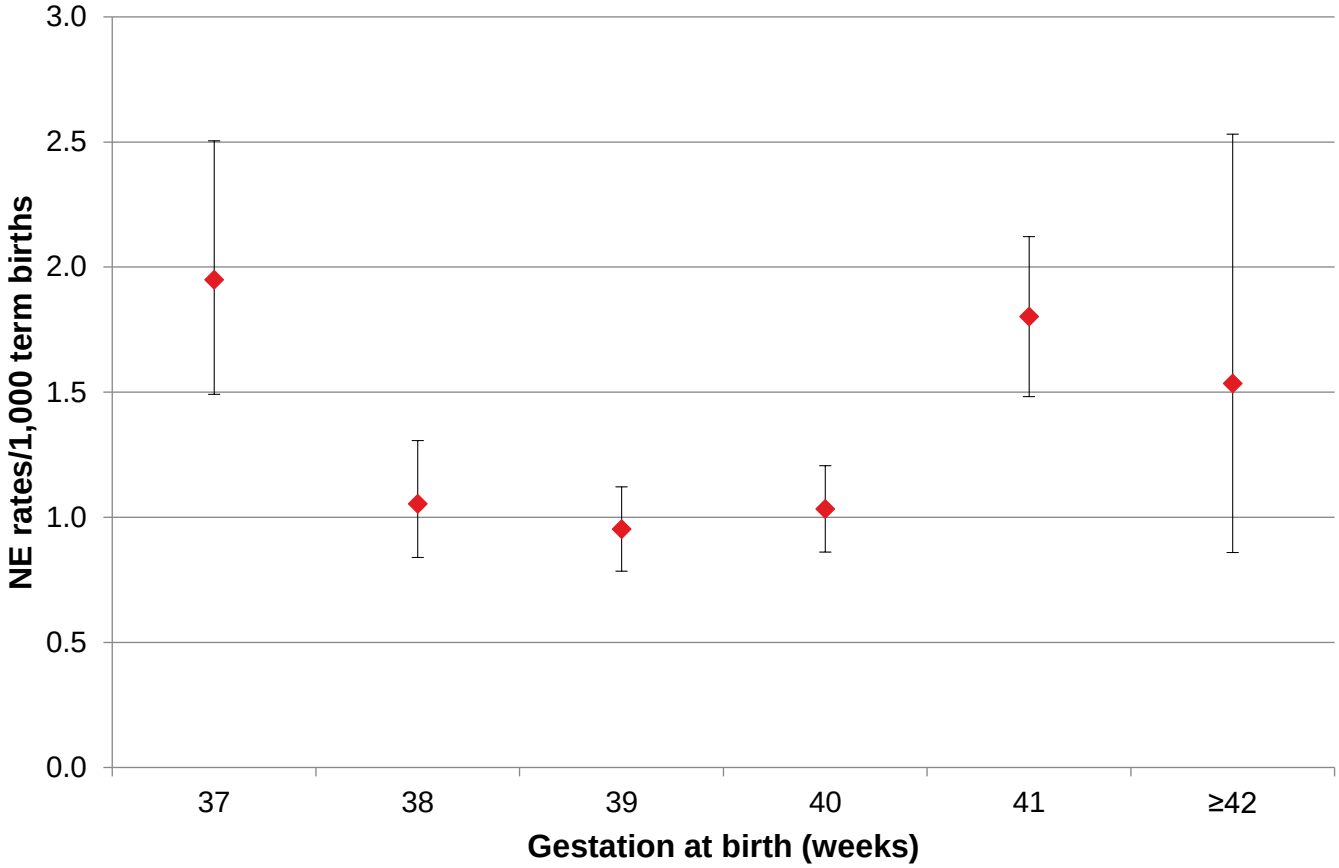


* All data limited to mothers who were registered for care with an LMC (either a midwife, obstetrician or GP) claiming from the Section 88 Primary Maternity Services Notice.

Sources: Numerator: PMMRC's NE data extract where matched to MAT data, ≥37 weeks 2010–2017; Denominator: MAT births ≥37 weeks 2010–2017.

There was variation in the rates of NE by gestational age at birth, with those at the extreme ends of term pregnancies having higher rates. The number of births in those ≥42 weeks was relatively small (Figure 4.6).

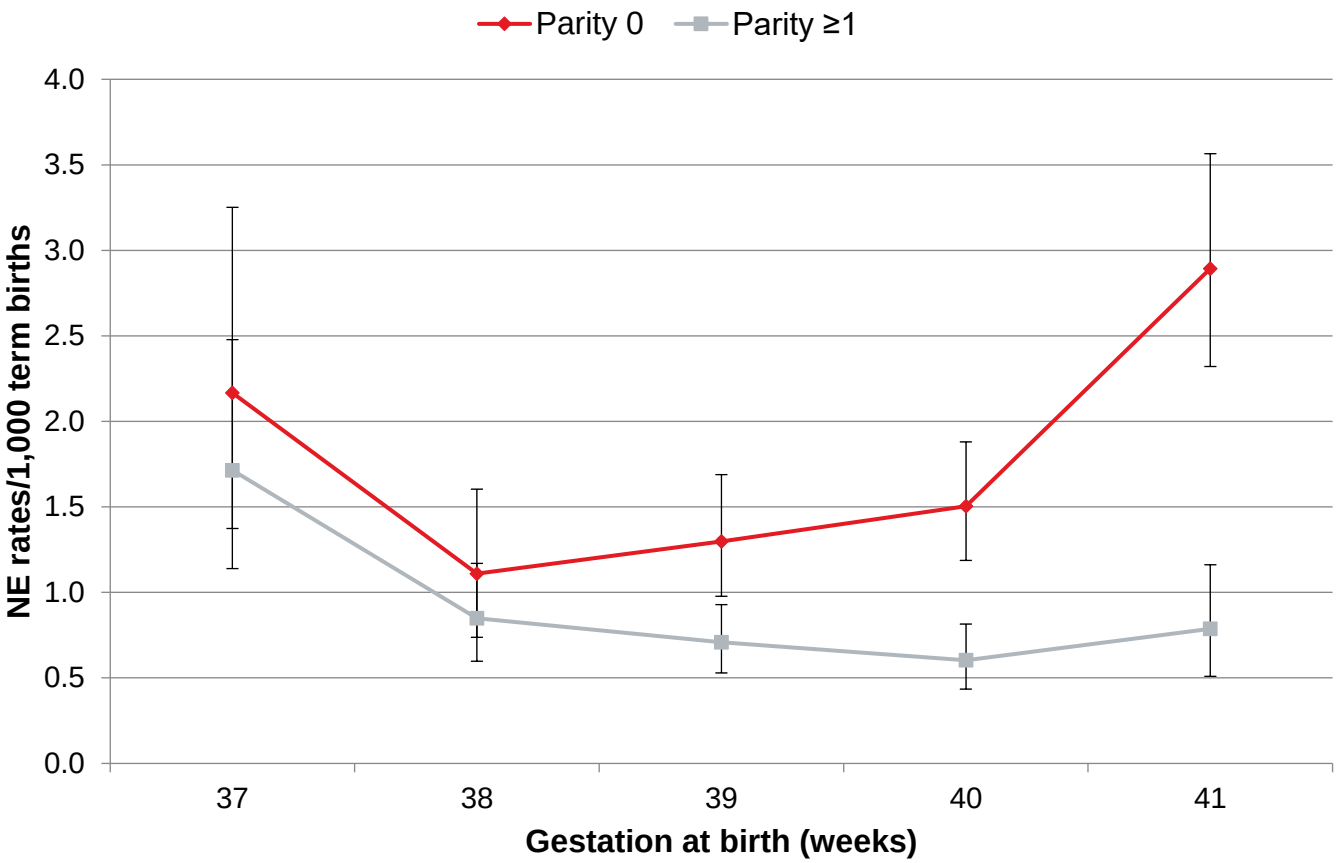
Figure 4.6: NE rates (per 1,000 term births) by gestation at birth (≥37 weeks) 2010–2017



Sources: Numerator: PMMRC's NE data extract ≥37 weeks 2010–2017; Denominator: MAT births ≥37 weeks 2010–2017.

When examined by both parity and gestational age, the same patterns remained. Rates of NE were higher in babies born at 37 and 41 weeks' gestation. Rates were elevated in primiparous women, regardless of gestational age, but statistically significantly higher from 39 weeks onwards (Figure 4.7).

Figure 4.7: NE rates (per 1,000 term births) by parity and gestation* 2010–2017



* All data limited to mothers who were registered for care with an LMC (either a midwife, obstetrician or GP) claiming from the Section 88 Primary Maternity Services Notice. Excludes gestation at birth greater than 41 weeks with fewer than three cases among parity ≥1. Excludes 16 unknown parity among MAT births.

Sources: Numerator: PMMRC's NE data extract where matched to MAT data, ≥37 weeks 2010–2017; Denominator: MAT births ≥37 weeks 2010–2017.

During the study period, there were no differences in NE rates amongst babies of smoking mothers compared with non-smoking mothers. However, smoking is a risk factor for late stillbirth[36] and small for gestational age[37]. NE rates were statistically significantly higher in babies of women who had a BMI of 35 or greater, compared with women with a BMI less than 25. This supports the Ministry of Health's *Guidelines for Consultation with Obstetric and Related Medical Services (Referral Guidelines)*, which state all women with a BMI of 35 or greater should be recommended by their LMC to have an obstetric consultation.[38]

There was no significant variation in NE rates by baby gestation at first antenatal visit. However, it should be noted that 37% of mothers whose babies developed NE did not have antenatal care in the first trimester. This was similar to the percentage of all mothers who did not book in the first trimester (33%). The PMMRC has previously recommended that the Ministry of Health, DHBs and professional colleges explore barriers to early booking with a view to increasing the number of women who book with an LMC before 10 weeks' gestation. This requires ongoing consideration and action. Consistent with the international literature, babies who were small for gestational age were twice as likely to have moderate to severe NE compared

[36] Cronin RS, Li M, Thompson JMD, et al. 2019. An individual participant data meta-analysis of maternal going-to-sleep position, interactions with fetal vulnerability, and the risk of late stillbirth. *The Lancet* 10: 49–57. URL: https://doi.org/10.1016/j.eclinm.2019.03.014 (accessed 15 August 2019).

[37] McCowan L, Horgan RP. 2009. Risk factors for small for gestational age infants. *Best Practice & Research: Clinical Obstetrics & Gynaecology* 23(6): 779–93.

[38] Ministry of Health. 2012. *Guidelines for Consultation with Obstetric and Related Medical Services (Referral Guidelines).* Wellington: Ministry of Health.

with babies who were appropriate size for gestational age.[39] As part of its NE prevention programme, ACC has funded the implementation of the Growth Assessment Protocol (GAP) in DHBs, which has occurred in some, but not all DHBs presently. We commend ACC on its action on this important issue, and anticipate the evaluation of this programme and its effectiveness once it has been established throughout Aotearoa/New Zealand.

Babies of primiparous women make up 61% of babies with NE, and have an NE rate that is significantly higher than babies of multiparous women, regardless of whether they were para one, two, three, four, or more. While primiparous women make up 41% of the birthing population, 60% of babies with NE are born to primips (Table 4.2 and Figure 4.5).

Table 4.2: Maternal smoking, BMI, gestation at first antenatal visit, customised birthweight centiles, and parity among NE babies* 2010–2017

	MAT births ≥37 weeks		NE cases		Rate (/1,000 term births)	
	N=403,616		n=469			
	n	%	n	%	/1,000	95% CI
Currently smoking						
Yes	57,615	14.3	69	14.7	1.20	0.93–1.52
No	345,988	85.7	400	85.3	1.16	1.04–1.27
Unknown	13	0.0	-	-	-	-
Maternal BMI (kg/m^2)						
<18.50	11,347	2.8	6	1.3	0.53	0.19–1.15
18.50–24.99	197,351	48.9	189	40.3	0.96	0.82–1.09
25.00–29.99	104,354	25.9	141	30.1	1.35	1.13–1.57
30.00–34.99	52,781	13.1	65	13.9	1.23	0.95–1.57
35.00–39.99	23,742	5.9	43	9.2	1.81	1.31–2.44
≥40	13,430	3.3	25	5.3	1.86	1.20–2.75
Missing data for height and or weight	611	0.2	-	-	-	-
Gestation first antenatal visit (weeks)						
≤14	270,094	66.9	297	63.3	1.10	0.97–1.22
15–27	114,963	28.5	148	31.6	1.29	1.08–1.49
≥28	16,895	4.2	22	4.7	1.30	0.82–1.97
Postnatal registration	1,655	0.4	<3	x	s	s
Unknown	9	0.0	-	-	-	-
Customised birthweight centiles						
Small for gestational age	36,970	9.2	86	18.3	2.33	1.86–2.87
Appropriate for gestational age	298,967	74.1	343	73.1	1.15	1.03–1.27
Large for gestational age	47,571	11.8	40	8.5	0.84	0.60–1.14
Unknown	20,108	5.0	-	-	-	-
Parity						
0	164,466	40.7	283	60.3	1.72	1.52–1.92
1	137,219	34.0	104	22.2	0.76	0.61–0.90
2	60,437	15.0	45	9.6	0.74	0.54–1.00
3	23,086	5.7	23	4.9	1.00	0.63–1.49
≥4	18,392	4.6	14	3.0	0.76	0.42–1.28
Unknown	16	0.0	-	-	-	-

* All data limited to mothers who were registered for care with an LMC (either a midwife, obstetrician or GP) claiming from the Section 88 Primary Maternity Services Notice.

'x' indicates percentage suppressed due to small numbers.

's' indicates rate suppressed due to small numbers.

BMI = body mass index.

Sources: Numerator: PMMRC's NE data extract where matched to MAT data, ≥37 weeks 2010–2017; Denominator: MAT births ≥37 weeks 2010–2017.

[39] The rate ratio for small for gestational age infants compared with appropriate for gestational age infants was 2.03, 95% CI 1.60–2.57.

There were a range of antenatal complications recorded for women whose babies developed NE, including antepartum haemorrhage and hypertension, including gestational hypertension and pre-eclampsia. Both primiparous and multiparous mothers of babies with NE experienced antenatal complications. The percentages of those affected generally followed patterns that would be expected from the birthing population – that is, there were lower numbers of multiparous women with pre-eclampsia compared with primiparous women. There were a number of women who were induced through a variety of means and who had epidural anaesthesia. Without denominator data – that is, without knowing the rates and use of these procedures during delivery of babies that did not have NE – we cannot comment on whether these factors indicated increased risk to babies. While most women whose babies developed NE had a good outcome, there were a number with an adverse outcome. Of those with an adverse outcome, 4 women died and 15 survived but with serious morbidity (Table 4.3).

Table 4.3: Antenatal complications, obstetric interventions, and maternal outcome among NE cases by parity and Sarnat stage 2010–2017

	NE cases		Primiparous#		Multiparous+		Sarnat stage			
							Moderate		Severe	
	n=542		n=318		n=224		n=375		n=167	
	n	%	n	%	n	%	n	%	n	%
Antenatal complications										
Antepartum haemorrhage (≥20 weeks vaginal bleeding)	56	10.3	29	9.1	27	12.1	37	9.9	19	11.4
Hypertension	68	12.5	48	15.1	20	8.9	52	13.9	16	9.6
Maternal trauma (antenatal)*	12	2.2	5	1.6	7	3.1	6	1.6	6	3.6
Induction/augmentation of labour										
Induction of labour	132	24.4	85	26.7	47	21.0	101	26.9	31	18.6
Induced or augmented labour (any method)	254	46.9	173	54.4	81	36.2	194	51.7	60	35.9
Oxytocin for induction or augmentation	125	23.1	91	28.6	34	15.2	99	26.4	26	15.6
Epidural anaesthesia	142	26.2	104	32.7	38	17.0	113	30.1	29	17.4
Maternal outcome										
Deceased or alive with serious morbidity	19	3.5	6	1.1	13	2.4	11	2.0	8	1.5
Alive and well	523	96.5	312	57.6	211	38.9	364	67.2	159	29.3

* Vehicular, violent personal injury, other.

Primiparous: parity = 0 defined prior to current birth.

+ Multiparous: parity ≥1 defined prior to current birth.

Source: PMMRC's NE data extract ≥37 weeks 2010–2017.

Nearly one-quarter of babies with NE had an acute peripartum event, including abruption (7.6%) and shoulder dystocia (6.6%). Table 4.4 points to many antenatal and intrapartum factors that may indicate risk for NE for the babies. This table is not definitive in itself but provides an indication of possible areas to focus on in the future.

Table 4.4: Peripartum complications and mode of birth among NE cases 2010–2017

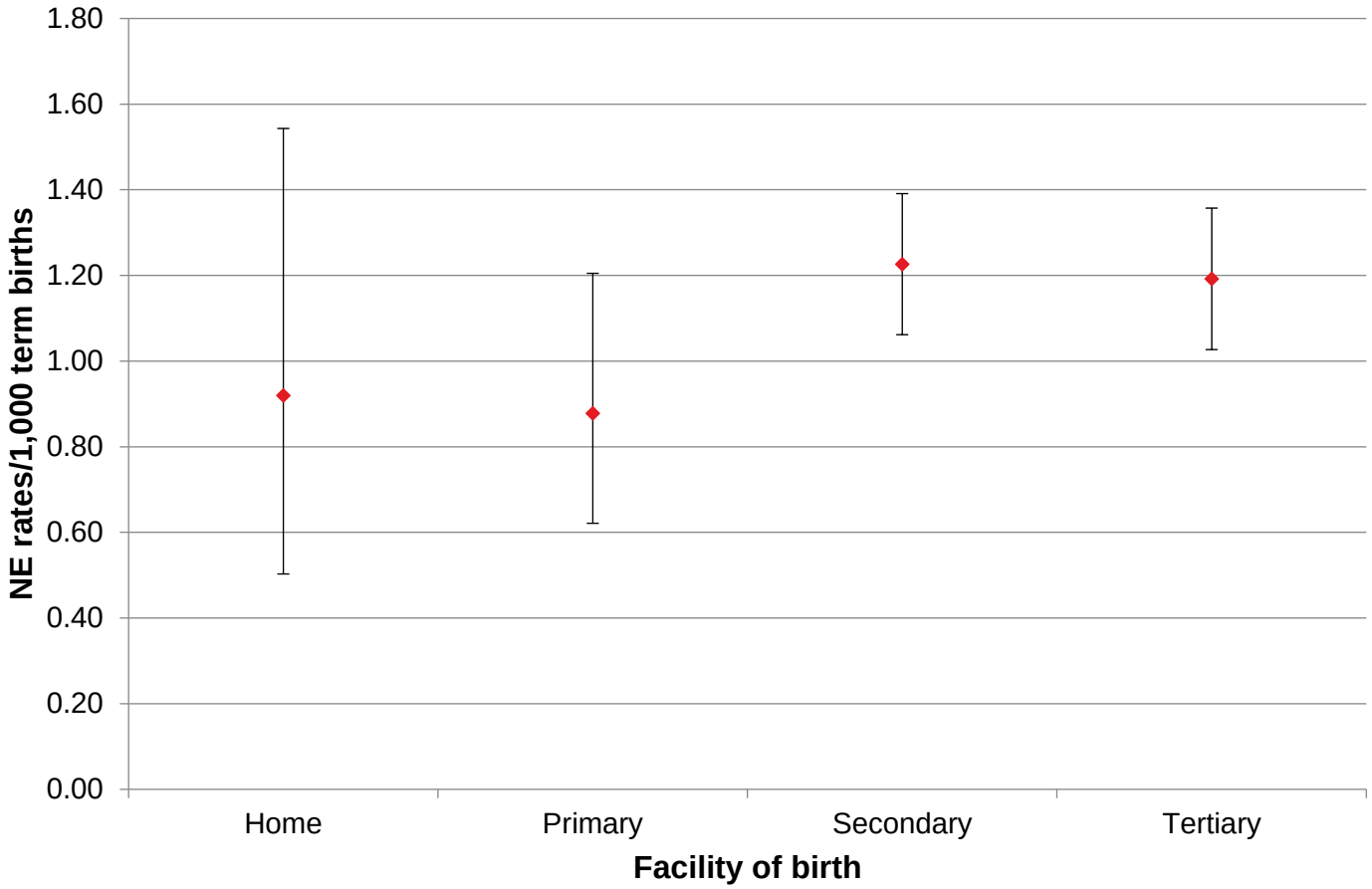
	Total NE cases	
	n=542	
	n	%
Acute peripartum events	131	24.2
Cord prolapse	18	3.3
Abruption	41	7.6
Uterine rupture	12	2.2
Shoulder dystocia	36	6.6
Breech complication	12	2.2
Other complication	18	3.3
Liquor		
Blood stained	46	8.5
Thick meconium	120	22.1
Thin meconium	71	13.1
Mode of birth		
Normal vaginal birth	216	39.9
Operative vaginal birth	80	14.8
Forceps	32	5.9
Ventouse	46	8.5
Unknown	2	0.4
Vaginal breech birth	10	1.8
Caesarean section birth	236	43.5
Elective	11	2.0
Prelabour emergency	57	10.5
Antepartum haemorrhage/Abruption	8	1.5
Suspected fetal distress	41	7.6
Other	8	1.5
Unknown	-	-
In labour emergency	168	31.0
Antepartum haemorrhage/Abruption	14	2.6
Suspected fetal distress	117	21.6
Failure to progress/Cephalopelvic disproportion	17	3.1
Other	20	3.7
Attempt at operative vaginal birth before caesarean	16	3.0

'x' indicates percentage suppressed due to small numbers.

Source: PMMRC's NE data extract ≥37 weeks 2010–2017.

There was some variation in rates of NE by the facility of birth (Figure 4.8 and Table 4.5). When examining rates of NE by the facility of birth, it is important to consider other information also. This includes where the intended place of birth was and, if transferred, when in the pregnancy or birthing process this occurred. Also important is whether the chosen facility of birth would be recommended for each particular woman and baby. This is the subject of a proposed research project by the Neonatal Encephalopathy Working Group.

Figure 4.8: NE rates (per 1,000 term births) by place of birth* (with 95% CIs) 2010–2017



* All data limited to mothers who were registered for care with an LMC (either a midwife, obstetrician or GP) claiming from the Section 88 Primary Maternity Services Notice.

Sources: Numerator: PMMRC's NE data extract where matched to MAT data, ≥37 weeks 2010–2017; Denominator: MAT births ≥37 weeks 2010–2017.

Table 4.5: NE rates (per 1,000 term births) by place of birth* 2010–2017

Facility of birth	MAT births ≥37 weeks N=403,616		NE cases n=469		Rate (/1,000 term births)	
	n	%	n	%	/1,000	95% CI
Home	15,221	3.8	14	3.0	0.92	0.50–1.54
Primary	43,288	10.7	38	8.1	0.88	0.62–1.20
Secondary	173,696	43.0	213	45.4	1.23	1.06–1.39
Tertiary	167,776	41.6	200	42.6	1.19	1.03–1.36
Unknown	3,635	0.9	4	0.9	-	-

* All data limited to mothers who were registered for care with an LMC (either a midwife, obstetrician or GP) claiming from the Section 88 Primary Maternity Services Notice.

Sources: Numerator: PMMRC's NE data extract where matched to MAT data, ≥37 weeks 2010–2017; Denominator: MAT births ≥37 weeks 2010–2017.

Neonatal wellbeing just after birth, measured by Apgar scores, was consistently poor at 1 minute. In those babies with moderate to severe NE, 76.6% had an Apgar score less than 7 at five minutes. The percentage of babies who had cord blood gases recorded has fluctuated over the years. However, of note in 2017, 22% of babies who went on to develop NE did not have cord blood gases recorded. Of all babies who developed NE, 66% had abnormal gases (Table 4.6).

Table 4.6: Immediate newborn wellbeing among NE babies 2010–2017

	2010		2011		2012		2013		2014		2015		2016		2017		Total	
	n=82		n=67		n=79		n=70		n=55		n=70		n=56		n=63		n=542	
	n	%	n	%	n	%	n	%	n	%	n	%	n	%	n	%	n	%
Apgar scores																		
Apgar score <3 at 1 minute	48	58.5	41	61.2	47	59.5	40	57.1	37	67.3	39	55.7	37	66.1	36	57.1	325	60.0
Apgar score <5 at 1 minute	65	79.3	54	80.6	62	78.5	58	82.9	49	89.1	51	72.9	48	85.7	50	79.4	437	80.6
Apgar score <7 at 1 minute	73	89.0	61	91.0	70	88.6	65	92.9	53	96.4	59	84.3	51	91.1	56	88.9	488	90.0
Apgar score <7 at 5 minutes	61	74.4	54	80.6	62	78.5	57	81.4	43	78.2	50	71.4	46	82.1	42	66.7	415	76.6
Apgar score <7 at 10 minutes	39	47.6	38	56.7	49	62.0	32	45.7	29	52.7	35	50.0	33	58.9	29	46.0	284	52.4
Apgar score <9 at 10 minutes	52	63.4	52	77.6	62	78.5	52	74.3	45	81.8	48	68.6	44	78.6	41	65.1	396	73.1
Cord blood gases: summary data																		
Normal (none of pH ≤7, BE ≤−12, lactate ≥6)	12	14.6	14	20.9	11	13.9	13	18.6	7	12.7	8	11.4	6	10.7	10	15.9	81	14.9
Abnormal (any of pH ≤7, BE ≤−12, lactate ≥6)	47	57.3	41	61.2	55	69.6	48	68.6	40	72.7	47	67.1	42	75.0	39	61.9	359	66.2
No gases reported	23	28.0	12	17.9	13	16.5	9	12.9	8	14.5	15	21.4	8	14.3	14	22.2	102	18.8
No gases and Apgar <7 at 1 minute	14	17.1	8	11.9	8	10.1	6	8.6	8	14.5	6	8.6	6	10.7	10	15.9	66	12.2
No gases and Apgar ≥7 at 1 minute	8	9.8	4	6.0	5	6.3	3	4.3	-	-	9	12.9	<3	x	3	4.8	34	6.3
No gases and unknown Apgar	<3	x	-	-	-	-	-	-	-	-	-	-	-	-	<3	x	<3	x

BE = base excess.

'x' indicates percentage suppressed due to small numbers.

Source: PMMRC's NE data extract ≥37 weeks 2010–2017.

Table 4.7: Induced cooling therapy among NE babies 2010–2017

Cooling	2010		2011		2012		2013		2014		2015		2016		2017		Total	
	n=82		n=67		n=79		n=70		n=55		n=70		n=56		n=63		n=542	
	n	%	n	%	n	%	n	%	n	%	n	%	n	%	n	%	n	%
Yes	56	68.3	51	76.1	62	78.5	58	82.9	45	81.8	56	80.0	44	78.6	43	68.3	415	76.6
No	26	31.7	16	23.9	17	21.5	12	17.1	10	18.2	14	20.0	12	21.4	20	31.7	127	23.4
Age at cooling	n=56		n=51		n=62		n=58		n=45		n=56		n=44		n=43		n=415	
≤6 hours	46	82.1	39	76.5	53	85.5	47	81.0	39	86.7	44	78.6	34	77.3	36	83.7	338	81.4
>6 hours	10	17.9	8	15.7	9	14.5	11	19.0	6	13.3	11	19.6	10	22.7	7	16.3	72	17.3
Unknown time	-	-	4	7.8	-	-	-	-	-	-	<3	x	-	-	-	-	5	1.2

'x' indicates percentage suppressed due to small numbers.

Source: PMMRC's NE data extract ≥37 weeks 2010–2017.

Table 4.7 reports on cooling therapy in babies with NE by year of birth. There was a slight reduction in the number and percentage of babies who were cooled in 2017 compared with previous years, with 20 babies who were not cooled. Of these, 8 had severe and 12 had moderate NE. Of those with severe NE, most babies died on the day of birth. The babies who had moderate NE who were not cooled usually either presented late or were not recognised within the 6-hour period. Of the seven babies in 2017 who were cooled starting at more than 6 hours after birth, all were born in a secondary unit and transferred to a tertiary unit. Some were cooled passively before this time (data not shown).

The majority of babies with NE were resuscitated at birth (92%). Resuscitation ranged from giving oxygen only, through to cardiac massage, and adrenaline. A small percentage of babies had a positive blood culture. Over 70% of babies were given anticonvulsants (Table 4.8).

Table 4.8: Neonatal resuscitation and early neonatal management by Sarnat stage among NE babies 2010–2017

	NE babies		Sarnat stage			
			Moderate		Severe	
	n=542		n=375		n=167	
	n	%	n	%	n	%
Resuscitation at birth						
Yes	498	91.9	343	91.5	155	92.8
No	44	8.1	32	8.5	12	7.2
Type of resuscitation at birth*						
Oxygen only	8	1.5	7	1.9	<3	x
IPPV with mask	357	65.9	256	68.3	101	60.5
IPPV with ETT	285	52.6	166	44.3	119	71.3
Cardiac massage	215	39.7	110	29.3	105	62.9
Adrenaline	87	16.1	28	7.5	59	35.3
Respiratory and ventilation management						
Mechanical ventilation	422	77.9	274	73.1	148	88.6
Nitric oxide	125	23.1	77	20.5	48	28.7
Infection						
Positive blood culture	21	3.9	16	4.3	5	3.0
Antibiotics	488	90.0	349	93.1	139	83.2
Anticonvulsant therapy	384	70.8	261	69.6	123	73.7
Phenobarbitone	342	63.1	225	60.0	117	70.1
Phenytoin	114	21.0	59	15.7	55	32.9
Benzodiazepines	136	25.1	85	22.7	51	30.5
Other	71	13.1	52	13.9	19	11.4

* Categories not mutually exclusive.

IPPV = intermittent positive pressure ventilation.

ETT = endotracheal tube.

'x' indicates percentage supressed due to small numbers.

Source: PMMRC's NE data extract ≥37 weeks 2010–2017.

Overall, 77% of babies were cooled, with a slightly higher proportion of babies with moderate NE being cooled. The rates of cooling were the same for babies of Māori mothers as for New Zealand European mothers. Mortality was much higher in babies with severe NE, with 61% of babies dying, compared with 2% of babies with moderate NE (Table 4.9).

Table 4.9: Use of cooling and outcomes of encephalopathy by Sarnat stage among NE babies 2010–2017

	NE babies		Sarnat stage			
			Moderate		Severe	
	n=542		n=375		n=167	
	n	%	n	%	n	%
Induced cooling						
Yes	415	76.6	298	79.5	117	70.1
No	127	23.4	77	20.5	50	29.9
Deceased						
Yes	108	19.9	7	1.9	101	60.5
No	434	80.1	368	98.1	66	39.5

Source: PMMRC's NE data extract ≥37 weeks 2010–2017.

Of those babies with NE who survived, nearly half of those with moderate NE had a normal physical examination on discharge or transfer, compared with 15% of those with severe NE. Nearly all babies (97%) with severe NE had an MRI prior to discharge (Table 4.10). The PMMRC has previously recommended that all babies with moderate and severe NE should receive an MRI scan.[40]

Table 4.10: Investigations and neonatal outcome by Sarnat stage of NE survivors 2010–2017

Investigations	Total NE survivors		Sarnat stage			
			Moderate		Severe	
	n=434		n=368		n=66	
	n	%	n	%	N	%
Examination on discharge/transfer						
Normal	193	44.5	183	49.7	10	15.2
Mild or moderate abnormality	150	34.6	126	34.2	24	36.4
Severe abnormality	30	6.9	6	1.6	24	36.4
Not examined	22	5.1	19	5.2	3	4.5
Examined but finding unknown	17	3.9	13	3.5	4	6.1
Missing data	22	5.1	21	5.7	<3	x
MRI (investigation done)	334	77.0	270	73.4	64	97.0
No MRI or Unknown	100	23.0	98	26.6	<3	x
Results of MRI						
Moderately/Severely abnormal	123	28.3	81	22.0	42	63.6
Normal or only mildly abnormal	205	47.2	184	50.0	21	31.8
Unknown result	6	1.4	5	1.4	<3	x

MRI = magnetic resonance imaging (of the brain).

'x' indicates percentage suppressed due to small numbers.

Source: PMMRC's NE data extract ≥37 weeks 2010–2017.

[40] PMMRC. 2013. *Seventh Annual Report of the Perinatal and Maternal Mortality Review Committee: Reporting mortality 2011*. URL: https://www.hqsc.govt.nz/assets/PMMRC/Publications/Seventh-PMMRC-Report-FINAL-June-2013.pdf (accessed 2 September 2019).

Neonatal encephalopathy appended tables

Table 4.11: NE rates (per 1,000 term births) by prioritised ethnic group, maternal age and NZDep2013 quintile 2010–2017

	MAT births ≥37 weeks		NE cases		Rate (/1,000 term births)	
	N=450,097*		n=542			
	n	%	n	%	/1,000	95% CI
Prioritised ethnic group (mother)						
Māori	112,614	25.0	144	26.6	1.28	1.07–1.49
Pacific peoples	48,467	10.8	73	13.5	1.51	1.18–1.89
Asian	65,599	14.6	67	12.4	1.02	0.79–1.30
Indian	20,367	4.5	30	5.5	1.47	0.99–2.10
Other Asian	45,232	10.0	37	6.8	0.82	0.58–1.13
MELAA	10,006	2.2	9	1.7	0.90	0.41–1.71
European	213,391	47.4	249	45.9	1.17	1.02–1.31
NZ European	169,638	37.7	217	40.0	1.28	1.11–1.45
Other European	43,753	9.7	32	5.9	0.73	0.50–1.03
Other	-	-	-	-	-	-
Maternal age (years)						
<20	24,099	5.4	34	6.3	1.41	0.98–1.97
20–34	331,714	73.7	405	74.7	1.22	1.10–1.34
35–39	75,935	16.9	84	15.5	1.11	0.88–1.37
≥40	18,326	4.1	19	3.5	1.04	0.62–1.62
Unknown	23	0.0	-	-	-	-
NZDep2013 quintile						
1 (least deprived)	64,296	14.3	49	9.0	0.76	0.56–1.01
2	70,481	15.7	79	14.6	1.12	0.89–1.40
3	82,352	18.3	101	18.6	1.23	0.99–1.47
4	102,499	22.8	144	26.6	1.40	1.18–1.63
5 (most deprived)	127,616	28.4	169	31.2	1.32	1.12–1.52
Unknown	2,853	0.6	-	-	-	-

* Includes 20 unknown maternal ethnicity among MAT births.

MELAA = Middle Eastern, Latin American, or African.

Sources: Numerator: PMMRC's NE data extract ≥37 weeks 2010–2017; Denominator: MAT births ≥37 weeks 2010–2017.

Table 4.12: NE rates (per 1,000 term births) by DHB of maternal residence 2010–2017

DHB of residence	MAT births ≥37 weeks[#]	Total NE cases[#]	Rate (/1,000 term births)	
	N=446,356	n=540		
	n	n	/1,000	95% CI
Northland	16,761	15	0.89	0.50–1.48
Waitematā	58,451	50	0.86	0.63–1.13
Auckland	46,677	44	0.94	0.68–1.27
Counties Manukau	62,332	68	1.09	0.85–1.38
Waikato	39,694	67	1.69	1.31–2.14
Bay of Plenty	21,480	29	1.35	0.90–1.94
Lakes	11,317	15	1.33	0.74–2.19
Hauora Tairāwhiti	5,384	7	1.30	0.52–2.68
Taranaki	11,272	22	1.95	1.22–2.95
Hawke's Bay	15,851	21	1.32	0.82–2.03
Whanganui	6,203	12	1.93	1.00–3.38
MidCentral	15,910	16	1.01	0.57–1.63
Capital & Coast	27,198	48	1.76	1.30–2.34
Hutt Valley	14,631	22	1.50	0.94–2.28
Nelson Marlborough	11,427	15	1.31	0.73–2.17
West Coast	2,741	6	2.19	0.80–4.76
Canterbury	45,775	47	1.03	0.75–1.37
South Canterbury	4,806	11	2.29	1.14–4.10
Southern	25,824	25	0.97	0.63–1.43
Other*	2,622	-	-	-

* Other includes Overseas, Unknown and Other.

[#] Wairarapa DHB excluded from this table (numerator and denominator) as there were <3 cases for the time period.

Sources: Numerator: PMMRC's NE data extract ≥37 weeks 2010–2017; Denominator: MAT births ≥37 weeks 2010–2017.

10. The PMMRC recommends that DHBs with rates of NE significantly higher than the national rate review, or continue to review, the higher rate of NE in their area and identify areas for improvement.	**Taranaki DHB** acknowledges that their DHB rate of NE (2.71/1,000 term births) for the 2012–2016 period is significantly higher than the national rate (1.19/1,000 term births). Taranaki DHB note that the year-by-year numbers are small, so it is difficult to generalise. There was an increased rate of NE cases in 2012, which is likely responsible for Taranaki DHB's overall findings. All cases of NE are captured by the Taranaki DHB maternity obstetric outcomes protocol in which a key indicator for review is unexpected admission to the Neonatal Unit. Any actions or quality improvements identified are entered onto a work plan to ensure these are completed. Taranaki DHB has also adopted the Health Quality & Safety Commission's guidance for SAC rating and reporting of maternity cases, which includes NE. **Capital & Coast DHB** continues to review each case of NE, looking for recurring themes that can be addressed. Communication workshops for senior medical officers and senior midwives to address culture/supervision issues have taken place. Education is supporting best practice. • Weekly multidisciplinary CTG (cardiotocograph) education sessions are in place. • All employed midwives and obstetricians are required to attend our mandatory Fetal Surveillance Education Programme. • There is no cost for LMCs to attend the Fetal Surveillance Education Programme at Capital & Coast DHB. Staffing is a challenge, and monitoring and systems around safe staffing are in place and reviewed regularly.

5 Te mate o ngā whaea | Maternal mortality

Definitions

Maternal death is the death of a woman while pregnant or within 42 days of termination of pregnancy (miscarriage, termination or birth), 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.[41]

The cause of maternal death is sub-classified into the following categories based on *The WHO Application of ICD-10 to Deaths during Pregnancy, Childbirth and Puerperium: ICD MM*.[42]

- **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. In 2018, the PMMRC adopted the World Health Organization (WHO) revision to include deaths by suicide with direct maternal deaths. This was then applied retrospectively to data from previous years.
- **Indirect maternal deaths**: those resulting from previous existing disease or disease that developed during pregnancy and was not due to direct obstetric causes but that was aggravated by the physiologic effects of pregnancy.
- **Unknown/Undetermined (or Unclassifiable) maternal death** is a death during pregnancy, childbirth and the puerperium where the underlying cause is unknown or was not determined.
- **Coincidental maternal deaths**: deaths from unrelated causes that happen to occur in pregnancy or the puerperium.

Findings

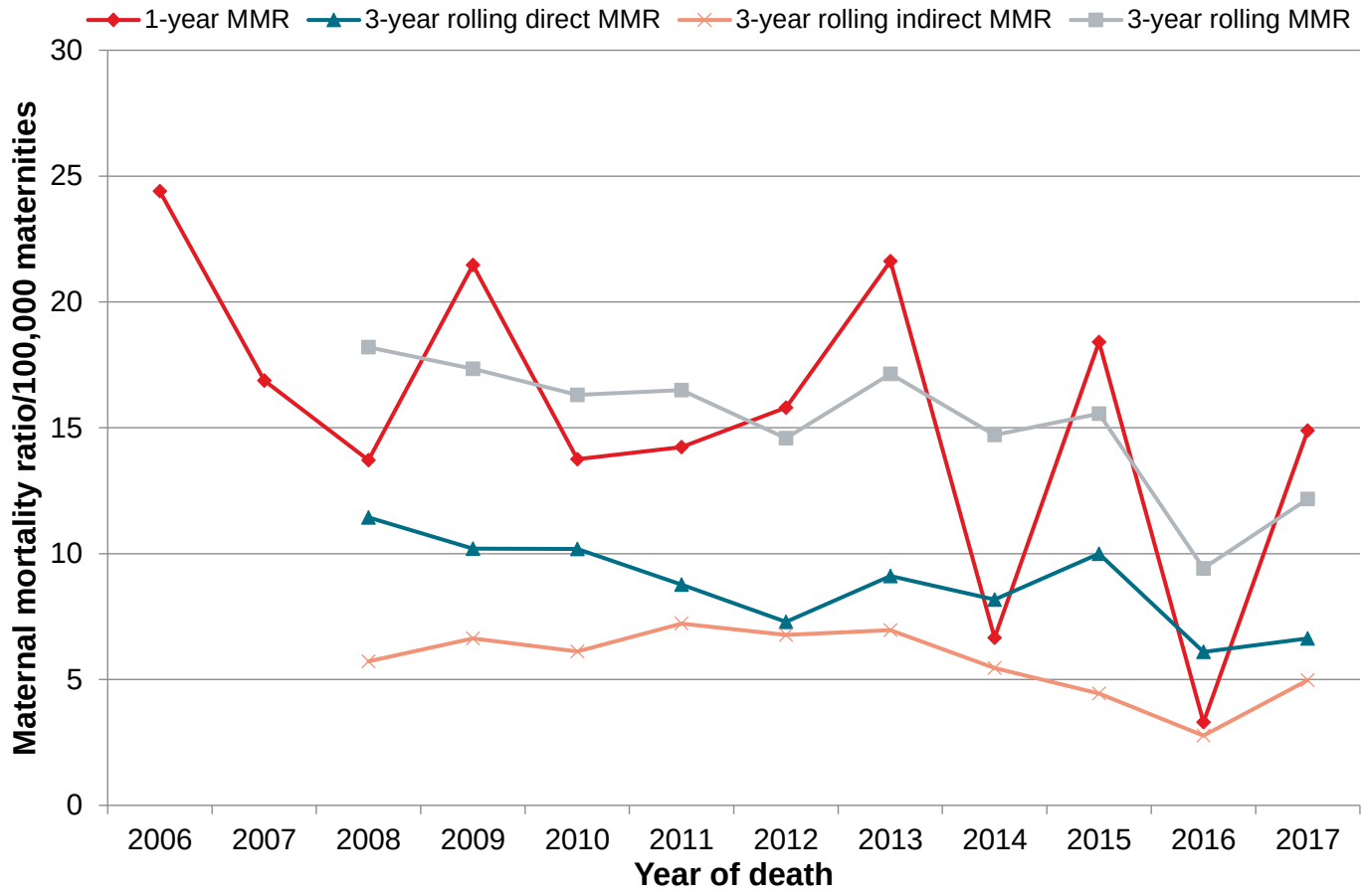
The number of maternal deaths has fluctuated substantially over the time period 2006–2017, with a range from 3.30 deaths per 100,000 to 24.40 deaths per 100,000 maternities. There is some evidence[43] of a reduction in the total number of maternal deaths over the time period (Figure 5.1 and Table 5.1).

[41] World Health Organization. (nd). Maternal mortality ratio (per 100 000 live births). URL: https://www.who.int/healthinfo/statistics/indmaternalmortality/en/ (accessed 16 August 2019).

[42] World Health Organization. 2012. *The WHO Application of ICD-10 to deaths during pregnancy, childbirth and the puerperium: ICD-MM*. URL: https://apps.who.int/iris/bitstream/handle/10665/70929/9789241548458_eng.pdf;jsessionid=CC029155D5B4A0E7BB4AE0129A0A6CEB?sequence=1 (accessed 16 August 2019).

[43] Chi-squared test for trend in proportions p=0.044.

Figure 5.1: Maternal mortality ratios (per 100,000 maternities) (rolling one-year and three-year)* 2006–2017



* Rolling three-year maternal mortality ratio represented at final year of triennium.

MMR = maternal mortality ratio.

Sources: Numerator: PMMRC's maternal mortality data extract 2006–2017; Denominator: MAT data 2006–2017.

Table 5.1: Single-year and three-year rolling maternal mortality ratios (per 100,000 maternities) 2006–2017

	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2006–2017			Chi-squared test for trend (p)
	n	n	n	n	n	n	n	n	n	n	n	n	n	%	Cause-specific ratio /100,000 maternities	
Total maternal deaths	**15**	**11**	**9**	**14**	**9**	**9**	**10**	**13**	**4**	**11**	**<3**	**9**	**116**	**100.0**	**15.46**	
Single-year MMR	24.40	16.87	13.71	21.47	13.75	14.23	15.80	21.62	6.66	18.40	s	14.89	-	-	-	0.044
Three-year rolling MMR	**-**	**-**	**06–08**	**07–09**	**08–10**	**09–11**	**10–12**	**11–13**	**12–14**	**13–15**	**14–16**	**15–17**	**-**	**-**	-	
	-	-	18.20	17.34	16.30	16.50	14.59	17.14	14.71	15.56	9.42	12.17	-	-	-	

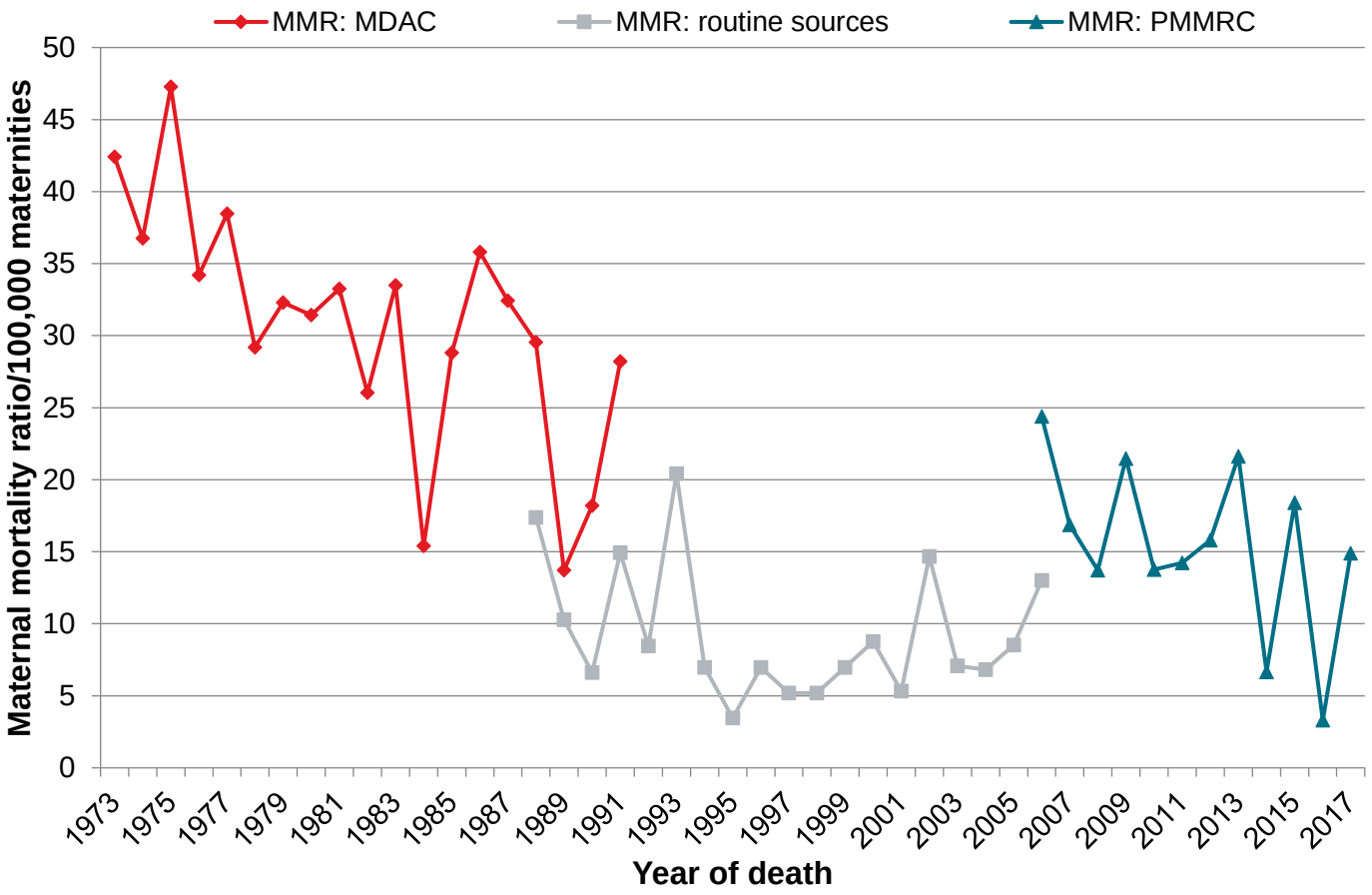
MMR = maternal mortality ratio.

‘s’ indicates rate not calculated due to small numbers.

Sources: Numerator: PMMRC’s maternal mortality data extract 2006–2017; Denominator: MAT data 2006–2017.

Substantial gains have been made in the rate of maternal death since the 1970s. Figure 5.2 shows the maternal mortality ratio over time, and by the different data sources that were available at various time periods. As well as an overall reduction in deaths over time, this figure shows that in the past, routine data sets are unlikely to have detected all maternal deaths, and there is now much better case ascertainment with active review of cases.

Figure 5.2: New Zealand maternal mortality ratio (per 100,000 maternities) by mortality data source 1973–2017



MMR = maternal mortality ratio.

MDAC = Maternal Deaths Assessment Committee.

Sources:

MMR: MDAC: Data from the MDAC, including maternal deaths to three months postpartum.

MMR: routine sources: Data from routine New Zealand data sets (ie, the Births, Deaths and Marriages (BDM) Mortality Collection and the National Minimum Dataset), including maternal deaths to six weeks postpartum.

MMR: PMMRC: PMMRC's maternal mortality data extract 2006–2017, including maternal deaths to six weeks postpartum; Denominator: MAT data 2006–2017.

The incidence of maternal death increased with age, with those aged 40 years and over having the highest rate (42.21 per 100,000 maternities). When examined by prioritised ethnic group, Māori and Pacific women had the highest rates, with 23.38 and 23.88 deaths per 100,000 maternities respectively. Women residing in the most deprived areas (NZDep2013 quintile 5) had the highest rate of mortality; there was some evidence of a statistically significant association between risk of death and increasing deprivation, as measured by NZDep2013 quintile (p=0.02).

Parity was unknown in 63,000 women over this time period, therefore it is not possible to comment on parity and the association with maternal death. This is largely due to a technical issue in the MAT data set. The Ministry of Health needs to urgently address this issue. It is recognised that high maternal BMI is associated with adverse outcomes for both the mother[44] and baby.[45] However, again, there were substantial amounts of missing data, with nearly 166,000 records (22%) with either height or weight

[44] McCall SJ, Li Z, Kurinczuk JJ, et al. 2017. Binational cohort study comparing the management and outcomes of pregnant women with a BMI >50–59.9 kg/m^2 and those with a BMI ≥60 kg/m^2. *British Medical Journal Open* 8:e021055. doi:10.1136/bmjopen-2017-021055.

[45] PMMRC. 2018. *Twelfth Annual Report of the Perinatal and Maternal Mortality Review Committee: Reporting mortality 2016*. URL: https://www.hqsc.govt.nz/assets/PMMRC/Publications/12th-PMMRC-report-final.pdf (accessed 9 September 2019).

incomplete. Given the significance of body size as a risk factor, it is of concern that information on height and weight is not consistently collected (Table 5.2).

Table 5.2: Demographic characteristics among maternal deaths 2006–2017

	Maternities		2006–2017					
	n=750,523		n=116		Maternal mortality ratio /100,000 maternities	95% CI	Rate ratio	95% CI
	n	%	n	%				
Maternal age (years)								
<20	46,684	6.2	6	5.2	12.85	4.72–27.97	1.04	0.43–2.51
20–24	132,895	17.7	16	13.8	12.04	6.88–19.55	0.97	0.52–1.80
25–29	192,288	25.6	31	26.7	16.12	10.95–22.88	1.30	0.78–2.18
30–34	217,643	29.0	27	23.3	12.41	8.18–18.05	1.00	-
35–39	129,941	17.3	23	19.8	17.70	11.22–26.56	1.43	0.82–2.49
≥40	30,798	4.1	13	11.2	42.21	22.48–72.18	3.40	1.76–6.59
Unknown	274	0.0	-	-	-	-	-	-
Prioritised ethnic group (mother)								
Māori	192,462	25.6	45	38.8	23.38	17.05–31.29	1.90	1.22–2.94
Pacific peoples	83,742	11.2	20	17.2	23.88	14.59–36.89	1.94	1.12–3.35
Asian	94,855	12.6	12	10.3	12.65	6.54–22.10		
Indian	29,841	4.0	4	3.4	13.40	3.65–34.32	1.09	0.39–3.05
Other Asian	65,014	8.7	8	6.9	12.31	5.31–24.25	1.00	0.46–2.15
MELAA	15,170	2.0	-	-	-	-	-	-
European	363,827	48.5	39	33.6	10.72	7.62–14.65		
NZ European	291,963	38.9	36	31.0	12.33	8.64–17.07	1.00	0.63–1.59
Other European	71,864	9.6	3	2.6	4.17	0.86–12.20	0.34	0.10–1.10
Other	-	-	-	-	-	-	-	-
Unknown	467	0.1	-	-	-	-	-	-
NZDep2013 quintile								
1 (least deprived)	105,602	14.1	11	9.5	10.42	5.20–18.64	1.00	-
2	114,379	15.2	11	9.5	9.62	4.80–17.21	0.92	0.40–2.13
3	136,046	18.1	23	19.8	16.91	10.72–25.37	1.62	0.79–3.33
4	172,442	23.0	31	26.7	17.98	12.21–25.52	1.73	0.87–3.43
5 (most deprived)	215,196	28.7	40	34.5	18.59	13.28–25.31	1.78	0.92–3.48
Unknown	6,858	0.9	-	-	-	-	-	-
Parity*								
0	272,435	36.3	31	26.7				
1–3	377,774	50.3	57	49.1				
4+	36,893	4.9	25	21.6				
Unknown	63,421	8.5	3	2.6				
Maternal BMI (kg/m^2)#								
<18.50	16,271	2.2	3	2.6				
18.50–24.99	284,596	37.9	39	33.6				
25.00–29.99	151,031	20.1	20	17.2				
30.00–34.99	77,165	10.3	23	19.8				
35.00–39.99	35,054	4.7	15	12.9				
≥40	20,414	2.7	12	10.3				
Missing data for height and or weight	165,992	22.1	4	3.4				

* Mortality rates by parity not calculated as denominator data unreliable.

Mortality rates by BMI not calculated as denominator data unreliable.

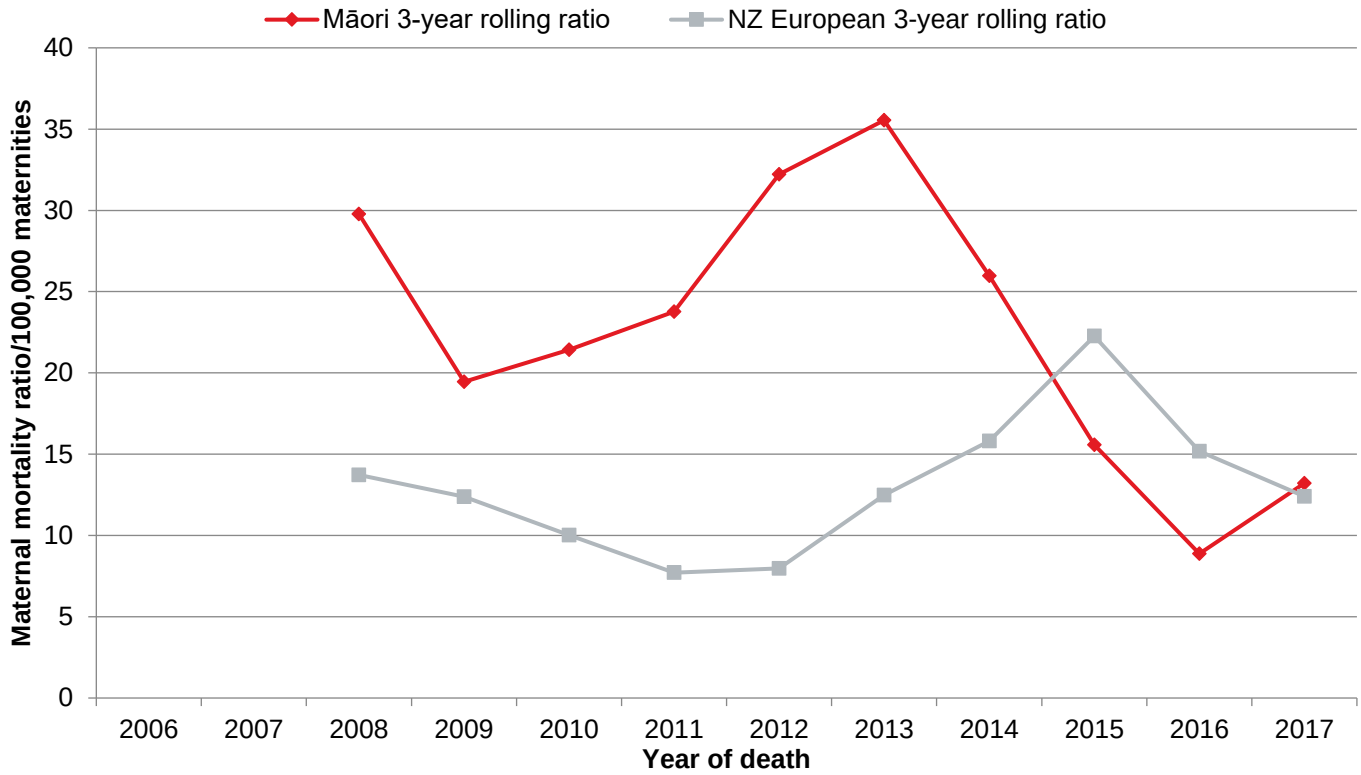
BMI = body mass index.

MELAA = Middle Eastern, Latin American, or African.

Sources: Numerator: PMMRC's maternal mortality data extract 2006–2017; Denominator: MAT data 2006–2017.

When examined by prioritised ethnicity, Māori women, until recently, had higher mortality rates than New Zealand European women. However, over the past four years their mortality rate has reduced and is currently similar to that for New Zealand European women. Over the time period 2006–2017 there is some evidence of a statistically significant reduction in deaths for wāhine Māori (p=0.04). There has been no change in the mortality rate for New Zealand European women over this time (Figure 5.3).

Figure 5.3: Maternal three-year rolling mortality ratios (per 100,000 maternities) by prioritised ethnic group (Māori and New Zealand European) and year 2006–2017



Sources: Numerator: PMMRC's maternal mortality data extract 2006–2017; Denominator: MAT data 2006–2017.

Table 5.3: Maternal mortality ratios (per 100,000 maternities) and cause of maternal death 2006–2017

	2006–2017		
	n=116		Cause-specific ratio
	n	%	/100,000 maternities
Maternities	**750,523**		
Direct maternal death	**66**	**56.9**	**8.79**
Suicide	30	25.9	4.00
Pregnancies with abortive outcome (ectopic and miscarriage)*	3	2.6	0.40
Hypertensive disorders	4	3.4	0.53
Obstetric haemorrhage	3	2.6	0.40
Pregnancy-related infection	6	5.2	0.80
Other obstetric complications	20	17.2	2.66
Amniotic fluid embolism	13	11.2	1.73
Venous thrombo-embolism	6	5.2	0.80
Other obstetric complications	<3	x	s
Indirect maternal death	**44**	**37.9**	**5.86**
Cardiac	11	9.5	1.47
Neurological	13	11.2	1.73
Infections not a direct result of pregnancy	8	6.9	1.07
Other non-obstetric complications	12	10.3	1.60
Unknown/undetermined	**6**	**5.2**	**0.80**

* This is the WHO category that includes first trimester pregnancy complications such as miscarriages and ectopic pregnancy.

Excludes 22 coincidental maternal deaths.

'x' indicates percentage suppressed due to small numbers.

's' indicates rate suppressed due to small numbers.

Sources: Numerator: PMMRC's maternal mortality data extract 2006–2017; Denominator: MAT data 2006–2017.

There were 66 direct maternal and 44 indirect maternal deaths over the 12-year study period 2006–2017 inclusive. The single largest cause of maternal death in Aotearoa/New Zealand is suicide, with 30 deaths during this time (45%). The next leading causes were amniotic fluid embolism and neurological conditions, which caused 13 deaths (11.2%) each (Table 5.3). While there were only three deaths due to ectopic pregnancy, these are highly preventable deaths. Suicide deaths particularly affect wāhine Māori, with both the largest number of deaths and the highest rate, compared with other ethnic groups. Wāhine Māori were 3.41 times more likely to die by suicide than New Zealand European women (Table 5.4).

Table 5.4: Maternal suicide by prioritised ethnic group* 2006–2017

Ethnicity (prioritised)	N	n	Rate	Rate ratio	95% CI
Māori	192,462	18	9.35	3.41	1.48–7.85
NZ European	291,963	8	2.74	1.00	-

* Excludes four cases that were in Pacific and 'Other Asian' ethnic groups. There were no deaths due to suicide in Indian; Middle Eastern, Latin American, or African (MELAA); Other European; or other ethnic groups.

Sources: Numerator: PMMRC's maternal mortality data extract 2006–2017; Denominator: MAT data 2006–2017.

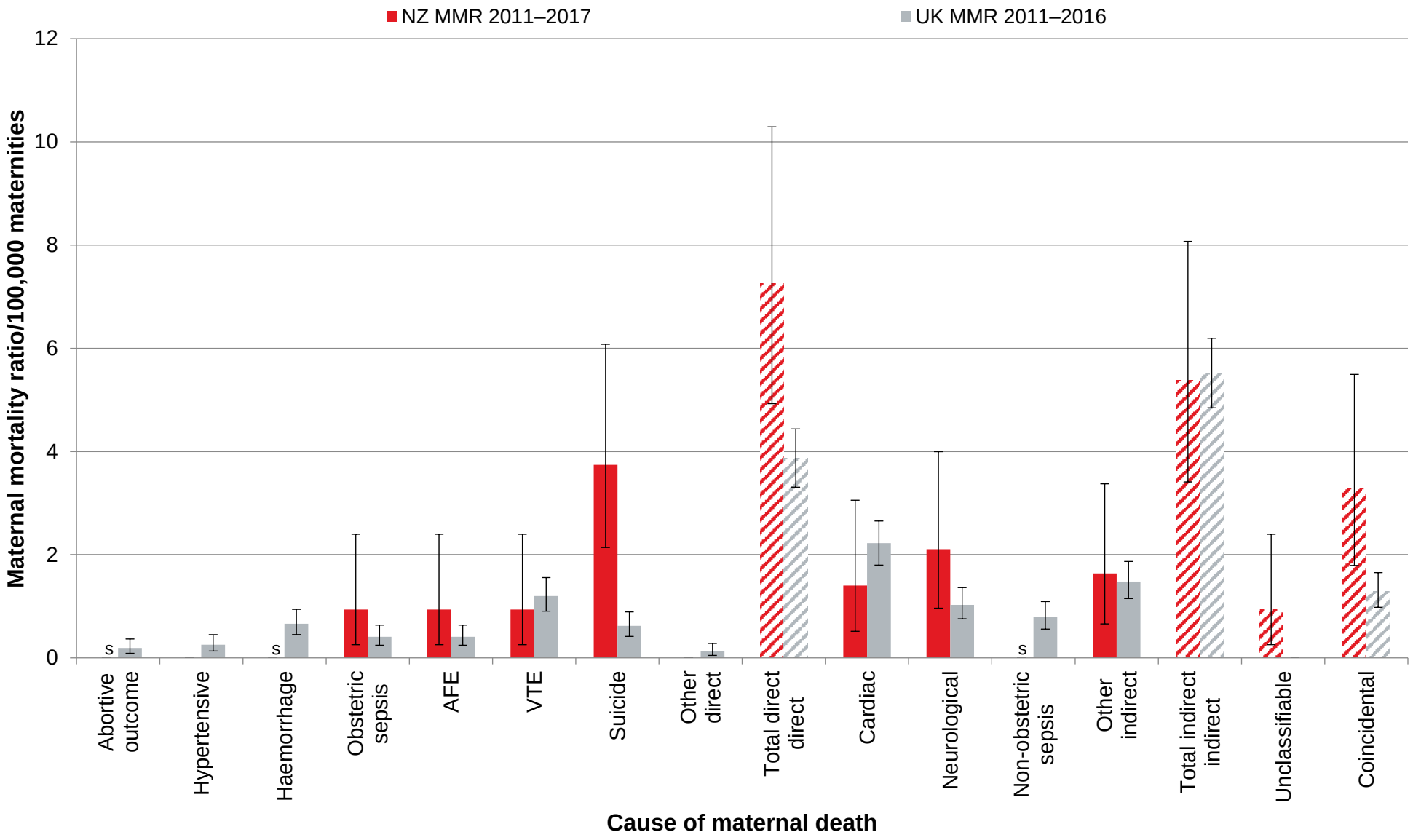
Figure 5.4 shows that rates of maternal death in Aotearoa/New Zealand compared with the United Kingdom (UK) are generally higher, with a statistically significantly higher rate of direct deaths. For most individual causes there were no statistically significant differences between rates in Aotearoa/New Zealand with the UK, except for suicide, where the New Zealand rate was substantially higher.

Given that suicide is the leading cause of maternal death, it is imperative that comprehensive action is taken. There are currently screening guidelines during the antenatal and postnatal period; however, their use is variable. Difficulties arise when mild to moderate illness is diagnosed, as maternal mental health service provision is variable within Aotearoa/New Zealand, with particularly limited resources for women with mild to moderate illness.

We have identified that wāhine Māori are a group at high risk, and warrant routine screening. The Edinburgh Postnatal Depression Scale has been used widely across many different cultures and found to have good validity across cultures.[46] However, this tool has never specifically been validated for Māori, and it has been shown that different cultural groups within Aotearoa/New Zealand may require different cut-offs to adequately detect women who require intervention.[47] While both suicide prevention and mental well-being are topical currently, there has not been any governmental budget provided specifically to reduce maternal suicide deaths. There has been only limited investment in maternal well-being – for example, there is inadequate provision of mother–baby units. Our findings show there is an urgent need for investment in this area, in the areas of prevention, developing appropriate screening tools and treatment for women and their babies. A previous review of maternal suicide in wāhine Māori made a number of recommendations around early recognition of risk factors, comprehensive assessment and active follow-up.[48] (See also 'Practice point: Psychosocial health and maternal suicide'.)

[46] Di Florio A, Putnam K, Altemus M, et al. 2017. The impact of education, country, race and ethnicity on the self-report of postpartum depression using the Edinburgh Postnatal Depression Scale. *Psychological Medicine* 47(5): 787–99.
[47] Ekeroma AJ, Ikenasio-Thorpe B, Weeks S, et al. 2012. Validation of the Edinburgh Postnatal Depression Scale (EPDS) as a screening tool for postnatal depression in Samoan and Tongan women living in New Zealand. *New Zealand Medical Journal* 125(1355): 41–50.
[48] PMMRC. 2017. *Eleventh Annual Report of the Perinatal and Maternal Mortality Review Committee: Reporting mortality 2015*. URL: https://www.hqsc.govt.nz/assets/PMMRC/Publications/2017_PMMRC_Eleventh_Annual_Report.pdf (accessed 12 August 2019).

Figure 5.4: Cause-specific maternal mortality ratios (per 100,000 maternities) in New Zealand 2011–2017 and the UK 2011–2016 (with 95% CIs)



‘s’ indicates rate not calculated due to small numbers.

AFE = amniotic fluid embolism.

MMR = maternal mortality ratio.

VTE = venous thromboembolism.

‘Other direct’ includes cardiomyopathy.

‘Other indirect’ includes endocrine, respiratory, neoplasm, other pre-existing medical.

‘Coincidental’ includes motor vehicle accident, external causes of accidental injury, assault, malignancy not related to pregnancy.

The shaded bars represent total of direct, indirect, unclassifiable and coincidental deaths.

Sources:

- NZ MMR: Numerator: PMMRC’s maternal mortality data extract 2011–2017; Denominator: MAT data 2011–2017.
- UK MMR: Numerator: Maternal Deaths and Morbidity, includes surveillance data on women who died during or up to one year after pregnancy 2011–2016 in the UK.
- UK MMR: Denominator: The number of pregnancies that result in a live birth at any gestation or stillbirths occurring at or after 24 completed weeks of gestation, supplied by organisations such as the Office for National Statistics, the General Register Office for Scotland, Northern Ireland Statistics and Research Agency, and Hospital Episode Statistics 2011–2016.
- UK MMR: Mothers and Babies: Reducing Risk through Audits and Confidential Enquiries across the UK (MBRRACE-UK). 2018. *Saving Lives, Improving Mothers Care: Lessons learned to inform maternity care from the UK and Ireland Confidential Enquiries into Maternal Deaths and Morbidity 2014–16*. URL: https://www.npeu.ox.ac.uk/downloads/files/mbrrace-uk/reports/MBRRACE-UK%20Maternal%20Report%202018%20-%20Web%20Version.pdf (accessed 16 August 2019).

Practice point: Psychosocial health and maternal suicide

Pregnancy and the postpartum period are **not** protective against mental illness, and can be a trigger for onset and for deterioration of mental illness.

Suicide is a leading cause of maternal mortality, with Māori women and young women (<20 years old) over-represented among maternal suicides.

Psychosocial health screening

Early during a woman's contact with health services, including request for termination of pregnancy, a comprehensive assessment of her psychosocial health and risk factors should be undertaken. This will involve identifying:

- her current social situation, including relationship with partner/ex-partner, whānau supports, and social stressors such as financial issues, housing, whether their other children are in care of other people, and phone and transport availability
- any previous and current experience of family violence, sexual abuse and assault
- a history of termination of pregnancy or miscarriage in the previous 12 months
- any past or present mental illness, including self-harm and previous suicide attempts, use of alcohol and other drugs
- any past or present treatment by a specialist mental health service, including inpatient care
- a family history of severe mental illness, including perinatal mental illness or suicide in a close relative.

Pregnant and postpartum women who use substances often have complex social and mental health needs, and face additional barriers in accessing services.

Communication

All clinicians involved in a woman's care need relevant mental health history and current knowledge of a woman's pregnancy to support them to provide the best care. Routine sharing of relevant information across general practice, LMC, maternity and mental health service interfaces will enable better-informed care, and any concerns regarding risk need to be clearly communicated to all clinicians involved.

Care provision

Women who have a history of severe mental illness (eg, severe depression/bipolar disorder/psychosis) should be referred to a secondary mental health service even if currently well, as their risk of relapse in the postpartum period may be high. They need an appropriate mental health birth plan and monitoring for the peripartum period, with advice around avoiding sleep deprivation.

Mental health medications should not be stopped without review by a doctor and risk–benefit analysis. Consultation with a perinatal psychiatrist should be considered.

Women should have continuity of, and culturally appropriate, mental health care. During pregnancy and the postpartum period there may be more than one mental health team involved – in such cases there should be one identified individual who coordinates care.

Doctors who refer women for termination of pregnancy should actively follow-up these women to ensure they have their free post-termination of pregnancy check, which should specifically include assessment of mental health status.

Acute mental health episodes

Any of the following identified at any time suggests a serious mental illness and requires urgent (same day) assessment by mental health services, including early consultant psychiatrist review and consultation with perinatal mental health services:

- suicidal ideation (new or increasing thoughts) and/or thoughts to harm baby or others
- suicide attempts
- psychotic symptoms
- recent significant change in mental state including fluctuating or emergence of new symptoms
- pervasive guilt or hopelessness
- ongoing beliefs of inadequacy as a mother
- a sense of estrangement or disconnection from the infant.

Following recovery

It is the responsibility of the treating team to ensure that all women experiencing postpartum psychosis or other severe postpartum mental illness receive a clear explanation of:

- future risk
- the availability of risk minimisation strategies including pre-pregnancy consultations prior to subsequent pregnancies
- the need for re-referral during subsequent pregnancies.

The GP should also be notified of risk, risk minimisation strategies and of any subsequent pregnancies.

Partners, family, whānau and other support people require explanation and education regarding maternal mental illness and its accompanying risks.

13. The PMMRC recommends that a Maternal and Infant Mental Health Network is funded by the Ministry of Health and that the network then determine an achievable work stream by the end of 2018 detailing work to be completed by the end of 2020, to include as potential areas of priority: a. a stocktake of current mental health services available across New Zealand for pregnant and recently pregnant women to identify both the strengths of services and gaps or inequity in current services and skills in the workforce b. a national pathway for accessing maternal mental health services, including: i. cultural appropriateness to ensure service access and provision ii. appropriate screening iii. care for women with a history of mental illness iv. communication and coordination.	**The Ministry of Health** is currently planning the implementation of the Government's response to He Ara Oranga and the Wellbeing Budget 2019, of which mental health and addiction is a priority area. While there is no specific recommendation for maternal and infant mental health services, the underlying message of the report is one of expanding access and choice, investing in workforce development and placing people at the centre. In order to achieve this vision, significant stakeholder engagement and sector co-design is required, and the Ministry of Health welcomes the PMMRC's participation in this work. Some of the mental wellbeing initiatives the Ministry of Health will be implementing include: • funding to co-design approaches to meet the needs of local communities • funding to extend the pregnancy and parenting service • the development of an enhanced support pilot for parents and whānau with mental wellbeing needs during pregnancy for the first years of a child's life or following a stillbirth • $30 million over four years for primary maternity services to increase the fees paid to LMCs • $4.3 million paid over four years to increase the Pacific nursing and midwifery workforce and to offer wrap-around support for Pacific nursing and midwifery students • $67 million over four years for primary health care to cover increasing costs and demands for initiatives that aim to increase access.

Ngā whakarāpopoto | Abbreviations

ACC	Accident Compensation Corporation
AFE	Amniotic fluid embolism
APH	Antepartum haemorrhage
BE	Base excess
βhCG	Beta human chorionic gonadotropin
BMI	Body mass index (kg/m^2)
CI	Confidence interval
CTG	Cardiotocograph
DHB	District health board
ETT	Endotracheal tube
GAP	Growth Assessment Protocol
GP	General practitioner
IPPV	Intermittent positive pressure ventilation
LMC	Lead maternity carer
MAT	National Maternity Collection
MDAC	Maternal Deaths Assessment Committee
MELAA	Middle Eastern, Latin American, or African
MIHI	Māori Indigenous Health Institute
MMR	Maternal mortality ratio
MQSP	Maternity Quality and Safety Programme
MRI	Magnetic resonance imaging
NE	Neonatal encephalopathy
NMDS	National Minimum Dataset
NZCOM	New Zealand College of Midwives
NZDep2013	New Zealand Index of Deprivation 2013
PMMRC	Perinatal and Maternal Mortality Review Committee
PSANZ	Perinatal Society of Australia and New Zealand
PSANZ-NDC	PSANZ neonatal death classification
PSANZ-PDC	PSANZ perinatal death classification
PUL	pregnancy of unknown location
RANZCOG	Royal Australian and New Zealand College of Obstetricians and Gynaecologists
SAC	Severity Assessment Code
SIDS	Sudden infant death syndrome
SUDI	Sudden unexpected death in infancy
UK	United Kingdom
VTE	Venous thromboembolism
WHO	World Health Organization