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

Executive Summary of the 11th Annual Report of the Perinatal and Maternal Mortality Review Committee

Reporting mortality and morbidity 2015

(Full report available online at www.hqsc.govt.nz/our-programmes/mrc/pmmrc/publications-and-resources/)

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Foreword

The Health Quality & Safety Commission (the Commission) welcomes the 11th report of the Perinatal and Maternal Mortality Review Committee (the PMMRC).

This report considers perinatal and maternal mortality and morbidity from 1 January to 31 December 2015; perinatal mortality from 2007 to 2015; maternal mortality from 2006 to 2015; and babies with neonatal encephalopathy from 2010 to 2015.

In this report the PMMRC have also introduced data and discussion related to Māori. We need to focus our lens on outcomes for Māori mothers and infants, as the inequity between Māori and non-Māori continues. The outlying causes of stillbirth and neonatal death among babies of Māori mothers are spontaneous preterm birth, antepartum haemorrhage, maternal conditions (mostly diabetes-related), and hypertension. There is a significantly higher, almost double, maternal mortality ratio among Māori mothers than New Zealand European mothers. Tragically, Māori women are over-represented among maternal suicides. The main contributory factors amongst these deaths continue to be barriers to access and/or engagement with care, which the PMMRC will be working with the sector to improve.

Also new to the PMMRC report is the work of the Maternal Morbidity Working Group (MMWG). In May 2016 we welcomed this working group dedicated to reducing maternal morbidity to the PMMRC. The MMWG transitioned to the Commission from the existing Severe Acute Maternal Morbidity (SAMM) research group based at the University of Otago. Supported and funded by the Ministry of Health, the group will be active through to June 2019. The MMWG is responsible for nationally reviewing incidences of women who are pregnant or have recently delivered who are also very ill, and developing quality improvement initiatives alongside the maternal health services. This group is supporting the work of the PMMRC to improve the quality and experience of maternity care for women, babies and whānau, informed by robust, consistent, reportable and women-centred maternal morbidity review.

The perinatal related mortality rate in 2015 is the lowest reported since the PMMRC began collecting data in 2007 and is significantly lower than the rate for the years 2007–2014 combined.

We are pleased to report a statistically significant reduction in fetal deaths (stillbirths and late terminations of pregnancy combined) from 2007 to 2015, and an ongoing statistically significant reduction in stillbirths.

The neonatal death rate has not changed significantly in New Zealand from 2007 to 2015, and note that the PMMRC have indicated that this will be a key are of investigation for 2017–2018. There have been significant reductions in neonatal mortality in the United Kingdom (UK), Australia and Scandinavia, and we will look to learn from those experiences.

This report would not be possible without the substantial contribution of a dedicated team of people: the local coordinators across the country who provide these data; Dr Sue Belgrave and the PMMRC; the National Coordination Service based at the University of Auckland; the New Zealand Mortality Review Data Group based at University of Otago; and the mortality review committee staff at the Commission.

On behalf of the Commission, I sincerely thank Dr Belgrave for leading this committee's important work.

Professor Alan Merry ONZM FRSNZ

Chair, Health Quality & Safety Commission

Chair's Introduction

This is the 11th annual report of the Perinatal and Maternal Mortality Review Committee (the PMMRC) and my fourth as Chair.

We acknowledge the grief of families and whānau who have lost babies and mothers in 2015. Their information is presented in this report. The goal of the PMMRC is not only to accurately report mortality and morbidity but also to work with the wider maternity community to reduce deaths and enhance maternity care in New Zealand. We report on perinatal deaths from 2007 to 2015, maternal deaths from 2006–2015, and babies with neonatal encephalopathy from 2010 to 2015.

The perinatal related mortality rate in 2015 (9.7/1000 births) is the lowest reported since the PMMRC began collecting data in 2007. However, the trend in overall perinatal related mortality is not statistically significant. A statistically significant reduction in stillbirths continues to be evident, and a statistically significant reduction in fetal death (stillbirths and late terminations of pregnancy combined) is reported for the first time.

New initiatives in the 2017 report are the development of a Māori chapter, a change in dataset to enable multivariable analysis, and an initial report of the Maternal Morbidity Working Group (MMWG).

This year we include a chapter on Māori perinatal and maternal mortality in collaboration with the Mortality Review Committees' Māori Caucus. The main areas of concern for Māori are the maternal suicide rate, especially of young Māori women, and the loss of babies to very preterm labour.

The PMMRC has recommended in previous reports that the New Zealand National Maternity Collection (MAT) dataset be available in order to report independent associations of perinatal death. The change of denominator from the Births, Deaths and Marriages (BDM) birth registration dataset to the MAT dataset has allowed us to use more clinical information but unfortunately not to perform multivariable analysis of perinatal related deaths as planned. This analysis was unable to adjust adequately for differences in the populations of women living in different DHBs across the country with regard to smoking, BMI, and parity due to missing registration data among women under DHB primary maternity services at some DHBs. The missing data from some DHBs in the MAT dataset is selectively from the women who are most likely to suffer a perinatal loss. Without this information, we are unable to make valid comparisons of care and outcomes between DHBs.

In 2015 we report an unusually high number of deaths at 41 weeks. A further review of these deaths has highlighted the importance of risk assessment leading up to term and appropriate induction of labour for recognised indications. This is a topic for discussion at our annual conference and has led to a recommendation for an interdisciplinary consensus guideline on induction of labour.

The neonatal mortality rate is unchanged over the time we have been reporting. However, there has been a reduction in other countries. This will be a focus in our next report.

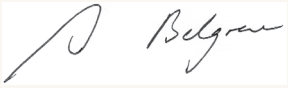
The establishment of the MMWG is an important initiative with the aim of reducing the incidence and severity of acute severe maternal morbidity. The initial areas of focus are maternal sepsis and unplanned peripartum hysterectomy. The in-depth reviews with inclusion of women's stories will guide recommendations for improvement in care.

There has been no significant change in the maternal death rate since the PMMRC began reporting in 2006. Our challenges are our rates of suicide and deaths from amniotic fluid embolism. Work with the

Ministry of Health is continuing on the Perinatal and Infant Mental Health Network, and the PMMRC supports the wider national review on suicide. Amniotic fluid embolism will be discussed further at our conference this year, and we include the practice point from the 10th report to highlight the importance of early recognition and management.

Although there appears to be a downward trend in rates of neonatal encephalopathy (NE) from 2010–2015, it is not statistically significant. NE is associated with maternal ethnicity, socioeconomic deprivation, gestation, birthweight and nulliparity. The framework for assessment of potential avoidability in reviews of NE has highlighted areas for improvement in care and has informed and assisted the establishment of the Neonatal Encephalopathy Taskforce, which has the long-term aim of reducing the burden of NE on New Zealand families.

We also recognise the challenges of the clinicians working with women and their families and whānau.



Dr Sue Belgrave

Chair, Perinatal and Maternal Mortality Review Committee

Parents, Families, Whānau

This foreword is designed for parents, families and whānau of the babies who died during the 2015 year.

Let me introduce myself. My name is Linda and my eldest daughter died shortly after birth. Her name was Georgia, and she fell into the 'unexplained death' category at the time (1999). I sit on the PMMRC and my job with this group is to represent you and me: bereaved parents. So, chances are, you and I understand child loss in a way that not all clinicians do. This is not a position any of us wanted to be in, or have any idea how to live with in the beginning. The shock and grief can seem to be a bottomless pit, and the unfairness of it all seems overwhelming.

This report from the PMMRC is the 11th annual edition of the report. What is becoming clear to those of us who work with the PMMRC is that positive, measurable changes are occurring in the mortality rate for our families here in New Zealand. There will sadly, and unavoidably, be deaths for our babies (and sometimes their mothers), but the purpose of this review group, and this report each year, is to see where and when we can make changes to the way we do things to try to minimise those deaths.

The PMMRC investigates all processes involved in the delivery of a baby. Everything is considered, from the medical details about the baby and the mother, the staff involved, the processes, the equipment and resources, the size of hospital where the mother lived, the transportation to a bigger hospital (if required) and even the weather, if this played a part. This is done through a review of your baby's case within your own district health board (DHB) shortly after your baby died. The DHB review is to determine the cause of your baby's death and to ensure the correct care was provided to you and your child. Each individual death is added to the national information so that trends can be identified.

As well as scrutinising the medical issues in each death, we also look at the processes from when a mother registers with antenatal care, the processes during the delivery of your baby, the personnel involved at each level, how information about risk is communicated to you the families, and how systems can be improved in all of those stages. There is a huge amount of information collected about each mother and baby, from before pregnancy, during pregnancy and in the weeks after birth. All of this complex information takes time to sort through, and it takes even more time to accumulate enough information over a few years to start to see trends.

In a nutshell, we can begin to see what possibly went wrong in some deaths, and therefore make changes to prevent future losses. In 2015 there were fewer deaths of babies up to 28 days of age than any other year since reporting began in 2007.

I realise that if you are reading this, then things have probably not gone well for you. Let me explain why your baby's short life and your whole experience make a difference.

Without all the details of your pregnancy, we cannot learn how to try to avoid this happening again, either to you or to other families with circumstances similar to yours. Sometimes, it is only in hindsight that we can try to understand the complications that led to a loss. This is why your story, and the stories of other families, are so important to ongoing understanding of perinatal loss.

Post-mortem examinations are valuable to help find why a baby has died. In my own case, I was hugely relieved to find that there was nothing I could have done to stop Georgia's death, and that I did not accidentally do something to make her sick. My partner and I were also desperate to know if any future baby of ours was going to die. Whilst there was no guarantee, we got some relief when we learned that there were no congenital (inherited) problems and that we could go ahead and have more babies. So, along with a post-mortem providing information to add to that obtained from other babies' deaths to help the PMMRC with review, it was for us as parents the only source of courage we had to try and have a

healthy baby (incidentally, we went on to have live twins five years later).

On behalf of the PMMRC, I want to say how desperately sorry we are that you are in this position. From my own point of view, I get it. Your loss is a massive life-changing event, and it can seem overwhelming. Sands is an international organisation here in New Zealand designed to support you and your family. Go to www.sands.org.nz for information on physical support groups in your area, virtual support groups online, and a host of articles and reading materials that you may find helpful. I can tell you that whilst your pain will not lessen, it does get easier to carry around over time.

This may have been a little life, but is not a little loss. Many thanks for reading this, and I hope it has helped you understand how the PMMRC and the maternity services in New Zealand are working to improve outcomes for our mothers and babies.

Kia kaha.

Linda Penlington

Executive Summary and Recommendations

Terms of Reference and Mortality Definitions PMMRC

Terms of Reference of the Perinatal and Maternal Mortality Review Committee

The Perinatal and Maternal Mortality Review Committee (PMMRC) is responsible for reviewing perinatal and maternal mortality and other mortality and morbidity as directed by the Health Quality & Safety Commission.

Mortality 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 includes any interrupted ongoing pregnancy from 20 weeks (whether the baby was stillborn or live born).

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 of the sixth day of life. **Late neonatal death** is a death that occurs between the seventh day and midnight of the 27th day of life.

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 1000 total babies born at 20 weeks or beyond, or 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 or beyond or weighing at least 400g if gestation is unknown. The maternal mortality ratio is calculated per 100,000 maternities.

Findings 2017 Report (Data 2015)

Significant changes to the report 2017

1. The 11th report introduces chapters on Māori perinatal and maternal mortality and the Maternal Morbidity Working Group (MMWG).

2. The New Zealand National Maternity Collection (MAT) dataset has been substituted for the Births, Deaths and Marriages (BDM) birth registration dataset as the denominator for analyses because it is the most complete record of births in a year and it contains more maternity clinical data.

Demography

3. From 2007 to 2015, there was a reduction in mothers under 20 years old, fewer mothers smoking, and fewer births at 40 and 41+ weeks among all births in New Zealand.

4. The change to using the MAT denominator in place of birth registrations has made a difference to the associations seen between ethnicity and perinatal related mortality. It is not known whether the ethnicity variable derived in the MAT dataset is the best approximation of self-defined ethnicity.

Perinatal related mortality

5. The perinatal related mortality rate in 2015, at 9.7/1000 births, is the lowest reported since the PMMRC began collecting data in 2007, but the test for trend is not statistically significant over this time. The rate in 2015 is, however, significantly lower than the rate for the years 2007–2014 combined (p=0.025), and the overall perinatal related mortality rate at 10.0 and 9.7/1000 in two of the past three years was lower than in any single year from 2007 to 2012.

Summary of New Zealand perinatal mortality rates 2015 (Table 3.1)

	Using NZ definition		Using UK definition*	
	n	Rate	n	Rate
Total births	59,808		59,551	
Fetal deaths (terminations of pregnancy and stillbirths)#	412	6.89	-	-
Terminations of pregnancy	107	1.79	-	-
Stillbirths	305	5.10	212	3.56
Early neonatal deaths <7 days	131	2.21	76	1.28
Late neonatal deaths 7–27 days	35	0.59	34	0.57
Neonatal deaths <28 days+	166	2.79	110	1.85
Perinatal mortalities^	543	9.08	288	4.84
Perinatal related mortalities•	578	9.66	322	5.41
Perinatal mortalities excluding lethal and terminated fetal abnormalities~	402	6.72	249	4.18
Perinatal related mortalities excluding lethal and terminated fetal abnormalities~	420	7.02	266	4.47

*Rates calculated using UK definition for perinatal mortality: births from 24 weeks excluding terminations of pregnancy (CMACE 2011).
Fetal death rate per 1000 babies born (includes terminations and stillbirths).
+ Neonatal death rate per 1000 live born babies.
^ Fetal deaths and early neonatal deaths per 1000 babies born.
• Fetal deaths and early and late neonatal deaths per 1000 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 Perinatal Society of Australia and New Zealand neonatal death classification (PSANZ-NDC) of congenital abnormality.

Perinatal related mortality rolling three-year rates (per 1000 births) using New Zealand definitions 2007–2015 (Figure 3.2)

6. There is an ongoing statistically significant reduction in stillbirths from 2007 to 2015 (chi-squared test for trend p=0.0099).

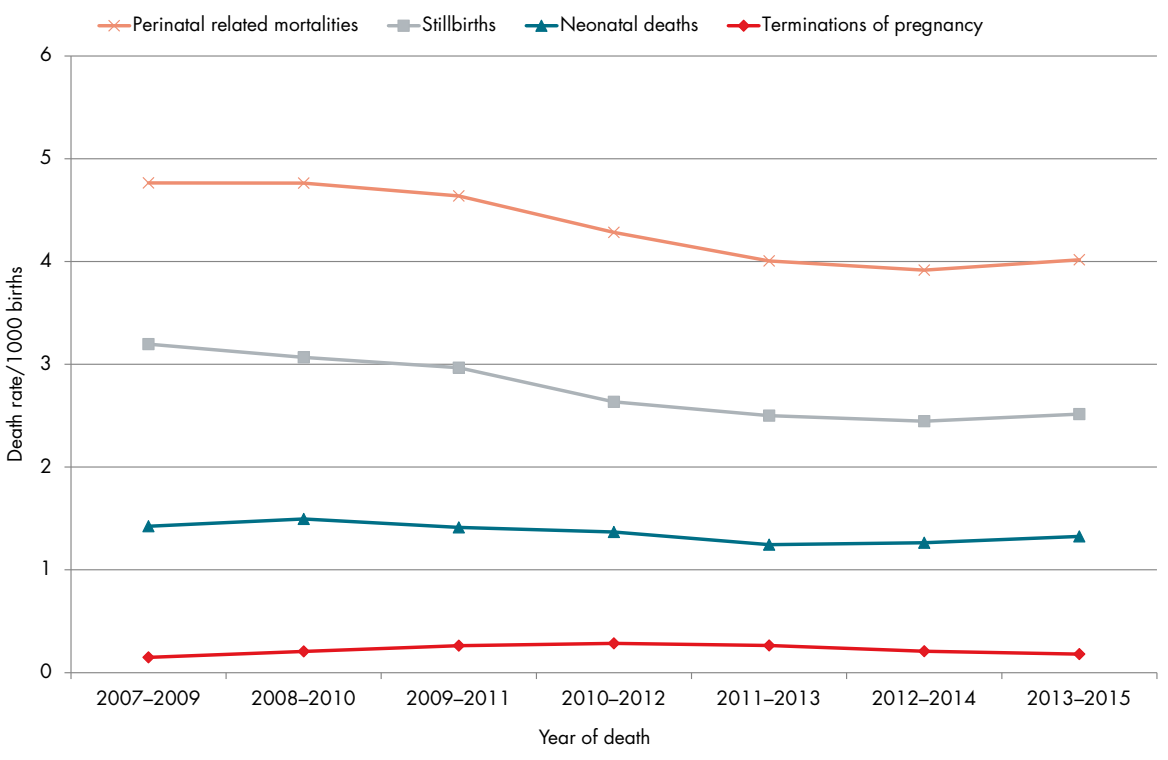
7. There is a statistically significant reduction in fetal deaths (stillbirths and late terminations of pregnancy combined) reported for the first time, from 2007 to 2015 (chi-squared test for trend p=0.035).

8. The late termination of pregnancy rate in 2015 was lower than any previously reported year (1.8/1000 births) and significantly lower than the years 2007–2014 combined (p=0.004), although the test for trend is not statistically significant.

9. There is a significant reduction in hypoxic peripartum deaths among total perinatal related deaths (births from 20 weeks) from 2007 to 2015 (chi-squared test for trend p=0.00031) and a trend to reduced deaths from fetal growth restriction (chi-squared test for trend p=0.053).

10. There is a significant reduction in stillbirths (p=0.00023), fetal deaths (p=0.0006) and overall perinatal related mortality rate (p=0.0011) using the international definition (≥1000g or 28 weeks if birthweight is unknown).

Perinatal related mortality rolling three-year rates (per 1000 births) using international definitions 2007–2015 (Figure 3.3)



11. Statistically significant reductions in hypoxic peripartum death (p=0.0003), and death from antepartum haemorrhage (p=0.031) and fetal growth restriction (p=0.015) are in part responsible for the significant reduction in perinatal related mortality using the international definition (from 1000g or 28 weeks if birthweight is unknown).

12. The neonatal death rate has not changed significantly in New Zealand from 2007 to 2015. This will be investigated in detail in 2017–2018. Meanwhile there have been significant reductions in neonatal mortality in the UK (from 2004 to 2014), Australia, and Scandinavia.

13. Mothers in their first pregnancy have higher stillbirth and neonatal death rates compared to women who are having their second birth, and mothers in their fourth or later pregnancies have higher rates of stillbirth compared to women who are having their second birth.

14. Multivariable analysis of perinatal related deaths from 2008 to 2015 showed that maternal ethnicity, age, deprivation decile, and multiple pregnancy were, variably, independent predictors of late termination of pregnancy, stillbirth and/or neonatal death. (It should be noted however that the numerator denominator bias arising from use of ethnicity derived from the PMMRC dataset in the numerator and MAT dataset in the denominator in this analysis may have led to inaccurate estimates of risk. This issue is outlined and discussed with regard to Māori mothers and babies in the Māori chapter. It is expected that this issue can be resolved by the inclusion of birth registration ethnicity data (BDM) in the MAT dataset in future years (as recommended again this year as it related specifically to Māori, by the Mortality Review Committees' Māori Caucus)).

Adjusted odds ratios for perinatal related mortality, termination of pregnancy, stillbirth, and neonatal death 2011–2015 (Table 3.12)

	Perinatal related mortality			Fetal deaths: Termination of pregnancy			Fetal deaths: Stillbirth			Neonatal mortality		
	n=494,210			n=494,210			n=494,210			n=490,578		
	OR adjusted	95%CI		OR adjusted	95%CI		OR adjusted	95%CI		OR adjusted	95%CI	
Ethnicity*												
Māori	0.90	0.83	0.97	0.53	0.44	0.64	0.93	0.83	1.03	1.18	1.02	1.36
Pacific	1.09	1.00	1.20	0.65	0.52	0.82	1.17	1.03	1.33	1.32	1.11	1.57
Indian	1.50	1.32	1.71	1.36	1.04	1.78	1.46	1.21	1.75	1.74	1.36	2.22
Other Asian	0.94	0.84	1.05	1.30	1.07	1.57	0.76	0.64	0.90	0.91	0.72	1.15
Other	0.69	0.62	0.77	0.76	0.62	0.93	0.69	0.59	0.81	0.62	0.49	0.78
New Zealand European	1.00			1.00			1.00			1.00		
Age#												
<20	1.62	1.45	1.81	1.62	1.25	2.12	1.49	1.28	1.75	1.81	1.49	2.20
20–24	1.11	1.01	1.21	1.18	0.97	1.43	1.11	0.98	1.25	1.05	0.89	1.23
25–29	1.00			1.00			1.00			1.00		
30–34	0.97	0.89	1.05	1.03	0.87	1.23	1.00	0.89	1.12	0.85	0.73	1.00
35–39	1.19	1.09	1.30	1.29	1.07	1.55	1.16	1.02	1.31	1.17	0.99	1.38
≥40	1.51	1.32	1.72	1.80	1.38	2.34	1.47	1.22	1.78	1.34	1.03	1.74
Deprivation decile# (per unit)	1.05	1.03	1.06	0.99	0.97	1.02	1.05	1.03	1.07	1.08	1.06	1.11
Year of birth#	0.99	0.98	1.01	1.00	0.97	1.03	0.99	0.97	1.00	1.00	0.98	1.03
Sex+												
Male	1.00			1.00			1.00			1.00		
Female	0.95	0.90	1.00	1.03	0.91	1.16	0.97	0.90	1.05	0.85	0.76	0.94
Multiple pregnancy*	4.28	3.91	4.69	2.07	1.60	2.67	4.01	3.52	4.56	6.73	5.80	7.81

* Data for numerator from the PMMRC dataset.
# Data for numerator from the MAT dataset.
+ Data for numerator from the MAT dataset, then the PMMRC dataset if MAT data are missing.
OR = odds ratio.
CI = confidence interval.

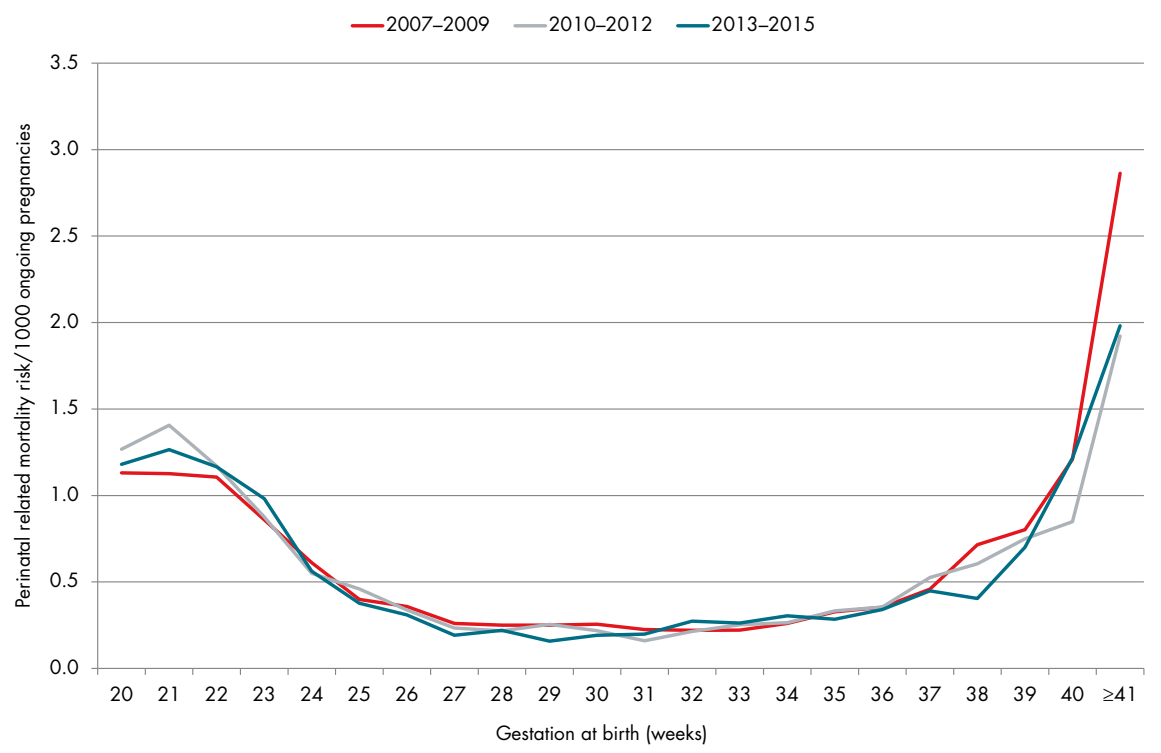
15. There is a significantly higher rate of perinatal related mortality than the national rate among residents of Counties Manukau DHB. There is a significantly higher stillbirth rate than the national rate among residents of Counties Manukau DHB. There is a significantly higher neonatal death rate than the national rate among residents of Counties Manukau and Waikato DHBs.

16. There continues to be a statistically significant reduction in perinatal related death at 37–38 weeks (p=0.025) and at 41 weeks and above (p=0.047) and a significant reduction in stillbirths at 37–40 weeks (p=0.0018) from 2007 to 2015 using chi-squared test for trend. The rate of stillbirth at 41 weeks and beyond for 2015 is higher than in any year from 2007 to 2014.

    a. Review of the 17 stillbirths in 2015 from 41 weeks without congenital abnormality, against the *Auckland Consensus Guideline on Induction of Labour* (Wise et al 2014) and against best practice for antenatal assessment in women with risk factors, found the care provided did not follow the guideline and/or best practice in 6 of the 17 stillbirths. This related to best practice

to perform serial growth scans following antepartum haemorrhage; best practice for obstetric review and/or to perform serial growth scans for BMI >35 in three pregnancies; and to offer induction of labour for diabetes with suspected small for gestational age (SGA) pregnancies, and for hypertension.

Perinatal related mortality risk by gestational age at birth and year (per 1000 ongoing pregnancies) 2007–2015 (Figure 3.15)



17. In 2015, one-quarter of perinatal related deaths were determined at local review to have contributory factors, and just over half of these (14 percent) were determined to be potentially avoidable deaths.

Investigation of perinatal related mortality

18. In 2015, 52 percent of babies who died in the perinatal period were optimally investigated (Table 3.57). Of the remainder, 8 percent were not investigated and 40 percent were partially investigated. There is a statistically significant increase from 2007 to 2015 in optimal investigation among perinatal related deaths, an increase in partial investigation, and a decrease in no investigation.

19. Perinatal death investigation continues to be significantly less frequent among babies of Māori and Pacific mothers than other ethnicities (20 percent had no investigation).

20. In 2015, data on the usefulness of post-mortem were available for 205 (83 percent) of deaths where post-mortem was performed, showing that in 118 deaths (48 percent) the post-mortem confirmed the clinical diagnosis, in 40 (16 percent) the post-mortem changed the diagnosis and resulted in altered counselling to parents for future pregnancies, in 27 (11 percent) additional information was gained but this did not change the clinical diagnosis, and in 20 (8 percent) of deaths, the post-mortem was non-contributory.

Maternal mortality

21. In 2015, 11 deaths within the definition of maternal mortality were reported to the PMMRC. One coincidental death was reported in 2015.

22. The maternal mortality ratio in New Zealand was 15.6/100,000 maternities (95% confidence interval (CI) 10.8–22.5/100,000) for the three years 2013–2015. There has been no statistically significant change in maternal mortality ratio in New Zealand since data collection by the PMMRC began in 2006 (chi-squared test for trend p=0.25).

Maternal mortality ratios (per 100,000 maternities) (rolling one-year and three-year) 2006–2015 (Figure 4.2)

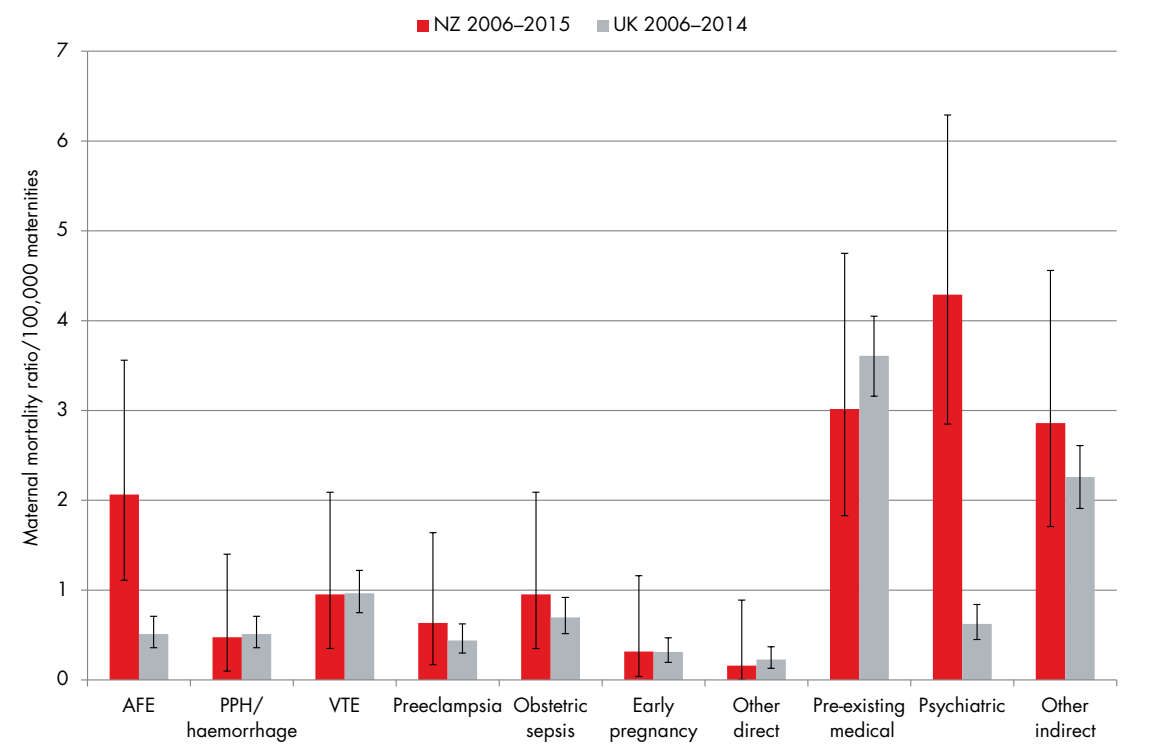
MMR = maternal mortality ratio
Rolling three-year maternal mortality ratio represented at final year of triennium.

23. In 2015, there were three direct deaths (one from amniotic fluid embolism and two from venous thromboembolism) and eight indirect deaths (five from suicide and three from pre-existing medical conditions).

24. Suicide continues to be the leading single cause of maternal death in New Zealand.

25. The maternal mortality ratio in New Zealand continues to be significantly higher than that in the UK (8.54/100,000 maternities for the 2012–2014 triennium). Specifically, maternal death from amniotic fluid embolism is four times higher and maternal death from suicide seven times higher than in the UK.

Cause-specific maternal mortality ratios in New Zealand 2006–2015 and the UK 2006–2014 (with 95% CIs) (Figure 4.3)



AFE = amniotic fluid embolism.
PPH = postpartum haemorrhage.
VTE = venous thromboembolism.
'Other direct' includes anaesthesia, cardiomyopathy, other.
'Pre-existing medical' includes cardiac, indirect neurological, indirect malignancies.
In New Zealand data, 'Other indirect' includes only non-obstetric sepsis.

26. From 2006 to 2015 the Maternal Mortality Review Working Group (MMRWG) found that post-mortem resulted in a change in clinical diagnosis in 10 percent (n=11) of maternal deaths. One quarter of mothers who died did not have a post-mortem examination.

27. Women aged 40 and older, Māori and Pacific mothers, and mothers who have had three previous births at ≥20 weeks are at higher risk of maternal mortality.

28. More than half of the mothers who died in pregnancy or the peripartum period were overweight or obese, and 34 percent were known smokers.

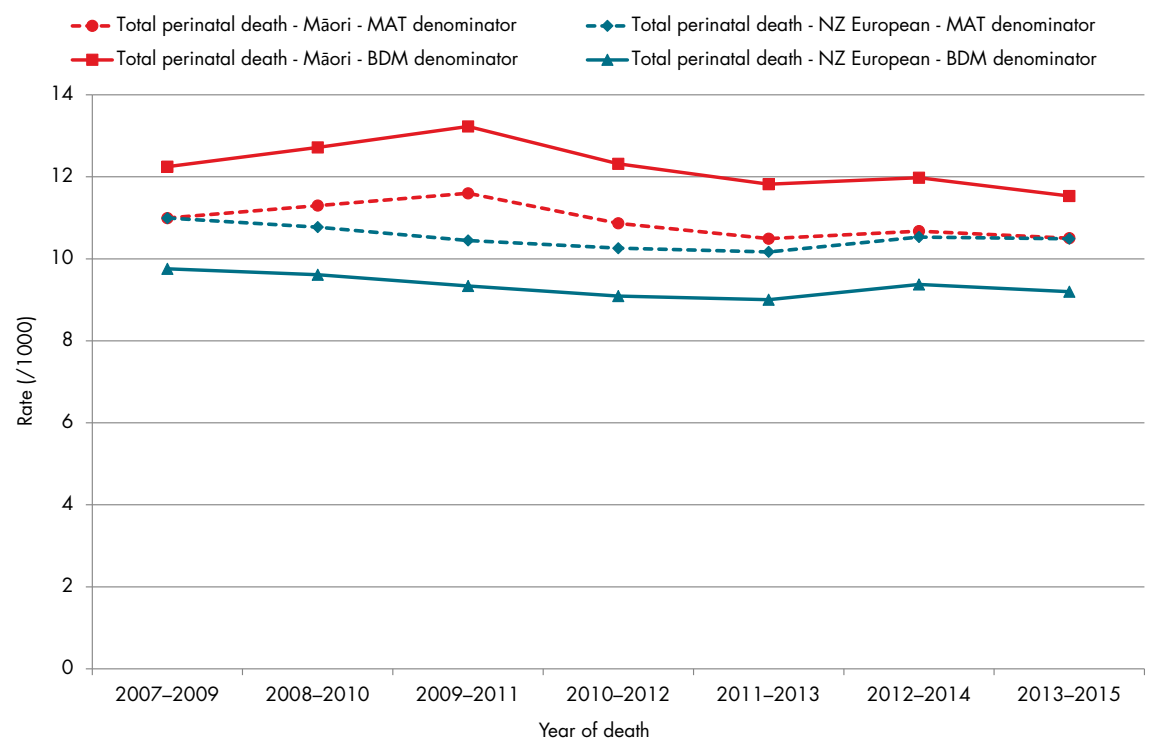
29. Alcohol or substance use was noted in a quarter of mothers who died, and a history of family violence was noted in at least 9 percent.

30. Contributory factors were identified in 62 percent of maternal deaths in the years 2006–2015, and 39 percent were identified as potentially avoidable.

Māori perinatal and maternal mortality

31. There are considerable differences demonstrated in comparative perinatal related mortality rates between Māori and New Zealand European mothers when using different denominators (BDM versus MAT). It is hypothesised that the birth registration dataset provides the best source of ethnicity data (given this is provided by parents when they register their child's birth) and eliminates numerator–denominator bias as these data are provided by BDM to the PMMRC for deaths.

Perinatal related mortality rolling three-year rates (per 1000 births) by ethnicity and year (Māori and New Zealand European 2007–2015) using MAT and BDM denominator data (Figure 5.1)



32. After adjusting for measured maternal age, deprivation decile, baby sex, year of birth, and multiple pregnancy, odds of perinatal related mortality (2008–2015) were lower for Māori mothers compared to New Zealand European mothers (adjusted odds ratio (OR) 0.91 (95% CI 0.84–0.99)). However, there is an excess of neonatal deaths of babies born under 28 weeks gestation to Māori mothers (adjusted OR 1.46 (95% CI 1.18–1.81)).

33. There is a significant reduction in neonatal mortality rate for New Zealand European babies born at 23–24 weeks compared to those born at 20–22 weeks, but no similar reduction in risk among Māori babies.

34. Māori and New Zealand European mothers have similar risks of perinatal related mortality irrespective of age. However, there are more perinatal deaths among Māori mothers under 20 years as there are more than twice as many young Māori mothers as New Zealand European.

35. There is a more prominent increase in death from spontaneous preterm birth with increasing deprivation quintile among Māori mothers than among New Zealand European mothers.

36. There is a statistically significantly higher maternal mortality ratio among Māori compared to New Zealand European mothers combining data from 2006–2015 (26.3 and 13.5 respectively); relative risk (RR) 1.94 (95% CI 1.24–3.06).

37. Māori women are over-represented among maternal suicides.

Neonatal encephalopathy

38. In 2015, there were 70 babies diagnosed with moderate and severe neonatal encephalopathy (NE) reported to the national dataset. There have been 423 babies reported from 2010–2015. The rate of NE for this period is 1.24/1000 term births. Although there appears to be a downward trend in rates, there is no statistically significant trend from 2010 to 2015.

39. NE is associated with maternal ethnicity, socioeconomic deprivation, gestation, birthweight, and nulliparity.

40. Pacific mothers are at increased risk of having a baby with NE compared to Other Asian, Other, and New Zealand European mothers. Mothers of Māori and Indian ethnicity are at increased risk of having a baby with NE compared to mothers of Other Asian and Other ethnicities.

41. Increasing socioeconomic deprivation is associated with increased risk of NE.

42. Waikato, Taranaki, and Capital & Coast district health boards (DHBs) continue to have statistically higher unadjusted rates of NE compared to the national rate.

43. Acute peripartum events were reported in 101 cases (24 percent) of all 423 cases in 2010–2015, of which abruption (31 cases) and shoulder dystocia (26 cases) were the most common.

44. There is no apparent association between level of facility of birth and NE.

45. In 2015, 80 percent of babies born in New Zealand with moderate or severe NE were managed with induced cooling. A review of 22 babies with severe NE who were not cooled revealed 20 were appropriately not cooled. Review of 32 babies with moderate NE who were not cooled revealed nine babies where transfer to a tertiary unit and cooling was possible and may have been indicated.

46. In 2015, the proportion of those cooled who were cooled within six hours of birth as recommended for maximal benefit was 79 percent.

47. Eighty-one of the 423 babies with NE during 2010–2015 (19.4 percent) died in the perinatal period (<28 days). A further nine babies are known to have died after discharge from three months to five years of age.

48. Of survivors during 2010–2015, 28 percent had a moderately or severely abnormal MRI (21 percent of moderate and 66 percent of severe cases) and 46 percent had a normal or only mildly abnormal scan (49 percent of moderate and 30 percent of severe cases). Twenty-five percent of survivors during 2010–2015 did not have a magnetic resonance imaging (MRI) scan (30 percent of moderate and 2 percent of severe cases).

Recommendations

The Mortality Review Committees' Māori Caucus reiterate, "As a matter of urgency, the Ministry of Health update the National Maternity Collection (MAT), including the ethnicity data as identified by the parents in the birth registration process." (PMMRC recommendation ninth report 2015).

Justification:

The analyses in the Māori perinatal and maternal mortality chapter provide clear evidence of the issues around fit for purpose ethnicity data collection. Use of data from the same source for numerator and denominator (birth registration (BDM)) is demonstrated in Figure 5.1 to Figure 5.5 in comparison to using a numerator ethnicity variable from birth registration (BDM) in the numerator and MAT in the denominator.

The sharing of BDM ethnicity data with the MAT dataset would allow maternity analyses the power to explore and address ethnic inequities, using an ethnicity definition akin to the Census definition, within a health dataset (MAT) which includes a wealth of maternity data.

Evidence:

BDM includes ethnicity data provided by parents within six weeks of the birth of their baby in their own time and space. This collection is theoretically akin to Census data. These data are currently provided to the PMMRC for perinatal deaths, but are not made available for the denominator (MAT) set for analysis. BDM currently provide data on a regular basis to match against the MAT dataset to ensure that the MAT dataset includes all births.

The PMMRC recommend the Ministry of Health:

a. **urgently require DHBs to provide complete and accurate registration data to the MAT dataset (as required of LMCs providing services to pregnant women in order to receive funding for those services). Specifically this should include women who present for birthing at DHB facilities without previous antenatal LMC registration and women who are provided primary maternity care by DHB maternity services**

b. **require that the MAT dataset include complete registration and antenatal data on live and stillborn babies from 20 weeks gestation (including terminations of pregnancy).**

Justification:

Parity, BMI and smoking data, which are collected at the registration visit, were more often missing from the MAT dataset among mothers whose babies died and among mothers receiving their primary maternity care from DHB services. Mothers receiving primary maternity care from DHB services are women who were unregistered for antenatal care prior to their birth admission and women who were unable to access LMC care in the community.

Adjusted analyses including these variables could not be progressed because BMI, smoking, and parity data were not missing at random. This means that it was not possible to provide robust adjusted estimates of perinatal related mortality risk by DHB or to adjust for parity, BMI, or smoking in estimates for ethnicity, age, and socioeconomic status.

Therefore, it is not possible to reassure women in New Zealand that DHBs where the perinatal mortality, termination of pregnancy, stillbirth and neonatal death rates are significantly higher (or lower) than the national average are providing care which is at the standard of the national average. (Similarly it cannot be assumed that other DHBs might not have higher rates than expected if analyses were able to adjust for known risk factors). It has been assumed that differences in mortality rates by DHB are due to differences in the populations served eg by ethnicity, BMI, socioeconomic status, age, smoking, and parity, but this cannot be confirmed without the provision of accurate data from these facilities to enable appropriate analyses.

Adjusted estimates could be calculated among women under LMC care alone (self-employed midwifery, private obstetrician and general practitioner care). However excluding women receiving other models of care, because women receiving no or DHB care were systematically different from those with LMC care by their risk profile and ethnicity, had an important effect on adjusted estimates for significant variables such as ethnicity and DHB.

Multivariable analyses in this report adjust only for ethnicity, socioeconomic status, age, baby sex, multiple pregnancy, and year of birth.

Evidence:

During the years 2008-2015, 97-98 percent of BMI, smoking and parity data were missing among the 8 percent of women who were either unregistered with an LMC prior to birth or who registered with a DHB providing primary maternity services and not providing data to the MAT dataset. During this time period, more than 10 percent of data were missing from residents of five DHBs, one of which was missing 48 percent of these data. These 8 percent of women are significantly different from women receiving care from LMCs by ethnicity, socioeconomic status and age and so their absence from the multivariable analysis has a significant effect on the adjusted risk estimates.

In 2015, 16 percent of women residing in Counties Manukau, 13 percent residing in Nelson Marlborough, and 6 percent residing in Hawkes Bay DHB areas had not had these data included in the MAT dataset, even though only 4-5 percent of data were missing for New Zealand overall. Five percent or less of smoking, BMI and parity data were missing from any other DHB region.

The PMMRC investigate why there has been no reduction in neonatal mortality in New Zealand.

Justification:

Neonatal mortality has remained static in New Zealand since 2007. The multivariable analyses in this report provide evidence of inequities for Māori in neonatal mortality, specifically among neonatal deaths after birth from 20 to 28 weeks.

Evidence:

There have been significant reductions reported in neonatal mortality in the UK, Australia and Scandinavia (Manktelow et al 2016; Australian Institute of Health and Welfare 2016; Heino and Gissler 2016).

The PMMRC supports the development of a national interdisciplinary clinical practice guideline on the indications and timing for induction of labour, to guide clinicians to offer induction when appropriate (that is, where evidence shows that benefit to mother and/or baby outweighs risk) and to avoid induction when not appropriate.

Justification:

In 2015 there was an increase in perinatal related mortality risk from 41 weeks compared to the lower rates of recent years. The risk in 2015 (3.19 per 1000 ongoing pregnancies) was the same as the risk in 2008 (3.15) and higher than the rates in any year from 2009 to 2014.

Review of the 17 stillbirths from 41 weeks without congenital abnormality in 2015, against the *Auckland Consensus Guideline on Induction of Labour* (Wise et al 2014), and against best practice for antenatal assessment in women with risk factors, found the care provided did not follow the guideline and/or best practice in 6 of the 17 stillbirths. This related to best practice to perform serial growth scans following antepartum haemorrhage; best practice for obstetric review and/or to perform serial growth scans for BMI >35; and to offer induction of labour for increased risk.

Evidence:

A clinical practice guideline on the induction of labour is ideally based on high quality research and formulates guidance on the indications, timing, and methods of induction; provides guidance on the balance of risk and benefit to the mother and/or baby where there is increased risk of perinatal mortality; and provides guidance on enhanced maternal and fetal surveillance where this is an alternative to induction of labour or where a mother declines the offer of induction of labour.

In 2014 the DHBs in the Auckland region collaborated to publish a consensus guideline on induction of labour which could be operationalised as local guidelines by individual DHBs within the region taking into account local characteristics and resources (Wise et al 2014). This guideline document was used by the PMMRC to audit stillbirths from 41 weeks in 2015. It is timely to update this interdisciplinary guideline incorporating up to date evidence.

That district health boards with rates of perinatal related mortality and neonatal encephalopathy significantly higher than the national rate review, or continue to review, the higher rate of mortality or morbidity in their area and identify areas for improvement.

Justification:

There is a significantly higher rate of perinatal related mortality than the national rate among residents of Counties Manukau DHB (Figure 3.13)

There is a significantly higher stillbirth rate than the national rate among residents of Counties Manukau DHB (Figure 3.28)

There is a significantly higher neonatal death rate than the national rate among residents of Counties Manukau and Waikato DHBs (Figure 3.29)

Waikato, Taranaki and Capital and Coast DHBs have significantly higher rates of neonatal encephalopathy than the national rate (Figure 6.4).

Evidence:

Audits of perinatal deaths are required to understand causes and focus prevention efforts (*The Lancet* 2016).

Previous reports have shown that review of neonatal encephalopathy using a confidential enquiry methodology revealed suboptimal care in more than 50 percent of cases (Draper et al 2002; Kernaghan 2006).

Maternal mortality recommendations

The PMMRC recommend the HQSC establish a permanent Suicide Mortality Review Committee.

Justification:

The suicide-specific maternal mortality ratio in New Zealand from 2006 to 2015 was seven times that in the UK for 2006 to 2014 (RR 6.9 (95%CI 4.2-11.1)). The background rate of suicide among young women in New Zealand is high.

There is a lack of visibility of suicide out to one year postpartum in New Zealand. In the UK, the postpartum period from six weeks out to one year has been shown to be a more vulnerable time for women than pregnancy and the immediate postpartum period (Knight et al 2016). Suicide review will provide insight into the broader factors influencing suicide rates in New Zealand.

Māori maternal suicide

Recommendations from the Mortality Review Committees' Māori Caucus.

Improved awareness and responsiveness to the increased risk for Māori women

Primary care (GPs, FPA), LMCs, TOP services, alcohol and drug services, and secondary and tertiary providers of maternity, obstetric, mental health, and maternal mental health services should improve their systems, guidelines and professional development to ensure that they are responsive to the identified increased risk for Māori women.

Justification:

Māori women are over-represented among maternal suicides with Māori women accounting for 56 percent of maternal suicides between 2006 and 2015. Most of the Māori women who died from suicide experienced multiple risk factors.

Evidence:

Culturally competent, responsive health services supported by an informed culturally competent workforce will improve access to high quality care, and health outcomes for pregnant Māori women.

Risk assessment

Comprehensive assessment of risk factors for Māori women should be undertaken at diagnosis of pregnancy and/or on first presentation for antenatal care. This should be undertaken for all Māori women, regardless of age, including those who are seeking termination of pregnancy.

Justification:

Just over a quarter of the suicides occurred following a TOP. Nearly half of the suicides occurred in women 24 years of age and younger. Most women who died from suicide experienced multiple risk factors. Early recognition of these risk factors, particularly where there are multiple factors, will assist health services and professionals to provide better services for these women. **See 'Practice Point: Māori women and maternal suicide' on page 161 in the main report.**

Management

a. **Where Māori women exhibit symptoms suggesting serious mental illness or distress, an urgent mental health assessment, including consultant psychiatrist review and consultation with perinatal mental health services, on the same day these symptoms are first noted should be undertaken**
b. **Māori women who have a history of serious mental illness and are currently well should be referred to specialist mental health services for a mental health birth plan, and monitored closely by their maternity care provider +/- mental health services. Where such a woman has a miscarriage, the GP should be notified immediately and an explicit process for early follow up that includes a review of mental health status agreed with the GP.**
c. **The referring doctor of women who undergo a TOP is expected to provide a free post-TOP follow up consultation 10-14 days after the procedure (Report of a Standards Committee to the Abortion Supervisory Committee 2009). The referring doctor should actively follow up Māori women referred for TOP to ensure this consultation is completed and review mental health status during this consultation.**

Justification:

Half of the women had self-harmed or attempted suicide prior to or during the final pregnancy. Nearly half of the women in this review identified as having mental health issues were not referred to mental health services, or it is unclear if a referral was made or appropriately acted on. Post-TOP consultations were not mentioned in any of the reviews for deaths that occurred post-TOP. **See 'Practice Point: Māori women and maternal suicide' on page 161 in the main report.**

Communication and coordination

Communication and coordination between primary care (GPs, FPA), LMCs, TOP services, alcohol and drug services, and secondary providers of maternity, obstetric, mental health, and maternal mental health services should be improved and enhanced using a variety of means including but not limited to case management, integrated notes systems, and electronic transfer of information.

Justification:

Over half of women had been seen by a general practitioner (GP) or at a Family Planning clinic (but mostly by a GP) in their final pregnancy. Forty percent of women were involved with mental health or alcohol and drug services during their final pregnancy. Some women had multiple services involved in their care – including midwifery, specialist obstetric and mental health services. Service related issues

including poor communication between services, poor coordination, and inadequate follow up were identified as were potentially delayed and/or missed diagnoses of physical and/or mental health issues.

Child and Youth Mortality Review

Child and Youth Mortality Review Committee (CYMRC) consider including information about whether female suicide cases were pregnant in the 12 months prior to their deaths in addition to the pregnancy status information currently collected.

Justification:

In the UK, the postpartum period from six weeks out to one year has been shown to be a more vulnerable time for women than pregnancy and the immediate postpartum period (Knight et al 2016). PMMRC review maternal suicide deaths from six weeks to one year postpartum when they are aware of them and it is determined appropriate to do so. However, the PMMRC have no certainty that case ascertainment is complete for this extended period as there is no current requirement for notification of cases beyond the first six postpartum weeks. The CYMRC reviews all deaths for women up to the age of 25 years and could potentially include pregnancy in the previous twelve months in their data collection and review.

Overview of the 2017 Report of the PMMRC

Significant changes to the report 2017

This year, the report introduces two new chapters. The first, in collaboration with the Mortality Review Committees' Māori Caucus, reports Māori perinatal and maternal mortality. This chapter includes a discussion of the definitions of ethnicity in the denominator datasets and their appropriateness for use for reporting perinatal mortality statistics. It includes analyses comparing Māori and New Zealand European perinatal and maternal mortality, and a review of Māori maternal suicide. Specific recommendations have been proposed based on this review. The second new chapter describes the current and future work of the newly formed Maternal Morbidity Working Group (MMWG) of the PMMRC.

The New Zealand National Maternity Collection (MAT) dataset has been used instead of the Births, Deaths and Marriages (BDM) birth registration dataset as the denominator for all analyses because it is the most complete record of births in a year and it contains more maternity clinical data. Therefore, this year the PMMRC reports associations between parity, smoking and body mass index (BMI) at registration with maternity care and perinatal mortality. Tables and figures also illustrate the associations between parity and maternal mortality and neonatal encephalopathy.

Most analyses in this report that involve current associations with mortality use data from 2011 to 2015. This is because there has been a significant reduction in some rates since the PMMRC started reporting in 2007. Time trend data are provided in two-year groupings or as rolling three-year rates.

Demography of births in New Zealand

There have been some changes in the make-up of the New Zealand birthing population since the PMMRC started reporting mortality rates in 2007. Fewer mothers were under 20 years of age (4.7 percent in 2015 compared to 7.9 percent in 2007) and fewer mothers are smoking in pregnancy. There were fewer births at 40 and more weeks of gestation and more births at 36 to 39 weeks gestation.

Perinatal related mortality

Perinatal related mortality rates

In New Zealand, perinatal mortality is reported from 20 weeks gestation, and all terminations of pregnancy from 20 completed weeks gestation are included. The perinatal related mortality rate in 2015 was 9.7/1000 births (approximately one death (late termination or stillbirth or neonatal death) for every 100 births from 20 weeks). This is the lowest rate reported since the PMMRC began collecting data in 2007. However, the rate in 2015 is significantly lower than the rate for the years 2007–2014 combined. From 2007 to 2015 there was a significant reduction in stillbirths.

New Zealand uses the Perinatal Society of Australia and New Zealand (PSANZ) classification of cause of perinatal death. There was a significant reduction in hypoxic peripartum deaths from 2007 to 2015 and a trend to reduced deaths from fetal growth restriction.

International comparisons of perinatal mortality

International comparison of perinatal mortality rates can be difficult because many countries do not collect information on births and deaths down to 20 weeks of gestation. For this reason, the PMMRC report mortality rates using the World Health Organization's (WHO's) international definition in

addition to the New Zealand definition. The international definition includes births and deaths from 1000g (or from 28 weeks if birthweight is not known). Because very early perinatal deaths are excluded from this definition, and the cause of death in very early perinatal deaths is different from the cause of death at later gestations, this makes a difference to the findings described above using the New Zealand definition.

If we consider the international definition, there was a significant reduction in the overall perinatal related mortality rate (p=0.0011) and in the stillbirth rate (p=0.00023) from 2007 to 2015. There were significant reductions in hypoxic peripartum death (p=0.0003), death from antepartum haemorrhage (p=0.031) and fetal growth restriction (p=0.015).

Using the UK definition, New Zealand perinatal mortality and stillbirth rates (defined from 24 weeks and excluding terminations of pregnancy and deaths where gestation was unknown) were significantly lower than UK rates in 2014, and the neonatal death rate was the same. New Zealand perinatal mortality rates (using the international definition from 1000g or 28 weeks and excluding terminations of pregnancy) were consistent with Scandinavian rates in 2014, excepting neonatal mortality, which was higher in New Zealand. The perinatal related mortality rate (using the New Zealand definition) in New Zealand in 2014 was significantly higher (11.2/1000 births) than the Australian rate (9.6/1000 births).

The neonatal death rate has not changed significantly in New Zealand from 2007 to 2015. This will be investigated in detail in 2017–2018. Meanwhile there have been significant reductions in neonatal mortality in the UK (from 2004 to 2014), Australia and Scandinavia. In the UK, there have been reductions in neonatal mortality among babies born from 22 to 27 weeks, but no increase in survival of these babies has been seen in New Zealand.

Ethnicity and perinatal related mortality

Adjusted analyses described in this year's report suggest that Māori mothers have a higher rate of neonatal death, but that overall there is no significant difference in perinatal related mortality between babies born to Māori mothers and babies born to New Zealand European mothers.

Babies born to Indian mothers have significantly higher late termination of pregnancy, stillbirth and neonatal death rates compared to New Zealand European mothers. Babies born to Pacific mothers have significantly lower late termination of pregnancy rates, and significantly higher stillbirth and neonatal death rates compared to New Zealand European mothers.

The outlying causes of stillbirth and neonatal death among babies of Māori mothers are spontaneous preterm birth, antepartum haemorrhage, maternal conditions (mostly due to diabetes), hypertension, and deaths with no obstetric antecedent. (For a description of conditions included in each PSANZ perinatal death classification (PSANZ-PDC) category, see Classifications of the Perinatal Society of Australia and New Zealand (PSANZ 2009).

The outlying causes of stillbirth and neonatal death among babies of Pacific mothers are spontaneous preterm birth, maternal conditions, specific perinatal conditions, antepartum haemorrhage, hypertension, perinatal infection, congenital abnormality, and deaths with no obstetric antecedent.

Outlying causes of death among babies of Indian mothers are spontaneous preterm birth, fetal growth restriction, specific perinatal conditions, and antepartum haemorrhage. There may be an excess of other causes among babies of Indian mothers, but as numbers are small and confidence intervals are large, it is hard to confirm.

Other clinical predictors of mortality

Mothers in their first pregnancy have higher stillbirth and neonatal death rates compared to women who are having their second birth, and mothers in their fourth or later pregnancies have higher rates of stillbirth.

After maternal age, ethnicity, multiple pregnancy, baby sex, and year of birth were accounted for, increasing socioeconomic deprivation was associated with an increase in the odds of stillbirth and of neonatal death. Mother's age (<20 years and ≥40 years) was associated with increased odds of late termination of pregnancy, stillbirth and neonatal death.

Gestation and perinatal mortality

There is a significant reduction from 2007 to 2015 in perinatal related death at 37–38 weeks and at 41 weeks and above. There is a significant reduction in stillbirths at 37–40 weeks from 2007 to 2015.

A number of initiatives to improve pregnancy care and/or to reduce perinatal death may be responsible for these reductions in mortality in late pregnancy since the PMMRC started reporting and making recommendations in 2007. Some changes in demography and the distribution of risk factors may also have had a small effect. Possible explanations for the observed reduction in perinatal mortality include:

- reduced births among teenage women
- reduced rates of smoking among pregnant women
- reduced births at 40 weeks and beyond (presumably associated with increased rates of iatrogenic birth by induction or elective caesarean for at-risk pregnancies)
- structured review and reporting of perinatal deaths at all New Zealand DHBs
- increased education around the risks of SGA
- introduction of the GROW tool for recognition of reduced fetal growth and the Maternal Fetal Network guideline for management of SGA from 34 weeks gestation
- the Maternity Quality and Safety Programme
- introduction of learning from the maternal sleep position studies suggesting that left-sided sleep is associated with reduced odds of late stillbirth.

The rate of stillbirth at 41 weeks and beyond for 2015 was, however, higher than in any year from 2007 to 2014. Review of the 17 stillbirths from 41+0 weeks without congenital abnormality, against the *Auckland Consensus Guideline on Induction of Labour* (Wise et al 2014) and against best practice for antenatal assessment in women with risk factors, found the care provided did not follow the guideline and/or best practice in six of the 17 stillbirths. This related to best practice to perform serial growth scans following antepartum haemorrhage; best practice for obstetric review and/or to perform serial growth scans for BMI >35 in three pregnancies; and to offer induction of labour for diabetes with suspected SGA, and for hypertension.

Potentially avoidable perinatal mortality

Part of the local review of perinatal related mortality is assessment of contributory factors to perinatal related mortality and an assessment of whether deaths were potentially avoidable. In 2015, one-quarter of perinatal related deaths were determined at local review to have contributory factors, and just over half of these (14 percent overall) were determined to be potentially avoidable deaths.

Investigation of perinatal related mortality

There has been a significant increase in optimal investigation of perinatal deaths since 2007, and in 2015, 52 percent of babies who died were optimally investigated. There has also been a significant increase in the babies who have partial investigations (40 percent in 2015) and a significant fall in deaths that have no investigation (8 percent in 2015).

To help caregivers and parents discuss the merits of post-mortem investigation, the PMMRC collects data on the usefulness of the investigation in adding to knowledge about cause of death. In 2015, data on the usefulness of post-mortem were available for 205 (83 percent) of deaths where post-mortem was performed. In 118 deaths (48 percent) the post-mortem confirmed the clinical diagnosis. In 40 (16 percent) the post-mortem changed the diagnosis and resulted in altered counselling to parents for future pregnancies. In 27 (11 percent) additional information was gained, but this did not change the clinical diagnosis, and in 20 (8 percent) of the deaths, the post-mortem was non-contributory.

Perinatal death investigation rates continue to be significantly lower among babies of Māori and Pacific mothers compared to babies of mothers of other ethnicities. Compared to the overall 8 percent rate of no investigation of perinatal death, there is no investigation of 19.8 percent of babies of Māori mothers and 12 percent of babies of Pacific mothers.

Maternal mortality

Maternal mortality ratio

Maternal deaths are deaths of pregnant women or women within six weeks after pregnancy. Maternal mortality is expressed as a ratio compared to births from 20 weeks gestation even though maternal deaths may occur in or after pregnancy prior to 20 weeks (eg, after early termination of pregnancy or miscarriage). In 2015, 11 maternal deaths were reported to the PMMRC. One coincidental death (death of a pregnant woman or within six weeks of the end of a pregnancy which was unrelated to pregnancy; eg, death in a road traffic accident) was reported in 2015.

The maternal mortality ratio in New Zealand was 15.6/100,000 maternities for the three years 2013–2015. There has been no statistically significant change in maternal mortality ratio in New Zealand since data collection by the PMMRC began in 2006.

In 2015, there were three direct deaths (one from amniotic fluid embolism and two from venous thromboembolism) and eight indirect deaths (five from suicide and three from pre-existing medical conditions).

Suicide continues to be the leading single cause of maternal death in New Zealand.

International comparisons

The maternal mortality ratio in New Zealand is significantly higher than that in the UK, which was 8.54/100,000 maternities for the three years 2012–2014. Specifically, maternal death from amniotic fluid embolism is four times higher and maternal death from suicide seven times higher in New Zealand than in the UK.

Demography

Women aged 40 years and older, Māori and Pacific mothers, and mothers who have had three previous births from 20 weeks are at higher risk of maternal mortality.

More than half of the mothers who died in pregnancy or the peripartum period were overweight or obese, and 34 percent were known smokers.

Alcohol or substance use was noted in a quarter of mothers who died, and a history of family violence was noted in at least 9 percent.

Maternal post-mortem

Post-mortem resulted in a change in clinical diagnosis in 10 percent (n=11) of maternal deaths from 2006 to 2015. New or additional information was made available in a further 25 percent of women who had a post-mortem. However, one quarter of mothers who died did not have a post-mortem.

Potentially avoidable maternal death

Contributory factors were identified in 62 percent of maternal deaths in the years 2006–2015, and 39 percent were identified as potentially avoidable.

Māori perinatal and maternal mortality

Perinatal mortality

The change in denominator for this report from the BDM birth registration dataset to the MAT dataset creates a particular problem for the analysis of mortality by ethnicity because the MAT dataset includes a derived variable (an algorithm to include the ethnicity from more than one dataset) for ethnicity, which differs from the self-defined variable in the BDM birth registration dataset. This variable increases the proportion of Māori in the MAT dataset and decreases the proportion of New Zealand Europeans. The potential effect of this on mortality rates if the PMMRC ethnicity is used for perinatal deaths is to reduce Māori perinatal mortality rates and to increase New Zealand European perinatal mortality rates. In the Māori mortality chapter, rates are given using both the birth registration (BDM) and maternity (MAT) denominators to illustrate the effect of these differences. Using the BDM denominator, Māori perinatal mortality rates are higher than New Zealand European perinatal mortality rates. Using the MAT denominator, Māori perinatal mortality rates are the same as New Zealand European perinatal mortality rates. To view these differences see Figure 5.1—Figure 5.5 in the main report.

It is believed that the BDM birth registration dataset would provide the best source of ethnicity data because this is the ethnicity given by parents when they register their child's birth. It is also the ethnicity collected by the PMMRC for perinatal deaths and cases of neonatal encephalopathy.

After adjusting for measured potential confounders, overall perinatal related mortality does not differ between Māori and New Zealand European mothers. However, there is an excess of neonatal deaths of babies born under 28 weeks gestation to Māori mothers.

Māori and New Zealand European mothers have similar rates of perinatal related mortality by age. However, there are more perinatal deaths among Māori mothers under age 20 as there are more than twice as many Māori mothers under 20 years as New Zealand European.

Maternal mortality

There is a significantly higher (almost double) maternal mortality ratio among Māori mothers (26.3 per 100,000 births from 20 weeks) compared to New Zealand European mothers (13.5 per 100,000 births from 20 weeks) combining data from 2006–2015.

Māori women are over-represented among maternal suicides.

Neonatal encephalopathy

Neonatal encephalopathy rates

Six years (2010–2015) and 423 neonatal encephalopathy (NE) cases have been described in this report. The rate of NE for this period was 1.24 cases per 1000 term births. Seventy cases were reported in 2015. Although there appears to be a downward trend in rates, there is no statistically significant trend from 2010–2015.

Eighty-one of the 423 babies with NE from 2010–2015 (19.4 percent) died in the perinatal period (<28 days). A further nine babies are known to have died after discharge from three months to five years of age.

From 2016 the Neonatal Encephalopathy Working Group (NEWG) widened the inclusion criteria for the NE cohort and will include cases from 35 weeks gestation at birth in line with international literature and practice of cooling of babies of this age. These numbers will be included from next year, although rates of NE at term will continue to be reported.

Demography of neonatal encephalopathy

NE is associated with maternal ethnicity, socioeconomic deprivation, gestation, birthweight, nulliparity, and baby sex.

Pacific mothers are at increased risk of having a baby with NE compared to Other Asian, Other, and New Zealand European mothers. Mothers of Māori and Indian ethnicity are at increased risk of having a baby with NE compared to mothers of Other Asian and Other ethnicities.

Waikato, Taranaki, and Capital & Coast DHBs continue to have statistically higher unadjusted rates of NE compared to the national rate. Adjusted rates were not calculated.

Induced cooling

In 2015, 80 percent of babies born in New Zealand with moderate or severe NE were treated with induced cooling.

In the dataset from 2011 to 2014 (4 years), 54 neonates were reported as not receiving full body cooling for NE. On further review 20 of the 22 severe NE infants were appropriately not cooled. In the moderate group it was determined that 23 of the 32 infants were appropriately not cooled. Of the remaining nine infants, transfer to a tertiary unit was possible and cooling may have been indicated.

This review will lead to a new item in the dataset asking for the reason infants were ‘not cooled’.

Summary of Key PMMRC 2016 Report Recommendations and Progress

Recommendation (PMMRC 10th report)	Progress to date (updated June 2017)
Perinatal epidemiology	
That the Perinatal Society of Australia and New Zealand perinatal death classification (PSANZ-PDC) system be modified to allow the classification of babies dying with placental pathology outside of unexplained antepartum death.	The PMMRC is working with PSANZ on the revision of the PSANZ-PDC system. The revised version will be in use from January 2018.
Perinatal mortality	
That district health boards 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.	**Perinatal related mortality rates** **Counties Manukau** The recommendations from an independent review of perinatal mortality in Counties Manukau in 2012 are being implemented in an ongoing process of quality improvement. In 2017 further work will commence on the following initiatives: • preterm birth • information for women and families in eight languages • counselling for women and families who have experienced a perinatal loss. **Neonatal mortality rates** **Waikato** Waikato DHB has undertaken a review of all neonatal deaths due to neurological causes from 2010 to 2014. Initiatives were identified to address modifiable risk factors in the following areas: • improving early pregnancy care • management of pregnancy in obese women • management of diabetes in pregnancy • smoking cessation • maternal immunisation • diagnosis and management of preterm labour • management of high-risk pregnancies. In 2017 further work will commence on the following initiatives: • intrapartum care and documentation • education sessions to share learnings from reviews. **Bay of Plenty** Bay of Plenty DHB has undertaken audits reviewing every perinatal death from 2010 to 2016. Initiatives were identified to address modifiable risk factors in the following areas: • improving access to antenatal care • smoking cessation • prediction, diagnosis and management of preterm labour • management of multiple pregnancies • management of pregnancies at increased risk of fetal growth restriction • management of decreased fetal movements • optimising the management of pregnancy in obese women.

Recommendation (PMMRC 10th report)	Progress to date (updated June 2017)
Maternal mortality	
That a Perinatal and Infant Mental Health Network be established to provide an interdisciplinary and national forum to discuss perinatal mental health issues.	The PMMRC and the MMRWG are working with the Ministry of Health to clarify the remit and purpose of this network, to ensure supportive links with pre-existing regional perinatal and infant mental health networks, and to identify a work plan consistent with the needs of DHBs.
As recommended in the fifth report of the PMMRC (PMMRC 2011): All clinicians involved in the care of pregnant women should undertake regular multidisciplinary training in management of obstetric emergencies.	Sixteen DHBs provide multidisciplinary training in management of obstetric emergencies; this is provided in-house for all but one secondary hospital. Three DHBs have indicated attendance is mandatory for all obstetric, midwifery (core and lead maternity carer) and anaesthetic clinicians. One additional DHB indicated attendance was mandatory for all DHB obstetric, midwifery and anaesthetic staff. A further eight DHBs indicated it was mandatory, but only for some disciplines. The most common areas identified as barriers to attendance were staffing and cost to attend. The most common areas identified as enablers to attendance were payment by the DHB and providing cover for staff to attend.
Neonatal encephalopathy	
That district health boards with rates of neonatal encephalopathy significantly higher than the national rate review, or continue to review, the higher rate of morbidity in their area and identify areas for improvement.	**Taranaki** Taranaki DHB reviews all unexpected admissions to the neonatal unit; this includes cases of NE. Current quality improvement initiatives include: • improvements to the obstetric emergency call system • multidisciplinary training in obstetric emergencies for all clinicians at both Taranaki Base and Hawera hospitals • fetal surveillance training • newborn life support training (New Zealand Resuscitation Council) • an improvement in numbers and rostering of obstetric doctors. Taranaki DHB will continue to monitor and review all NE cases and implement quality improvements where indicated. **Capital & Coast** Capital & Coast DHB has reviewed all term infants diagnosed with NE from 2010 to 2014. The benefit of multidisciplinary reviews was recognised and the review team recommends ongoing resourcing and support of multidisciplinary reviews of adverse events. On completion of the review document the findings were fed back to the steering group and further assessment and implementation of the findings and recommendations will be undertaken. The review is being presented at the national PMMRC annual conference in June 2017.

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