Government of **Western Australia**
Department of **Health**

The 15th Report of the Perinatal and Infant Mortality Committee of Western Australia, for births between 2011 and 2013

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The 15th Report of the Perinatal and Infant Mortality Committee of Western Australia, 2011-2013.

Public and Aboriginal Health Division

Department of Health, WA

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Foreword

Chairman's Report

It is with pleasure that I submit, on behalf of the Committee, the 15th Report of the Perinatal and Infant Mortality Committee of Western Australia.

This is the fifth Report of the Committee since it was re-established in October 2001. The Report covers the triennium 2011-2013 and includes 978 perinatal and infant deaths from more than 100 000 births. When considered with data from this Committee's previous four Reports, there are descriptions of detailed investigation of more than 2100 cases from a total 4284 deaths and 404 123 births.

The primary purpose of the Committee's work is educational. Cases are identified for investigation by the Chief Health Officer and include stillbirths and infant deaths of at least 26 weeks gestation. Each of these cases is then investigated and the case is presented to the Committee with the names of the health care personnel and the hospital de-identified. The cause of death is then classified using the system developed by the Perinatal Society of Australia and New Zealand and any medical preventability is assessed and classified.

A letter is written to all medical practitioners involved in the care of each case. This letter contains the outcomes of the Committee's decisions including the classification of cause of death and preventability, together with any specific recommendations as to how the management could have been improved. The content of these letters is confidential and cannot be released to any other person for any reason.

For this triennial Report, the Committee has decided to include full versions of two Educational Papers rather than the short Papers typically included in previous Reports. The topics, one describing an innovative Aboriginal Maternity Group Practice Program in the South Metropolitan Health Service and the other being a review of Planned Home Birth in Western Australia 2002 – 2013 that was in response to a recommendation by the Committee, are of such great importance to warrant full inclusion.

There were many aspects of perinatal and infant care in Western Australia during this triennium that should be celebrated and valued. The outcomes in terms of overall risk of mortality are relatively low when compared both with similar environments across the developed world and with eastern Australia (see Table 13a). These good outcomes in Western Australia are being achieved despite the very large distances that many women need to travel to access high quality care and the vast distances over which health care needs to be delivered. Outcomes for Aboriginal children after birth continue to improve although mortality rates still remain higher overall than for non-Aboriginals. When the data for this triennium are compared with the 1990-1992 period, in Aboriginal children the neonatal death rate has fallen from 9.3 to 5.3 per 1000 live births and the post-neonatal death rate has fallen from 11.8 to 3.6 per 1000 live births.

The improved outcomes after planned homebirth are also very reassuring. The Committee noted in 2007 that the perinatal mortality rate in cases of planned homebirth was significantly higher than in cases with planned hospital birth and a variety of recommendations were made. Since that time, there have been many improvements in governance and clinical practice that have contributed to the substantial improvement in safety of planned homebirth in Western Australia.

Not all outcomes, however, are so reassuring. The overall stillbirth rate remains stubbornly unchanged, with no sign of improvement in more than two decades. It is possible that the unchanged overall rate conceals improvements in care in some areas, and in the face of changes in background risk such as increasing obesity and use of fertility treatments, but the static rate overall nevertheless is cause for concern. In Aboriginal women the stillbirth rate has also not decreased and remains higher than for non-Aboriginals. It would appear that many aspects of contemporary obstetric care may have reached a plateau of success pointing to a clear need for innovation and perhaps new models of care. Now as much as ever we need high quality research, a thorough evaluation of the effectiveness of our health care models, and awareness that many of the discoveries being made in other fields of medicine may be transferrable to perinatal care.

Finally, I would like to express my grateful appreciation to the many people who contribute to the very important work of the Committee. The members represent the many and diverse sections of our health care workforce and give their time freely as volunteers. Our deliberations are greatly assisted by the excellence of our investigators and the dedicated secretariat.

On behalf of the Committee, I would like to thank members who have retired including Prof Carol Bower, Prof Karen Edmond and Dr Adrian Charles. Mrs Vivien Gee retired in 2016 after 15 years of diligent and loyal service as Secretary of the Committee.

None of this work would have been achieved without many other members of the Health Department including Dr Teresa Ballestas who was the primary author of this Report, Professor Tarun Weeramanthri (Chief Health Officer) and the many health care providers of Western Australia whose skill and dedication is reflected in the very reassuring outcome data.

Together, the Committee and the health care workforce of this state are providing ongoing evaluation of outcomes that contribute to high quality health care for the women and children of Western Australia and help to ensure that our next generation has the greatest chance of a healthy start to life.

Respectfully submitted

Professor John Newnham AM

Chair

Executive Summary

This report provides an overview of the epidemiology on stillbirths, neonatal deaths and postneonatal deaths between 2011 and 2013, with a summary of the Perinatal and Infant Mortality Committee (The Committee) findings and recommendations.

Data were obtained for the birth cohort from 2011 to 2013. Infant deaths occurred up to 364 days after birth. Data sources included the Midwives Notification System and the Perinatal and Infant Dataset.

Key findings

- Overall the rates of perinatal and infant mortality are low. The neonatal death rate has significantly decreased from 3.9 to 1.7 per 1000 live births since 1990-92; and the post neonatal death rate has significantly decreased from 2.9 to 0.9 per 1000 live births since 1990-92; however, the rate of stillbirths has remained unchanged for more than two decades.
- Aboriginal stillbirth, neonatal and postneonatal death rates continue to be higher than the comparable rates for non-Aboriginal people.

Recommendations:

1. That the Department of Health and the Women and Newborn Health Service consider the reasons why the stillbirth rate has not changed and identify opportunities for interventions/prevention with a view to develop a strategy to reduce the rate of stillbirth in WA

2. That all health service providers provide evidence based and culturally appropriate services for Aboriginal women; and that funding for such programs is needs-based, effective and sustainable.

RISK FACTORS

- The risk factors associated with increased odds of stillbirths were: maternal age more or equal to 40 years of age; Aboriginal ethnicity, South Asian ethnicity, African ethnicity and 'other ethnicity'; multiple pregnancy; and unbooked births.
- The risk factors associated with increased odds of neonatal deaths were: maternal age less than 20 years of age; Aboriginal ethnicity, 'other' ethnicity; multiple pregnancy; and unbooked births.
- The risk factors associated with increased odds of post-neonatal deaths were: maternal age more or equal to 40 years of age, Aboriginal ethnicity, and smoking.
- Preterm birth (gestational age < 37 weeks) was associated with higher rates of stillbirth, neonatal deaths and post neonatal deaths.
- Low birth weight (<2,500g) was associated with higher rates of stillbirth, neonatal deaths and post neonatal deaths.

Recommendations:

3. Health Practitioners should be aware of the King Edward Memorial Hospital (KEMH) Clinical Guidelines available at http://www.kemh.health.wa.gov.au/development/manuals/.
All twin pregnancies should have a 12 week ultrasound to determine chorionicity. If monochorionic diamniotic, arrange a 16 week scan to look for twin-to-twin transfusion and contact KEMH if results abnormal.
For couples seeking fertility treatments, counselling should include realistic information on the risks of multiple pregnancies.

4. The Committee accepts the recommendations from the study on the planned home birth services in Western Australia; and the Committee will continue to monitor perinatal outcomes. The methodology for the assessment of such outcomes will also continue to be improved.

CAUSES OF DEATH

- The most common causes of stillbirths and neonatal deaths were congenital abnormalities and spontaneous preterm labour.
- The most common causes of postneonatal deaths were 'Other' which includes Sudden Infant Death Syndrome, and congenital abnormalities.
- The majority of stillbirths underwent post-mortem investigation to ascertain causes of death (n=435, 60.8%); however, a higher rate of post-mortem investigations is desirable as this might reduce the number of unexplained deaths.
- For neonatal death, the proportion of cases that underwent post-mortem investigation was 38.0% (n= 38). For postneonatal deaths, the proportion of cases who underwent post-mortem investigation was 72.5% (n=66).

Recommendations:

5. Women at high risk of preterm birth may benefit from referral to, or consultation with, the Preterm Birth Prevention Clinic at KEMH (phone number 0466 329 638, fax 6453 2469). More information is available at http://www.thewholeninemonths.com.au/

CASES INVESTIGATED (>= 26 WEEKS GESTATION)

- For investigated stillbirth deaths, the main causes of death were unexplained antepartum deaths, specific perinatal conditions and fetal growth restriction.
- For investigated neonatal deaths, the main causes of death were congenital abnormality, no obstetric antecedent and hypoxic peripartum.
- For investigated postneonatal deaths, the main causes of death were 'Other' which includes Sudden Infant Death Syndrome, and congenital abnormalities.

Recommendations:

6. Health Practitioners need to be aware of the need for thorough investigation of perinatal and infant deaths and refer to the guideline included in Appendix 4.

CLINICAL PREVENTABILITY

- The overall standard of perinatal health care in WA continued to be high. The majority of investigated deaths were considered not preventable.
- Fourteen out of 281 investigated stillbirths had evidence of high degree medical preventability; 23 had evidence of low preventability; the majority (n=244) had no evidence of preventability.
- Seven out of 109 investigated neonatal deaths had evidence of high medical preventability; five had evidence of low preventability; the majority (n=97) had no evidence of preventability.
- Two out of 90 investigated post neonatal deaths had evidence of high medical preventability; two had evidence of low preventability; the majority (n=86) had no evidence of preventability.
- The main clinical areas for improvement were: Management of hypertension in pregnancy and fetal growth restriction; and interpretation of cardiotocography.

Background

Between 2011 and 2013, the *Health Act 1911* continued to be the main piece of public health legislation. In 2016, the *Public Health Act 2016* ("the Public Health Act") passed through Parliament and received Assent.

The Public Health Act provides a modern, flexible and proactive risk based framework for the regulation of public health in Western Australia. It is supported by the Consequential Act, which provides for the consequential amendment of the *Health Act 1911* (the Health Act) and a range of other Acts.

Accordingly, amendments were made to the Health Act to modernise some elements of the framework for the Mortality Committees and the Health Act was re-named the *Health (Miscellaneous Provisions) Act 1911*.

Section 336 and Section 336A of the *Health (Miscellaneous Provisions) Act 1911* now requires midwives, nurses and/or medical practitioners to notify the Chief Health Officer (CHO) of stillbirths, neonatal deaths, infant deaths (section 336A(1)) and maternal deaths (section 336(1)).

The Perinatal and Infant Mortality Committee continues to function under Part XIIIB of the *Health (Miscellaneous Provisions) Act 1911* as statutory committees under the direction of the CHO. Members of the Committee comprise experts in the areas of obstetrics, perinatal care, neonatal paediatrics, clinical epidemiology, general medicine, perinatal pathology, rural medicine and midwifery.

No changes have been made to the investigation process. Currently, the Committee continues to investigate and discuss all stillbirths and deaths of infants from at least 26 week gestational age, with the exception of therapeutic pregnancy terminations. The aim of the Committee is to determine whether, in the opinion of the Committee, the stillbirth or death could have been prevented. In order to achieve this objective, the CHO appoints an investigator to examine all deaths requiring further investigation. The investigator prepares a de-identified report which is discussed at the Committee meetings. Subsequently, the Committee makes the determination and provides constructive comments to the attending medical practitioner. A report on the investigated cases is also submitted to the CHO.

Since 2000, the Committee has identified areas for improvements, including better governance, increased funding and quality improvement of health services, better antenatal care, culturally appropriate services for Aboriginal people, continuous performance development of health professionals and safer homebirth services.

This is the 15th Report of the Committee. The Report provides an overview of the epidemiology of perinatal and infant deaths between 2011 and 2013, with a summary of the Committee findings and recommendations. The purpose is to better inform clinicians and public health professionals in their efforts to improve perinatal and infant care in Western Australia.

All notifications

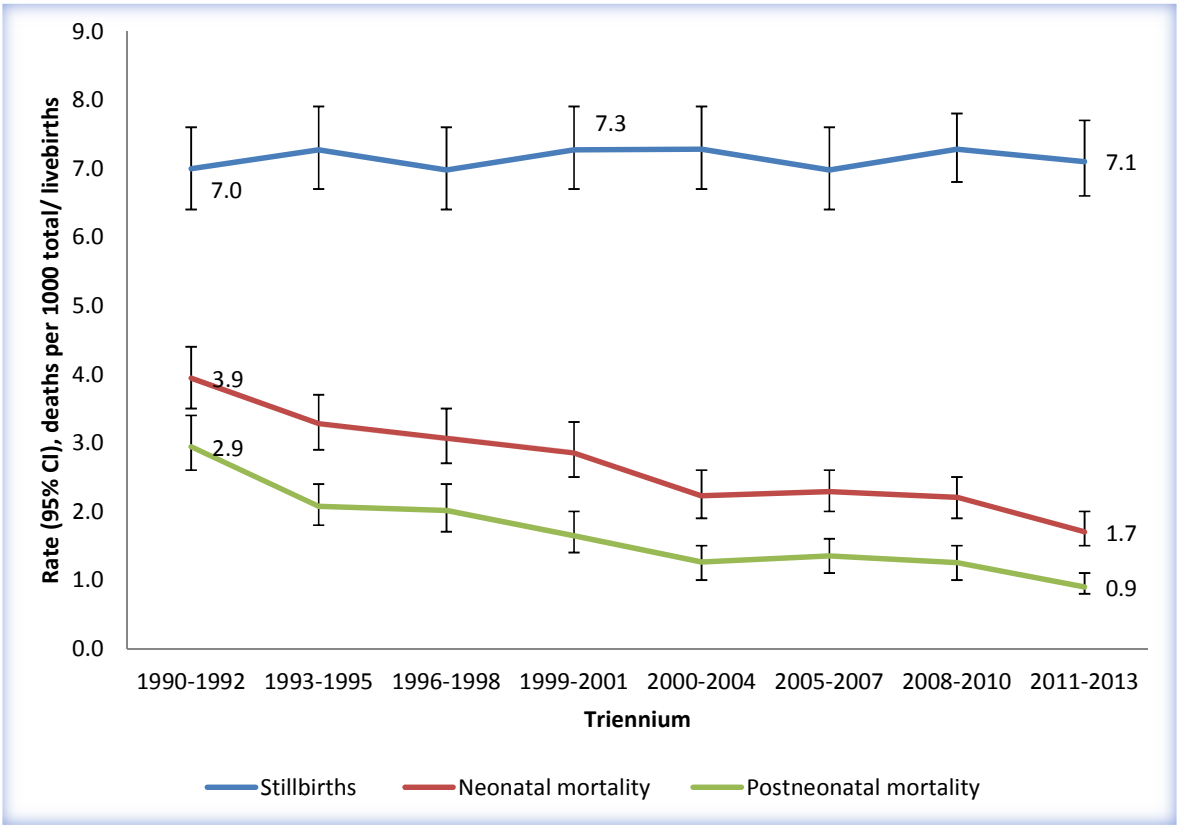
1. Trends

Between 2011 and 2013, there were 100 460 babies born in Western Australia. Of those, 716 were stillbirths, 171 died within 28 days of birth (neonatal period) and 91 died between 28 days and 364 days after birth (post neonatal period). This represents a total of 887 perinatal deaths (stillbirths plus neonatal deaths) and 262 infant deaths (neonatal deaths plus post neonatal deaths).

The perinatal mortality rate was 8.8 (CI: 8.3-9.4) per 1000 births and the infant mortality rate was 2.6 (CI: 2.3-3.0) per 1000 live births in this period.

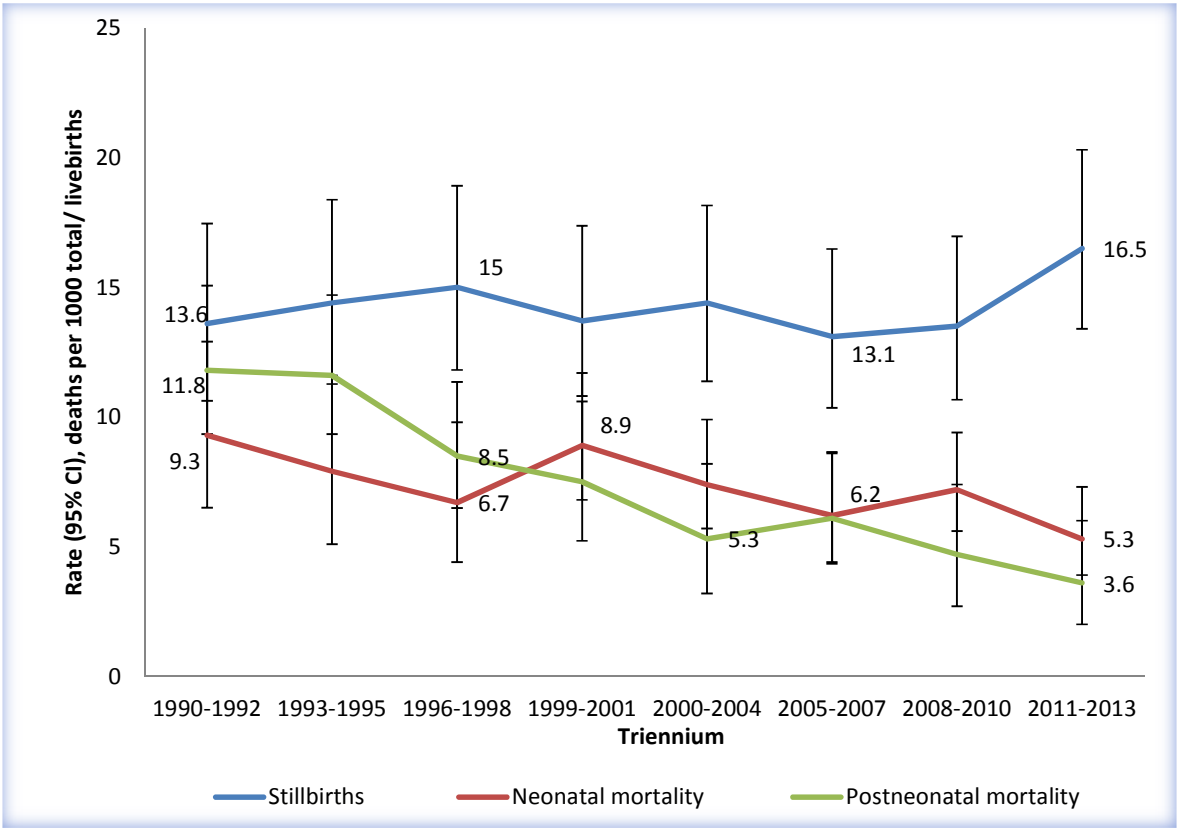
Figure 1 shows that the rate of stillbirths has remained unchanged for more than two decades (correlation coefficient [r] = 0.14; p =0.75); while the neonatal rate has decreased significantly from 3.9 in the years 1990-1992 to 1.7 per 1000 live births in the period 2011-2013 (correlation coefficient [r] = -0.97; p = <0.005); and the post neonatal rate has decreased significantly from 2.9 in the years 1990-1992 to 0.9 per 1000 live births in the period 2011-2013 (correlation coefficient [r] = - 0.94; p = <0.005).

Figure 1: Stillbirths, neonatal and post neonatal death rates in the total population; Western Australia, 1990-2013



The neonatal deaths rate for Aboriginal children has decreased from 9.3 in 1990-1992 to 5.3 per 1000 live births in 2011-2013 (correlation coefficient [r] = -0.75; p = <0.03); and post neonatal death rate for Aboriginal children has decreased from 11.8 in 1990-1992 to 3.6 per 1000 live births in 2011-2013 (r = -0.9; p = 0.003) (Figure 2). The stillbirth rate for Aboriginal babies has not changed significantly from 1990-1992 to 2011-2013 (r = 0.29; p =0.49).

Figure 2: Stillbirths, neonatal and post neonatal death rates in the Aboriginal population; Western Australia, 1990-2013



Commentary

There are many possible reasons for the reduction in infant deaths. Epidemiological evidence shows that risk factors vary according to the age at which the infant died and the time period of death. Postneonatal deaths have been markedly reduced via improvements in social conditions and major public health interventions, as well as better availability of health care options such as antibiotics and vaccines[1].

Neonatal death rates are influenced by pregnancy complications and stage of fetal development. Successful strategies to reduce neonatal deaths have included improvements in the treatments for high risk pregnancies, better antenatal and intrapartum care, and better care for low birthweight and preterm babies such as the availability of antenatal testing and the use of corticosteroids[1].

Unfortunately, despite the success in reducing the rate of infant deaths, the rate of stillbirths has remained unchanged for more than two decades in WA. Similar trends have been reported worldwide[2]. In 2015, the United Nations member states committed to the Sustainable Development Goals supported by the Strategy for Women's, Children's and Adolescents' Health 2016-30[3].

Action areas identified are: Leadership, Financing for health, Quality Health Care, Individual Potential, Community Engagement, Multisector Action, Humanitarian and high risk groups, Research and Innovation and Accountability[3].

While current efforts to reduce the number of neonatal and post neonatal deaths should continue, there is a need to explore new ways to reduce preventable stillbirths in WA.

2. Risk factors

The following risk factors were significantly associated with increased odds of stillbirth in multivariate analyses: maternal age ≥40 years; Aboriginal ethnicity, South Asian ethnicity, African ethnicity and 'other ethnicity'; multiple pregnancy; and unbooked births (Table 1).

The following risk factors were also significantly associated with increased odds of neonatal deaths in multivariate analyses: maternal age less than 20 years, Aboriginal ethnicity, 'other' ethnicity, multiple pregnancy, and unbooked births.

The following risk factors were also significantly associated with increased odds of post-neonatal deaths in multivariate analyses: maternal age ≥ 40 years, Aboriginal ethnicity, and smoking.

Fortunately, the prevalence of smoking during pregnancy has continued to decline from 21.2 per cent in 2000 to 10.7 per cent in 2013[4].

Socio-economic status and health region were not significantly associated with increased odds of stillbirth, neonatal death or postneonatal death.

Table 1: Number of deaths and odds ratio by risk factors and stillbirths, neonatal deaths and postneonatal deaths, Western Australia, 2011-2013

Risk factor	Stillbirths		Neonatal mortality		Postneonatal mortality	
	N	OR (95% CI)	N	OR (95% CI)	N	OR (95% CI)
MATERNAL AGE						
<20	36	1.0 (0.7-1.3)	19	**2.1 (1.1-3.8)**	6	1.6 (0.6-4.3)
20-24	121	1.0 (0.8-1.5)	32	1.1 (0.7-1.8)	23	2.0 (1.0-3.9)
25-29	187	0.9 (0.8-1.2)	48	1.1 (0.7-1.6)	27	1.5 (0.8-2.9)
30-34*	211		46		17	
35-39	117	1.1 (0.8-1.3)	20	0.8 (0.5-1.4)	12	1.3 (0.6-2.8)
≥40	44	**1.8 (1.3-2.4)**	6	1.0 (0.4-2.5)	6	**2.8 (1.1-7.1)**

* reference category: all other categories within the same risk factor are compared with the reference category.

Table 1 (Continue)

Risk factor	Stillbirths		Neonatal mortality		Postneonatal mortality	
	N	OR (95% CI)	N	OR (95% CI)	N	OR (95% CI)
ETHNICITY						
Caucasian*	436		99		57	
Aboriginal	85	**2.3 (1.7-3.1)**	27	**2.0 (1.1-3.4)**	18	**2.7 (1.4-5.3)**
South East and East Asian	63	1.2 (0.9-1.6)	8	0.7 (0.3-1.5)	7	1.4 (0.6-3.2)
South Asian	40	**2.2 (1.5-3.0)**	8	1.8 (0.9-3.7)	1	0.6 (0.1-4.0)
African	27	**2.4 (1.6-3.7)**	4	1.4 (0.5-3.9)	2	1.5 (0.4-6.4)
Maori	11	1.2 (0.6-2.2)	5	1.9 (0.8-4.8)	2	1.1 (0.3-4.7)
Other	54	**1.6 (1.2-2.1)**	**20**	**2.4 (1.5-3.9)**	4	0.9 (0.3-2.5)
PARITY						
Primipara*	230		55		22	
Multipara	486	0.9 (0.8-1.1)	116	1.0 (0.7-1.4)	69	1.3 (0.8-2.1)
PLURALITY						
Singleton*	647		153		86	
Multiple pregnancy	69	**3.6 (2.8-4.7)**	18	**4.2 (2.6-6.9)**	5	2.1 (0.9-5.2)
SMOKING DURING PREGNANCY:						
yes	123	1.3 (1.1-1.7)	37	1.4 (0.9-2.0)	33	**3.3 (1.9-5.2)**
no*	593		134		58	
PLANNED PLACE OF BIRTH						
Hospital birth[1]*	700		162		89	
Home birth[2]	1	0.2 (0.0-1.6)	1	1.0 (0.1-6.9)	1	2.0 (0.3-14.6)
Unbooked birth[3]	15	**7.4 (4.3-12.8)**	8	**13.1 (6.1-28.1)**	1	2.0 (0.3-14.5)

[1]Hospital (includes non-maternity site and clinics)
[2]It includes planned homebirths with the Community Midwifery Program and with privately funded midwives. It also includes intended homebirths that were transferred to hospitals;
[3]Unbooked births are not planned homebirths, and include women who perhaps had no antenatal care, unacknowledged/undiagnosed pregnancy, and arrived at hospital in labour or following birth en route or unexpected, unplanned at home.
* reference category: all other categories within the same risk factor are compared with the reference category.

Table 1 (Continue)

Risk factor	Stillbirths		Neonatal mortality		Postneonatal mortality	
	N	**OR (95% CI)**	**N**	**OR (95% CI)**	**N**	**OR (95% CI)**
SOCIO-ECONOMIC STATUS[4]						
1 (most deprived)	163	1.0 (0.7-1.3)	43	1.3 (0.7-2.5)	21	1.2 (0.5-2.8)
2	119	0.9 (0.6-1.2)	31	1.2 (0.6-2.4)	25	2.1 (0.9-4.7)
3	163	1.0 (0.8-1.4)	45	1.7 (0.9-3.0)	21	1.4 (0.6-3.1)
4	154	0.9 (0.7-1.2)	36	1.3 (0.7-2.4)	13	0.8 (0.3-1.8)
5 (least deprived)*	108		16		10	
REGION[5]						
North Metro*	161		32		26	
South Metro	177	1.3 (1.0-1.6)	34	1.2 (0.7-1.9)	17	0.6 (0.3-1.1)
East Metro	198	1.2 (0.9-1.4)	57	1.5 (1.0-2.4)	19	0.5 (0.3-0.9)
Kimberley	26	1.4 (0.8-2.2)	10	2.3 (1.0-5.2)	3	0.3 (0.1-1.2)
Pilbara	17	1.0 (0.6-1.6)	8	1.9 (0.9-4.3)	4	0.8 (0.3-2.6)
Midwest	27	1.4 (0.9-2.2)	8	1.8 (0.8-4.1)	4	0.7 (0.2-2.0)
Wheatbelt	26	1.6 (1.0-2.5)	5	1.2 (0.5-3.2)	3	0.3 (0.1-1.4)
Goldfields	18	0.9 (0.6-1.6)	5	1.1 (0.4-2.8)	5	0.8 (0.3-2.3)
Great Southern	18	1.5 (0.9-2.5)	2	0.7 (0.2-2.9)	1	0.2 (0.0-1.8)
South West	41	1.2 (0.8-1.7)	10	1.2 (0.6-2.5)	9	0.8 (0.4-1.8)

[4]There were 9 stillbirths and 1 postneonatal death for which it was not possible to assign socio-economic status.
[5] There were 7 stillbirths for which it was not possible to assign a health region as the mother's usual residency was outside of WA or not recorded.
* reference category: all other categories within the same risk factor are compared with the reference category.
These data must be interpreted with caution due to the small numbers used for calculation of ethnicity, planned place of birth and, health regions.

Commentary

It is known that multiple pregnancies have a higher rate of stillbirth and neonatal deaths compared to single pregnancies. Some fertility treatments carry a high risk of twin pregnancy. Evidence shows that the risk of fertility treatments producing twin pregnancies can be minimised and this is therefore a good prevention strategy[5].

It is also known that Aboriginal women have a higher risk of perinatal and infant deaths compared to non-Aboriginal women. Many factors affect the health of Aboriginal mothers and babies including access to culturally appropriate services, socio-economic status, education, remoteness of residency, the effects of discrimination, higher levels of smoking compared to non-Aboriginal mothers, and harmful alcohol and drug use[6].

The importance of culturally secure services that are scientifically based is widely accepted. Appendix 1 includes a report of a successful program that has been implemented in the South Metropolitan Health Service.

There is also increased discussion around the effects of ethnicity as a risk factor for stillbirth. In this report, African and South Asian women had a higher risk of stillbirth compared to Caucasian women, but did not have a significant higher risk for neonatal deaths or postneonatal deaths. Risk factors for these populations include migration, in particular humanitarian reasons; social disadvantage; language barriers; and access to health care services [7]. It has also been suggested that there may be ethnicity differences in placental function[8]. Further research aimed at understanding these differences may help reduce the rate of stillbirths.

Health Care during pregnancy and at birth

In WA, pregnant women have access to different options for birthing services, including hospitals, attached and free standing birth services and homebirth services. The latter can be provided by private practising midwives (PPM) or by publicly funded services.

The largest and longest running publicly funded homebirth service, the Community Midwifery Program (CMP), started in 1995 and provides services in the Perth Metropolitan Area. Since its inception, the CMP has gone through several governance changes. It was under the responsibility of Public Health and Ambulatory Care, North Metropolitan Health Service, from 2009 to 2015; and has transferred to the Women and Newborn Health Service, North Metropolitan Health Service from 2015[9].

A second publicly funded homebirth service has been available in Bunbury since 2012, namely the Bunbury Midwifery Group Practice[9].

In 2007, the 12th Report of the Committee identified a higher perinatal mortality rate in term babies whose mothers planned to have a home birth compared to those who planned to have a hospital birth. The Committee recommended a review of homebirths in WA, which was conducted in 2008[10].

Following the review, several changes in governance and policy have occurred to achieve better case selection, and improve the safety and quality of the service. A review on the progress of the 2008 homebirth review was undertaken in 2011[10]. Many of the changes suggested by the review require system and legislative changes, which are still ongoing. The latest WA Health Policy for publicly funded homebirths was issued in 2013; and it is available at: http://www.health.wa.gov.au/circularsnew/pdfs/13045.pdf

The policy sets out:

- the selection criteria for pregnant women considering home birth
- a description of the services provided by CMP and hospital maternity services provided by the WA Health Service Providers
- the care pathways and referral protocols
- the performance development for the workforce
- the clinical safety and quality guidelines and reporting mechanisms.

An independent research study was also commissioned to address methodology challenges. The final report of the study is likely to be published in the near future.

As recommended by the independent research study, the Midwives Notification System (MNS) has been enhanced to ensure antenatal contracted homebirths can be analysed separately from other births not occurring in hospital/birth centre or intended to occur in hospital/birth centre.

Note that from this study's audit of intrapartum transfers from contracted homebirth services it was found that approximately 40 per cent had been determined as not meeting intended homebirth criteria (Appendix 2). The results of the audit have not been used to update MNS data provided for this report.

Table 1 shows the classification used in this report for planned place of birth at onset of labour. Consistent with previous reports, between 2011 and 2013 the majority of women planned to have their babies in a hospital (99 422; 98.9%).

For all births, the risk of stillbirth or neonatal deaths was not significantly different when comparing homebirths to hospital planned births.

Table 2 shows the number and rates of stillbirths and neonatal deaths for full term pregnancies by planned placed of birth.

Table 2: Stillbirths and neonatal deaths for full term pregnancies (>= 37 weeks gestational age) by planned place of birth, Western Australia, 2011-2013

Risk factor	Total births	Live births	Stillbirths		Neonatal deaths	
	N	N	N	Rate per 1,000 births (95% CI)	N	Rate per 1,000 live birth (95% CI)
Homebirth Planned[1]	808	807	1	1.2 (0.0-6.9)	1	1.2 (0.0-6.9)
Unbooked[2]	140	138	2	14.3 (1.7-50.7)	1	7.2 (0.2-39.7)
Hospital Planned[3]	90585	90483	102	1.1 (0.9-1.4)	47	0.5 (0.4-0.7)

[1]It includes planned homebirths with the Community Midwifery Program and with privately funded midwives. It also includes intended homebirths that were transferred to hospitals.
[2]Unbooked hospital is not a planned homebirth, perhaps had no antenatal care, unacknowledged/undiagnosed pregnancy, and arrived at hospital in labour or following birth en route or unexpected, unplanned at home.
[3]Hospital (includes non-maternity sites and clinics)

Commentary

There were no statistically significant differences between the rates of stillbirths and neonatal deaths for planned homebirths and planned hospital births in this triennium. This finding is consistent with the results of the study on the planned home birth services in Western Australia 2002-2013 (Appendix 3).

Following the above study, methodological changes have been made to the analysis of this report. Some methodological challenges remain. It has been argued that it is inappropriate to classify intrapartum transfers as hospital births or as homebirths because they represent a different category, in which it is difficult to ascertain whether the negative outcome was related to the care received at the planned place of birth or the actual place of birth. In this report, all births have been classified by the intention to have a planned homebirth or a planned hospital birth regardless of any transfer to a different service.

The Committee welcomes the results of the study on the planned home birth services in Western Australia 2002-2013. It is likely that the reduction in the rates of perinatal deaths associated with homebirth services is explained by the policy changes of the public program and the improvements in the methodology to assess the services.

WA Health Guidelines for homebirth services must continue to be evidence based; and staff should follow the guidelines and ensure that all women who choose the homebirth service are provided with appropriate information to facilitate an informed decision. It is likely that the antenatal care provided to those who planned a home birth is of a similar standard to the antenatal care provided to those who planned a hospital birth; however, the benefits of timely treatment offered at hospital services to those who have complications during labour should also be recognised.

The Committee accepts the recommendations from the study on the planned home birth services in Western Australia and will continue to monitor perinatal outcomes. The methodology for the assessment of such outcomes will also continue to be improved.

Finally, in this report, it is clear that the rate of stillbirth or neonatal death associated with an unbooked hospital or homebirth is significantly higher compared to the rate of stillbirth and neonatal death associated with planned homebirths and hospital births. A better characterisation of this group is needed to design and implement strategies to reduce the risk of perinatal deaths.

Birth characteristics

Consistent with the published literature, preterm birth (gestational age < 37 weeks) and low birth weight (< 2,500 g) were associated with a higher rate of stillbirths, neonatal deaths and postneonatal deaths (Table 3).

Table 3 Stillbirths, neonatal deaths and post neonatal deaths by birth characteristics Western Australia, 2011-2013

Antecedent	Total births	Live births	Stillbirths		Neonatal mortality		Postneonatal mortality	
	N	N	N	Rate per 1,000 births (95% CI)	N	Rate per 1,000 live birth (95% CI)	N	Rate per 1,000 births (95% CI)
GESTATIONAL AGE (weeks) 20-23	419	66	353	842.5 (804.5-874.2)	40	606.1 (485.5-715.0)	0	0.0 (0.0-55.0)
24-25	185	121	64	345.9 (281.2-417.0)	20	165.3 (109.6-241.6)	0	0.0 (0.0-30.8)
26-31	970	876	94	96.9 (79.8-117.1)	29	33.1 (23.1-47.1)	10	11.4 (6.2-20.9)
32-36	7353	7253	100	13.6 (11.2-16.5)	33	4.5 (3.2-6.4)	16	2.2 (1.4-3.6)
≥37	91533	91428	105	1.1 (0.9-1.4)	49	0.5 (0.4-0.7)	65	0.7 (0.6-0.9
BIRTHWEIGHT (kg) [1] <1.5	1440	916	524	363.9 (339.0-389.3)	84	91.7 (73.8-112.3)	7	7.6 (3.1-15.7)
1.5-<2.5	5284	5212	72	13.6 (10.7-17.1)	25	4.8 (3.1-7.1)	23	4.4 (2.8-6.6)
2.5-<3.0	15992	15940	52	3.3 (2.4-4.3)	24	1.5 (1.0-2.2)	17	1.1 (0.6-1.7)
3.0-<4.0	67469	67408	61	0.9 (0.7-1.2)	35	0.5 (0.4-0.7)	38	0.6 (0.4-0.8)
≥4.0	10272	10268	4	0.4 (0.1-1.0)	3	0.3 (0.1-0.9)	6	0.6 (0.2-1.3)

[1]There were 3 stillbirths for which it was not possible to assign birthweight.

3. Causes of Death

Perinatal Deaths

All notifications of perinatal death are classified using the “Perinatal Society of Australia and New Zealand Perinatal Death Classification” (PSANZ PDC).

The Committee investigates and classifies all deaths of 26 weeks, or greater, gestational age. All deaths less than 26 weeks gestational age are classified by staff from the Department of Health based on information provided by the notifying practitioner. One neonatal death is still under investigation.

In keeping with the previous report, Table 4 shows that the most common PSANZ PDC causes of perinatal deaths were congenital abnormality (n= 259; 29.2%), spontaneous preterm labour (n=225, 25.4%) and unexplained antepartum death (n=83; 9.4%).

Table 4: Perinatal mortality by cause of death (PSANZ PDC), Western Australia, 2011-2013

Cause of Death	Stillbirths			Neonatal mortality			Perinatal mortality		
	N	%	Rate 1,000 births (95% CI)	N	%	Rate per 1,000 live births (95% CI)	N	%	Rate per 1,000 births (95% CI)
1. Congenital abnormality	197	27.5	2.0 (1.7-2.3)	62	36.5	0.6 (0.5-0.8)	259	29.2	2.6 (2.32.9)
2. Perinatal infection	30	4.2	0.3 (0.2-0.4)	11	6.5	0.1 (0.1-0.2)	41	4.6	0.4 (0.3-0.6)
3. Hypertension	37	5.2	0.4 (0.3-0.5)	2	1.2	0.0 (0.0-0.1)	39	4.4	0.4 (0.3-0.5)
4. Antepartum haemorrhage	33	4.6	0.3 (0.2-0.5)	5	2.9	0.1 (0.0-0.1)	38	4.3	0.4 (0.3-0.5)
5. Maternal conditions	26	3.6	0.3 (0.2-0.4)	3	1.8	0.0 (0.0-0.1)	29	3.3	0.3 (0.2-0.4)
6. Specific perinatal conditions	69	9.6	0.7 (0.5-0.9)	7	4.1	0.1 (0.0-0.1)	76	8.6	0.8 (0.6-0.9)
7. Hypoxic peripartum death	5	0.7	0.0 (0.0-0.1)	14	8.2	0.1 (0.1-0.2)	19	2.1	0.2 (0.1-0.3)
8. Fetal growth restriction	58	8.1	0.6 (0.4-0.7)	7	4.1	0.1 (0.0-0.1)	65	7.3	0.6 (0.5-0.8)
9. Spontaneous preterm	178	24.9	1.8 (1.5-2.1)	47	27.6	0.5 (0.4-0.6)	225	25.4	2.2 (2.0-2.6)
10. Unexplained antepartum death	83	11.6	0.8 (0.7-1.0)	0	0.0	0.0 (0.0-0.0)	83	9.4	0.8 (0.7-1.0)
11. No obstetric antecedent	0	0.0	0.0 (0.0-0.0)	12	7.1	0.1 (0.1-0.2)	12	1.4	0.1 (0.1-0.2)
Total	**716**	**100**	**7.1 (6.6-7.7)**	**170**[1]	**100**	**1.7 (1.5-2.0)**	**886**	**100**	**8.8 (8.3-9.4)**

[1] One neonatal death is still under investigation

Aboriginal people

The most common PSANZ PDC causes of perinatal deaths for Aboriginal people were spontaneous preterm (n=38; 33.8%), congenital abnormalities (n=13; 11.6%) and fetal growth restriction (n=11; 9.8%, Table 5).

Table 5: Aboriginal population: perinatal mortality by cause of death (PSANZ PDC), Western Australia, 2011-2013

Cause of death	Stillbirths			Neonatal mortality			Perinatal mortality		
	N	%	Rate 1,000 births (95% CI)	N	%	Rate per 1,000 live births (95% CI)	N	%	Rate per 1,000 births (95% CI)
1. Congenital abnormality	7	8.2	1.4 (0.5-2.8)	6	22.2	1.2 (0.5-2.6)	13	11.6	2.5 (1.5-4.3)
2. Perinatal infection	5	5.9	1.0 (0.3-2.3)	2	7.4	0.4 (0.1-1.4)	7	6.3	1.4 (0.7-2.8)
3. Hypertension	8	9.4	1.6 (0.8-3.1)	1	3.7	0.2 (0.0-1.1)	9	8.0	1.7 (0.9-3.3)
4. Antepartum haemorrhage	4	4.7	0.8 (0.2-2.0)	1	3.7	0.2 (0.0-1.1)	5	4.5	1.0 (0.4-2.3
5. Maternal conditions	7	8.2	1.4 (0.5-2.8)	0	0.0	0.0 (0.0-0.7)	7	6.3	1.4 (0.7-2.8)
6. Specific perinatal conditions	3	3.5	0.6 (0.1-1.7)	2	7.4	0.4 (0.1-1.4)	5	4.5	1.0 (0.4-2.3)
7. Hypoxic peripartum death	1	1.2	0.2 (0.0-1.1)	1	3.7	0.2 (0.0-1.1)	2	1.8	0.4 (0.1-1.4)
8. Fetal growth restriction	9	10.6	1.7 (0.8-3.3)	2	7.4	0.4 (0.1-1.4)	11	9.8	2.1 (1.2-3.8)
9. Spontaneous preterm	32	37.6	6.2 (4.3-8.8)	6	22.2	1.2 (0.4-2.6)	38	33.8	7.4 (5.4-10.1)
10. Unexplained antepartum death	9	10.6	1.7 (0.9-3.3)	0	0.0	0.0 (0.0-0.7)	9	8.0	1.7 (0.9-3.3)
11. No obstetric antecedent	0	0.0	0.0 (0.0-0.7)	6	22.2	1.2 (0.5-0.6)	6	5.4	1.2 (0.5-2.5)
Total	**85**	**99.9**	**16.5 (13.4-20.3)**	**27**	**99.9**	**5.3 (3.7-7.7)**	**112**	**100**	**21.7 (18.1-26.1)**

Infant deaths

All notifications

As there are no official classifications for infant deaths, all infant deaths are classified using the 'Perinatal Society of Australia and New Zealand Perinatal Death Classification' (PSANZ PDC) and the 'Perinatal Society of Australia and New Zealand Neonatal Death Classification' (PSANZ NDC) for consistency.

Table 6 shows that the leading PSANZ NDC causes of infant deaths were congenital abnormality (n=88; 34.1%), other diagnosis (n=63; 24.0%) and extreme prematurity (n=39; 15.1).

Table 6: Infant mortality by cause of death (PSANZ NDC), Western Australia, 2011-2013

Cause of death	Neonatal mortality			Post-neonatal mortality			Infant mortality		
	N	%	Rate per 1,000 live births (95% CI)	N	%	Rate per 1,000 live births (95% CI)	N	%	Rate per 1,000 live births (95% CI)
1. Congenital abnormality	59	35.1	0.6 (0.4-0.8)	29	32.2	0.3 (0.2-0.4)	88	34.1	0.9 (0.7-1.1)
2. Extreme prematurity	39	23.2	0.4 (0.3-0.5)	0	0.0	0.0 (0.0-0.0)	39	15.1	0.4 (0.3-0.5)
3. Cardio-respiratory disorders	9	5.4	0.1 (0.0-0.2)	2	2.2	0.0 (0.0-0.1)	11	4.3	0.1 (0.1-0.2)
4. Infection	17	10.1	0.2 (0.1-0.3)	6	6.7	0.1 (0.0-0.1)	23	8.9	0.2 (0.1-0.3)
5. Neurological	26	15.5	0.3 (0.2-0.4)	6	6.7	0.1 (0.0-0.1)	32	12.4	0.3 (0.2-0.5)
6. Gastrointestinal	3	1.8	0.0 (0.0-0.1)	0	0.0	0.0 (0.0-0.0)	3	1.2	0.0 (0.0-0.1)
7.Other	15	8.9	0.2 (0.1-0.2)	47	52.2	0.5 (0.4-0.6)	62	24.0	0.6 (0.5-0.8)
Total	**168**[1]	**100**	**1.7 (1.4-2.0)**	**90**[2]	**100**	**0.9 (0.7-1.1)**	**258**	**100**	**2.6 (2.3-2.9)**

[1]Excludes one neonatal death that is still under investigation; two neonatal deaths did not have a PSANZ NDC code.

[2]Excludes one postneonatal death that is still under investigation

When PSANZ-PDC and PSANZ-NDC were cross-examined, it was observed that the majority of infant deaths with PSANZ-PDC 'no obstetric antecedent' were correlated with PSANZ-NDC 'infections' and 'other conditions', such as Sudden Infant Death Syndrome (SIDS) and Trauma (Table 7).

The majority of PSANZ-PDC 'hypoxic peripartum infant deaths' were correlated with the PSANZ-NDC coding for 'neurological complications'.

Table 7: Number of infant deaths by cause of death classification systems (PSANZ NDC and PSANZ PDC), Western Australia, 2011-2013

PSANZ-PDC	PSANZ-NDC							
	1. Congenital abnormality	2. Extreme prematurity	3. Cardio-respiratory disorders	4. Infection	5. Neurological	6. Gastro-intestinal	7.Other	Total
1. Congenital abnormality	83	0	4	1	1	1	0	90
2. Perinatal infection	0	0	0	11	1	0	0	12
3. Hypertension	0	0	0	0	0	0	2	2
4. Antepartum haemorrhage	1	2	0	0	4	0	0	7
5. Maternal conditions	0	1	0	2	1	0	0	4
6. Specific perinatal conditions	4	1	0	0	3	0	0	8
7. Hypoxic peripartum death	0	0	1	0	15	0	1	17
8. Fetal growth restriction	0	3	2	0	3	0	0	8
9. Spontaneous preterm	0	32	4	4	3	2	2	47
10. Unexplained antepartum death	0	0	0	0	0	0	0	0
11. No obstetric antecedent	0	0	0	5	1	0	57	63
Total	88	39	11	23	32	3	62	258

Aboriginal babies

For Aboriginal babies, the leading PSANZ-NDC causes of infant mortality were other (n=19, 42.2%), congenital abnormality (n=11; 24.4%) and extreme prematurity (n=6; 13.3%, Table 8).

For Aboriginal babies, the leading PSANZ-NDC causes of neonatal deaths were congenital abnormality (n=8, 29.6%), other (n= 7; 25.9%) and extreme prematurity (n=6; 22.2%).

For Aboriginal babies, the leading PSANZ-NDC causes of post-neonatal deaths were other (n=12, 66.7%), congenital abnormality (n=3; 16.7%) and infection (n=3; 16.7%).

Table 8: Aboriginal population: Infant mortality by cause of death (PSANZ NDC), Western Australia, 2011-2013

Cause of death	Neonatal mortality			Post-neonatal mortality			Infant mortality		
	N	%	Rate per 1,000 live births (95% CI)	N	%	Rate per 1,000 live births (95% CI)	N	%	Rate per 1,000 live births (95% CI)
1. Congenital abnormality	8	29.6	1.6 (0.8-3.1)	3	16.7	0.6 (0.2-1.7)	11	24.4	2.2 (1.2-3.9)
2. Extreme prematurity	6	22.2	1.2 (0.5-2.6)	0	0.0	0.0 (0.0-0.8)	6	13.3	1.2 (0.5-2.6)
3. Cardio-respiratory disorders	2	7.4	0.4 (0.1-1.4)	0	0.0	0.0 (0.0-0.8)	2	4.4	0.4 (0.1-1.4)
4. Infection	2	7.4	0.4 (0.1-1.4)	3	16.7	0.6 (0.2-1.7)	5	11.1	1.0 (0.4-2.3)
5. Neurological	2	7.4	0.4 (0.1-1.4)	0	0.0	0.0 (0.0-0.8)	2	4.4	0.4 (0.1-1.4)
7.Other	7	25.9	1.4 (0.7-2.8)	12	66.7	2.4 (1.4-4.1)	19	42.2	3.7 (2.4-5.8)
Total	**27**	**99.9**	**5.3 (3.7-7.7)**	**18**	**100.1**	**3.6 (2.2-5.6)**	**45**	**99.8**	**8.9 (6.6-11.9)**

4. Cases investigated by the Committee

Causes of death – Cases investigated by the Committee

Perinatal deaths

The Committee investigates all deaths of 26 weeks or greater gestational age. The aim is to determine whether, in the opinion of the Committee, the stillbirth or death could have been prevented.

All investigated perinatal deaths are classified using the “Perinatal Society of Australia and New Zealand Perinatal Death Classification” (PSANZ PDC).

For births between 2011 and 2013, the Committee investigated 503 deaths, including 300 stillbirths (59.6 per cent), 112 neonatal deaths (22.3 per cent) and 91 post neonatal deaths (18.1 per cent).

Five perinatal deaths, which occurred in babies under 26 weeks of gestational age, were investigated, including 3 stillbirths and 2 neonatal deaths. Unfortunately, three deaths in babies of 26 weeks or greater gestational age were not investigated. Two perinatal and infant deaths are still under investigation. These deaths have been excluded from the analyses.

For investigated perinatal deaths, the main PSANZ PDC causes of death were congenital abnormality (n=97, 23.9%), unexplained antepartum death (n= 83, 20.4%) and specific perinatal conditions (n= 54; 13.3%; Table 9).

For investigated stillbirth deaths, the main PSANZ PDC causes of death were unexplained antepartum death (n= 83; 27.9%), specific perinatal conditions (n=48; 16.2%) and fetal growth restriction (n=45; 15.2%).

For investigated neonatal deaths, the main PSANZ PDC causes of death were congenital abnormality (n=53; 48.6%), no obstetric antecedent (n=12; 11.2%) and hypoxic peripartum death (n=10; 9.2%).

Of note, babies less than 26 weeks were more likely to die from spontaneous preterm birth compared to babies who were born after 26 weeks gestation.

More details in these categories are provided as follows:

Unexplained antepartum deaths – 83 deaths:

- Placental pathology was associated with 51 cases:
    - Evidence of reduced vascular perfusion was found in 16 cases
    - Chronic villitis was found in 7 cases
    - 'Other' placenta pathology was noted in 28 cases
- No placental pathology was noted in 21 cases
- There was no examination of the placenta in 10 cases. Placental examination was unspecified or unknown in one case.

Specific perinatal conditions – 48 deaths:

- Twin-twin transfusion was associated with 14 deaths
- Feto-maternal haemorrhage was associated with 9 deaths
- Antepartum cord complications were associated with 18 deaths
- Idiopathic hydrops was associated with 4 cases
- Other conditions were associated with 3 cases.

Fetal growth restriction – 45 deaths

- Twenty six cases had evidence of reduced vascular perfusion
- Eight cases had evidence of chronic villitis
- For five cases, no placental pathology was noted.
- Five cases had 'other' placental pathology
- There was no examination of the placenta in one case.

Table 9: Cases investigated[1]: perinatal mortality by cause of death (PSANZ PDC), Western Australia, 2011-2013

Cause of death	Stillbirths		Neonatal mortality		Perinatal mortality	
	N	%	N	%	N	%
1. Congenital abnormality	44	14.8	53	48.6	97	23.9
2. Perinatal infection	12	4.0	8	7.3	20	4.9
3. Hypertension	26	8.8	1	0.9	27	6.7
4. Antepartum haemorrhage	18	6.1	3	2.8	21	5.2
5. Maternal conditions	16	5.4	1	0.9	17	4.2
6. Specific perinatal conditions	48	16.2	6	5.5	54	13.3
7. Hypoxic peripartum death	5	1.7	10	9.2	15	3.7
8. Fetal growth restriction	45	15.2	6	5.5	51	12.6
9. Spontaneous preterm	0	0.0	9	8.3	9	2.2
10. Unexplained antepartum death	83	27.9	0	0.0	83	20.4
11. No obstetric antecedent	0	0.0	12	11.2	12	3.0
Total	**297[2]**	**100.1**	**109[3]**	**100.2**	**406**	**100.1**

1Cases investigated includes all deaths of 26 or greater gestational age only.
2 Excludes 3 stillbirths that were investigated but were less than 26 weeks gestational age
[3] Excludes 2 neonatal deaths that were investigated but were less than 26 weeks gestational age and one neonatal death that is still under investigation.

Pathology Investigations into cause of death

The majority of stillbirths underwent post-mortem investigation to ascertain causes of death (n=435, 60.8%), while 37 per cent of stillbirths did not have a post-mortem investigation (n=266). For the remaining 14 cases, it was unknown.

For neonatal deaths, the proportion of cases that underwent post-mortem investigation was 38.0 per cent (n= 38), while 58.5 per cent did not (n=100), for the remaining (n=6, 3.5%) it was unknown.

A higher rate of post-mortem investigations is desirable as this might reduce the number of unexplained deaths.

Infant deaths

Between 2011 and 2013, the Committee investigated 203 infant deaths. Two neonatal deaths, which occurred in babies under 26 weeks of age, were investigated. These deaths have been excluded from the analyses in this section.

For investigated infant deaths, the main PSANZ-PDC causes of death were congenital abnormality (n=81; 40.1%), no obstetric antecedent (n=63, 31.3%) and hypoxic peripartum death (n=13; 6.5%).

For investigated infant deaths, the main PSANZ-NDC causes of death were congenital abnormality (n=79; 39.3%), other (n=60; 29.9%) and neurological (n=28; 13.9%).

More details in these categories are provided as follows:

Infant deaths due to Congenital Abnormality (PSANZ-PDC and PSANZ-NDC) – 74 deaths:

- Central Nervous System abnormalities were found in 9 cases
- Cardiovascular system abnormalities were found in 18 cases
- Urinary System abnormalities were found in 9 cases
- Gastrointestinal System abnormalities were found in 6 cases
- Chromosomal abnormalities were found in 10 cases
- Metabolic abnormalities were found in 7 cases
- Multiple –non chromosomal syndromes were found in 6 cases
- Other abnormalities were found in 12 cases, including 4 cases with musculoskeletal abnormalities, 6 cases with diaphragmatic hernia and 2 cases with tumours.

More than one congenital abnormality was reported for some cases.

Infant deaths due to Hypoxic peripartum death (PSANZ-PDC) and Neurological (PSANZ-PDC) – 11 cases:

- All cases were attributed to hypoxic ischaemic encephalopathy. Associated conditions included uterine rupture, cord prolapse, shoulder dystocia and non-reassuring fetal status in a normally grown infant.

Infant deaths coded as no obstetric antecedent (PSANZ-NDC) and other (PSANZ-PDC) – 57 deaths:

- Forty five cases were attributed to Sudden Infant Death Syndrome
- Two cases were attributed to road crash injuries.
- Ten cases were classified as other or unknown. This category includes drownings and intentional injuries.

Table 10: Cases Investigated: Number of infant deaths by cause of death classification systems (PSANZ NDC and PSANZ PDC), Western Australia, 2011-2013

PSANZ-PDC	PSANZ-NDC							
	1. Congenital	2. Extreme prematurity	3. Cardio-respiratory disorders	4. Infection	5. Neurologica	6. Gastro-intestinal	7.Other	Total
1. Congenital abnormality	74	0	4	1	1	1	0	81
2. Perinatal infection	0	0	0	8	1	0	0	9
3. Hypertension	0	0	0	0	0	0	1	1
4. Antepartum haemorrhage	1	0	0	0	4	0	0	5
5. Maternal conditions	0	0	0	1	1	0	0	2
6. Specific perinatal conditions	4	0	0	0	3	0	0	7
7. Hypoxic peripartum death	0	0	1	0	11	0	1	13
8. Fetal growth restriction	0	2	2	0	3	0	0	7
9. Spontaneous preterm	0	0	3	3	3	1	1	11
10. Unexplained antepartum death	0	0	0	0	0	0	0	0
11. No obstetric antecedent	0	0	0	5	1	0	57	63
Total	79	2	10	18	28	2	60	199[1]

[1]Excludes 2 neonatal deaths that were investigated but were less than 26 weeks gestational age and two infant deaths that are still under investigation.

For neonatal deaths, the main PSANZ-NDC causes of death were congenital abnormality (n=50; 4.6%), neurological (n=22; 20.2%) and other (n=13; 11.9%)

When PSANZ-PDC and PSANZ-NDC were cross-examined, it was observed that the majority of neonatal deaths had an antenatal factor (i.e. congenital abnormality, Table 11).

Table 11: Cases Investigated: Number of neonatal deaths by cause of death classification systems (PSANZ NDC and PSANZ PDC), Western Australia, 2011-2013

PSANZ-PDC	PSANZ-NDC							
	1. Congenital	2. Extreme prematurity	3. Cardio-respiratory disorders	4. Infection	5. Neurologica	6. Gastro-intestinal	7.Other	Total
1. Congenital abnormality	46	0	4	1	1	1	0	53
2. Perinatal infection	0	0	0	7	1	0	0	8
3. Hypertension	0	0	0	0	0	0	1	1
4. Antepartum haemorrhage	0	0	0	0	3	0	0	3
5. Maternal conditions	0	0	0	1	0	0	0	1
6. Specific perinatal conditions	4	0	0	0	2	0	0	6
7. Hypoxic peripartum death	0	0	0	0	9	0	1	10
8. Fetal growth restriction	0	2	1	0	3	0	0	6
9. Spontaneous preterm	0	0	3	2	3	1	0	9
10. Unexplained antepartum death	0	0	0	0	0	0	0	0
11. No obstetric antecedent	0	0	0	1	0	0	11	12
Total	50	2	8	12	22	2	13	109[1]

[1] Excludes 2 neonatal deaths that were investigated but were less than 26 weeks gestational age and one neonatal death that is still under investigation.

In contrast, the majority of postneonatal deaths were caused by postnatal factors

Table 12: Cases Investigated: Number of postneonatal deaths by cause of death classification systems (PSANZ NDC and PSANZ PDC), Western Australia, 2011-2013

PSANZ-PDC	PSANZ-NDC							
	1. Congenital	2. Extreme prematurity	3. Cardio-respiratory disorders	4. Infection	5. Neurologica	6. Gastro-intestinal	7.Other	Total
1. Congenital abnormality	28	0	0	0	0	0	0	28
2. Perinatal infection	0	0	0	1	0	0	0	1
3. Hypertension	0	0	0	0	0	0	0	0
4. Antepartum haemorrhage	1	0	0	0	1	0	0	2
5. Maternal conditions	0	0	0	0	1	0	0	1
6. Specific perinatal conditions	0	0	0	0	1	0	0	1
7. Hypoxic peripartum death	0	0	1	0	2	0	0	3
8. Fetal growth restriction	0	0	1	0	0	0	0	1
9. Spontaneous preterm	0	0	0	1	0	0	1	2
10. Unexplained antepartum death	0	0	0	0	0	0	0	0
11. No obstetric antecedent	0	0	0	4	1	0	46	51
Total	29	0	2	6	6	0	47	90[1]

[1] Excludes 1 postneonatal death that is still under investigation.

Pathology investigations into cause of death

For neonatal deaths, the proportion of cases that underwent post-mortem investigation was 38.0 per cent (n= 38), while 58.5 per cent did not (n=100), for the remaining (n=6, 3.5%) it was unknown.

For postneonatal deaths, the proportion of cases who underwent post-mortem investigation was 72.5 per cent (n=66), while 25.3 per cent (n=23) did not, for the remaining (n=2, 2.2%) it was unknown.

Preventable factors

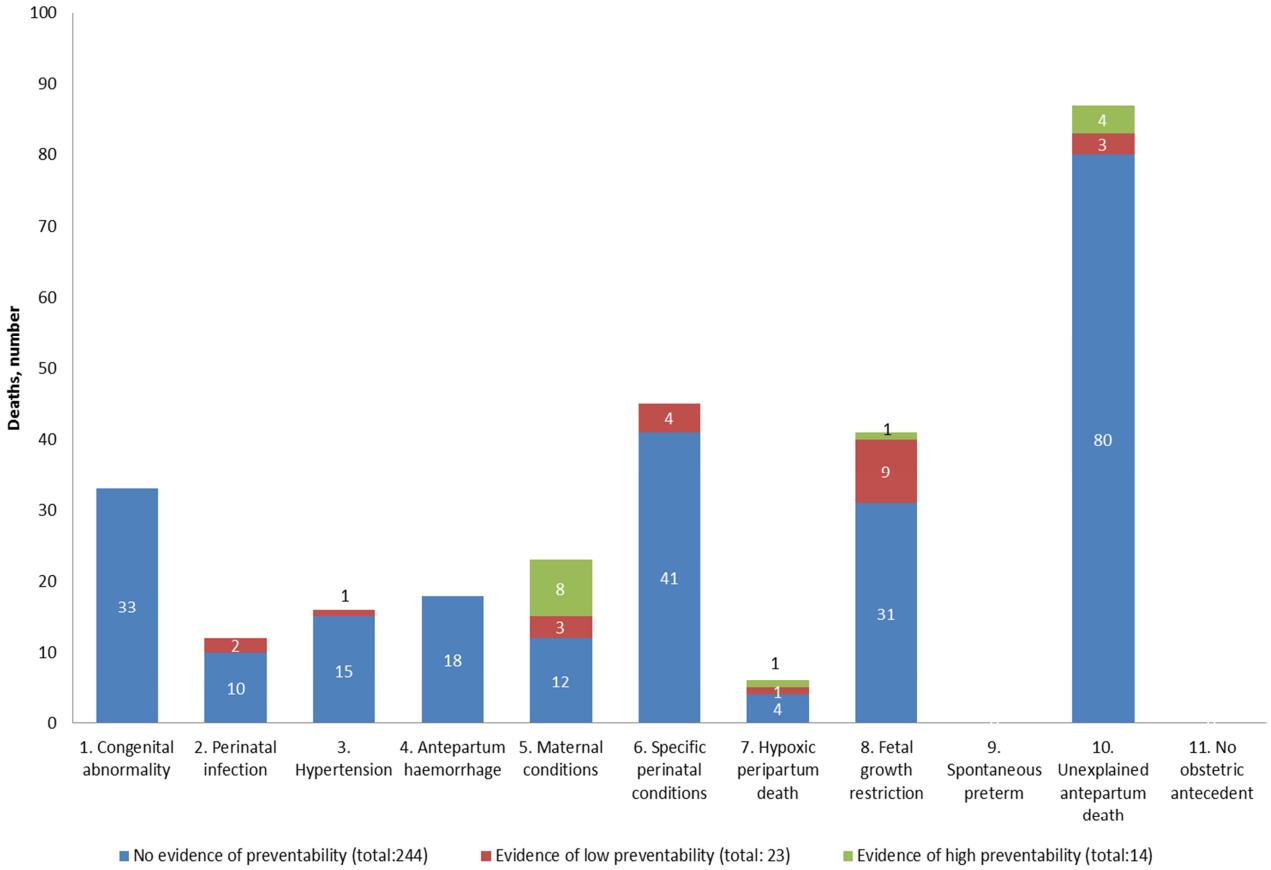
Medical preventability

All investigated deaths were classified using a preventability scale to identify those cases with possible preventable medical factors. A medical preventability score of one indicates no evidence of medical preventability, a score between two and three indicates low degree of medical preventability and a score between four and six indicates high medical preventability.

The overall standard of perinatal health care in WA continued to be high. The majority of investigated stillbirths (n=244; 82.2%) had no evidence of medical preventability; 23 (7.7%) stillbirths had evidence of low degree medical preventability and 14 (4.7%) stillbirths had evidence of high degree medical preventability (Figure 3). Sixteen stillbirths were not classified as the preventability could not be coded appropriately.

Of those stillbirths found to have some evidence of high degree medical preventability, the PSANZ-PDC cause of deaths were maternal conditions (n=8), unexplained antepartum death (n=4), hypoxic peripartum death (n=1) and fetal growth restriction (n=1).

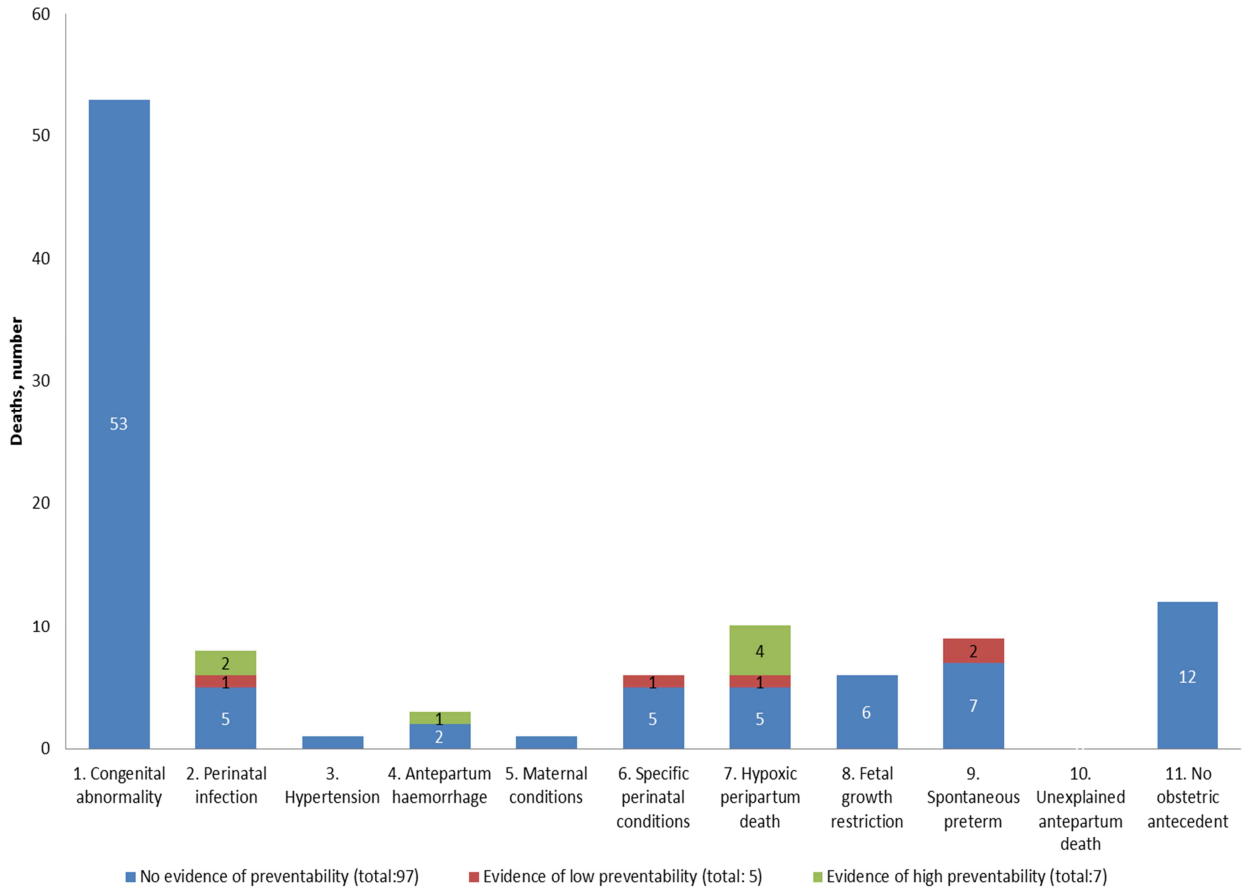
Figure 3: Number of stillbirths > = 26 weeks gestations with showing any evidence of medical preventability by cause of death (PSANZ-PDC), Western Australia, 2011-2013



The majority of investigated neonatal deaths (n=97; 88.2%) had no evidence of medical preventability; five (4.5%) neonatal deaths had some evidence of low degree medical preventability and seven (6.4%) neonatal deaths had evidence of high medical preventability (Figure 4).

Of those neonatal deaths found to have some evidence of high degree medical preventability, the PSANZ-PDC cause of deaths were hypoxic peripartum death (n=4), antepartum haemorrhage (n=1) and perinatal infection (n=2).

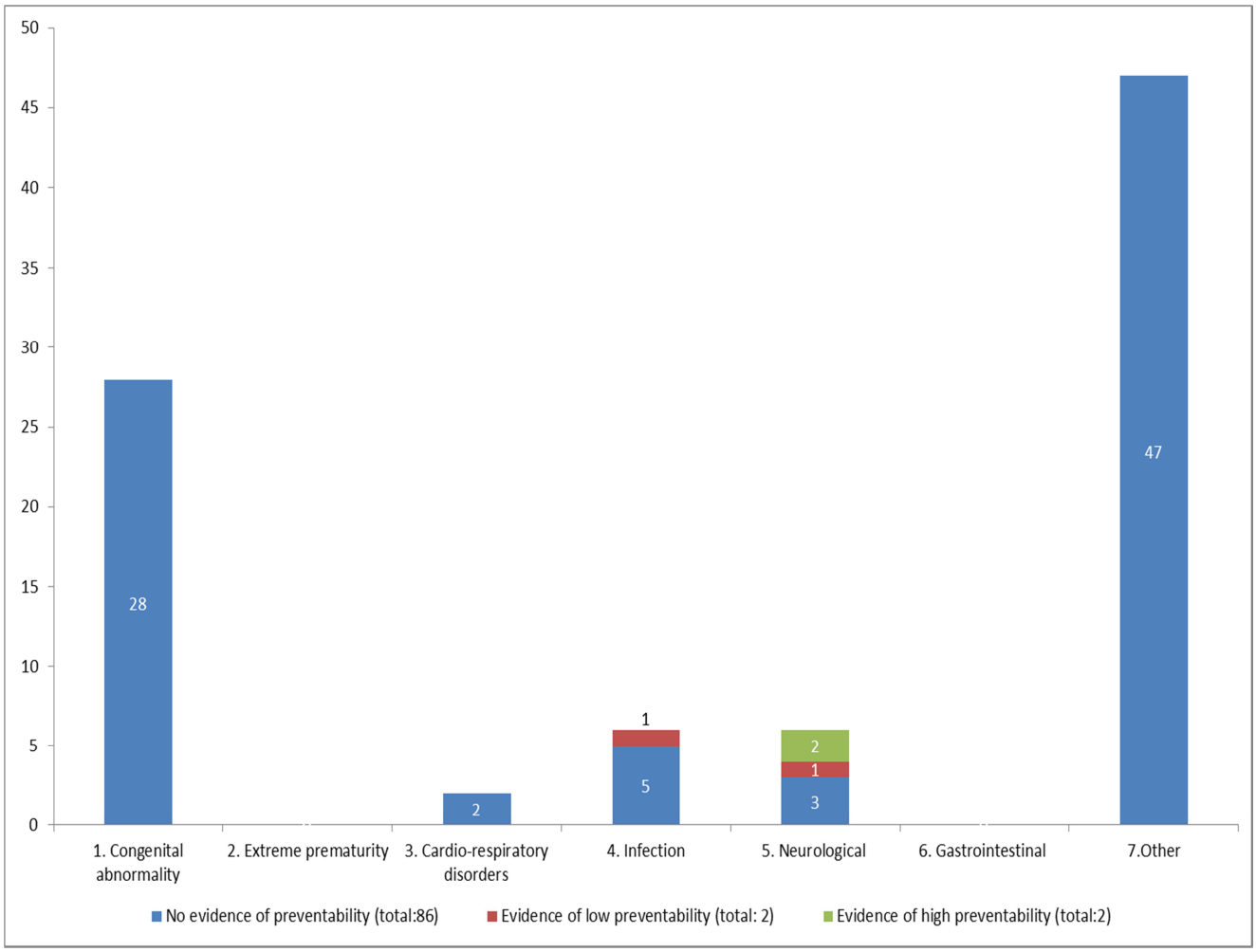
Figure 4: Number of neonatal deaths> = 26 weeks gestations showing any evidence of medical preventability by cause of death (PSANZ-PDC), Western Australia, 2011-2013



The majority of investigated postneonatal deaths (n=86; 94.5%) had no evidence of medical preventability; two (2.2%) neonatal deaths had some evidence of low preventability and two (2.2%) neonatal deaths had evidence of high medical preventability (Figure 4).

Of those postneonatal deaths found to have some evidence of high medical preventability, the PSANZ-PDC cause of deaths was neurological condition (n=2).

Figure 5: Number of postneonatal deaths> = 26 weeks gestations showing any evidence of medical preventability by cause of death (PSANZ-NDC), Western Australia, 2011-2013



The Committee identified the reasons why these perinatal and infant deaths were considered preventable.

Alternative clinical management decisions would have improved outcomes in the following areas:

- Management of hypertension during pregnancy (9 deaths)
- Management of fetal growth restriction (3 deaths)
- Indications and interpretation of cardiotocography (3 deaths)
- Management of diabetes (1 death)
- Group B Streptococcus screening and management of sepsis (1 death).

Conclusions and recommendations

In conclusion, this Report provides further evidence that perinatal and infant deaths are the result of complex interactions of multiple factors. It is recommended:

1. That the Department of Health and the Women and Newborn Health Service consider the reasons why the stillbirth rate has not changed and identify opportunities for interventions/prevention with a view to develop a strategy to reduce the rate of stillbirth in WA

2. That all health service providers provide evidence based and culturally appropriate services for Aboriginal women; and that funding for such programs is needs-based, effective and sustainable.

3. Health Practitioners should be aware of the King Edward Memorial Hospital Clinical (KEMH) Guidelines available at http://www.kemh.health.wa.gov.au/development/manuals/

All twin pregnancies should have a12-week ultrasound to determine chorionicity. If monochorionic diamniotic, arrange a 16-week scan to look for twin-to-twin transfusion and contact KEMH if results abnormal.

For couples seeking fertility treatments, counselling should include realistic information on the risks of multiple pregnancies.

4. Women at high risk of preterm birth may benefit from referral to, or consultation with, the Preterm Birth Prevention Clinic at King Edward Memorial Service.

5. The Committee accepts the recommendations from the study on the planned home birth services in Western Australia and the Committee will continue to monitor perinatal outcomes. The methodology for the assessment of such outcomes will also continue to be improved.

Appendix 1 - Methods and Glossary

The methodology for this report followed the same methods described in the 14th Report of the Perinatal and Infant Mortality Committee available from http://ww2.health.wa.gov.au/Reports-and-publications/Perinatal-infant-and-mortality-committee.
For rare events, Poisson distribution was used to derive 95% confidence interval.

Data were obtained for the birth cohort from 2011 to 2013. Infant deaths occurred up to 365 days after birth. Data sources included the Midwives Notification System and the Perinatal and Infant Dataset. A glossary of common terms is included in Appendix 1.

GLOSSARY

Birthweight: The first weight, measured of the infant, to the nearest five grams. Usually obtained within the first hour of birth.

Ethnic status: Self-reported ethnic origin of the woman giving birth.

> **Aboriginal:** An infant was nominated "Aboriginal" if the mother identified as an Aboriginal or Torres Strait Islander. Please note that within Western Australia, the term Aboriginal is used in preference to Aboriginal and Torres Strait Islander, in recognition that Aboriginal people are the original inhabitants of Western Australia. No disrespect is intended to our Torres Strait Islander colleagues and community.
>
> **Caucasian:** Woman who self-reports ethnic origin as Caucasian.
>
> **South East and East Asian** (SE and EA): Woman who self-reports ethnic origin as SE and SEA (i.e. Vietnamese, Malaysian, Cambodian, Chinese, Japanese, etc.).
>
> **South Asian:** Woman who self-reports ethnic origin as Indian, which usually includes descendants of people originating in the area of the Indian subcontinent, Pakistan etc.
>
> **African:** Woman who self-reports ethnic origin as African, which usually includes descendants of people from Africa i.e. Nigerian, Somalian etc.
>
> **Maori:** Woman who self-reports ethnic origin as Maori, which usually includes people of New Zealand origin.
>
> **Other:** Woman who self-reports any ethnic origin not elsewhere specified in this list or who is unable to specify any ethnic origin.

Gestational age: The duration of pregnancy in completed weeks from the first day of the last normal menstrual period.

Infant death: The death within a year of birth of a live born infant.

Livebirth: The complete expulsion or extraction from its mother of an infant irrespective of duration of pregnancy, which after birth shows signs of life.

Mortality rates:

Stillbirth rate: the number of stillbirths per 1,000 total births in a year.
Neonatal mortality: the number of neonatal deaths per 1,000 live births in a year.
Perinatal mortality: the number of stillbirths and neonatal deaths per 1,000 total births in a year.
Postneonatal mortality rate: the number of postneonatal deaths per 1,000 live births
Infant mortality rate: Number of deaths of infants per 1,000 live births.

Neonatal death: The death of a live born infant within 28 days of birth

Parity: The total number of pregnancies resulting in one or more infants born alive or stillborn.

Nulliparous: never having completed a pregnancy beyond 20 weeks gestation prior to the index pregnancy.
Multiparous: having completed one or more pregnancies beyond 20 weeks gestation.

Perinatal death: A stillbirth (fetal death) or neonatal death.

Postneonatal death: The death of a live born infant from 28 to 364 days after birth.

Stillbirth or Fetal death: The complete expulsion or extraction from its mother of an infant weighing at least 400 grams birthweight or at least 20 weeks gestation, which shows no sign of life from the time of birth.

Term Infants: Infants born at gestational age of 37 weeks or greater.

Unbooked births: are not planned homebirths or hospital births, and include women who perhaps had no antenatal care, unacknowledged/undiagnosed pregnancy, and arrived at hospital in labour or following birth en route or unexpected, unplanned at home.

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9. Appendix 3. Planned home birth in Western Australia: 2002-2013. Authors: Dorota Doherty, Janet Hornbuckle, Yvonne Hauck, Maureen Hutchinson, Susanne Somerville, Elizabeth Nathan

10. Homer C, Nicholl M, Review of Homebirths in Western Australia. Department of Health WA, 2009.

Appendix 2- Nguluk Durapin Wongin Norba - 'Our Happy Healthy Babies'

The Aboriginal Maternity Group Practice Program in the South Metropolitan Health Service[1] (1 July 2011 – 30 September 2015)

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1.1 Background

Aboriginal[2] women have a higher risk of poor pregnancy and neonatal outcomes compared to non-Aboriginal women, including greater risks of low birth weight, preterm labour, and neonatal and infant mortality. The Aboriginal Maternity Group Practice Program (AMGPP) was developed to address these issues, as part of the Council of Australian Governments' (COAG) suite of *Closing the Gap* reforms. The program commenced in 2011 in the South Metropolitan Health Service (SMHS)[1] of Perth, Western Australia, with separate but similar programs operating from each of the five SMHS districts of Armadale, Bentley, Fremantle, Rockingham/Kwinana and Peel/Mandurah.

The South Metropolitan Population Health Unit (SMPHU) contract managed the program, and the model of service delivery was developed in partnership with the SMHS District Aboriginal Health Action Groups (DAHAGs; which were the SMHS Aboriginal community engagement groups). The model employed Aboriginal Health Officers (AHOs), Aboriginal Grandmothers, and midwives working collaboratively alongside existing services including the five SMHS district hospitals, general practitioners (GPs), GP obstetricians and specialist obstetricians.

The host organisations employing AMGPP staff were two Medicare Locals (AHOs and Grandmothers), two Aboriginal Health Centres (one employed an AHO; the other employed AHOs, Grandmothers and midwives), one Aboriginal antenatal clinic running from one of the district hospitals (AHOs, Grandmothers, midwives), and the four remaining district hospitals (employing midwives only). Women birthed at their local SMHS district hospital or, if their pregnancy was categorised as high risk, the state's tertiary maternity hospital, King Edward Memorial Hospital (KEMH).

The AMGPP aimed to improve the access of Aboriginal women, particularly young women, to pre-existing maternity and child health services in the SMHS. An evaluation was performed to

[1] Please note this report refers to the boundaries of the South Metropolitan Health Service up until June 30 2016.

[2] The use of the term 'Aboriginal' within this document refers to Australians of both Aboriginal and Torres Strait Islander origin.

assess whether the target population was reached; what services the program provided and whether they were evidence-based; whether the services provided were culturally competent; whether the services provided improved health behaviours and health outcomes; and what the barriers were to implementation and operation of the program.

1.2 Methodology

The evaluation used a mixed methodology. The qualitative component included staff interviews, program partner surveys and client surveys to describe the services provided, including cultural aspects.[3]

The quantitative component comprised:

(1) Summary data on all Aboriginal women residing in the SMHS who birthed between 1 July 2011 and 31 December 2012, regardless of whether they enrolled in the AMGPP to examine what proportion of the target population participated.
(2) A non-randomised intervention study,[4] conducted using routinely collected data from the Midwives Notification System (MNS) to determine health outcomes.
(3) More recent demographic and outcome data from the public hospitals' Stork database (for the four hospitals where this was available) for the two-year period from 1 October 2013 to 30 September 2015, although no comparison group was available for that analysis.
(4) Aggregate hospital of delivery data from the MNS for the period 2000-2013 to analyse any changes that had occurred in the birthing patterns among locally-residing Aboriginal women.

The non-randomised intervention study included all women participating in the AMGPP from 1 July 2011 to 31 December 2012, compared to frequency-matched historical and contemporary control groups who were eligible for standard antenatal care. The outcomes of interest were preterm births, neonatal birth weight, neonatal resuscitation and a hospital stay exceeding five days. Adjusted odds ratios (aORs) were calculated using binomial logistic regression.

1.3 Findings

In the qualitative component of the evaluation, 15 staff, 22 program partners and 16 clients participated. The quantitative component included 350 pregnancies that were managed by the AMGPP between 1 July 2011 and 31 December 2012 (**period 1**) and 291 pregnancies managed between 1 October 2013 and 30 September 2015 (**period 2**).

Target population

Of all Aboriginal women residing in SMHS who birthed during period 1, 58.2 per cent participated in AMGPP, exceeding the target of 50 per cent participation that was set during the program planning stage. Of all Aboriginal teenagers birthing in the same period, 66.0 per cent participated in the program, suggesting that the program was effectively targeting young women. The feedback indicated that Grandmothers employed by the AMGPP had strong community networks and were effective at identifying pregnant young women in the community and bringing them into the program.

[3] Bertilone CM, McEvoy SP, Gower D, Naylor N, Doyle J, Swift-Otero V. Elements of cultural competence in an Australian maternity program. *Women and Birth* 2016; In press, http://dx.doi.org/10.1016/j.wombi.2016.09.007

[4] Bertilone C, McEvoy S. Success in 'Closing the Gap': Favourable neonatal outcomes in a metropolitan Aboriginal Maternity Group Practice Program. *Med J Aust* 2015;203(6):262.e1-7; doi 10.5694/mja14.01754

Services provided by the program

The services provided by the program were similar in all five districts, with subtle variations depending on the pre-existing services available in the area and the needs of the community. All districts provided transport, care coordination, health promotion, and direct clinical care. All districts developed two sets of partnerships with community health service providers and social service providers. The latter targeted the social determinants of health such as housing, Medicare, clothing or household goods, and Centrelink. This resulted in the provision of holistic care.

The antenatal care provided by the program adhered with current evidence-based guidelines (nationally, *Module 1: Clinical Practice Guidelines (Antenatal Care*)[5] and locally, the *KEMH Antenatal Shared Care Guidelines for General Practitioners*).[6] Of the 291 women who participated in the program during period 2,[7] the majority of program clients were tested/offered testing for sexually-transmitted and blood-borne viral infections including chlamydia, syphilis, HIV, hepatitis B and C (in excess of 95 per cent of women tested/offered testing for each condition). The proportion of women tested for gestational diabetes mellitus (GDM) with an oral glucose tolerance test (OGTT) at 28 weeks was 58.8 per cent. Rubella vaccination post-partum is necessary for many women in the program, as almost half of the women who participated in the AMGPP were not immune to rubella. Data were not available to clarify how many women received postpartum vaccination.

Cultural competence of the service

The services provided by the AMGPP were culturally competent. Continuity of care and the ability to address the social determinants of health were essential components of the model. Access to pre-existing services had improved as a result of the program, particularly related to three key program components: the provision of transport, team home visits, and the employment of Aboriginal staff.[3] Obstacles to the provision of home visits existed in two of the five districts. The employment of Aboriginal staff was identified as crucial, and Grandmothers were able to use their respected position in the community to influence young women's behaviour and help them to feel more comfortable engaging with community health service providers. Aboriginal staff were consistently described as being the link between the community and antenatal care services.

The program has positively influenced the cultural competence of services provided in the district hospitals as well as the practice of community health service providers in at least three of the five districts.[8] Support from hospital management was essential for changes in the physical environment and culture of hospitals to occur, with evidence of this in three of the five districts.

[5] Australian Health Minister's Advisory Council. Clinical practice guidelines: Antenatal care (module 1). Canberra (Australia): Australian Government Department of Health and Ageing; 2012.

[6] King Edward Memorial Hospital. Antenatal shared care guidelines for general practitioners. Perth (Australia): Women and Newborn Health Service; 2014.

[7] These figures underestimate the true number of women who participated in the program, as data for this period were only available for women who birthed at four district hospitals, excluding those who birthed at KEMH, Peel Health Campus, or elsewhere outside of the SMHS.

[8] Lower rates of participation precluded the conclusions that could be made in one district.

Were the services provided effective?

Self-report from clients, backed by staff and program partner case histories, indicated that clients had successfully instituted lifestyle changes including smoking cessation, improvements in diet, and cessation of drinking of alcohol. Over period 1, almost half (44.6%) of program clients smoked sometime during pregnancy, and 8.4 per cent (13/155) of all women who smoked in the first 20 weeks of pregnancy quit smoking before 20 weeks gestation. Over period 2, 8.6 per cent of clients reported alcohol use, 19.9 per cent reported smoking and 17.5 per cent reported substance misuse when they entered the program. No quantitative data were available to report changes in these parameters over the course of the pregnancy.

Estimates of the proportions of AMGPP clients having their first antenatal visit in the first trimester ranged from 30.6 per cent in period 1 to 56 per cent in period 2. Prior to program commencement, local community members had expressed concerns about women presenting late in pregnancy, resulting in referral to KEMH. Therefore, proportions of women birthing at local hospitals over time were analysed as a surrogate measure for the antenatal care uptake behaviours of women. Data from the MNS showed that in 2008, 38.3 per cent of all Aboriginal women who birthed that year and resided in SMHS gave birth in a SMHS district hospital and 53.1 per cent birthed at KEMH; by 2013, these proportions had reversed to 51.7 per cent and 36.6 per cent, respectively.

The results of the non-randomised intervention study,[4] conducted over period 1, demonstrated that participation in the AMGPP was associated with significantly improved neonatal health outcomes including:

(1) **Fewer preterm births**. The proportion of AMGPP clients who had a preterm birth (9.1%), was significantly lower than both control groups (historical group 15.9%, p=0.02; contemporary group 15.3%, p=0.02), and was lower than that previously reported for all Aboriginal women residing in WA in 2011 (14.4%).[9] Additionally, in WA in 2011, 8.6 per cent of births to all women (i.e. Aboriginal and non-Aboriginal) were preterm, which is very similar to the 9.1 per cent preterm deliveries among AMGPP clients.[9]
(2) **Lower neonatal resuscitation rates**. Women who participated in AMGPP were significantly less likely to have babies requiring resuscitation at birth (AMGPP 17.8% versus historical group 24.4%, p=0.04; versus contemporary group 31.2%, p<0.001).
(3) **Fewer postpartum hospital stays exceeding five days**. Women who participated in AMGPP were significantly less likely to require postpartum hospitalisation of over five days (AMGPP 4.0% versus historical group 11.3%, p=0.001; versus contemporary group 11.6%, p<0.001).

Barriers to implementation and operation of the program

Specific challenges were encountered relating to the implementation of two new roles – the Grandmother and AHO. The most important concern related to clinical governance of these positions. Despite being non clinical roles, staff required some clinical knowledge in order to provide effective health promotion and to be able to recognise symptoms requiring urgent medical review (on days when the program midwife was not available). All staff reported receiving appropriate professional development to assist them with this aspect of their role.

Several barriers were reported to the ongoing operation of the program. The biggest barrier related to funding of the program, which had initially been financed for a four year period, with a

[9] Joyce A, Hutchinson M. Western Australia's mothers and babies 2011: Twenty-ninth annual report of the Western Australian Midwives Notification System [Internet]. Department of Health, Western Australia; 2014.

one year extension later announced. The program was not funded in the 2015-16 Federal Budget and funding ceased on 30 June 2015. The program continues to exist to varying degrees at three hospitals.

Another area to focus on was child health postpartum. The AMGPP functioned through to six weeks postpartum. Child and Adolescent Community Health (CACH) also provided services for infants and mothers postpartum that were available longer term. A more streamlined transition between these services may further boost outcomes for infants including health and development monitoring, and timely immunisation.

1.4 Conclusion

This evaluation demonstrated that the AMGPP model was culturally competent and had an impact on the cultural security of both the SMHS district hospitals and community service providers in the majority of districts. The access of local Aboriginal women to SMHS district hospitals improved demonstrably as a result of participation in the program. Babies born to AMGPP clients were significantly less likely to be born preterm, to require resuscitation at birth and to require a hospital length of stay of over five days. In the shorter term, deductions in length of stay postpartum have implications for hospital costs, which may offset the costs of delivery of the program. In the longer term, the positive impact of improved neonatal health outcomes may be life-long, given the associations between prematurity, and neonatal and infant mortality, as well as childhood and adult chronic disease.

Appendix 3. Planned home birth in Western Australia: 2002-2013

Planned home birth in Western Australia: 2002-2013

Authors: Dorota Doherty, Janet Hornbuckle, Yvonne Hauck, Maureen Hutchinson, Susanne Somerville, Elizabeth Nathan

Summary

- Only women with low risk pregnancies at onset of labour should continue to be considered suitable for a planned home birth.
- Women not at low risk at onset of labour are at higher risk of adverse outcomes, irrespective of parity, and should not be considered suitable for a planned home birth.
- Low risk nulliparous women have more transfers of care than parous women and may be more likely to have adverse perinatal outcomes.
- Nulliparous women considering home birth and their healthcare providers should be informed about their increased risk of transfers of care and of poorer perinatal outcomes.
- Perinatal mortality in planned home and hospital births decreased over time and was the lowest in the 2011-2013 triennium.

Planned home birth as a model of care

Pregnancy care for women who plan home birth is provided by registered midwives operating within clearly defined clinical guidelines, and with links for referrals and transfers of care at any stage of pregnancy and birth when the pregnancy is no longer considered low risk.

The evidence about safety of planned home birth is mostly based on international studies of planned home birth in low risk pregnancy within maternity services comparable to those operating in Western Australia (WA) (Netherlands: de Jonge, van der Goes, Ravelli *et al.* 2009; Canada: Janssen, Saxell, Page *et al.* 2009; UK: Birthplace in England Collaborative Group, 2011; USA: Cheyney, Bovbjerg, Everson *et al.* 2014). This evidence applies to women at low risk at onset of labour, defined as women without medical conditions that may influence pregnancy, without obstetric complications, and a singleton fetus with cephalic presentation at term. The debate on the safety of planned home birth continues in literature, policy and practice across the developed world (Roome, Hartz, Tracy *et al.* 2015). Difficulty in the evaluation of safety of home birth primarily relates to the limitation of the existing evidence that is associated with the low number of adverse events. Within the limitations of evidence on perinatal mortality, international studies suggest that home birth for low risk women is safe (WA Department of Health, 2011). Most recent evidence from the *Birthplace in England Study* (Birthplace in England Collaborative Group, 2011) showed that while all women planning home birth experience less interventions, parous women have perinatal outcomes comparable to those in planned hospital births, and nulliparous women have poorer perinatal outcomes. Based on this evidence, home birth is only recommended for parous women.

The main source of WA data regarding the safety of planned home birth are the Perinatal and Infant Mortality Committee (PIMC) reports, where the last three consecutive reports published in 2007 (12th PIMC Report), 2010 (13th PIMC Report) and 2014 (14th PIMC Report) found increased perinatal mortality associated with home births in the respective PIMC triennia 2002-2004, 2005-2007 and 2008-2010. These reports considered whether this apparent excess mortality may be due to some women choosing and being able to access home birth, whilst not being considered at low risk of complications or refusing transfer in a timely manner when recommended.

Planned home birth services in Western Australia

In WA less than 1 per cent of women elect to have home birth. Women who choose home birth either access a publicly funded home birth service (<180 home births per year in 2002-2013) or receive care from privately practising midwives (<75 home births per year in 2002-2013).

The Community Midwifery Program (CMP) is the longest running publicly funded model for planned home birth operating in Australia. WA was the first state to introduce a publicly funded planned home birth service within metropolitan Perth that began as a pilot program in 1996. In 1997, the management of the CMP was transferred from pilot governance to the Fremantle Community Midwives WA Inc., later known as Community Midwifery WA (CMWA) (Homer & Nicholl, 2008). The CMP midwives were employed by the Department of Health WA but were professionally responsible to CMWA between 2000 and 2003. Thereafter they were employed by and professionally responsible to the Women's and Children's Health Service (WCHS) (2004-2005), the Public Health and Ambulatory Care, North Metropolitan Health Service (NMHS) (2006-2015) and the Women and Newborn Health Service (WNHS), NMHS from 2015 onwards. Until 2009, some part-time midwives in publicly funded care also provided care as private practitioners, after which time the publicly and privately funded models became completely separate. A second publicly funded home birth program, the Bunbury Midwifery Group Practice, has been available to women residing within 30km of Bunbury since 2012.

Publicly funded home birth programs operate within the governance of WA Health and private midwives practise as private providers outside the governance of WA Health. Midwives in the publicly funded model follow the WA Health home birth policy *Home Birth Policy and Guidance for Health Professionals, Health Services and Consumers* (policies introduced in 2001, 2012, and 2013) which from 2012 prevented women not at low risk from acceptance to a home birth program. Privately practising midwives have no requirement to follow WA Health home birth policy. Instead they follow professional midwifery guidelines, *Guidance for midwives regarding homebirth services,* introduced by the Australian College of Midwives (ACM) in 2011 and the *National Midwifery Guidelines for Consultation and Referral* (2013). Since February 2016, privately practising midwives are also obliged to follow the National Nursing and Midwifery Board of Australia's *Safety and Quality Framework for Privately Practicing Midwives* or risk losing their professional registration.

Western Australian home birth study

The WA home birth study was conducted in response to a recommendation of the 13th PIMC report (2010) to assess morbidity and mortality of planned home birth. The study included prospectively recruited pregnant women who planned home birth in years 2012-2014 (n=211), and all retrospective home births planned at onset of labour in years 2002-2013 (n=2729).

The main aims of the study were to conduct a detailed prospective audit of planned home births and to compare perinatal morbidity and mortality between planned home and hospital births. Planned home and hospital births were identified from the Midwives' Notification System (MNS) and all cases reported as intrapartum transfers were audited.

Comparisons between planned home and hospital births included singleton term pregnancies and were matched by the level of obstetric risk, with planned hospital births at low risk at onset of labour as the comparator. Level of obstetric risk was assigned according to the latest WA home birth policy eligibility criteria. Four risk levels were allocated: low risk at onset of labour (L1); low risk at booking and not low risk at onset of labour due to pregnancy complications (L2); not low risk at booking and no pregnancy complications (L3); and not low risk at booking or at onset of labour (L4). The risk allocation derived from the retrospective data was based solely on

the presence/absence of medical conditions and obstetric complications irrespective of their severity.

Logistic regression analysis was used to compare pregnancy outcomes. Simultaneous adjustments were made for maternal characteristics, the level of obstetric risk, and changes in policy and governance in years 2002-2013. The effects of planned home birth relative to planned hospital birth were summarised using adjusted odds ratios (aOR) and their 95 per cent confidence intervals (CI). Except for analyses of rare outcomes such as mortality, analyses were conducted separately in nulliparous and parous women due to nulliparity being a strong confounder. When stratification for nulliparity was not feasible, the adjustment for nulliparity was made.

Study outcomes

Planned home births in years 2002-2013 represented <0.9 per cent (n=2729) of all births in WA, with less than 300 planned home births per year.

Data from the prospectively recruited women planning home birth illustrated that the women who planned home birth were older than the general obstetric population, predominantly Australian-born or born in western developed countries, well-educated, and believed that choosing a planned home birth was an informed choice for a better model of care. Women choose home birth to avoid what they considered 'unnecessary' intervention, to be in the comfort and familiarity of their own home, to have continuity of care, and to be more involved in the decision making during labour and birth. One in three women who planned home birth feared a hospital birth and had previous negative hospital birth experiences.

The majority of women planning home birth were satisfied with their midwifery care during pregnancy. Women who accessed the privately funded care attained higher satisfaction levels, likely due to the greater continuity of care and carer offered by the private model. Transfers to hospital care were associated with increased dissatisfaction with labour and/or birth when women were unable to achieve their birth plan during labour. However, some intrapartum transfers still resulted in a positive hospital experience if women encountered hospital staff who were supportive and who attempted to accommodate the woman's birth plan, or when the home birth midwife was able to remain as carer or support person. For some women the transfer of care was associated with dissatisfaction and, in rare cases, was sufficiently traumatic to produce symptoms meeting the diagnostic criteria for post-traumatic stress disorder.

The audit of 520 intrapartum transfers reported in the MNS in years 2002-2013 identified 189 (36.3%) cases determined not to be intrapartum transfers. These cases comprised antenatal transfers from planned home birth (n=87, 16.7%), planned hospital births (n=80, 15.4%), unbooked hospital births and unattended home births (n=22, 4.2%). The incorrectly reported intrapartum transfers were likely to be associated with an increased perinatal mortality. Six fetal deaths occurred among women who transferred antenatally from a planned home birth (69.0 per 1000 births, 95% CI 32.0-142.1), two fetal deaths among women who had never planned a home birth (25.0 per 1000 births, 95% CI 6.9-86.6), and three fetal deaths in women who were not booked for any birth place (136.4 per 1000 births, 95% CI 47.5-333.3). This is compared to a stillbirth rate of 3.12 per 1000 births (95% CI 0.55-17.49) and perinatal mortality rate of 15.62 per 1000 births (95% CI 6.69-36.05) in planned home births transferred intrapartum to a hospital.

Data on 320 actual intrapartum transfers demonstrated that nulliparous women were more likely to require intrapartum transfers for non-urgent reasons in the first stage of labour, mainly for delay in progress or for pain relief. Neonates born to women transferred for urgent reasons including fetal distress, meconium and need for fetal monitoring were more likely to experience adverse outcomes, including increased perinatal mortality that is not statistically different to the perinatal mortality among the non-urgent transfers. Women's resistance to clinical advice (in 14.1 per cent of transfers, and in 1.6 per cent of all planned home births) either at home and/or in hospital may have contributed to increased risk of adverse neonatal outcomes including perinatal mortality (44.4 per 1000, 95% CI 12.7-148.3 *vs* 10.9 per 1000, 95% CI 3.72-31.6).

The majority of 2729 women who planned home birth at term were at low risk at onset of labour. Intrapartum transfers were required by 11.8 per cent of women (n=320). Nulliparous women were transferred more frequently with annual transfer rates ranging from 6 per cent to 38 per cent compared to transfer rates of at most 11 per cent among parous women.

Epidemiological comparisons between planned home and hospital births demonstrated that home birth planned by low risk women was associated with significant reductions in obstetric interventions during labour and birth, while achieving at least comparable perinatal morbidity and mortality. Planned home birth among women not at low risk at onset of labour had higher rates of delayed progress in labour and postpartum haemorrhage. Neonates born to low risk women at onset of labour were less likely to require resuscitation and admission to special care nursery or have low Apgar scores at five minutes. Neonates born to women who were not at low risk at onset of labour had outcomes similar to those among neonates born in planned hospital births.

Twelve perinatal deaths occurred in planned home births at term in years 2002-2013, with five perinatal deaths among births at low risk at onset of labour. Perinatal mortality in planned home birth was associated with the level of obstetric risk at onset of labour (Table 1). Perinatal mortality rates among low risk planned home births were statistically similar to those observed in low risk hospital births (stillbirth: 1.45 *vs* 0.73 per 1000; neonatal death: 0.97 *vs* 0.48 per 1000; and perinatal mortality: 2.41 *vs* 1.21 per 1000, for home and hospital births respectively). Compared to planned hospital births, planned home births not at low risk at onset of labour were associated with significantly increased neonatal mortality (9.51 *vs* 0.48 per 1000) and perinatal mortality (11.08 *vs* 1.21 per 1000).

Perinatal mortality in intrapartum transfers (15.62 per 1000, 95% CI 6.69-36.05) was significantly higher than the perinatal mortality in the actual home births (2.93 per 1000, 95% CI 1.42-6.05) (p=0.009). No statistically significant differences were found between the publicly funded and private planned home birth models when comparing their respective perinatal mortality rates of 5.02 per 1000 births (95% CI 2.73-9.21) and 2.81 per 1000 births (95% CI 0.77-10.18) (p=0.743).

Perinatal mortality in planned home and hospital births decreased over time and was the lowest in the 2011-2013 triennium. The perinatal mortality rate in low risk planned hospital births was 0.71 per 1000 births, in low risk planned home births was 1.93 per 1000 births, and in planned home births not at low risk at onset of labour was 4.10 per 1000 births. The observed perinatal mortality rates overall and stratified by level of risk for each PIMC triennia are presented in Table 2. Mortality rates in planned hospital births are presented separately for each of the four obstetric risk categories, and planned home births are presented in two groups, low risk (L1) and not low risk at onset of labour (risk levels L2-4).

The neonatal and infant emergency presentations (0.5%, n=13) and hospitalisations (5.2%, n=141) in planned home births were infrequent. Among low risk women, the rates of neonatal emergency presentations and hospital admissions were lower in planned home births (emergency presentations: 2.9 *vs* 10.5 per 1000, aOR=0.39, 95%CI 0.17-0.86; hospital admissions: 49.3 *vs* 77.9 per 1000, aOR=0.69, 95%CI 0.56-0.84). Among women who planned home birth while not low risk at onset of labour, the rates of neonatal emergency presentations (11.1 *vs* 10.5 per 1000) and hospital admissions (61.8 *vs* 77.9 per 1000) did not differ from those among low risk hospital births.

Conclusions

Pregnancy outcomes in planned home birth in WA illustrate that low obstetric risk, particularly at onset of labour, is an essential eligibility criterion for home birth in accordance with the WA home birth policy (2013) and the *Australian College of Midwifery guidance for midwives regarding homebirth services* (2011). Women not at low risk at onset of labour should continue to be considered unsuitable for a planned home birth.

WA data on home births planned by parous women are well aligned with the findings and recommendations of the *Birthplace in England Study*, but suggest a far lesser disparity between the major adverse neonatal outcomes of home and hospital births planned by low risk nulliparous women. Until more data on home birth outcomes are accumulated, nulliparous women planning and considering home birth and their healthcare providers should be informed of the clinical implications of planning home birth for their first baby.

Low risk nulliparous women are more likely to require transfer of care than low risk parous women, and may be more likely to experience adverse perinatal outcomes. Healthcare providers should be aware of the evidence around the safety of home birth to ensure women who choose a planned home birth are provided information to facilitate an informed decision.

Future assessments of perinatal mortality should be limited to low risk planned hospital births. Improved reporting of intrapartum transfers will facilitate more accurate assessment of perinatal mortality in planned home birth. The ability to identify and exclude home births planned without a registered birth attendant and unplanned unattended out of hospital births will prevent an overestimation of perinatal mortality attributed to planned home birth.

Table 1. Perinatal mortality in planned hospital and home birth in years 2002-2013 reported as rate per 1000 births. Rate differences relative to low risk planned hospital birth (L1) are summarised using univariate and adjusted odds ratios (OR, aOR), together with their 95 per cent confidence intervals (95% CI). Adjustments have been made for maternal age, nulliparity, Caucasian and Indigenous ethnicity, smoking, rural, tertiary hospital, PIMC triennia, and non-cephalic presentation. Effects of nulliparity are also shown. N and (%) have been removed to suppress cells counts <5.

		Rate per 1000	95 % CI	OR (95% CI)	aOR (95% CI)
Stillbirth					
Hospital	L1	0.73	(0.60-0.89)	1.00	1.00
	L2	2.63	(2.20-3.15)	3.61 (2.75-4.73)	1.64 (1.21-2.22)
	L3	0.69	(0.54-0.88)	0.94 (0.69-1.30)	1.01 (0.73-1.39)
	L4	2.97	(2.50-3.54)	4.08 (3.12-5.33)	1.71 (1.25-2.35)
Home	L1	1.45	(0.49-4.25)	1.97 (0.63-6.24)	2.13 (0.67-6.74)
	L2-4	1.58	(0.28-8.91)	2.16 (0.30-15.51)	2.13 (0.30-15.37)
Nulliparity		1.52	(1.33-1.75)	1.29 (1.06-1.56)	1.36 (1.11-1.67)
Neonatal death					
Hospital	L1	0.48	(0.37-0.62)	1.00	1.00
	L2	1.23	(0.95-1.60)	2.52 (1.75-3.64)	1.88 (1.29-2.75)
	L3	0.33	(0.24-0.47)	0.70 (0.45-1.07)	0.62 (0.40-0.97)
	L4	1.07	(0.80-1.43)	2.19 (1.49-3.22)	1.35 (0.89-2.05)
Home	L1	0.97	(0.27-3.52)	2.01 (0.49-8.21)	2.58 (0.63-10.58)
	L2-4	9.51	(4.37-20.59)	19.92 (8.58-46.25)	23.12 (9.85-54.24)
Nulliparity		0.62	(0.50-0.77)	0.95 (0.72-1.25)	0.84 (0.62-1.14)
Perinatal mortality					
Hospital	L1	1.21	(1.03-1.42)	1.00	1.00
	L2	3.86	(3.33-4.47)	3.18 (2.56-3.95)	1.75 (1.38-2.22)
	L3	1.02	(0.84-1.25)	0.84 (0.65-1.09)	0.86 (0.66-1.11)
	L4	4.04	(3.49-4.69)	3.33 (2.68-4.14)	1.62 (1.26-2.08)
Home	L1	2.41	(1.03-5.63)	1.99 (0.82-4.85)	2.24 (0.92-5.47)
	L2-4	11.08	(5.38-22.68)	9.21 (4.30-19.72)	9.61 (4.46-20.71)
Nulliparity		2.15	(1.91-2.41)	1.17 (1.00-1.36)	1.17 (0.98-1.39)

L1-low risk at onset of labour, L2-low risk at booking and not low risk at onset of labour due to pregnancy complications, L3-not low risk at booking and no pregnancy complications, L4-not low risk at booking or at onset of labour.

Table 2. Perinatal mortality in years 2002-2013 presented by PIMC triennia. Rates in planned hospital births are shown for all four risks levels, and in planned home births for low and not low risk. Rates per 1000 and their estimated 95% confidence intervals (95% CI) are shown. N and (%) have been removed to suppress cell counts <5.

		Stillbirth		Neonatal death		Perinatal mortality	
Triennia		**Rate**	**95% CI**	**Rate**	**95% CI**	**Rate**	**95% CI**
2002-2004	Home	0.00	(0.00-8.04)	4.18	(1.15-15.13)	4.22	(1.16-15.25)
	L1	0.00	(0.00-10.01)	2.63	(0.46-14.75)	2.63	(0.46-14.75)
	L2-4	0.00	(0.00-39.26)	10.64	(1.88-57.82)	10.64	(1.88-57.82)
	Hospital	1.58	(1.30-1.91)	0.70	(0.50-0.93)	2.28	(1.94-2.67)
	L1	0.09	(0.62-1.32)	0.59	(0.37-0.95)	1.49	(1.11-2.01)
	L2	2.31	(1.60-3.34)	0.99	(0.57-1.74)	3.31	(2.43-4.50)
	L3	0.88	(0.52-1.48)	0.31	(0.13-0.74)	1.19	(0.76-1.86)
	L4	3.94	(2.85-5.45)	1.32	(0.75-2.30)	5.25	(3.96-6.95)
2005-2007	Home	3.22	(0.88-11.67)	3.23	(0.89-11.70)	6.44	(2.51-16.44)
	L1	2.11	(0.37-11.83)	0.00	(0.00-8.04)	2.11	(0.37-11.83)
	L2-4	6.85	(1.21-37.77)	13.79	(3.79-48.89)	20.55	(7.01-58.67)
	Hospital	1.30	(1.07-1.58)	0.68	(0.52-0.90)	1.98	(1.69-2.33)
	L1	0.84	(0.58-1.23)	0.28	(0.15-0.54)	1.13	(0.81-1.56)
	L2	2.10	(1.41-3.12)	1.31	(0.80-2.16)	3.41	(2.49-4.65)
	L3	0.66	(0.39-1.10)	0.61	(0.36-1.04)	1.26	(0.87-1.84)
	L4	3.25	(2.30-4.58)	1.43	(0.85-2.39)	4.67	(3.50-6.22)
2008-2010	Home	1.18	(0.21-6.65)	3.54	(1.21-10.36)	4.72	(1.84-12.07)
	L1	1.43	(0.25-8.05)	1.43	(0.25-8.06)	2.86	(0.78-10.36)
	L2-4	0.00	(0.00-25.30)	13.51	(3.71-47.93)	13.51	(3.71-47.93)
	Hospital	1.39	(1.16-1.67)	0.75	(0.59-0.97)	2.14	(1.85-2.49)
	L1	0.85	(0.59-1.22)	0.68	(0.45-1.01)	1.53	(1.16-2.00)
	L2	3.31	(2.41-4.54)	1.57	(1.00-2.49)	4.88	(3.76-6.33)
	L3	0.76	(0.48-1.18)	0.44	(0.24-0.78)	1.19	(0.84-1.70)
	L4	2.59	(1.78-3.77)	0.87	(0.46-1.65)	3.46	(2.50-4.78)
2011-2013	Home	1.31	(0.23-7.40)	1.31	(0.23- 7.41)	2.62	(0.72-9.52)
	L1	1.93	(0.34-10.85)	0.00	(0.00-7.38)	1.93	(0.34-10.85)
	L2-4	0.00	(0.00-15.50)	4.10	(0.72-22.85)	4.10	(0.72-22.85)
	Hospital	1.04	(0.85-1.28)	0.41	(0.30-0.57)	1.45	(1.22-1.73)
	L1	0.34	(0.19-0.60)	0.37	(0.21-0.64)	0.71	(0.47-1.06)
	L2	2.84	(1.99-4.05)	1.04	(0.58-1.87)	3.88	(2.86-5.26)
	L3	0.56	(0.35-0.89)	0.07	(0.00-0.24)	0.62	(0.40-0.97)
	L4	2.42	(1.73-3.40)	0.81	(0.45-1.45)	3.23	(2.41-4.33)

L1-low risk at onset of labour, L2-low risk at booking and not low risk at onset of labour due to pregnancy complications, L3-not low risk at booking and no pregnancy complications, L4-not low risk at booking or at onset of labour.

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Appendix 4 -The Perinatal Autopsy (Post-mortem)

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The Role of Perinatal Post-Mortems & Services Offered in Western Australia
"It is every parent's right to be offered a post-mortem examination of their child, and equally their right to refuse."

Perinatal post-mortem (autopsy) examination: is the examination of the body of the baby, with the aim to understand why the baby died. A post mortem examination is the only certain method of determining and recording the cause of death. It involves an external and internal examination of the deceased. Some tissue and blood samples are usually retained for laboratory analysis. Photographs and radiology are also attended to.

In Western Australia we have amongst the highest rate in the country for perinatal post-mortem examinations of around 50-55 per cent, although this figure seems to have declined a little over recent years. During the Perinatal and Infant Mortality Committee meetings the post mortem examination contributes useful information for the assessment of the causes of death.

The Guidelines for health-care professionals applicable to all perinatal deaths sent to King Edward Memorial Hospital are available from:
http://www.kemh.health.wa.gov.au/brochures/health_professionals/wnhs0074.pdf

Is the autopsy still useful?
The post-mortem examination significantly affects the overall understanding of the cause of a perinatal death. Recent publications of the usefulness of post mortem examinations have shown that in between 30 and 50 per cent of cases significant information is gained, and this leads to a classification being determined and/or to a change of classification in around 20 per cent of cases.

Some publications have examined whether the post-mortem examination is still useful or can be supplanted by other investigations such as MRI scans. The overwhelming consensus is that the full post-mortem examination still provides more information than available from other techniques (although the MRI may be useful for some neurological conditions).

Some studies have also shown that in general parents are more likely to express regret at not having an autopsy than to express regret at having an autopsy on their baby. Many wish to understand as much as possible why the tragedy occurred.

Coronial autopsies.

Under the *Coroners Act (1996)* a death is reportable to the Coroner if the death is unexpected, unnatural or violent, or occurs in other prescribed circumstances (eg under anaesthesia, is a maternal death). The aim is to determine the cause of death. Under this Act, reportable deaths must be reported to a coroner (see *Coroners Act 1996*); and the coroner may request an autopsy. It is worth discussing any case with the Office of the State Coroner (contact details are on the Death in Hospital Form) if there is any doubt about whether the death is reportable or not.

These autopsies do not require consent from next-of-kin, although there are legal means for the parents to object to the examination. The coronial post-mortem examination takes place usually at the state mortuary on the Queen Elizabeth site with the coroner's pathologists, although for perinatal deaths it is common for the post-mortem examination to be conducted at KEMH (potentially, to be conducted at Perth Children's Hospital) with specialist Paediatric Perinatal Pathologists in collaboration with the state coroner's pathologists, and may include medical photographs and radiology

Non -coronial, consented autopsies

Most perinatal autopsies are performed at KEMH by a specialist perinatal/paediatric pathologist. Cases are transferred from all over the state and, when requested, returned usually within two to three working days. The Perinatal Pathology technician is available for advice including what forms are required, what information is required on forms, transport system and logistics and other information.

Perinatal Pathology will collect mementoes of every baby/fetus that is in Perinatal Pathology. This includes mementoes such as hand/footprints and social photographs. With parental consent, stillborn babies less than 28 weeks gestation can be cremated, with individual ashes. Contact details for Perinatal Pathology: (6458 2730).

The autopsy - full or limited?

The autopsy involves examination of the body, external and internal, including cranial contents, the abdomen and the thorax. The placenta is a particularly important part of any perinatal examination. Some parents will ask for a limited post-mortem where only a particular system is examined.

Some parents consent to an external examination, where no incisions are made, and the baby is not examined internally. This includes visual examination, weight, measurements of external growth parameters, radiology, photographs and examination of the placenta.

No whole major organ is retained (i.e. brain, heart, lungs, liver or kidneys) without specific consent. In cases of abnormal Central Nervous System development or a complicated cardiac defect, it is useful to obtain consent for retention for a better examination.

Unless there is an objection, small pieces of the major organs are routinely taken for histology. Small samples may be taken for other investigations (e.g. microbiological, metabolic, cytogenetic, PCR, etc.) as appropriate.

The Consent for Autopsy (non-coronial)

The current law in WA with the recent rules of practice means that the consent form is detailed, covering the full or limited examination, clearly indicating parents' wishes. If an organ is to be retained there needs to be a plan if there is to be a delay in burial of the body, allowing the return (usually a week or so) of the organ. The organ can be cremated and returned, or donated for research or teaching. There are places to indicate consent for tissue to be retained for teaching or research.

The consent form must be signed by a parent. The referring clinician (doctor, midwife, nurse or other) can provide clinical information and witness the consent signature. The human tissue act officer for the institution needs to sign that there is satisfactory evidence of parental consent, and the post mortem coordinator also signs the form.

The Autopsy Report (non-coronial)

A written report listing the provisional anatomic diagnosis is available within two working days, and a full report including ancillary investigations, and conclusions usually within 2-6 weeks. A plain language report can be issued to be given to the parents after discussion with the clinician.

Interpreting the autopsy report
The pathophysiology of perinatal death is complicated and much research is needed in this area. The best way to investigate a perinatal death undoubtedly involves a review of all the clinical investigations, together with the pathology reports. Often the autopsy finds a complete explanation of the cause of death, but frequently there is only a partial explanation, such as unexpected growth restriction, or placental abnormality.

There are also a number of cases where, to the frustration of all concerned, no significant abnormalities are identified at autopsy. Recently diseases such as obstetric cholestasis are being recognised, with a high incidence of stillbirth at term, with no post mortem features. The post mortem examination is not good at detecting transient physiological mechanisms. The purpose of the autopsy is to exclude many potential recurrent conditions.

Other forms (babies 20 weeks gestation and greater)

BDM 201 Medical Certificate for Stillbirth or Neonatal Death
Form 7 Cremation Form
BDM Birth Registration Form Consent for Cremation . Stillborn < 28 weeks gestation

The Perinatal Loss Service
KEMH has a multidisciplinary Perinatal Loss Service , consisting of a fetal medicine specialist, neonatologist, pathologist, specialist midwife, social worker, psychologist and chaplain. The aim is to support and counsel parents, investigate if appropriate using protocols, and to provide consultancy, guidance and advice for health professionals. Telehealth facilities are sometimes used for rural hospital links. The contact person is Clinical Midwife Consultant: 6458 2222 pager 3430, or phone 0416 019 020). Perinatal Loss Clinic is available for appointments, referral is required.

Concluding comments
Information and Support

Statewide Obstetric Support Unit: eLearning package available at:
http://kemh.health.wa.gov.au/services/SOSU/elearning.php

Perinatal Society of Australia and New Zealand (PSANZ) guidelines
Perinatal Pathology guidelines. https://psanz.com.au/guidelines/

We are grateful to the health professionals who have spent their time counselling parents to obtain consent and provide feedback, to allow this service to work.

Appendix 5. What to do when there is a stillbirth or infant death

1. Make detailed legible notes about the event.
2. Carefully examine the infant and placenta.

   Document relevant “positive and negative” findings.

   Ensure that relevant investigations (as below) are instigated.
3. Notify the Chief Health Officer, preferably by sending a copy of the Death Certificate to: edphwa@health.wa.gov.au or by mail to

   Medical and Regulatory Support
   Office of the Chief Health Officer

   Public and Aboriginal Health Division
   Department of Health
   PO Box 8172
   Perth Business Centre WA 6849
4. Notify the Coroner if required:

   Extract from the Coroners Act 1996:

   *A “**reportable death**” means a Western Australian death –*

   (a) that appears to have been unexpected, unnatural or violent or to have resulted, directly or indirectly, from injury; or

   (b) that occurs during an anaesthetic; or

   (c) that occurs as a result of an anaesthetic and is not due to natural causes; or

   (d) that occurs in prescribed circumstances; or

   (e) of a person who immediately before death was a person held in care; or

   (f) that appears to have been caused or contributed to while the person was held in care; or

   (g) that appears to have been caused or contributed to by any action of a member of the Police Force; or

   (h) of a person whose identity is unknown; or

   (i) that occurs in Western Australia where the cause of death has not been certified under section 44 of the Births, Deaths and Marriages Registration Act 1998; or

   (j) that occurred outside Western Australia where the cause of death is not certified to by a person who, under the law in force in that place, is a legally qualified medical practitioner.

5. Refer to Guidelines for the arrangement of appropriate investigations.

In particular, encourage the parents to consent to post mortem examination. There are options for full and modified (such as external examination only) post-mortem examinations.

Take microbiological swabs of the placenta prior to transfer. Do not put the baby or placenta in formalin.

Multi-lingual information brochures and consent forms may be obtained online:

http://www.health.wa.gov.au/postmortem/

6. “De-brief” for staff involved in the case.

   This will depend on the hospital involved. Where possible, it is preferable for hospitals to review cases with poor outcomes, to provide emotional support for involved staff and to reflect on any useful learning experience that may have come from the event.

7. Counselling for the parents and follow up appointment and contacts are given.
8. Mementos such as photos and footprints are suggested.
9. Notify the General Practitioner, Child Health Nurse, and/or other relevant care providers.
10. Complete Death Certificates (and Cremation Certificates where required).
11. Consider professional counselling for oneself.

Appendix 6 - Supplementary tables

Table 13a: Perinatal mortality in Australia 2011-2013, by state*

State	Total births	Live births	Stillbirths		Neonatal mortality		Perinatal mortality	
	N	N	N	Rate (95% CI) per 1000 births	N	Rate (95% CI) per 1000 live birth	N	Rate (95% CI) per 1000 births
Western Australia	100470	99754	716	7.1 (6.6-7.7)	170	1.7 (1.5-2.0)	886	8.8 (8.3-9.4)
New South Wales	259902	291922	1 884	7.2 (6.9-7.6)	669	2.3 (2.1-2.5)	2 553	9.8 (9.5-10.2)
Victoria	230650	228487	2 010	8.7 (8.3-9.1)	603	2.6 (2.4-2.9)	2 613	11.3 (10.9-11.8)
Queensland	222843	187762	1 270	5.7 (5.4-6.0)	573	3.1 (2.8-3.3)	1 843	8.3 (7.9-8.7)
South Australia	61273	60847	426	7.0 (6.3-7.6)	135	2.2 (1.9-2.6)	561	9.2 (8.4-9.9)
Tasmania	18284	18163	121	6.6 (5.5-7.9)	54	3.0 (2.3-3.9)	175	9.6 (8.3-11.1)
Australian Capital Territory	18012	17875	137	7.6 (6.4-9.0)	52	2.9 (2.2-3.8)	189	10.5 (9.1-12.1)
Northern Territory	12018	11 916	102	8.5 (7.0-0.3)	60	5.0 (3.9-6.5)	162	13.5 (11.6-15.7)
	-	-	-				-	
Australia	**923452**	**916726**	**6666**	**7.2 (7.0-7.4)**	**1579**	**1.7 (1.6-1.8)**	**8245**	**8.9 (8.7-9.1)**

* Source: Australia's mothers and babies reports 2011-2013

Table 14a: Infant mortality in Australia by state, 2011-2013

State	Live births	Infant deaths	
	N	N	Rate (95% CI) per 1000 live birth
Western Australia	99754	245	2.5 (2.2-2.8)
New South Wales	291922	1029	3.5 (3.3-3.7)
Victoria	228487	608	2.7 (2.5-2.9)
Queensland	187762	842	4.5 (4.2-4.8)
South Australia	60847	175	2.9 (2.5-3.3)
Tasmania	18163	28	1.5 (1.1-2.2)
Australian Capital Territory	17875	39	2.2 (1.6-3.0)
Northern Territory	11916	16	1.3 (0.8-2.2)
Australia	916726	1124	1.2 (1.2-1.3)

* Source: Australian Bureau of Statistics and Australia's mothers and babies reports 2011-2013

Table 15a: Number of stillbirths, neonatal deaths and postneonatal deaths in Western Australia by triennium, 1990-2013.

	Total births	Livebirths	Stillbirths	Neonatal deaths	Post-neonatal deaths
1990-1992	76352	75818	534	299	223
1993-1995	76207	75653	554	248	157
1996-1998	76528	75994	534	233	153
1999-2001	75939	75387	552	215	124
2002-2004	74992	74445	546	166	94
2005-2007	85717	85119	598	195	115
2008-2010	93159	92481	678	204	116
2011-2013	100460	99744	716	171	91

Table 16a: Rates of perinatal and infant mortality in Western Australia by triennium, 1990-2013

Triennium	Stillbirths	Neonatal mortality	Postneonatal mortality	Perinatal mortality	Infant mortality
	Rate (95% CI) per 1000 births	Rate (95% CI) per 1000 live births	Rate (95% CI) per 1000 live births	Rate (95% CI) per 1000 births	Rate (95% CI) per 1000 live births
1990 - 1992	7.0 (6.4-7.6)	3.9 (3.5-4.4)	2.9 (2.6-3.4)	10.9 (10.2-11.7)	6.9 (6.3-7.5)
1993 - 1995	7.3 (6.7-7.9)	3.3 (2.9-3.7)	2.1 (1.8-2.4)	10.5 (9.8-11.3)	5.4(4.9-5.9)
1996 - 1998	7.0 (6.4-7.6)	3.1 (2.7-3.5)	2.0 (1.7-2.4)	10.0 (9.3-10.8)	5.1(4.6-5.6)
1999 - 2001	7.3 (6.7-7.9)	2.9 (2.5-3.3)	1.6 (1.4-2.0)	10.1 (9.4-10.8)	4.5(4.0 – 5.0)
2002 - 2004	7.3 (6.7-7.9)	2.2 (1.9-2.6)	1.3 (1.0-1.5)	9.5 (8.8-10.2)	3.5 (3.1-3.9)
2005 - 2007	7.0 (6.4-7.6)	2.3 (2.0-2.6)	1.4(1.1-1.6)	9.3 (8.6 – 9.9)	3.6 (3.3-4.1)
2008 - 2010	7.3 (6.8-7.8)	2.2 (1.9-2.5)	1.3 (1.0-1.5)	9.5 (8.9-10.1)	3.5 (3.1-3.9)
2011 - 2013	7.1 (6.6-7.7)	1.7 (1.5-2.0)	0.9 (0.7-1.1)	8.8 (8.3-9.4)	2.6 (2.3-3.0)

Table 17a: Number of stillbirths, neonatal deaths and postneonatal deaths in Western Australia by triennium, 1990-2013, in the Aboriginal population

	Total births	Live births	Stillbirths	Neonatal	Post-neonatal
1990-1992	4479	4418	61	41	52
1993-1995	4375	4312	63	34	50
1996-1998	4548	4480	68	30	38
1999-2001	4889	4822	67	43	36
2002-2004	4796	4727	69	35	25
2005-2007	5357	5287	70	33	32
2008-2010	5204	5134	70	37	24
2011-2013	5154	5069	85	27	18

Table 18a: Rates of perinatal and infant mortality in Western Australia by triennium, 1990-2013, in the Aboriginal population

Triennium	Stillbirths	Neonatal mortality	Postneonatal mortality	Perinatal mortality	Infant mortality
	Rate (95% CI) per 1000 births	Rate (95% CI) per 1000 live births	Rate (95% CI) per 1000 live births	Rate (95% CI) per 1000 births	Rate (95% CI) per 1000 live births
1990 - 1992	13.6 (10.6-17.5)	9.3 (6.8-12.6)	11.8 (9.0-15.4)	22.8 (18.8-27.6)	21.1 (17.2-25.7)
1993 - 1995	14.4 (11.3-18.4)	7.9 (5.6-11.0)	11.6 (8.8-15.3)	22.2 (18.2-27.0)	19.5 (15.8-24.1)
1996 - 1998	15.0 (11.8-18.9)	6.7 (4.7-9.5)	8.5 (6.2-11.6)	21.5 (17.7-26.2)	15.2 (12.0-19.2)
1999 - 2001	13.7 (10.8-17.4)	8.9 (6.6-12.0)	7.5 (5.4-10.3)	22.5 (18.7-27.0)	16.4 (13.2-20.4)
2002 - 2004	14.4 (11.4-18.2)	7.4 (5.3-10.3)	5.3 (3.6-7.8)	21.7 (17.9-26.2)	12.7 (9.9-16.3)
2005 - 2007	13.1 (10.4-16.5)	6.2 (4.4-8.8)	6.1 (4.3-8.5)	19.2 (15.9-23.3)	12.3 (9.7-15.6)
2007 - 2010	13.5 (10.7-17.0)	7.2 (5.2-9.9)	4.7 (3.1-6.9)	20.6 (17.0-24.8)	11.9 (9.3-15.2)
2011 - 2013	16.5 (13.4-20.3)	5.3 (3.7-7.7)	3.6 (2.2-5.6)	21.7 (18.1-26.1)	8.9 (6.6-11.9)

Table 19a: Stillbirths, neonatal deaths and post neonatal deaths by maternal characteristics, Western Australia, 2011-2013

Risk factor	Total births	Live births	Stillbirths		Neonatal		Postneonatal	
	N	**N**	**N**	**Rate per 1,000 births (95% CI)**	**N**	**Rate per 1,000 live births (95% CI)**	**N**	**Rate per 1,000 live births (95% CI)**
MATERNAL AGE <20	3976	3940	36	9.1 (6.3-12.5)	19	4.8 (2.9-7.5)	6	1.5 (0.6-3.3)
20-24	14757	14636	121	8.2 (6.8-9.8)	32	2.2 (1.5-3.1)	23	1.6 (1.0-2.4)
25-29	28561	28374	187	6.5 (5.6-7.6)	48	1.7 (1.3-2.2)	27	1.0 (0.7-1.4)
30-34	32346	32135	211	6.5 (5.7-7.5)	46	1.4 (1.0-1.9)	17	0.5 (0.3-0.8)
35-39	16870	16753	117	6.9 (5.8-8.3)	20	1.2 (0.7-1.8)	12	0.7 (0.4-1.3)
≥40	3950	3906	44	11.1 (8.3-14.9)	6	1.5 (0.6-3.3)	6	1.5 (0.6-3.3)
ETHNICITY Caucasian	73650	73214	436	5.9 (5.4-6.5)	99	1.4 (1.1-1.6)	57	0.8 (0.6-1.0)
Aboriginal	5154	5069	85	16.5 (13.4-20.3)	27	5.3 (3.7-7.7)	18	3.6 (2.2-5.6)
Other	21656	21460	195	9.0 (7.8-10.4)	45	2.1 (1.6-2.8)	16	0.7 (0.5-1.2)
PARITY Primipara	31477	32247	230	7.3 (6.4-8.3)	55	1.8 (1.3 -2.2)	22	0.7 (0.4-1.1)
Multipara	68983	68497	486	7.0 (6.4-7.7)	116	1.7 (1.4- 2.0)	69	1.0 (0.8-1.3)
SMOKING yes	11507	11384	123	10.7 (9.0-12.7)	37	3.3 (2.3-4.5)	33	2.9 (2.0-4.1)
No	88953	88360	593	6.7 (6.2-7.2)	134	1.5 (1.3-1.8)	58	0.7 (0.5-0.8)
PLURALITY Singletons	97671	97024	647	6.6 (6.1-7.2)	153	1.6 (1.3-1.8)	86	0.9 (0.7-1.1)
Twins	2738	2669	69	25.2 (20.0-31.8)	18	6.7 (4.3-10.6)	5	1.9 (0.8-4.4)

Table 20a: Stillbirths, neonatal deaths and post neonatal deaths by maternal socioeconomic status and health region Western Australia, 2011-2013

Antecedent	Total births	Live births	Stillbirths		Neonatal		Postneonatal	
	N	N	N	Rate per 1,000 births 95% CI)	N	Rate per 1,000 live births (95% CI)	N	Rate per 1,000 live births (95% CI)
SOCIO-ECONOMIC STATUS 1 (most deprived)	19242	19079	163	8.5 (7.3-9.9)	43	2.3 (1.7-3.0)	21	1.1 (0.7-1.7)
2	17705	17586	119	6.7 (5.6-8.0)	31	1.8 (1.2-2.5)	25	1.4 (1.0-2.1)
3	21677	21514	163	7.5 (6.5-8.8)	45	2.1 (1.6-2.8)	21	1.0 (0.6-1.5)
4	24578	24424	154	6.3 (5.4-7.3)	36	1.5 (1.1-2.0)	13	0.5 (0.3-0.9)
5 (least deprived)	16644	16536	108	6.5 (5.4-7.8)	16	1.0 (0.6-1.6)	10	0.6 (0.3-1.1)
REGION North Metro	27092	26931	161	5.9 (5.1-6.9)	32	1.2 (0.8-1.7)	26	1.0 (0.6-1.4)
South Metro	23673	23496	177	7.5 (6.5-8.7)	34	1.4 (1.0-2.0)	17	0.7 (0.4-1.2)
East Metro	27676	27478	198	7.2 (6.2-8.2)	57	2.1 (1.6-2.7)	19	0.7 (0.4-1.1)
Kimberley	2063	2037	26	12.6 (8.6-18.4)	10	4.9 (2.4-9.0)	3	1.5 (0.3-4.3)
Pilbara	2622	2605	17	6.5 (4.1-10.4)	8	3.1 (1.3-6.0)	4	1.5 (0.4-3.9)
Midwest	2752	2725	27	9.8 (6.8-14.2)	8	2.9 (1.3-5.8)	4	1.5 (0.4-3.8)
Wheatbelt	2823	2797	26	9.2 (6.3-13.5)	5	1.8 (0.6-4.2)	3	1.1 (0.2-3.1)
Goldfields	2908	2890	18	6.2 (3.9-9.8)	5	1.7 (0.6-4.0)	5	1.7 (0.6-4.0)
Great Southern	2167	2149	18	8.3 (5.3-13.1)	2	0.9 (0.1-3.4)	1	0.5 (0.0-2.6)
South West	6489	6448	41	6.3 (4.7-8.6)	10	1.6 (0.7-2.9)	9	1.4 (0.6-2.6)
Metro	78441	77905	536	6.8 (6.3-7.4)	123	1.6 (1.3-1.9)	62	0.8 (0.6-1.0)
WACHS	21824	21651	173	7.9 (6.8-9.2)	48	2.2 (1.6-2.9)	29	1.3 (0.9-1.9)

[1] Includes 195 births for which it was not possible to assign a health region as the mother's usual residency was outside of WA or not recorded; and 614 births for which it was not possible to assign socio-economic status.
[2] Includes 188 livebirths for which it was not possible to assign a health region as the mother's usual residency was outside of WA or not recorded; and 605 live births for which it was not possible to assign socio-economic status.

Table 21a: Stillbirths, neonatal deaths by planned place of birth, Western Australia, 2011-2013

Risk factor	Total births	Live births	Stillbirths		Neonatal	
	N	N	N	Rate per 1,000 births (95% CI)	N	Rate per 1,000 live birth (95% CI)
PLANNED PLACE OF BIRTH	816	815	1	1.2 (0.0-6.8)	1	1.2 (0.0-6.8)
Homebirth Planned[1]						
Unbooked[2]	222	207	15	67.6 (38.3-109.0)	8	38.6 (16.8-74.7)
Hospital Planned[3]	99422	98722	700	7.0 (6.5-7.6)	162	1.6 (1.4-1.9)

[1]Hospital (includes non-maternity site and clinics)
[2]It includes planned homebirths with the Community Midwifery Program and with privately funded midwives. It also includes intended homebirths that were transferred to hospitals;
[3]Unbooked hospital births are not planned homebirths, and include women who perhaps had no antenatal care, unacknowledged/undiagnosed pregnancy, and arrived at hospital in labour or following birth en route or unexpected, unplanned at home.

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