Maternal Ethnicity, Stillbirth and Neonatal Death Risk in Western Australia 1998-2010

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Abstract

This study investigated the scale of difference in stillbirth and neonatal death rates in Western Australia (1998-2010) by maternal ethnicity. Aboriginal and/or Torres Strait Islander (Indigenous) mothers, African mothers and mothers from ‘Other’ ethnic backgrounds were found to have increased risk of stillbirth compared with Caucasian mothers. Babies of Indigenous mothers also had increased risk of neonatal death. The gap between the stillbirth and neonatal death rates for Indigenous mothers and non-Indigenous mothers did not close over the study period.
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Introduction

Marked improvements in the perinatal death rate (stillbirths and neonatal deaths within 28 days of birth) in high-income countries during the 20th century have been followed by continued improvements in the neonatal death rate and more modest (mostly for pregnancies of 28+ weeks gestation) or no improvement in the stillbirth rate in the last two decades.\textsuperscript{1-3} However, significant ethnic disparities remain, with Indigenous and migrant populations (particularly those from Africa and South Asia) among those at greatest risk.\textsuperscript{4-12} These disparities are thought to reflect differences in a range of factors including the social determinants of health, life course stress, institutionalised and interpersonal discrimination, preconception health, perinatal care, and preterm birth.\textsuperscript{6,7}

The Australian literature has consistently identified that Indigenous (Aboriginal and/or Torres Strait Islander) mothers are at a higher risk for stillbirth than non-Indigenous mothers.\textsuperscript{13} While that trend has persisted,\textsuperscript{14,15} the latest available research suggests that the gaps in mortality rates between Indigenous and non-Indigenous populations is closing in some jurisdictions. For example, there was a 57.3\% reduction in the stillbirth disparity in Queensland between 1995 and 2011.\textsuperscript{16}

The Western Australian data paints a contrasting picture of stillbirth and neonatal death rate disparities. Between 1980 and 1998, the Western Australian stillbirth rate (for births of 400g birthweight or more) for Indigenous mothers (13.7 per 1,000 births) was more than twice that for non-Indigenous mothers (6.2 per 1,000 births) with the gap tending to increase over time.\textsuperscript{17} Subsequent Western Australian research found no significant change in the stillbirth rate (for births of 20+ weeks
gestation or 400g birthweight or more) between 1984-93 and 1994-2003 for Indigenous mothers (15.8 and 15.7 per 1,000 births respectively) or for Caucasian mothers (7.0 and 6.6 per 1,000 births respectively). In contrast, while the neonatal death rate in Western Australia between 1980 and 1998 for Indigenous mothers (9.4 per 1,000 births) was more than twice that for non-Indigenous mothers (4.0 per 1,000 births) the gap slightly closed over the period with the rate for Indigenous mothers decreasing by 6.3% per annum and the rate for non-Indigenous mothers decreasing by 4.5% per annum. More recent Western Australian research found that the neonatal death rate for Caucasian mothers significantly decreased between 1984-93 and 1994-2003 (4.3 and 2.4 per thousand livebirths respectively) whereas the neonatal death rate for Indigenous mothers did not significantly decrease (9.1 and 7.5 per thousand livebirths respectively).

While the relative risks in Indigenous populations have been a feature of perinatal mortality reporting in Western Australia in recent years, few studies have focussed on other ethnic groups. This partly reflects that maternal ethnicity categories beyond Caucasian and Indigenous were not systematically recorded prior to 1998. The current study sought to fill this gap in our understanding, and aimed to (1) investigate relative stillbirth and neonatal death risks between ethnic groups (Caucasian, Indigenous Australian, Asian, Indian, African, and Maori) including any differences by gestational age, and (2) investigate whether the gap between the stillbirth and neonatal death rates for singleton births to Indigenous and non-Indigenous mothers has widened or closed between 1998 and 2010.

**Materials and Methods**

This retrospective cohort study included all singleton births with a gestation of 20 weeks or more in Western Australia between 1998 and 2010, inclusive. Study data
were primarily sourced from core population health datasets held by the Data Linkage Branch of the Western Australian Government Department of Health (DLB)—including the Midwives’ Notification System (MNS) and the Birth Registration and Death Registration datasets (from the Western Australian Registry of Births, Deaths and Marriages). Information on birth outcomes (birth status, gestational age) was sourced from the MNS and Births Registration datasets. The MNS records the circumstances of all births of 20 weeks or more gestation, with information received from attending midwives. The Death Registration dataset was used to identify in-scope children that had died.

These data were linked together by the DLB by probabilistic linkage using common identifiers including name, address and birthdate. Multiple linkage passes are conducted in order to minimise both false-positive and false-negative errors along with clerical review to resolve doubtful links. The procedures used in the extraction of data from the WA Data Linkage System (WADLS) have been internationally accepted as best practice. The MNS record was used as the initial master file and data linked across datasets. Only de-identified data files were extracted (for each dataset) by the DLB and provided to the researchers. We then merged the datasets using a linkage key. This research was granted ethics approval by the University of Western Australia Human Research Ethics Committee, the Western Australian Department of Health Human Research Ethics Committee, and the Western Australian Aboriginal Health Ethics Committee.

Stillbirths were identified using the birth status variable on both the MNS and Death Registration datasets. Neonatal deaths were identified using the information available in the Death Registration dataset in combination with the date of birth data.
from the MNS. Discrepancies between the birth status reported in the MNS and the age at death variables from Death Registrations were resolved via consideration of all information from these variables plus the cause of death codes and associated text fields (because of its greater proximity to the actual birth, the information from the MNS was given priority in ambiguous cases). The level of mother’s relative geographic isolation was assessed using the Accessibility/Remoteness Index of Australia. Maternal ethnicity was sourced from the MNS. Maternal self report of ethnic origin categorised by the midwife into the categories of Caucasian, Aboriginal and/or Torres Strait Islander (Indigenous Australian), Asian (including Chinese, Japanese, Vietnamese, Cambodian and other South-East Asian origins), Indian (Indian subcontinent), African, Polynesian and Maori. The number of births to Polynesian women was very small and, accordingly, the maternal ethnicity of these cases was recoded as ‘Other’.22

Gestational age groupings were constructed consistent with World Health Organization guidelines. Extremely preterm birth was defined as between 20 and 27 weeks gestation (inclusive), very preterm as 28 to 31 weeks, moderate to late preterm as 32 to 36 weeks, and term as 37 or more weeks. The stillbirth rate was calculated as the number of stillbirths divided by the number of births in that particular gestational age range multiplied by one thousand. The neonatal death rate was calculated as the number of neonatal deaths divided by the number of livebirths in that particular gestational age range multiplied by one thousand. Trends over time were analysed using linear regression and logistic regression was used to assess differences in stillbirth and neonatal death risk by maternal ethnicity.
Results

For the 1998-2010 period there were a total of 344,538 singleton births (176,024 male, 168,502 female, 12 undetermined gender) with gestations of 20 weeks or more, including 2,303 stillbirths (6.7 stillbirths per 1,000 births) and 697 neonatal deaths (babies aged 0-27 days; 2.0 neonatal deaths per 1,000 livebirths). Descriptive statistics by maternal ethnicity and gestational age are presented in Table 1. The proportion of births to Caucasian mothers fell significantly across time \((p < .01)\) from 86.1% in 1998 to 77.1% in 2010 as did the proportion of births to Indigenous mothers \((p < .02)\) from 6.0% in 1998 to 5.5% in 2010. In contrast, the proportion of births to Asian, Indian, African, Maori and ‘Other’ ethnicities significantly increased \((all p’s < .01)\) over time.

When compared with the stillbirth rate for Caucasian mothers, African mothers had a 119% increased risk \((p < .01)\), Indigenous mothers had a 116% increased risk \((p < .01)\), and mothers from ‘Other’ ethnicities had a 63% increased risk \((p < .01)\). For Indigenous mothers this increased risk appears to be driven by an increased risk at term (with decreased risk at extremely preterm) and African mothers by increased risk at moderate to late preterm and term (see Table 1). The risk of stillbirth for Asian, Indian and Maori mothers were not significantly different from that for Caucasian mothers.

In comparison to the neonatal death rate for Caucasian mothers, Indigenous mothers had a 246% increased risk \((p < .01)\) and this increased risk appears to be driven by increased risk at all gestational age ranges except very preterm (see Table 1). The risk of neonatal death for Asian, Indian, African, Maori mothers and mothers from ‘Other’ ethnicities were not significantly different from that for Caucasian mothers.

Compared to the stillbirth rate for all non-Indigenous mothers, Indigenous mothers had a 108% increased risk of stillbirth \((p < .01)\), and the gap did not
significantly close ($p = .90$) between 1998 and 2010 (see Figure 1). Similarly, when compared to the neonatal death rate for non-Indigenous mothers, Indigenous mothers had a 237% increased risk of neonatal death ($p < .01$) and the gap did not significantly close ($p = .29$) over the study period (see Figure 1).

**Discussion**

The study has confirmed that differences in stillbirth and neonatal death rates apply to some but not all ethnic groups. In Western Australia between 1998 and 2010, Indigenous mothers were (uniquely) at an increased risk for both stillbirth and neonatal death, while African mothers and mothers from ‘Other’ ethnic backgrounds had a significantly increased risk of stillbirth compared with Caucasian mothers. These gaps are likely the result of a complex mix of factors, including differential access to quality perinatal care, and the social, economic and environmental processes that lead to differences in preconception health and pose risks to intra-uterine growth and preterm birth.\textsuperscript{6, 7} Differences between the findings of the current study and previous research (e.g., no increased risk for South Asian/Indian mothers in the current study) are possibly due to the fact that previous research focussed on the mother’s country of birth in contrast to maternal ethnic origin in the current study.

The gap in the stillbirth rates for Indigenous mothers and non-Indigenous mothers in the present study is higher than that found at the national level in 2013 whereas the gap in the neonatal death rates in the present study is roughly equivalent to that found at the national level in 2013.\textsuperscript{23} Indeed, the gap between the stillbirth and neonatal death rates for Indigenous mothers and non-Indigenous mothers in Western Australia did not close between 1998 and 2010. These results are surprising, given the substantial reductions in inequalities in (1) the stillbirth rate in other Australian
jurisdictions in recent years, and (2) broader indices of child mortality across Australia in the last decade. We plan to use linked administrative data to further investigate the factors responsible for the ongoing ethnic disparities in stillbirth and neonatal death rates including those identified in previous research (maternal conditions, perinatal infection, spontaneous preterm birth, hypertension, fetal growth restriction and antepartum haemorrhage).

Fig. 1. Stillbirth and neonatal death rates by maternal Indigenous status
References


### Table 1. Descriptive statistics by maternal ethnicity and gestational age

<table>
<thead>
<tr>
<th>Maternal Ethnicity</th>
<th>All Births</th>
<th>Extremely preterm</th>
<th>Very preterm</th>
<th>Moderate to late preterm</th>
<th>Term</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Births (%)</td>
<td>Stillbirths (rate)</td>
<td>Neonatal deaths (rate)</td>
<td>Births (%)</td>
<td>Stillbirths (rate)</td>
</tr>
<tr>
<td>Indigenous</td>
<td>21,249 (6.2%)</td>
<td>275 (12.9)b</td>
<td>126 (6.0)b</td>
<td>369 (1.7%)</td>
<td>159 (430.9)ab</td>
</tr>
<tr>
<td>Non-Indigenous</td>
<td>323,289 (93.8%)</td>
<td>2,028 (6.3)</td>
<td>571 (1.8)</td>
<td>2,115 (0.7%)</td>
<td>1,172 (554.1)</td>
</tr>
<tr>
<td>Caucasian</td>
<td>284,261 (82.5%)</td>
<td>1,718 (6.0)</td>
<td>490 (1.7)</td>
<td>1,782 (0.6%)</td>
<td>975 (547.1)</td>
</tr>
<tr>
<td>Asian</td>
<td>19,111 (5.5%)</td>
<td>126 (6.6)</td>
<td>33 (1.7)</td>
<td>128 (0.7%)</td>
<td>79 (617.2)</td>
</tr>
<tr>
<td>Indian</td>
<td>3,518 (1.0%)</td>
<td>22 (6.3)</td>
<td>10 (2.9)</td>
<td>26 (0.7%)</td>
<td>13 (500.0)</td>
</tr>
<tr>
<td>African</td>
<td>2,973 (0.9%)</td>
<td>39 (13.1)b</td>
<td>8 (2.7)</td>
<td>40 (1.3%)</td>
<td>21 (525.0)</td>
</tr>
<tr>
<td>Maori</td>
<td>2,820 (0.8%)</td>
<td>17 (6.7)</td>
<td>7 (2.5)</td>
<td>25 (0.9%)</td>
<td>11 (440.0)</td>
</tr>
<tr>
<td>“Other”</td>
<td>10,606 (3.1%)</td>
<td>104 (9.8)b</td>
<td>23 (1.7)</td>
<td>114 (1.1%)</td>
<td>73 (640.4)</td>
</tr>
<tr>
<td>Total</td>
<td>344,538 (100.0%)</td>
<td>2,303 (6.7)</td>
<td>697 (2.0)</td>
<td>2,484 (100.0%)</td>
<td>1,331 (535.8)</td>
</tr>
</tbody>
</table>

N = 344,538, a significantly different (p < .05) from non-Indigenous, b significantly different (p < .05) from Caucasian, c rate suppressed due to small cell size
Note: cells with n < 5 are suppressed for privacy reasons.