




ORIGINAL ARTICLE

Maternal and neonatal health outcomes for First Nations Australian women and children: A retrospective cohort study in a Western Sydney metropolitan tertiary referral centre

Kathryn Garsia,¹ Anthony Liu ,² Gary Low,^{3,4} Sowmya Gandham,¹ Martin Wensing,¹ Linnette Ocariza,¹ Rachel Scobie,⁵ Alison Poulton ² and Habib Bhurawala ^{1,4,6}

¹Nepean Hospital, ³Research Operations, Nepean Blue Mountains Local Health District, ⁵Aboriginal Health Unit, Nepean Hospital, Penrith, ²Paediatrics, Faculty of Medicine and Health, ⁴Nepean Clinical School, Faculty of Medicine and Health, University of Sydney and ⁶University of Notre Dame Australia, Sydney, New South Wales, Australia

Aim: To analyse key pregnancy and birth outcomes for First Nations women and children at a Western Sydney metropolitan tertiary referral centre.

Methods: The birth and health-determining characteristics of 470 First Nations infants born at Nepean Hospital in 2018 and their mothers were included in a retrospective audit and compared with a contemporaneous control group of 470 infants and their mothers.

Results: Mothers of First Nations infants had significantly higher rates of socioeconomic disadvantage ($P < 0.001$), psychosocial vulnerability ($P < 0.007$), mental illness ($P < 0.001$), teenage pregnancy ($P < 0.001$), smoking (45.6% vs. 19.4%, $P < 0.001$) and drug and alcohol use than control mothers ($P < 0.001$, $P < 0.048$). First Nations peoples did not have increased rates of maternal morbidity, nor any difference in rates of Caesarean section, resuscitation at birth, NICU admission, preterm birth or low birth weight in multivariable analysis. However, multivariable analysis demonstrated significant associations between low birth weight and maternal smoking ($P < 0.001$), hypertension ($P < 0.01$) and drug use ($P < 0.01$).

Conclusions: Despite challenges facing First Nations mothers and infants, our study found no significant difference in maternal morbidity nor adverse birth outcomes for First Nations infants. The study occurred in the context of culturally specific, First Nations-led antenatal and infant services. Future studies should further investigate relationships between participation in these services and health outcomes. This could identify strengths and areas for improvement in current services, with the goal of further improving outcomes for First Nations peoples through targeted health services that address their psychosocial vulnerabilities and support women to make healthy choices during pregnancy.

Key words: birth weight; indigenous people; infant, newborn; maternal health; pregnancy complication.

What is already known on this topic

- 1 Key factors contributing to comparatively higher national rates of maternal and neonatal morbidity and mortality amongst First Nations Australians include underuse of antenatal and postnatal services, a high adolescent birth rate and socioeconomic status.
- 2 The Closing the Gap strategy aims to improve key outcomes for Aboriginal women and children, such as engagement with antenatal services, birth weight and infant mortality.

What this paper adds

- 1 Despite significantly higher socioeconomic disadvantage and challenges facing First Nations peoples, in this study, there was no difference in rates of Caesarean section, resuscitation at birth, NICU admission, preterm birth or birth weight between First Nations and non-First Nations peoples.
- 2 Smoking rates and substance use were higher in First Nations women and were significantly associated with lower birth weight, highlighting the need to prioritise culturally specific smoking and substance use cessation strategies.

Correspondence: Dr Habib Bhurawala, Nepean Hospital, Level 5, South Block, Derby St, Penrith, NSW 2750, Australia. Fax: 0247341144; email: habib.bhurawala@health.nsw.gov.au

Conflict of interest: None declared.

Accepted for publication 18 March 2024.

Approximately 6.1% of newborn babies born in Australia are First Nations Australians.¹ Despite recent improvements, First Nations women and neonates continue to have disproportionately high morbidity and mortality rates compared to non-First Nations peoples; dispossession, underuse of antenatal services, and intergenerational trauma have been identified as contributing factors.^{2,3} First Nations infants in Australia are 1.6 times as

likely to be preterm, 1.8 times as likely to have a low birth weight, 1.5 times as likely to require a special care nursery (SCN) or Neonatal Intensive Care Unit (NICU) admission and 1.7 times the risk of perinatal death compared to non-First Nations infants.¹

However, it is important to acknowledge the strengths and resilience of First Nations childrearing practices.⁴ Accessible, community-based, culturally appropriate First Nations maternal and neonatal health programmes including continuity of midwifery care programmes across Australia have yielded positive results, with improved health outcomes for First Nations peoples across several domains, including pre-term birth and access to antenatal care in the first trimester.^{2,5,6,7}

First Nations peoples constitute approximately 4.7% of the Nepean Blue Mountains Local Health District (NBMLHD) population, the highest percentage of First Nations peoples amongst the eight New South Wales (NSW) metropolitan districts.⁸ At Nepean Hospital, mothers of First Nations children are offered antenatal care through the Aboriginal Midwifery and Infant Health Service (AMIHS). Nepean Hospital is also a tertiary referral centre for high-risk pregnancies from regional and remote Western NSW.

This study aimed to assess the current pregnancy and birth outcomes for First Nations women and children at Nepean Hospital. This study analysed outcomes in key domains including those prioritised in the 'Closing the Gap' strategy to improve First Nations maternal and neonatal healthcare with the aim of better understanding current health priorities for First Nations mothers and infants which could be applied both locally and to a wider Australian context.⁹

Methods and Materials

Inclusion and exclusion criteria

Infants and their mothers were included in the study if the infant was identified as being of First Nations origin and was born at Nepean Hospital in 2018. A control group of infants and their mothers were included in which neither parent identified as First Nations Australians and 1:1 controls were matched by date of birth. Women with pregnancy loss prior to 20 weeks gestation were not included in the eMaternity database and were therefore excluded.

Data collection

Data was accessed through the hospital's electronic platforms eMaternity and Powerchart.

Outcomes assessed

The analytical variables were:

Maternal: age, Socio-economic Indexes for Areas (SEIFA), smoking status, antenatal alcohol and drug use, mental illness, psychosocial vulnerability, maternal morbidity, gestation at first antenatal visit, type of antenatal services accessed (mainstream vs. AMIHS) and mode of delivery. The SEIFA score is a tool developed by the Australian Bureau of Statistics to determine relative socioeconomic disadvantage based on street address. It is

represented as a score from 0 to 100, where 100 is the least disadvantaged.¹⁰ Psychosocial vulnerability assessment is a scoring system used by NSW Health Safe Start where certain risk factors such as antenatal substance use, domestic violence and child protection service involvement determine a higher score.¹¹

Neonatal: stillbirth, birth weight, APGAR scores, admission to SCN/NICU, resuscitation at birth, gestation at delivery, length of stay.

Statistical analysis

Descriptive analysis, paired *t*-tests and χ^2 tests were performed using SPSS (version 28). Simple and multiple conditional logistic regression were used to analyse binary maternal outcome variables and mixed model of linear regression was used to analyse continuous maternal outcome variables. 'Survival' and 'lme4' packages were used for these analyses, respectively. Variance inflation factor (VIF) was used to check for multi-collinearity, but none was found. R version 4.1.0 was used for these analyses. A *P*-value of less than 0.05 was considered statistically significant.

Results

Our study included 940 children and their mothers (470 in the study group 1:1 matched with the control group). Of the First Nations children born in 2018, 40% had First Nations mothers only, 40% had First Nations fathers only and 20% had parents who both identified as First Nations Australians. Twenty-four participants (5% of First Nations participants) used AMIHS during their pregnancy.

Table 1 compares demographic data between mothers of First Nations babies and non-First Nations babies and First Nations mothers compared with non-First Nations mothers. Mothers of First Nations babies were significantly younger (25.7 vs. 29.3, $P < 0.001$), with higher rates of teenage pregnancy (14.9% vs. 5.4%, $P < 0.001$). They were more likely to have demographic vulnerabilities including a lower SEIFA index ($P < 0.001$), factors rating them to have a high psychosocial vulnerability ($P < 0.007$) and mental illness ($P < 0.001$). Drug and alcohol use were significantly higher amongst First Nations mothers ($P < 0.001$, $P < 0.048$). There was an extremely high rate of smoking during pregnancy amongst First Nations mothers (45.6% vs. 19.4%, $P < 0.001$). On average, First Nations mothers accessed antenatal care 1.3 weeks later than non-First Nations mothers ($P = 0.008$) and were significantly more likely to have no antenatal care ($P = 0.005$).

There was no significant difference in maternal morbidity or mortality between First Nations and non-First Nations mothers (Table 2). First Nations women had lower rates of hypertension and diabetes than non-First Nations women. Mean gestation at delivery was significantly lower for children of First Nations mothers (38.4 weeks vs. 38.8 weeks, $P < 0.04$); no other birth outcomes were found to be statistically significant (Table 3).

Multivariable analyses were performed on five key maternal and neonatal outcomes; Caesarean birth, birth weight, preterm birth, NICU admission and resuscitation at birth. There was no significant difference in outcomes between the First Nations group and non-First Nations group on simple or multiple analysis (Table 4). Multiple analysis revealed a significant association between increasing maternal age and Caesarean birth (OR 1.08, 95% CI 1.03–1.14, $P < 0.002$); women with

Table 1 Demographics of study population

Demographics	First Nations Australian mother or father	Non-First Nations Australian control	P value	First Nations Australian mother	Non-First Nations Australian mother	P value
	N (%)	N (%)		N (%)	N (%)	
Teenage pregnancy, N = 78	67 (14.2)	11 (2.3)	<0.001	42 (14.9)	36 (5.4)	<0.001
Smoking during pregnancy, N = 253	192 (40.9)	61 (13.0)	<0.001	128 (45.6)	125 (19.4)	<0.001
No antenatal care, N = 8	6 (1.3)	2 (0.4)	0.16	6 (2.2)	2 (0.3)	0.005
Level 3 psychosocial vulnerability, N = 107	67 (14.9)	40 (8.5)	0.005	44 (15.7)	63 (9.6)	0.007
Illicit drug use, N = 35	30 (6.4)	5 (1.1)	<0.001	21 (7.5)	14 (2.1)	<0.001
Alcohol use, N = 20	14 (3.0)	6 (1.3)	0.07	10 (3.6)	10 (1.5)	0.048
Mental health condition, N = 106	64 (13.6)	42 (8.9)	0.02	51 (18.1)	55 (8.3)	<0.001
Total	N = 471	N = 471		N = 281	N = 659	
Age (mean (SD))	25.7 (5.8)	29.3 (5.5)	<0.001	25.6 (5.8)	28.4 (5.8)	<0.001
SEIFA (mean (SD))	37.8 (25.4)	46.7 (24.5)	<0.001	37.3 (25.3)	44.4 (25.1)	<0.001
Gestation first accessed antenatal care mean (SD)	19.3 (6.1)	18.3 (5.6)	0.02	19.7 (6.4)	18.4 (5.6)	0.008

Table 2 Univariate analysis of maternal morbidity and mortality comparing First Nations Australian mothers and non-First Nations Australian mothers

Maternal morbidity and mortality	First Nations Australian mother	Non-First Nations Australian mother	P value
	N (%)	N (%)	
Hypertension	17 (6.0)	45 (6.8)	0.66
Diabetes (pre-existing and gestational diabetes)	27 (9.6)	92 (16.5)	0.06
Pre-eclampsia	9 (3.3)	12 (1.8)	0.18
IUGR	13 (4.6)	22 (3.3)	0.34
Maternal mortality	0	0	
Total	N = 281	N = 659	
Composite maternal morbidity†	Mean (SD) 0.61 (0.8)	Mean (SD) 0.60 (0.8)	0.86

† Composite maternal morbidity – sum of several maternal morbidity risk factors (hypertension, diabetes, pre-eclampsia, intrauterine growth restriction, thromboembolism, thyroid disease, arrhythmias, intimate partner violence, renal disease, pre-term premature rupture of membranes, antepartum haemorrhage, threatened preterm labour, cholestasis of pregnancy, HELLP syndrome, placental abruption, cervical incompetence, other maternal morbidity).

higher parity were less likely to have Caesarean births (OR 0.72, 95% CI 0.589–0.88, $P < 0.002$). There was a significant association between lower birth weight and maternal smoking (OR 3.66×10^{-93} , 95% CI 3.11×10^{-139} – 4.31×10^{-47} , $P < 0.001$), hypertension (OR 7.00×10^{-94} , 95% CI 1.64×10^{-167} – 2.98×10^{-20} , $P < 0.01$) and drug use (OR 1.35×10^{-141} , 95% CI 7.14×10^{-250} – 4.31×10^{-33} , $P < 0.01$). Drug use in pregnancy had a significant correlation with NICU admission (OR 7.89, 95% CI 1.32–47.3, $P < 0.02$).

Discussion

The demographic analysis of this cohort of First Nations pregnancies highlights the immense challenges that persist for First Nations

Australian parents. They are more likely to have socioeconomic disadvantage, teenage pregnancies, psychosocial issues, smoking, drug and alcohol use, and mental illness in pregnancy. First Nations women had significantly higher rates of no antenatal care at all, although numbers in this subgroup were pleasingly few.

Somewhat surprisingly, First Nations mothers did not have an increased risk of maternal morbidity nor any difference in rates of Caesarean section, resuscitation at birth, NICU admission, preterm birth or birthweight in multivariable analysis. This finding may be influenced by locally high rates of socioeconomic disadvantage and variability in relevant comorbidities amongst all study participants. Availability of First-Nations specific programmes which aim to improve health disparities may also contribute to this finding; however, the relationship between

Table 3 Descriptive and univariable analysis of birth outcomes comparing First Nations Australian babies and non-First Nations Australian babies

Birth outcomes	First Nations Australian mother or father	Non-First Nations Australian control	P value	First Nations Australian mother	Non-first Nations Australian mother	P value
	N (%)	N (%)		N (%)	N (%)	
Stillbirth	3 (0.6)	3 (0.6)	0.51	3 (1.1)	3 (0.5)	0.28
Resuscitation at birth	88 (18.77)	71 (15.11)	0.14	56 (20.1)	103 (15.7)	0.10
SCN/NICU admission	99 (21.11)	89 (18.9)	0.41	61 (22.0)	127 (19.4)	0.34
	N = 470	N = 470		N = 281	N = 659	
	Mean (SD)	Mean (SD)		Mean (SD)	Mean (SD)	
Birth weight g (mean (SD))	3268 (706.8)	3299 (661.6)	0.48	3225 (757)	3308 (649)	0.08
Gestation at delivery (mean (SD))	38.61 (2.64)	38.80 (2.35)	0.26	38.4 (2.9)	38.8 (2.3)	0.04
Length of stay	3.5 (8.6)	3.0 (6.1)	0.30	3.7 (8.0)	3.0 (7.2)	0.16
APGAR AT 1 min	8.29 (1.6)	8.35 (1.4)	0.54	8.25 (1.7)	8.35 (1.5)	0.36
APGAR at 5 min	8.78 (1.0)	8.87 (0.9)	0.18	8.75 (1.1)	8.86 (0.8)	0.10

Table 4 Multivariable analysis of maternal factors on maternal and neonatal health and birth outcomes

Multivariable analysis P value	Caesarean birth	Birth weight	Preterm birth	NICU/SCN admission	Resuscitation at birth
First Nations parent (either)	0.95	0.21	0.88	0.10	0.10
Maternal age	<0.001	0.82	0.35	0.13	0.10
SEIFA	0.77	0.69	0.96	1.00	0.87
First Nations mother	0.42	0.31	0.92	0.18	0.23
First Nations father	0.54	0.54	0.71	0.15	0.33
Parity	<0.001	0.15	0.91	0.46	0.45
Gestation at first antenatal care visit	0.74	0.10	0.15	0.55	0.99
Level 3 psychosocial vulnerability	0.50	0.20	0.57	0.97	0.90
Maternal smoking	0.27	<0.001	0.70	0.92	0.86
Maternal alcohol use	0.17	0.59	0.42	0.20	1.00
Maternal drug use	0.83	0.01	0.96	0.02	0.07
Hypertension in pregnancy	0.08	0.01	0.08	0.28	0.31
Diabetes in pregnancy	0.42	0.22	0.99	0.15	0.84

participation in the AMIHS service and health outcomes was not specifically analysed in this study.

Significantly higher rates of substance use, teenage pregnancy and mental illness amongst First Nations women as seen in our study have been consistently described in Australian urban and regional studies.^{1,12,13,14} Nationally, First Nations mothers are nine times more likely than non-First Nations mothers to give birth as teenagers.¹ First Nations women who have no antenatal care are 4.1 times as likely to have preterm birth and 3.6 times as likely to have a perinatal death compared with those accessing antenatal care in the first trimester, highlighting the importance of ensuring all women have access to timely, culturally acceptable care.^{1,15}

Composite maternal morbidity score was also calculated in a Tasmanian study, similarly finding no significant difference between First Nations and non-First Nations women, potentially explained by First Nations mothers being younger in both studies and having less pre-existing medical conditions such as

hypertension and diabetes.¹⁶ Nationally, a higher percentage of First Nations women experience hypertension and diabetes during their pregnancy, with particularly high rates of pre-existing morbidity in remote First Nations populations.^{1,17}

This study showed lower mean gestation at delivery for First Nations women on univariable analysis but no significant difference in preterm birth rates on multivariable analysis. This differs from national data, which demonstrates a higher incidence of preterm birth and low birth weight in First Nations women, especially in remote settings; this data is collected in a much larger cohort with variable antenatal care structures and accessibility.¹ A cohort study at Royal Melbourne Hospital, a similar tertiary Australian referral centre, found that First Nations women were more likely to have preterm deliveries, but not small for gestational age babies, and proposed that this may be due to higher rates of smoking and teenage pregnancy which were each associated with preterm birth.¹² However, other studies in more socio-economically disadvantaged areas of Victoria and Tasmania

found no significant difference between First Nations and non-First Nations groups in preterm birth and birth weight.^{13,16} A recent analysis of trends in Tasmanian infant birthweight highlighted a significant weakening of association between First Nations ethnicity and low birth weight after adjusting for confounding variables, indicating that addressing socioeconomic inequalities could improve birthweight disparities.¹⁴ Preterm delivery and low birth weight risk factors are numerous and complex, and perhaps due to high rates of chronic health conditions and obesity in NBMLHD that have a complex relationship with socioeconomic disadvantage, we did not see a higher rate of preterm birth in our First Nations population once other factors were adjusted. Our study also includes First Nations children with non-First Nations mothers unlike the studies discussed above. Comparing study First Nations babies with national data, this study encouragingly showed lower rates of NICU admissions (21% vs. 24.5%), and resuscitation at birth (15.2% vs. 23.4%); stillbirth (6.2 per 1000 live births vs. 11.1 per 1000 live births nationally).¹ Reflecting Nepean Hospital's role as a

Referral centre for high-risk births and its socioeconomically disadvantaged local population, it was not unexpected to find SCN/NICU admission rates overall in this study to be higher than national rates of SCN/NICU admission (20% vs. 17%) and indeed much higher than rates in Nordic countries (11%).^{1,18}

This study reveals a very high rate of smoking in pregnancy in all women, especially amongst First Nations women, and significantly higher rates of drug and alcohol use in First Nations mothers. Of concern, 45.6% of study First Nations women smoked during pregnancy compared with 19.4% of non-First Nations women. National rates of smoking in pregnancy are 42% for First Nations mothers and 7% for non-First Nations mothers.¹ We did not collect smoking cessation rates in pregnancy, however national data shows that First Nations mothers are more likely to attempt to quit smoking but less likely to succeed, and smoke-free pregnancies are 4.5 times higher amongst women accessing culturally specific health services.¹⁹ This study showed significantly lower birth weight associated with smoking and drug use, highlighting a need for prioritisation of First Nations led approaches to smoking and substance use cessation within local antenatal care and improved preconception support for pre-pregnancy smoking cessation.²⁰ Higher rates of maternal smoking, alcohol and drug use, and psychosocial vulnerabilities in children where either or both parents are First Nations indicate that culturally specific support services may need to be offered to both parents during the antenatal period. However, the maternal and birth outcomes of First Nations women and babies are encouraging when reflecting on NBMLHD's provision of care and its efforts to work towards 'closing the gap' in pregnancy and birth outcomes.

One strength of this study is that it investigated a unique cohort with a substantial number of First Nations births. It explored a mixed urban, regional and rural First Nations population, as Nepean Hospital has an outer metropolitan location whilst also being a tertiary referral centre for high-risk obstetric births for large parts of regional and rural Western NSW. This study investigates maternal and neonatal outcomes for First Nations children not born to First Nations mothers for whom there is much less data reported, as most research in this field only includes babies of First Nations mothers.

Regarding limitations, this study only assessed gestation at first hospital antenatal care visit; data about earlier engagement with general practitioners could not be obtained. This study relies on self-reporting of First Nations status and other personal information, which may be sensitive and associated with stigma, thus risks being under-reported. Some study correlations, such as with birth weight, had wide confidence intervals. Some women, albeit few, received antenatal care at other hospitals primarily, which makes it unreliable to extrapolate associations between antenatal care provided and maternal or neonatal outcomes.

Priorities for future studies

Since AMIHS was implemented in 2001, more First Nations women are accessing pregnancy care prior to 20 weeks gestation, with lower rates of preterm birth and higher satisfaction with antenatal care.³ Whilst this study did not specifically assess the association between AMIHS use and maternal/neonatal outcomes, it would be interesting to investigate this in future studies to recognise strengths and areas needing increased support in First Nations-specific antenatal programmes.

This study reflects data from a single centre over a single year. It would be useful to further compare trends over several years and involve other centres to investigate any differences in outcomes between locations and the use of First Nations-specific services. Further, it would be interesting to follow this cohort of First Nations children and their utilisation of paediatric First Nations services to understand how health services might better support First Nations paediatric populations, including those of non-First Nations mothers.

Conclusions

Overall, this study showed no significant difference between First Nations and non-First Nations pregnancies regarding Caesarean section rates, birth weight, preterm birth, NICU admissions or resuscitation at birth. It did, however, show that First Nations mothers have a higher psychosocial burden, smoking rates, teenage pregnancy rates, substance use and socioeconomic disadvantage that requires ongoing attention and support with culturally specific strategies. This study highlights the importance of the continuation and potential expansion of First Nations-specific programmes in NBMLHD to be able to support women and children through the antenatal period and infancy.

Acknowledgement

We would like to acknowledge Tracey Codner with her assistance in the collection of e-maternity data for this project. Open access publishing facilitated by The University of Sydney, as part of the Wiley - The University of Sydney agreement via the Council of Australian University Librarians.

References

- 1 Australian Institute of Health and Welfare. Australia's Mothers and Babies, [Internet]. 2023. Available from: <http://www.aihw.gov.au> [accessed 10 October 2023].

- 2 Smith R, Dawson A, Foureux M, Fowler C, Sherwood J, Homer CSE. Development of the Building Strong Foundations for Aboriginal Children, Families and Communities (BSF) Program Service Standards: Literature Review, Faculty of Health, University of Technology Sydney. 2014.
- 3 Murphy E, Best E. The aboriginal maternal and infant health service: A decade of achievement in the health of women and babies in NSW. *N. S. W. Public Health Bull.* 2012; **23**: 68–72.
- 4 Geia L. A strengths based approach to Australian Aboriginal child-rearing practices is the answer to better health outcomes in Aboriginal family and child health. *Collegian* 2011; **18**: 99–100.
- 5 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**: 262.
- 6 Cousins S. Birthing on country: Improving maternal care in Australia. *Lancet* 2023; **401**: 184–5.
- 7 Kildea S, Gao Y, Hickey S et al. Effect of a birthing on country service redesign on maternal and neonatal health outcomes for First Nations Australians: A prospective, non-randomised, interventional trial. *Lancet Global Health* 2021; **9**: e651–9.
- 8 Australian Bureau of Statistics. *Census of Population and Housing – Counts of Aboriginal and Torres Strait Islander Australians* [Internet]. Canberra: ABS; 2021 Available from: <https://www.abs.gov.au/statistics/people/aboriginal-and-torres-strait-islander-peoples/census-population-and-housing-counts-aboriginal-and-torres-strait-islander-australians/latest-release> [accessed 14 October 2023].
- 9 Department of Prime Minister and Cabinet. *Closing the Gap Report 2020*. [Internet]. Canberra, AU: Commonwealth of Australia; 2020 Available from: <https://ctgreport.niaa.gov.au/content/closing-gap-2020> [accessed 8 October 2021].
- 10 Census of Population and Housing: Socio-Economic Indexes for Areas (SEIFA), Australia, 2016. 2018. Available from: <https://www.abs.gov.au/ausstats/abs@.nsf/mf/2033.0.55.001> [accessed 6 Jan 2023].
- 11 NSW Health. Maternal and Child Health Primary Healthcare Policy (PD2010_017). 2010. Available from: https://www1.health.nsw.gov.au/pds/ActivePDSDocuments/PD2010_017.pdf [accessed 19 Nov 2022].
- 12 Ford EJ, Cade TJ, Doyle LW, Umstad MP. Pregnancy risk factors associated with birthweight of infants born to Australian Aboriginal women in an urban setting – a retrospective cohort study. *BMC Pregnancy Childbirth* 2018; **18**: 382.
- 13 Whish-Wilson T, Tacey M, McCarthy E, Howat P. Indigenous birth outcomes at a Victorian urban hospital, a retrospective 5-year cohort study 2010–2014. *Aust. N. Z. J. Obstet. Gynaecol.* 2016; **56**: 238–44.
- 14 Herath MP, Hills AP, Beckett JM, Jayasinghe S, Byrne NM, Ahuja KDK. Trends and associations between maternal characteristics and infant birthweight among indigenous and non-Indigenous people in Tasmania, Australia: A population-based study. *Public Health* 2023; **221**: 10–6.
- 15 Australian Institute of Health and Welfare. Pregnancy and birth outcomes for Aboriginal and Torres Strait Islander women 2016–2018 [Internet]. 2021. Available from: <http://www.aihw.gov.au> [accessed 14 October 2023].
- 16 Hakeem R, Dennis A, Ogen K, Ahuja KD, Hakeem MA. Obstetric and perinatal morbidity in northern Tasmanian aboriginal population: A retrospective cohort study. *J. Clin. Diagn. Res.* 2016; **10**: QC06–9.
- 17 Hare MJL, Barzi F, Boyle JA et al. Diabetes during pregnancy and birthweight trends among Aboriginal and non-Aboriginal people in the Northern Territory of Australia over 30 years. *Lancet Reg. Health West. Pac.* 2020; **1**: 100005.
- 18 Norman M, Padkær Petersen J, Stensvold HJ et al. Preterm birth in the Nordic countries—Capacity, management and outcome in neonatal care. *Acta Paediatr.* 2023; **112**: 1422–33.
- 19 Rahman T, Baker AL, Gould GS, Palazzi K, Lambkin D, Kennedy M. Factors associated with smoke-free pregnancy among aboriginal and Torres Strait women and their experience of quitting smoking in pregnancy: A mixed method cross-sectional study. *Int. J. Environ. Res. Public Health* 2021; **18**: 11240.
- 20 Bovill M, Chamberlain C, Bennett J et al. Building an indigenous-led evidence base for smoking cessation care among aboriginal and Torres Strait islander women during pregnancy and beyond: Research protocol for the which way? Project. *Int. J. Environ. Res. Public Health* 2021; **18**: 1342.