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ORIGINAL ARTICLE

Being a First Nations baby is not independently associated with low birthweight in a large metropolitan health service

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Aim: To examine low birth weight (LBW) in First Nations babies born in a large metropolitan health service in Queensland, Australia.

Materials and Methods: A retrospective population-based study using routinely collected data from administrative data sources. All singleton births in metropolitan health services, Queensland, Australia of ≥20 weeks gestation or at least 400 g birthweight and had information on First Nations status and born between 2019 and 2021 were included. The study measured birthweight and birthweight z-score, and also identified the predictors of LBW. Multivariate regression models were adjusted by demographic, socioeconomic and perinatal factors.

Results: First Nations babies had higher rates of LBW (11.4% vs 6.9%, $P < 0.001$), with higher rates of preterm birth (13.9% vs 8.8%, $P < 0.001$). In all babies, the most important factors contributing to LBW were: maternal smoking after 20 weeks of gestation; maternal pre-pregnancy underweight (body mass index <18.5 kg/m^2); nulliparity; socioeconomic disadvantage; geographical remoteness; less frequent antenatal care; history of cannabis use; pre-existing cardiovascular disease; pre-eclampsia; antepartum haemorrhage; and birth outcomes including prematurity and female baby. After adjusting for all contributing factors, no difference in odds of LBW was observed between First Nations and non-First Nation babies.

Conclusions: First Nations status was not an independent factor influencing LBW in this cohort, after adjustment for identifiable factors. The disparity in LBW relates to modifiable risk factors, socioeconomic disadvantage, and prematurity. Upscaling culturally safe maternity care, focusing on modifiable risk factors is required to address LBW in Australian women.

KEYWORDS

First Nations, low birth weight, non-First Nations, prematurity, socioeconomic disadvantage

INTRODUCTION

Low birthweight (LBW) is associated with short-term neonatal morbidity, and long-term disability, diabetes, cardiovascular and renal disease into adulthood, with high social and economic costs.[1] Reducing the incidence of LBW in First Nations babies has been a focus for the Australian Government's Closing the Gap campaign since 2008,[2] which aims to reduce the gaps in life expectancy and health-related outcomes between Aboriginal and Torres Strait Islander (hereafter called First Nations) and non-First Nations Australians. The disparities in health outcomes between First Nations and non-First Nations Australians are well known and attributed to complex, interrelated issues such as colonisation, paternalistic government policy, institutional racism, unconscious bias and ongoing structural and geographical barriers to accessing health care.[2,3] On this background, First Nations women are more likely to experience poorer perinatal health outcomes, including LBW, stillbirth, preterm birth, small for gestational age babies, and higher neonatal death rates.[3–6]

For both First Nations and non-First Nations women, the risk factors associated with LBW include social and demographic factors such as maternal age, socioeconomic status, domestic violence, substance abuse, low or high body mass index (BMI), maternal smoking during pregnancy, living in remote areas and delayed or limited access to antenatal care,[4,7–11] and maternal co-morbidities such as urinary tract infections (UTI), hypertension and diabetes; and, fetal conditions such as intrauterine growth restriction and congenital anomalies.[3, 4, 9]

Evidence suggests that a healthy lifestyle prior to conception and during pregnancy, appropriate antenatal care, and physically and culturally safe health care improves healthy birth weights, maternal and child health.[8,12,13] While there are some culturally safe models of care, these are not available to all First Nations women, with targets to reduce the 'gap'[2,14] not met.[13] Further, there is limited research examining the influence of the Closing the Gap Campaign on the determinants of birthweight.[3,4,9] Therefore, this study aimed to examine LBW in a contemporary cohort of First Nations and non-First Nations babies born in a large, metropolitan health service, inclusive of three hospitals with maternity services in Queensland, Australia.

MATERIALS AND METHODS

Study design and setting

We conducted a retrospective cohort analysis utilising population-based administrative data. We used two linked data collections from perinatal administrative data and a hospital-based administrative database, which included any inpatient admission of the mother or offspring from the first antenatal care visit onward. All births in Queensland are registered in the perinatal database for administrative purposes, which holds sociodemographic and maternal and neonatal clinical information.

Study population

In this cohort study, we included all women with singleton live births at three metropolitan hospitals, after 20 weeks gestation and with birthweights more than 400 g between 1 January 2019 and 31 December 2021. Mothers were also asked if their baby identified as First Nations at time of birth. These babies had one parent who self-identified as First Nations. This information was recorded on hospital admission and after the birth of the baby. We considered the First Nations status of the baby as the primary exposure variable and LBW (birthweight <2500 g) as the primary outcome.

Sociodemographic explanatory factors assessed included maternal age, marital status (de-facto or registered), relative socioeconomic status derived from the Socio-Economic Index for Areas (SEIFA) based on the place of residence. Based on the SEIFA scores, we categorised socioeconomic disadvantages as of 1–2 being most disadvantaged (Q1), 3–4 (Q2), 5–6 (Q3), 7–8 (Q4), and 9–10 (Q5) being least disadvantaged, and geographic remoteness was categorised as major cities, inner regional, outer regional, remote, or very remote. Pregnancy and neonatal factors assessed included BMI, smoking status after 20 weeks of pregnancy, cannabis use, number of antenatal care (ANC) visits adjusted for gestational age (GA) at birth which were categorised as seven or more when GA was equal to more than 37 weeks. This was deemed as adequate ANC and GA less than 37 weeks, and the number of expected ANC visits was graded by GA and categorised as inadequate ANC for GA,[15] GA at birth, and baby's sex.

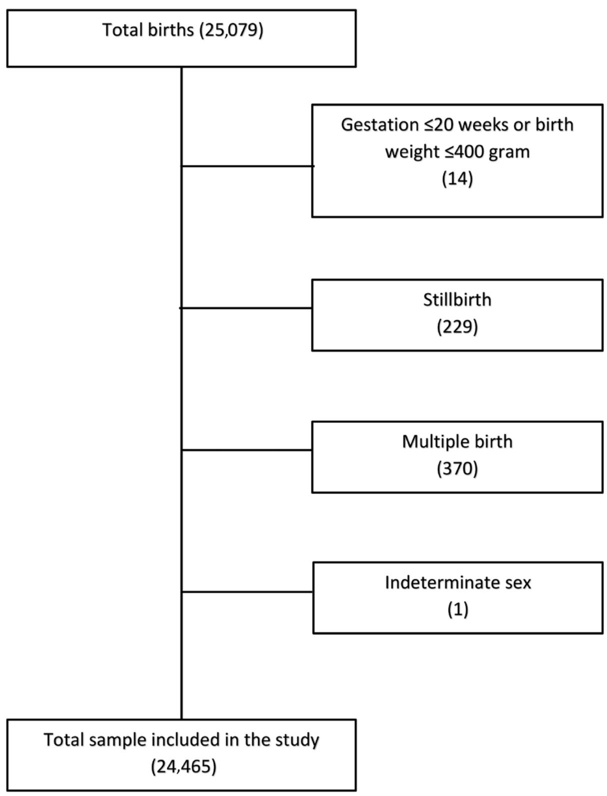

FIGURE 1 Flow chart of the sample included in the study.

TABLE 1 Maternal and newborn characteristics and outcome for 24 465 Australian singleton births at metropolitan hospitals between 1 January 2019 and 31 December 2021

Maternal sociodemographic and peri-natal characteristics[†]	Total (*n* = 24 465)	First Nations babies (*n* = 1968)	Non-First Nations babies (*n* = 22 497)	*P*-value
Maternal age				
<20 years	545 (2.5)	182 (10.1)	363 (1.8)	**<0.001**
20–35 years	17,902 (81.3)	1463 (80.9)	16 439 (81.4)	
>35 years	3565 (16.2)	163 (9.0)	3402 (16.8)	
Marital status				
Unmarried[‡]	4955 (22.5)	880 (48.7)	4075 (20.2)	**<0.001**
Married	17,057 (77.5)	928 (51.3)	16 129 (79.8)	
Body mass index, kg/m^2[§]	24.6 (21.6–29.4)	25.9 (21.9–31.3)	24.5 (21.6–29.3)	**<0.0001**
Underweight	1,118 (4.6)	132 (6.7)	986 (4.4)	**<0.001**
Normal weight	11,341 (46.3)	688 (35.0)	10 653 (47.3)	
Overweight/obese	12,006 (49.1)	1148 (58.3)	10 858 (48.3)	
Smoking after 20 weeks of pregnancy				
Yes	2245 (9.18)	555 (28.2)	1690 (7.5)	**<0.001**
Parity				
None	3163 (18.7)	210 (14.3)	2953 (19.2)	**<0.001**
One	8257 (48.9)	516 (35.2)	7741 (50.2)	
Two or more	5458 (32.3)	741 (50.5)	4717 (30.6)	
Remoteness area				
Inner/outer regional	1171 (4.8)	123 (6.3)	1048 (4.7)	**<0.001**
Major cities	23 217 (95.0)	1829 (93.2)	21 388 (95.2)	
Remote/very remote	46 (0.2)	11 (0.5)	35 (0.1)	
Socioeconomic status				
Q1 (most disadvantage)	2989 (12.2)	485 (24.7)	2504 (11.1)	**<0.001**
Q2	1355 (5.6)	169 (8.6)	1186 (5.3)	
Q3	3186 (13.0)	361 (18.4)	2825 (12.6)	
Q4	1518 (6.2)	149 (7.5)	1370 (6.1)	
Q5 (least disadvantage)	15 386 (63.0)	800 (40.8)	14 586 (64.9)	
Pregnancy characteristics and previous medical conditions				
Gestational age (GA) adjusted antenatal care (ANC) visits[¶]				
Inadequate ANC by GA	4363 (17.8)	476 (24.2)	3887 (17.3)	**<0.001**
Adequate ANC by GA	20 102 (82.2)	1492 (75.8)	18 610 (82.7)	
History of cardiovascular diseases	575 (2.3)	58 (2.9)	517 (2.3)	0.07
Depression	1188 (4.9)	125 (6.4)	1063 (4.7)	**0.001**
Anxiety	5308 (21.7)	563 (28.6)	4745 (21.1)	**<0.001**
Post-traumatic stress disorder	478 (1.95)	85 (4.3)	393 (1.7)	**<0.001**
Cannabis use	444 (1.8)	139 (7.1)	305 (1.36)	**<0.001**
Pregnancy complications				
Gestational diabetes	4437 (18.1)	303 (15.4)	4134 (18.3)	**0.001**
Gestational hypertension	732 (3.0)	42 (2.1)	690 (3.1)	**0.02**
Pre-eclampsia/HELLP	654 (2.7)	62 (3.1)	592 (2.6)	0.17
Anaemia during pregnancy	894 (3.6)	115 (5.8)	779 (3.5)	**<0.001**
Antepartum haemorrhage	1281 (5.2)	116 (5.9)	1165 (5.2)	0.17
Urinary tract infection	953 (3.9)	95 (4.8)	858 (3.8)	**0.03**
Labour and birth outcome				
Mode of birth				
Spontaneous vaginal birth	13 557 (55.4)	1196 (60.8)	12 361 (54.9)	**<0.001**
Assisted vaginal birth	2398 (9.8)	129 (6.5)	2269 (10.1)	
Caesarean section	8510 (34.8)	643 (32.7)	7867 (35.0)	

TABLE 1 (Continued)

Maternal sociodemographic and perinatal characteristics†	Total (*n* = 24 465)	First Nations babies (*n* = 1968)	Non-First Nations babies (*n* = 22 497)	*P*-value
Gestation age at birth††				
Extremely preterm	189 (0.8)	26 (1.3)	163 (0.7)	**<0.001**
Very preterm	324 (1.3)	44 (2.2)	280 (1.2)	
Moderate to late preterm	1537 (6.3)	183 (9.3)	1354 (6.0)	
Term, ≥37 weeks	22 415 (91.6)	1715 (87.2)	20 700 (92.0)	
Birthweight in grams, mean ± SD	3331.2 ± 3.9	3220.8 ± 680.5	3340.9 ± 602.7	**<0.0001**
Birth weight				
Low birthweight	1774 (7.2)	225 (11.4)	1549 (6.9)	**<0.001**
Normal	20 238 (82.7)	1583 (80.5)	18 655 (82.9)	
High birthweight	2453 (10.0)	160 (8.1)	2293 (10.2)	
Birthweight z-score, mean ± SD	0.35 ± 0.97	0.31 ± 1.0	0.35 ± 0.9	0.06
Child sex				
Male	12 688 (51.9)	1020 (51.8)	11 668 (51.9)	0.97
Female	11 777 (48.1)	948 (48.2)	10 829 (48.1)	

†Data presented as *n* (%), unless otherwise specified.
‡Unmarried (also included divorced, separated, widowed).
§Body mass index, median (interquartile range).
¶Based on Department of Health (2020) Clinical Practice Guidelines: Part B: Core practices in pregnancy Care: ANC visits, the ANC visits was adjusted by GA and classified as 100% expected for gestational age (as adequate ANC visit); and < 100% expected for gestational age (as inadequate ANC visit by GA).
††GA at birth: Extremely preterm (20–27 weeks); very preterm (28–31 weeks); moderate to late preterm (32–36 weeks); term (≥37 weeks).
HELLP, haemolysis, elevated liver enzymes, low platelet count.
The bold values are statistically significant.

Additionally, maternal pregnancy complications and previous medical history associated with birthweight were identified from hospital records and were included in the analysis. These were gestational diabetes, hypertension, pre-eclampsia or haemolysis, elevated liver enzymes, low platelet count (HELLP) syndrome, anaemia, antepartum haemorrhage (APH)/placental complications, and UTI. Maternal medical conditions prior to current pregnancy were cardiovascular diseases, depression, anxiety, and post-traumatic stress disorder. Any medical condition and mental health diagnosis recognised by the International Statistical Classification of Diseases and Related Health Problems (ICD-10-AM) was included in this study. We excluded one baby due to sex being indeterminate at birth from this study. Stillbirth was defined as fetal death of at least 20 weeks gestation or 400 g birthweight (*n* = 229). Births less than 20 weeks and less than 400 g birthweight (*n* = 14), and multiple births (*n* = 370) were excluded (Fig. 1).

Statistical analysis

We performed descriptive analysis to explore characteristics of the sample and present those as frequency and percentage for categorical variables, mean (± standard deviations, SD) for normally distributed data continuous variables, and medians and interquartile ranges (IQR) for non-normally distributed continuous variables. Outcomes were compared between First Nations and non-First Nations women using logistic (binary) regression for birthweight categories and linear regression for birthweight z-score. Multivariable logistic regression and linear regression analyses were used to explore the association between outcomes and maternal risk factors, adjusting for all included explanatory variables in the analysis. Odds ratios (ORs) with 95% confidence intervals (CIs) and regression coefficients (β) with CIs were calculated and presented in the adjusted analysis. Sensitivity analyses were performed by restricting one birth per mother to assess the difference in outcome estimation. Statistical analyses were performed using Stata/SE for Windows 17.0 (StataCorp LP, College Station, TX, USA, 2013). A two-tailed *P*-value below 0.05 was considered significant.

This study was approved by the Metro North Human Research Ethics Committee (HREC) (EX/2022/MNHA/89596).

RESULTS

Of the 25 079 eligible births, 24 465 (97.6%) had information for all variables of interest (Fig. 1). Of these, 1968 (8.0%) births were First Nations babies and 22 497 (91.9%) were non-First Nations babies. Maternal sociodemographic and perinatal characteristics of the sample are provided in Table 1. First Nations women were younger, had a higher rate of both lower and higher BMI and had more socioeconomic disadvantage. Most First Nations women had more than recommended ANC visits for GA (75.8%). They had a higher rate of spontaneous vaginal births (60.8%). Rates of smoking,

TABLE 2 Predictors for low birth weight for 24 465 Australian infants born at metropolitan hospitals in Queensland, Australia from 2019 to 2021

	Unadjusted odds ratio		Adjusted odds ratio*	
Low birth weight	**Odds ratio* (95% CI)**	***P*-value**	**Odds ratio (95% CI)**	***P*-value**
Non-First Nations babies	Reference		Reference	
First Nations babies	**1.74 (1.50, 2.02)**	**<0.001**	1.10 (0.88, 1.37)	0.38
Maternal age				
20–35 years	Reference		Reference	
<20 years	**1.80 (1.39, 2.32)**	**<0.001**	1.07 (0.73, 1.59)	0.87
>35 years	**1.16 (1.02, 1.32)**	**0.017**	**1.30 (1.09, 1.55)**	**0.003**
Marital status				
Married	Reference		Reference	
Unmarried	**1.58 (1.42, 1.76)**	**<0.001**	**1.17 (1.00, 1.36)**	**0.05**
Body mass index, kg/m^2				
Normal weight	Reference		Reference	
Underweight	**2.04 (1.69, 2.46)**	**<0.001**	**1.94 (1.48, 2.53)**	**<0.001**
Overweight/obese	1.02 (0.92, 1.13)	0.67	**0.78 (0.68, 0.90)**	**0.001**
Smoking after 20 weeks of gestation				
No	Reference		Reference	
Yes	**2.45 (2.16, 2.79)**	**<0.001**	**1.80 (1.47, 2.21)**	**<0.001**
Parity				
Multiparous	**Reference**			
Nulliparous	**1.23 (1.11, 1.35)**	**<0.001**	**1.40 (1.22, 1.60)**	**<0.001**
Remoteness area of home address				
Major cities	Reference		Reference	
Inner/outer regional	**3.41 (2.93, 3.98)**	**<0.001**	**1.62 (1.27, 2.07)**	**<0.001**
Remote/very remote	**3.94 (1.95, 7.97)**	**<0.001**	0.92 (0.31, 2.71)	0.88
Socioeconomic status				
Q5, least disadvantage	Reference		Reference	
Q1, most disadvantage	**1.60 (1.39, 1.84)**	**<0.001**	**1.31 (1.07, 1.60)**	**0.007**
Q2	**1.77 (1.46, 2.12)**	**<0.001**	**1.47 (1.12, 1.93)**	**0.005**
Q3	**1.43 (1.24, 1.65)**	**<0.001**	**1.24 (1.02, 1.50)**	**0.02**
Q4	**1.38 (1.14, 1.68)**	**0.001**	1.25 (0.95, 1.63)	0.09
Gestational age (GA) adjusted antenatal care (ANC) visits				
Adequate ANC by GA	Reference		Reference	
Inadequate ANC by GA	**0.53 (0.46, 0.62)**	**<0.001**	**0.69 (0.56, 0.84)**	**<0.001**
Maternal previous medical condition				
Cardiovascular diseases				
No	Reference		Reference	
Yes	**2.54 (2.03, 3.20)**	**<0.001**	**1.53 (1.09, 2.13)**	**0.01**
Depression				
No	Reference		Reference	
Yes	**1.45 (1.19, 1.76)**	**<0.001**	0.96 (0.72, 1.26)	0.77
Anxiety				
No	Reference		Reference	
Yes	**1.41 (1.26, 1.57)**	**<0.001**	0.89 (0.76, 1.04)	0.15
Post-traumatic stress disorder				
No	Reference		Reference	

TABLE 2 (Continued)

	Unadjusted odds ratio		Adjusted odds ratio*	
Low birth weight	**Odds ratio* (95% CI)**	***P*-value**	**Odds ratio (95% CI)**	***P*-value**
Yes	**1.72 (1.29, 2.28)**	**<0.001**	0.86 (0.57, 1.29)	0.47
Cannabis use				
No	Reference		Reference	
Yes	**3.52 (2.78, 4.44)**	**<0.001**	**2.57 (1.79, 3.70)**	**<0.001**
Maternal pregnancy complications				
Eclampsia				
No	Reference		Reference	
Yes	**6.32 (5.31, 7.52)**	**<0.001**	**3.09 (2.36, 4.03)**	**<0.001**
Anaemia				
No	Reference		Reference	
Yes	1.19 (0.94, 1.52)	0.14	0.81 (0.58, 1.14)	0.23
Antepartum haemorrhage				
No	Reference		Reference	
Yes	**5.40 (4.71, 6.18)**	**<0.001**	**1.91 (1.56, 2.34)**	**<0.001**
Urinary tract infection				
No	Reference		Reference	
Yes	**1.77 (1.44, 2.16)**	**<0.001**	0.95 (0.71, 1.28)	0.77
Birth outcomes				
Child sex				
Male	Reference		Reference	
Female	**1.19 (1.08, 1.31)**	**<0.001**	**1.59 (1.40, 1.82)**	**<0.001**
Preterm birth				
Full-term birth	Reference		Reference	
Preterm birth	**71.7 (63.2, 81.3)**	**<0.001**	**61.5 (53.6, 70.5)**	**<0.001**

*Fully adjusted for all covariates.

The bold values are statistically significant.

cannabis use, pregnancy complications and pre-existing medical conditions differed between groups. The overall LBW ($n = 225$, 11.4% vs $n = 1549$, 6.9%; $P < 0.001$) and preterm birth ($n = 253$, 12.9% vs 1797, 8.0%; $P < 0.001$) rate was higher in First Nations women compared to non-First Nations women, respectively (Table 1).

Unadjusted logistic regressions showed an association between First Nations status and risk of LBW (OR: 1.74; 95% CI: 1.50–2.02; $P < 0.001$). The association did not remain after adjusting for preterm birth with other relevant confounders in the adjusted analysis. In the fully adjusted multivariate model, maternal older age, pre-pregnancy underweights, smoking after 20 weeks of gestation, nulliparity, regional living, socioeconomic disadvantage, cardiovascular disease, cannabis use, eclampsia, APH, female baby, and preterm birth were all associated with LBW. After adjusting for all social and perinatal variables, the difference in LBW between First Nations and non-First Nations babies did not persist (adjusted OR: 1.10; 95% CI: 0.88–1.37; $P = 0.38$) (Table 2; Table S1).

We included the same variables to assess the birthweight z-score and associated factors (Table 3; Table S2). After adjustment, the result of the models showed negative z-scores for babies to women with age > 35 years, pre-pregnancy underweights, smoking during pregnancy, inadequate ANC, cannabis use, and eclampsia. Birthweight z-score was positively associated with nulliparous women, higher BMI, depression, anxiety, and anaemia. Moreover, the association of birthweight z-score with preterm birth was negative (Table 3). These risk factors were relevant for both First Nations and non-First Nations women. After adjustment for all perinatal factors, the birthweight z-score was not different between First Nations and non-First Nations women. Figure 2 demonstrates the impact of GA at birth on baby's birthweight, stratified by First Nations status, showing the importance of prematurity.

DISCUSSION

In this study, we investigated the occurrence of LBW in First Nations and non-First Nations babies born in a large metropolitan health service and identified the factors associated with LBW

TABLE 3 Predictors of birthweight z-score for 24 465 Australian infants born at metropolitan hospitals in Queensland, Australia from 2019 to 2021.

	Unadjusted β		Adjusted β*	
Birthweight z-score	**β (95% CI)**	***P*-value**	**β (95% CI)**	***P*-value**
Non-First Nation babies	Reference		Reference	
First Nation babies	−0.04 (−0.08, 0.00)	0.06	−0.01 (−0.06, 0.03)	0.50
Maternal age				
20–35 years	Reference		Reference	
<20 years	**−0.18 (−0.26, −0.10)**	**<0.001**	0.04 (−0.03, 0.12)	0.29
>35 years	0.02 (−0.01, 0.05)	0.21	**−0.04 (−0.08, −0.01)**	**0.003**
Marital status				
Married	Reference		Reference	
Unmarried	**−0.04 (−0.07, −0.01)**	**0.002**	**0.03 (0.00, 0.06)**	**0.01**
Body mass index, kg/m^2				
Normal weight	Reference		Reference	
Underweight	**−0.28 (−0.34, −0.22)**	**<0.001**	**−0.23 (−0.28, −0.17)**	**<0.001**
Overweight/obese	**0.27 (0.24, 0.29)**	**<0.001**	**0.24 (0.22, 0.27)**	**<0.001**
Smoking after 20 weeks of gestation				
No	Reference		Reference	
Yes	**−0.34 (−0.38, −0.30)**	**<0.001**	**−0.36 (−0.41, −0.32)**	**<0.001**
Parity				
Multiparous	Reference		Reference	
Nulliparous	**−0.31 (−0.33, −0.29)**	**<0.001**	**0.31 (0.28, 0.33)**	**<0.001**
Remoteness area of home address				
Major cities	Reference		Reference	
Inner/outer regional	−0.01 (−0.06, 0.05)	0.81	−0.01 (−0.06, 0.05)	0.80
Remote/very remote	0.04 (−0.24, 0.31)	0.80	0.05 (−0.21, 0.32)	0.69
Socioeconomic status				
Q5, least disadvantage	Reference		Reference	
Q1 (most disadvantage)	**0.07 (0.03, 0.11)**	**0.001**	0.05 (0.01, 0.09)	0.09
Q2	0.03 (−0.02, 0.08)	0.29	0.01 (−0.04, 0.06)	0.06
Q3	**0.05 (0.01, 0.08)**	**0.01**	0.03 (0.00, 0.07)	0.07
Q4	0.02 (−0.02, 0.07)	0.33	0.01 (−0.03, 0.06)	0.06
Gestational age (GA) adjusted antenatal care (ANC) visits				
Adequate ANC by GA	Reference		Reference	
Inadequate ANC by GA	**−0.05 (−0.08, −0.02)**	**0.001**	**−0.06 (−0.09, −0.03)**	**<0.001**
Maternal previous medical condition				
Cardiovascular diseases				
No	Reference		Reference	
Yes	0.03 (−0.04, 0.11)	0.37	−0.02 (−0.09, 0.05)	0.59
Depression				
No	Reference		Reference	
Yes	**0.10 (0.05, 0.16)**	**<0.001**	**0.12 (0.06, 0.17)**	**<0.001**
Anxiety				
No	Reference		Reference	
Yes	0.00 (−0.02, 0.03)	0.73	**0.06 (0.03, 0.09)**	**<0.001**
Post-traumatic stress disorder				
No	Reference		Reference	

TABLE 3 (Continued)

	Unadjusted β		Adjusted β*	
Birthweight z-score	**β (95% CI)**	***P*-value**	**β (95% CI)**	***P*-value**
Yes	−0.04 (−0.13, 0.04)	0.30	0.01 (−0.08, 0.09)	0.89
Cannabis use				
No	Reference		Reference	
Yes	**−0.61 (−0.70, −0.52)**	**<0.001**	**−0.42 (−0.51, −0.33)**	**<0.001**
Maternal pregnancy complications				
Eclampsia				
No	Reference		Reference	
Yes	**−0.34 (−0.41, −0.26)**	**<0.001**	**−0.29 (−0.36, −0.22)**	**<0.001**
Anaemia				
No	Reference		Reference	
Yes	**0.13 (0.07, 0.20)**	**<0.001**	**0.12 (0.06, 0.18)**	**<0.001**
Antepartum haemorrhage				
No	Reference		Reference	
Yes	**−0.08 (−0.13, −0.03)**	**0.004**	−0.05 (−0.10, −0.01)	0.08
Urinary tract infection				
No	Reference		Reference	
Yes	**−0.07 (−0.13, −0.01)**	**0.02**	−0.02 (−0.08, 0.04)	0.50
Birth outcomes				
Child sex				
Male	Reference		Reference	
Female	0.00 (−0.02, 0.03)	0.82	0.00 (−0.02, 0.02)	0.91
Preterm birth				
Full-term birth	Reference		Reference	
Preterm birth	**−0.15 (−0.19, −0.11)**	**<0.001**	**−0.10 (−0.14, −0.05)**	**<0.001**

*Fully adjusted for all covariates.

The bold values are statistically significant.

in all babies. Our findings suggest there continues to be social, pregnancy and health complexities associated with LBW in this contemporary cohort, regardless of Indigenous status. However, many of these risk factors are more prevalent for First Nations women. The most important finding of this study is that First Nations status was not an independent risk factor for LBW babies. While there are more LBW First Nations babies, this was explained by identifiable risk factors that may be improved with culturally appropriate, strengths-based care. Maternal demographic factors and obstetric factors, such as maternal age, pre-pregnancy underweight, smoking after 20 weeks of gestation, parity, remoteness, socioeconomic disadvantage, cannabis use, maternal history of cardiovascular disease, eclampsia, APH, preterm birth and baby being of female sex were strongly associated with LBW in First Nations and non-First Nations women.

Our study highlights the importance of pre-pregnancy underweight as a risk for LBW.[16] Our findings are consistent with a national cohort study of Australian women where pre-pregnancy underweight was associated with LBW regardless of ethnicity.[17] This relationship has been confirmed in First Nations women attending Townsville Aboriginal and Islander Health Services (TAIHS), where low maternal BMI was associated with LBW and preterm birth.[9] High-quality nutrition throughout life, along with pre-conception care to identify and address low BMI may be an important prevention strategy. In Australia, there remains a relatively high proportion of unintended pregnancies in all reproductive age women,[18] so novel health promotion strategies may be required to address maternal low BMI prior to pregnancy.

An important finding of this study is to re-affirm that the most important outcome to assess improved perinatal outcomes is GA at birth rather than birth weight. Our findings suggest that preterm birth is the most important driver of LBW in Australian women regardless of First Nations status. Evidence from our study is consistent with previous studies that show similar non-significant differences in birthweight between First Nations and non-First Nations babies, after analyses adjusted for prematurity.[4,5,19] Two hospital-based studies in Australia also found higher LBW rates in First Nations neonates but confirmed there was no significant difference in birthweight after accounting for preterm

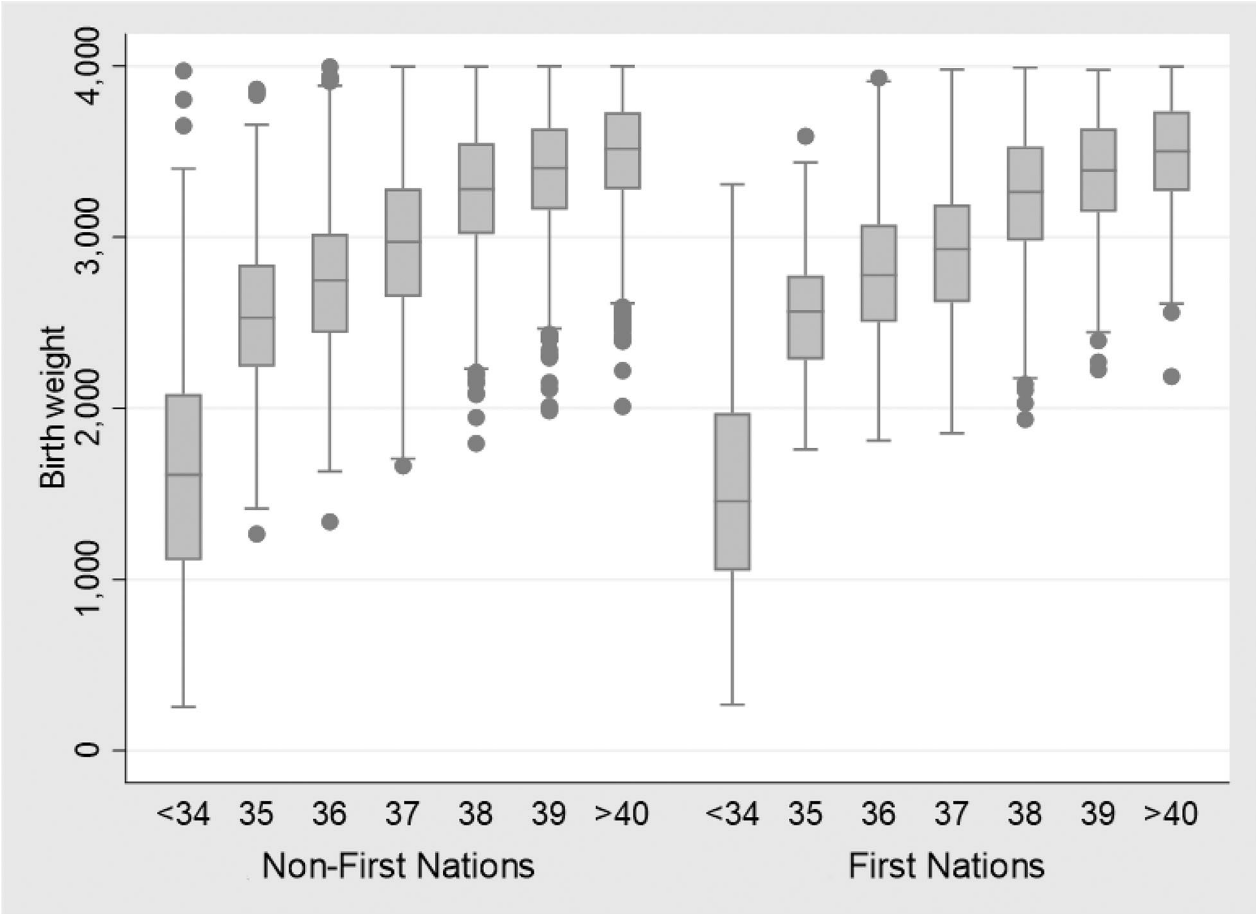

FIGURE 2 Comparison of birthweight by gestational weeks among study participants.

birth.[4,5] A retrospective study in Queensland, Australia, examined GA using a series of ultrasounds prior to 20 weeks gestation also found no difference in birthweight in First Nations women compared to non-First Nations.[19] Taken together, this suggests that preterm birth is the most important independent risk factor for LBW.[4,20] Thus, we suggest that GA at birth is the most important measure of perinatal health in 'Closing the Gap' initiatives, rather than birthweight. Interventions that target preterm birth prevention should be prioritised.

Despite increasing public health concerns, smoking during pregnancy and cannabis use remain the most common risk factors for LBW among women of childbearing age in Australia.[9] Higher rates of smoking and cannabis use were observed in First Nations women in pregnancy, which is consistent with existing literature.[21,22] Culturally sensitive, First Nations-led smoking cessation initiatives are currently being trialled in our health service.[23] Similar programs need to be developed for cannabis use prior to and during pregnancy.[24] The importance of maternal pre-pregnancy cardiovascular disease, pre-eclampsia and APH in current pregnancy as risk factors for LBW babies was highlighted in all women in our cohort, consistent with other studies.[25,26] This highlights the need for culturally safe medical and obstetric care in high-risk pregnancies, with efforts to ensure equality in guideline-concordant care for First Nations women. In our health service, 24.2% of First Nations women had fewer antenatal visits than recommended for GA at delivery. Culturally safe continuity of midwifery care and holistic wraparound support services for First Nations women has been well documented to improve ANC attendance.[13] We need to better understand the reasons women are not engaging in care and make concerted efforts to make care accessible to all women. Fifteen years after the initiation of the Closing the Gap strategy, there remains a gap in maternal health status between First Nations and non-First Nations women in our metropolitan cohort. This gap is fully accounted for by risk factors identified in our study, with LBW largely influenced by GA at delivery.[27] LBW as a marker of poor birth outcomes may be an inappropriate proxy measure, and others have raised this concern.[28,29] Reporting preterm birth or birthweight z-scores may be more appropriate. This approach will more accurately assess the outcomes of any change in model of care or preventative strategies.

Our study has several limitations. One of the included sites is a large tertiary referral centre, and thus there is likely to be an over-representation of complicated pregnancies with LBW neonates and preterm infants who required intensive care nursery support which is only available in a tertiary hospital.[30] The LBW rates may therefore not be generalisable to the whole population. The data were retrospective routinely collected sets and potential for under-reporting and misreporting exists. The strength of our study is the use of a large contemporary dataset of pregnant women who gave birth in metropolitan hospitals with comprehensive data on maternal pregnancy characteristics and perinatal information. We also adjusted for several predictors which have been recognised as important factors associated with LBW in the existing literature.

In conclusion, our study shows that First Nations status is not an independent factor influencing LBW in our health service, but rather may be explained by maternal sociodemographic and pregnancy factors. Given the success of community-based continuity of midwifery care, holistic services designed and led by First Nations communities and First Nations healthcare professionals, we need to challenge this discourse that First Nations status is an independent risk factor for LBW. If we build on the strengths and resilience of First Nations communities, engage with First Nations communities and healthcare professionals, and collaboratively redirect public health strategies, health promotion, community level care and maternity care, these modifiable risk factors should be able to be addressed. These efforts need to be focused on preventing preterm birth. We identified several factors that are a focus of the Closing the Gap initiative, which we routinely measure in our health service, such as smoking and ANC attendance. However, we identified novel risk factors that contribute to LBW, including maternal cardiovascular disease and cannabis use. Led by our First Nations staff and communities, Australian health services need to carefully consider these important contributors to LBW. Culturally informed interventions need to be explored to ensure every First Nations baby is given a strong start to life.

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ETHICAL STATEMENT

This study was approved by the Health HREC, reference number EX/2022/MNHA/89596.

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SUPPORTING INFORMATION

Additional supporting information may be found online in the Supporting Information section at the end of the article.

Table S1. Predictors for low birth weight (LBW) for 22 981 Australian infants (restricted to one random birth per mother) born at metropolitan hospitals in Queensland, Australia from 2019 to 2021.

Table S2. Predictors of birthweight z-score for 22 981 Australian infants born (restricted to one random birth per mother) at metropolitan hospitals in Queensland, Australia from 2019 to 2021.