Original Article

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Obstetric and Perinatal Morbidity in Northern Tasmanian Aboriginal Population: A Retrospective Cohort Study

Obstetrics and Gynaecology Section

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ABSTRACT

Introduction: Aboriginal and Torres Strait Islander women are at increased risk of maternal morbidity and mortality as compared to non-Aboriginals. Similarly, aboriginal babies are at increased risk of low birth weight and infant mortality.

Aim: To investigate the independent association of aboriginality with Tasmanian maternal and neonatal morbidity.

Materials and Methods: A retrospective analysis of all the births (gestation more than 20 weeks) from June 2013 to May 2014 was conducted at the Launceston General Hospital, Tasmania. The study compared 66 Aboriginal (4.2% of the total births) to 1477 non-aboriginal births for maternal and neonatal morbidity. Comparisons were made using logistic regression. The outcome measures were maternal and neonatal morbidity.

Results: Significantly higher number of aboriginal women (49% vs 19%; OR 4.15 90%CI 2.52- 6.85) smoked and used illicit drugs (15% vs 2%; OR 9.24; 95%CI 4.28-19.96) than the non-aboriginal women (both p<0.001). Maternal morbidity was not significantly different between aboriginal compared to non-aboriginal women (OR 0.64; 95%CI 0.36-1.14; p=0.13; adjusted OR 1.00; 95%CI 0.52-1.93; p=0.99). Factors positively associated with maternal morbidity included: age (OR 1.28; 95%CI 1.13-1.46; p<0.01) and BMI (OR 1.50; 95%CI 1.33-1.70; p<0.01). The unadjusted OR of neonatal morbidity for aboriginality was 1.98 (95%CI 1.17-3.34; p=0.01) and adjusted was 1.45 (95%CI 0.77-2.72; p=0.25). Factors positively associated with neonatal morbidity included smoking (OR 2.24; 95%CI 1.59-3.14; p<0.01), illicit drug use 95%CI 1.49-(OR 3.26; 95%CI 1.49-7.13; p <0.01), hypertension (OR 2.49; 95%CI 1.61-3.84; p<0.01) and diabetes (OR 1.92; 95%CI 1.33-2.78; p<0.01).

Conclusion: The composite Aboriginal maternal morbidity does not differ, however the increased rates of smoking and illicit drug use are largely responsible for neonatal morbidity. Along with strengthening strategies to decrease medical comorbidities in aboriginals, we recommend intensifying smoking and illicit drug cessation programs.

Keywords: Maternal, Neonatal, Pregnancy

INTRODUCTION

Aboriginal and Torres Strait Islander women remain at three times the risk of maternal death as non–aboriginal women [1]. Between 2008 and 2012, infant deaths (age under 1 year) represented 4.2% of deaths in indigenous people compared with 0.8% of deaths in non-indigenous people and live born babies born to indigenous mothers were about twice as likely as babies born to non-indigenous mothers to be of low birth weight, a factor strongly associated with infant mortality [2]. In countries where maternal deaths are infrequent, maternal morbidity is now widely recognized as a robust approach in improving maternal health and quality of healthcare provision [3]. Although a number of factors have been implicated for higher rates of adverse outcomes among infants born to aboriginal women, the majority of literature of association of pregnancy outcomes and aboriginal women lack adjustment for confounding factors [4].

Since the introduction of the 'Close the Gap Statement of Intent' by the Commonwealth Government in 2008, the health system has been striving to achieve various aboriginal health targets, one of which is child mortality including low birth weight. In 2012, 5.1% of women who gave birth in Tasmania were Aboriginal and Torres Strait Islanders [5].

AIM

This study aimed to determine whether there is an association between aboriginality and maternal and neonatal morbidity in the Australian region of Northern Tasmania, of which Launceston is the major town. Secondary aims were to assess other factors that may influence the relationship between aboriginal ethnicity and morbidity in mothers and babies.

MATERIALS AND METHODS

A retrospective analysis of all the births at the Queen Victoria maternity unit of the Launceston General Hospital, from June 2013 to May 2014 was conducted. The Launceston General Hospital is the only major Obstetrics and Gynaecology unit in northern Tasmania with approximately 1600 births per year serving a population of 160,000. All patients deliver in the same maternity unit at the Launceston General Hospital, irrespective of whether they belong to the private or the public healthcare system. The inclusion criterion was any birth > 20 weeks gestation in the study period whose aboriginal ethnicity was known. The exclusion criterion was unknown ethnicity and births < 20 weeks gestation. For neonatal morbidity we excluded the stillbirths in the study period and for maternal morbidity we included mothers who had stillbirths.

Data for the study was extracted in a de-identified manner from Obstetrix, the hospital obstetric database which has antepartum, intrapartum and postpartum information regarding all deliveries, as well as maternal and baby health related information. Aboriginal ethnicity in our study was self-defined and collected from the mother at her first antenatal visit for public and at the time of delivery for private patients.

Analytical Variables: Maternal morbidity indicators consisted of hypertension (pre-existing, gestational and pre-eclampsia), diabetes (pre-existing and gestational) and obstetric haemorrhage

(antepartum haemorrhage and postpartum haemorrhage) which were obtained from a priority list of seven conditions based on prevalence and health burden in Australia by the Australian Institute of Health and Welfare [6]. These indicators were combined to formulate the primary indicator of composite maternal morbidity. Presence of any one indicator was considered adequate to be included in the composite maternal morbidity group.

Maternal demographic indicators consisted of age, BMI, parity, smoking, illicit drug use, alcohol use and socioeconomic status. The socioeconomic status of each patient was derived from the street address applying the 2011 Australian Bureau of Statistics socioeconomic indexes for area (SEIFA) index of relative socioeconomic disadvantage [7]. This index was used to rank women according to their socioeconomic status and identified five quintile groups of equal numbers. The women in the lowest quintile (first) were the most disadvantaged compared to the rest hence considered as of lower socioeconomic status.

Neonatal morbidity indicators comprised of any neonatal complication (including metabolic issues such as hypoglycaemia, hypothermia, suspected neonatal sepsis, respiratory distress, intra uterine growth restriction and congenital abnormalities), admission to the special care nursery, APGAR score < 6 at 5 minutes of birth, preterm birth (gestational age < 37 weeks) and birth weight < 2.5 kg. All of these indicators were used to construct the composite primary indicator of neonatal morbidity. Presence of any single indicator was considered enough to be included in the combined neonatal morbidity group.

STATISTICAL ANALYSIS

The data was first explored using univariate analysis to assess the association between various morbidity factors and aboriginality. The association between aboriginality and various factors of maternal and neonatal morbidity was then investigated using multivariate logistic regression. The variables included in the multivariate model were selected using forward stepwise logistic regression model selected from a list of demographic (age, BMI, socio-economic status based on residential address) and lifestyle (smoking, alcohol, drug use etc.) factors. Variables with p<0.2 in this regression model were accepted for covariate inclusion. All analyses were performed using Stata (Version 13.1, StataCorp, USA). Comparative results are presented as odds ratio and 95% confidence interval (OR; 95% CI).

RESULTS

Of the 1559 women who delivered at Launceston general hospital, 16 were excluded because of unknown maternal ethnicity leaving complete data for 1543 women. Of those 66 were Aboriginal and Torres Strait Islanders accounting for 4.2% of the total births and 1477 were non-Aboriginal. Baseline characteristics of the two groups are compared in [Table/Fig-1]. While the mean age of women in both Aboriginal and non-Aboriginal were similar, the proportion of teenage pregnancies in Aboriginals (10.16%) was almost twice that of non-Aboriginals (5.82%). There were also higher rates in the Aboriginal women of smoking (48.48% v/s 18.48%) and illicit drug use (15.15% v/s 1.9%). The proportion of women with hypertension and diabetes were similar between the groups. There were no stillbirths in the Aboriginal group but all the individual neonatal mortalities were higher than the non-Aboriginals [Table/Fig-2] on univariate analyses.

The association between individual maternal morbidities and aboriginality was not significant when tested either as univariate analysis or when adjusted for various confounding factors. Similarly, the association between the composite maternal morbidity and aboriginality was also not significant on univariate analysis or when adjusted ([Table/Fig-3]; all p>0.13). Although not statistically significant, the odds of hypertension in Aboriginal women was twice that of non-Aboriginal women (OR 2.09; 95% CI 0.79 to 5.54; p=0.14).

While all individual unadjusted neonatal morbidities were observed to be significantly higher for Aboriginal babies than non-Aboriginal, the individual adjusted neonatal morbidities with significant association were APGAR score <6 at 5 minutes of birth (OR 3.62; 95% CI 1.35 to 9.68; p=0.01) and preterm birth (OR 4.05; 95% CI 1.50 to 10.95; p<0.01). Neonatal complications, low birth weight, admission to nursery and composite neonatal morbidity were not significantly associated with aboriginality after adjustment for confounders [Table/Fig-4].

The stepwise model demonstrated a positive association of composite maternal morbidity with advanced age (OR 1.28; 95% CI 1.12 to 1.46; p<0.01) and BMI of mother (OR 1.50; 95%CI

Characteristics	Aboriginal (n=66)	Non-aboriginal (n=1477)	OR (95%CI)
Age (years; Mean±SD)	26.52 ± 5.83	29.32 ± 5.90	0.43 (0.28-0.66)*
Teenage (<20years) n (%)	7 (10.16)	86 (5.82)	0.47 (0.13-1.69)
20-29 years n (%)	39 (59.09)	692 (46.85)	0.48 (0.28-0.83)*
BMI (kg/m^2; Mean±SD)	27.02 ± 9.21	26.17 ± 6.28	0.91 (0.55-1.51)
Primiparous n (%)	19 (28.36)	577 (38.67)	0.64 (0.37-1.09)
Grand multiparous(para>4) n (%)	2 (3.03)	29 (1.96)	1.56 (0.36 to 6.68)
Smoking status at delivery n (%)	32 (48.48)	273 (18.48)	4.15 (2.52 to 6.85)*
Illicit drug use at delivery n (%)	10 (15.15)	28 (1.90)	9.24 (4.28-19.96)*
Alcohol use during pregnancy n (%)	1 (1.52)	18 (1.22)	1.25 (0.16-9.48)
Hypertension† n (%)	6 (9.09)	115 (7.79)	1.18 (0.50-2.80)
Diabetes† n (%)	7 (10.61)	194 (13.13)	0.55 (0.35-1.74)
Low SES‡ n (%)	26 (40.00)	338 (23.21)	2.2 (1.32 to 3.68)*

[Table/Fig-1]: Demographic characteristics for Aboriginal and non-aboriginal mothers delivered at the Launceston General hospitalfrom June 2013 to May 2014. †Pre-existing and pregnancy induced, ‡SES (socioeconomic status) first quintile of index of relative socioeconomic disadvantage;* significantly different between aboriginal and non-aboriginal women

Outcomes	Aboriginal (n=66)	Non-aboriginal (n= 1472)	OR (95%CI)
Stillbirths† n (%)	none	5 (0.34)	-
Preterm birth (<37 weeks gestation) n (%)	13 (19.69)	131(8.78)	2.60 (1.38-4.89)*
Low birth weight (<2.5 kg) n (%)	10 (15.15)	116 (7.77)	2.13 (1.06-4.29)
Low Apgar (<6 at 5 min of birth) n (%)	5 (7.57)	38 (2.55)	3.55 (1.34-9.41)*
Neonatal Complications‡ n (%)	13 (19.69)	176 (11.80)	1.78 (0.95-3.33)
Admission to nursery n (%)	17 (25.75)	238 (16.01)	1.78 (1.01-3.15)

[Table/Fig-2]: Birth outcomes for Aboriginal and non-aboriginal mothers delivered at the Launceston General Hospital from June 2013 to May 2014. †n for non-aboriginal group is 1477, ‡ consisted of metabolic issues (e.g. hypoglycaemia), hypothermia, suspected neonatal sepsis, respiratory distress, intra uterine growth restriction and congenital abnormalities,*significantly different.

Maternal morbidities	Unadjusted OR (95% CI)	p	Adjusted OR† (95% CI)	p
Hypertension (pre-existing and pregnancy induced)	1.18 (0.50 to 2.80)	0.70	2.09 (0.79 to 5.54)	0.14
Diabetes (pre-existing and GDM)	0.78 (0.35 to 1.74)	0.55	0.90 (0.37 to 2.19)	0.82
Obstetric Haemorrhage (antepartum and postpartum haemorrhage)	0.58 (0.27 to 1.22)	0.15	0.81 (0.36 to 1.85)	0.62
Composite maternal morbidity‡	0.64 (0.36 to 1.14)	0.13	1.00 (0.51 to 1.93)	0.99

[Table/Fig-3]: Effect of aboriginality on maternal morbidity for births at the Launceston General Hospital from June 2013 to May 2014. †Analyses adjusted for maternal age, BMI, parity, smoking status at delivery, alcohol intake, illicit drug use and low socioeconomic status (1st quintile of index of relative socioeconomic disadvantage), ‡ consists of hypertension, diabetes and obstetric haemorrhage.

Neonatal morbidity	Unadjusted OR (95% CI)	p-value	Adjusted OR (95% CI)*	p-value
Neonatal complications†, ‡	1.78 (0.95 to 3.33)	0.07	1.12 (0.81 to 3.41)	0.17
Apgar < 6 at 5 min§	3.55 (1.34 to 9.41)	0.001	3.61 (1.27 to 10.20)	0.02
Preterm birth (<37 weeks gestation)‖	2.60 (1.38 to 4.89)	<0.01	4.05 (1.50 to 10.95)	<0.01
Low birth weight (<2.5 kg)¨	2.13 (1.06 to 4.29)	0.03	0.48 (0.15 to 1.49)	0.20
Admission to nursery††	1.78 (1.01 to 3.15)	0.05	1.17 (0.51 to 2.66)	0.71
Composite neonatal morbidity‡‡	1.98 (1.17 to 3.34)	0.01	1.45 (0.77 to 2.72)	0.25

[Table/Fig-4]: Effect of aboriginality on neonatal morbidity for births at the Launceston General Hospital from June 2013 to May 2014.
*Analyses adjusted for maternal age, BMI, parity, smoking status at delivery, alcohol intake, illicit drug use, low socioeconomic status (1st quintile of index of relative socioeconomic disadvantage), hypertension, diabetes and antepartum haemorrhage for all the morbidities. †consisted of metabolic issues (e.g. hypoglycaemia), hypothermia, suspected neonatal sepsis, respiratory distress, intra uterine growth restriction and congenital abnormalities. ‡was also adjusted for preterm birth, low birth weight and low Apgar. §also adjusted for preterm birth and low birth weight. ‖also adjusted for low birth weight. ¨also adjusted for preterm birth. ††also adjusted for preterm birth, low birth weight, low Apgar. ‡‡consists of neonatal complications, Apgar <6, preterm birth, low birth weight and admission to nursery.

1.33 to 1.70; p<0.01) and a protective association with multiparty (OR 0.67; 95%CI 0.52 to 0.87; p<0.01) and smoking (OR 0.52; 95%CI 0.36 to 0.74; p<0.01). Various maternal factors were also associated with composite neonatal morbidity. There was a positive association between composite neonatal mortality and smoking (OR 2.24; 95%CI 1.59 to 3.14; p<0.01), illicit drug use (OR 3.26; 95%CI 1.49 to 7.13; p<0.01), hypertension (OR 2.49; 95% CI 1.61 to 3.84; p<0.01) and diabetes (OR 1.92; 95%CI 1.33 to 2.78; p<0.01). In contrast, multiparity was negatively associated (OR 0.70; 95%CI 0.53 to 0.93; p=0.01) with composite neonatal morbidity. Socioeconomic status was not found to significantly affect any of the maternal or neonatal morbidity variables.

DISCUSSION

This was the first study to investigate the effect of aboriginality on maternal and neonatal morbidity in Tasmania. The study suggests that in our population there was no independent association between aboriginality and composite maternal morbidity. The study revealed that maternal morbidity has a positive association with increasing maternal age and BMI and a negative association with smoking and multiparity (second to fourth parity). The protective effect of smoking on maternal morbidity could be due to the inverse association between cigarette smoking during pregnancy and preeclampsia with a reduction of risk by up to 50% [8].

The study also found that there is no independent association of aboriginality and composite morbidity in the neonate. The positive association between aboriginality and composite neonatal morbidity on univariable analysis does not remain when lifestyle factors and maternal comorbidities are taken into account. Significant positive associations were found between smoking [9], illicit drug use [10], hypertension [11], diabetes [12] in the mother and neonatal morbidity, similar to researches in the past. It was these related lifestyle factors and medical conditions, rather than aboriginality as an independent risk factor, which caused poorer outcomes.

A recent systematic review of pregnancy outcomes in aboriginals revealed greater unadjusted odds of low birth weight, pre-term birth, stillbirths and neonatal and perinatal mortality [4]. In our study, the unadjusted odds of almost all the individual neonatal morbidities including preterm birth and low birth weight and the composite neonatal morbidity were greater, however when adjusted for potential confounders we found that only preterm birth and low Apgar at 5 minutes remained significant. Low Apgar score has been associated in the past with maternal ethnicity [13], alcohol intake [14], illicit drug use [15], and preterm birth [16] but in our study only Aboriginal ethnicity was related to low Apgar scores. We have been unable to explain the reason behind this independent association but propose a genetic basis, which needs further investigation. Similarly preterm birth has been associated with ethnicity [4], BMI [17], alcohol [18], smoking [17], illicit drugs [15,17], hypertension [19] and infections [20]. In our study, preterm births were associated with Aboriginal ethnicity, low birth weight, preterm premature rupture of membranes, twin pregnancy and grand-multiparity.

One of the factors implicated for poor obstetric outcome among Aboriginal and Torres Strait Islander women is their socioeconomic status. The evidence available to date regarding the association of low socioeconomic status and poor obstetric outcomes is conflicting. The complex inter-relation of mediating factors that are not only confounding but also lie on the causal path between low SES and poor outcomes complicate the association [3,21,22]. In spite of having 40% of our Aboriginal mothers in the 1st two quintiles (most disadvantaged), low socioeconomic status was not associated with maternal or neonatal morbidity.

Differences in Tasmanian Aboriginal mother's v/s mainland Aboriginal mothers in our study: Currently the teenage fertility rates of Aboriginal women in Australia are four times the overall Australian teenage fertility rate [2]. In our study, the percentage of Aboriginal teenage mothers was twice that of non-Aboriginals. Aboriginal mothers are four times as likely as non-Aboriginal mothers to have smoked during pregnancy (age standardised rates of 49% and 12%) [2]. Our study showed similar results with smokers making up 48.48% in the Aboriginal group compared with 18.48% in the non-Aboriginal group. Analysis of the 2008 National Aboriginal and Torres Strait Islander Social Survey showed that twenty percentage of Aboriginal women reported consuming alcohol during pregnancy in 2008 [23]. Our cohort of Aboriginal women had similar rates of alcohol consumption during pregnancy as compared to the non-Aboriginal women.

There is mixed evidence in the Australian literature, with roughly equal numbers of studies reporting a higher incidence of GDM in Australian Aboriginal women compared with non-Aboriginal populations, as those reporting a lower incidence [24]. Our study found no significant difference between the two cohorts, however small numbers may have precluded a conclusive finding. There was a non-significant doubling in the odds ratio for hypertension in Aboriginal mothers in our study, this is contrary to the studies in literature with greater prevalence of pregnancy induced hypertension in the Aboriginals residing in other parts of Australia [10]. This inconsistency may also be explained by our small sample; however, it could also be related to the younger age of mothers in our cohort.

In 2008, Tasmania was one of the three states with the largest recorded increase in the rate of year 12 education completion for Aboriginal children from 17% to 22% [25]. These and further improvements may be reflected in some of the positive differences of Tasmanian Aboriginals as compared to the main land communities. Also, Tasmanian Aboriginals due to the smaller size of the state may have better access to services in comparison to isolated mainland communities. Alternately, it could be the poor socioeconomic condition of Tasmanians in general. Generalising our results for the whole of Australia or Aboriginals in other parts of the world may not be justifiable due to these differences.

Implications of the study: Although aboriginal ethnicity did not have an independent association with composite maternal or neonatal morbidity, lifestyle and demographic factors did have statistically significant associations, indicating that in Tasmania these should be the focus for improving maternal and child health. Considering the positive association of smoking and illicit drug use with neonatal morbidity and the fact that the percentage of women who smoked and used illicit drugs in Tasmanian Aboriginal women was higher than the non-Aboriginals, we recommend

strengthening our strategies for smoking as well as drug cessation and support programs. These cessation programs are more likely to succeed when designed as per the socio-cultural context and being community based. A culturally appropriate holistic approach, recruiting assistance from aboriginal health care workers and liaison officers may assist in closing the gap.

STRENGTHS OF THE STUDY

The pre-requisite of adjusting for confounding factors is crucial to any study that investigates into the relationship of aboriginality and morbidity. We have adjusted not only the composite morbidity but also all individual morbidities, so as to be able to suggest associations with true significance. One of the factors implicated for poor obstetric outcome among Aboriginal and Torres Strait Islander women is their socioeconomic status. This paper used the 2011 SEIFA index of relative socioeconomic disadvantage, an ecological index that measures socioeconomic status. Using ecological index at a fine spatial level has shown to be a good substitute for individual level information and any bias introduced by this approach will usually lead to conservative estimates of association [22]. Also, the 2011 SEIFA uses the new base unit of analysis – the Statistical Area Level 1 rather than the Census Collection District, which is a finer spatial level [7].

LIMITATIONS

Unsuspected confounding variables, which are not routinely recorded or inconsistently recorded, may have affected our outcomes. It is difficult to be sure that all relevant risk factors and outcomes were included especially due to the retrospective nature of the study. The exclusion of 16 women with missing data on ethnicity is one of the other limitations of our study. Although it is difficult to assess the impact of these missing women, we do not believe that this 1% of missing data has a major effect on our results.

CONCLUSION

While clinicians and researchers have identified that aboriginal mothers and babies are at increased risk of poor outcomes, our study has gone a step further to analyse several independent associations and contributes to our understanding. Further studies with larger sample sizes and in different aboriginal populations will be useful to examine these associations and contribute to improved care.

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