# The roles of socioeconomic status and Aboriginality in birth outcomes at an urban hospital

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## ABSTRACT

**Objectives:** To explore the role of socioeconomic status and Aboriginality on birthweight at an urban hospital.

**Design, participants and setting:** Extraction of data on the demographic characteristics (socioeconomic status, mothers' single-parent status, age and smoking status) and infants' birthweight from a clinical record system. Infants delivered at an outer urban hospital to mothers residing in the local government area during 2002 were included. Infants were identified and results interpreted in consultation with Indigenous health workers.

**Main outcome measure:** Infant birthweight.

**Results:** Indigenous infants had a lower mean birthweight than non-Indigenous infants (difference, 127 g), and were more likely to weigh < 2500 g. Mothers of Indigenous infants were more likely to be single, aged < 20 years and to smoke during pregnancy. Lower birthweight was associated with lower socioeconomic status for Indigenous and non-Indigenous infants. Indigenous infants in the most socioeconomically disadvantaged quintile in this study were at higher risk and had a mean birthweight 204 g less than non-Indigenous infants in the same quintile. In multivariate analysis, differences in birthweight were associated with socioeconomic status and smoking during pregnancy.

**Conclusions:** For both Indigenous and non-Indigenous infants, birthweights were associated with socioeconomic status. Differences between Indigenous and non-Indigenous infants were largely explained by low socioeconomic status and smoking during pregnancy.


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Compared with Australian infants, Indigenous Australian infants have lower birthweights, a greater risk of preterm birth and higher infant mortality.[1-3] Several risk factors for poorer outcomes have been identified, including rurality, socioeconomic and educational disadvantage, smoking and access to services.[3-6] Most of the data on these risk factors come from Indigenous people living in rural and remote parts of Australia, or in the western states, where identification of Indigenous people in routine data collections is thought to be more reliable.[7,8] However, most Indigenous people live in urban areas on the eastern seaboard, where they represent a low proportion of the total population (2%) and so remain largely invisible. There are limited data on the health and wellbeing of these urban Indigenous populations.

It is generally assumed that issues relating to Indigenous health are related to poverty, yet data relating to socioeconomic status have not been widely reported.[2,9] However, research suggests that factors other than socioeconomic differences affect the health of Indigenous people, including dispossession, discrimination, sense of control and power, identity and stress, and that these contribute to and help to explain what are often seen as intractable health and social problems.[5-8]

Our relationship with an outer urban hospital and the local Indigenous community in Sydney provided an important opportunity to perform a comparative study of the role of socioeconomic status and Aboriginality on birth outcomes. Some suburbs within the region rank among the most disadvantaged localities in New South Wales, allowing us to identify a group of low-socioeconomic-status infants and their mothers. The region also has a large Indigenous population, and the hospital uses both maternal and paternal cultural identification to define the Indigenous status of infants.

The aim of this study was to compare the birthweights of Indigenous and non-Indigenous urban infants, and to examine the association between birthweight, Aboriginality and socioeconomic status.

## METHODS

The study population included all infants (singletons) born at a large outer metropolitan hospital in 2002, to mothers residing in the hospital's local government area (LGA). Maternity services at the hospital used a population-based clinical record system, the Obstetrics Data Package (ODP), to record clinical information on antenatal care, delivery and postnatal care. De-identified unit record data, including medical record number, demographic characteristics, obstetric outcomes, and maternal and paternal Indigenous status were extracted. Indigenous infants (born to an Indigenous mother and/or father) were identified through the hospital ODP, and their Indigenous status confirmed by Indigenous health workers.

Our primary outcome measure was birthweight, summarised in two ways: first, as the initial weight of the infant recorded after birth, measured in grams; and second, as the proportion of infants of birthweight less than 2500 g. We also present data on admission to either the special-care nursery or neonatal intensive care unit for more than 4 hours.

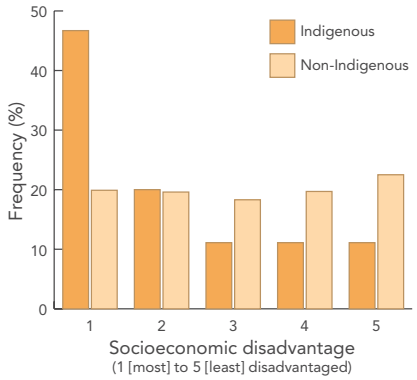
The primary study factor was socioeconomic status. As there was limited information available on socioeconomic status in the ODP, we applied the 1996 Australian Bureau of Statistics Socio-Economic Indexes for Areas (SEIFA) index of relative socioeconomic disadvantage, based on maternal suburb of residence.[10] This enabled us to rank mothers according to socioeconomic status of their suburb of residence and identify five quintile groups of about equal numbers (ranked from most [Quintile 1] to least [Quintile 5] disadvantaged). We compared the birth outcomes and maternal risk factors for mothers in the most disadvantaged group (three suburbs; Quintile 1) to the remainder (29 suburbs).

Several potential maternal risk factors for birth outcomes including age, single-parent status, and smoking were examined. Mater-

**1 Comparison of demographic characteristics and birth outcomes (showing 95% CIs) for Indigenous and non-Indigenous infants born at an outer urban hospital in 2002 to mothers residing in the hospital's local government area**

| Characteristic/outcome | Indigenous | Non-Indigenous | Significance $\chi^2$ | Significance *P* |
|---|---|---|---|---|
| No. of infants | 90 | 1616 | | |
| Mean birthweight | 3268 g (3129–3406 g) | 3395 g (3366–3424 g) | — | 0.05 |
| Birthweight < 2500 g | 11.1% (5.7%–19.9%) | 6.0% (4.9%–7.3%) | 3.8 | 0.05 |
| Special-care nursery or neonatal intensive care unit | 16.7% (10.0%–25.4%) | 11.2% (9.7%–12.8%) | 2.5 | 0.1 |
| Mean Apgar score at 1 minute | 8.3 (8.0–8.6) | 8.2 (8.2–8.3) | — | 0.8 |
| Mother aged < 20 years | 16.7% (12.8%–20.6%) | 7.2% (6.6%–7.8%) | 10.6 | 0.001 |
| Single mother | 47.8% (42.7%–52.9%) | 23.7% (22.6%–24.8%) | 26.4 | < 0.001 |
| Mother smoked | 47.8% (42.7%–52.9%) | 27.8% (26.7%–28.9%) | 16.6 | < 0.001 |

**2 Distribution of infants according to socioeconomic ranking of suburb[10]**




nal age was classified to indicate mothers who were aged less than 20 years at delivery (higher risk group[11,12]). Mothers were classified as single (also a higher risk group[13]) if they reported that they were not married or in a de-facto relationship. Mothers were classified as current smokers if smoking during pregnancy was noted in the ODP.

Analyses were conducted using SPSS, version 10.07 (SPSS Inc, Chicago, Ill, USA). Descriptive statistics based on contingency tables and the $\chi^2$ statistic (at $\alpha = 0.05$) were used to compare outcomes of different study groups. Continuous variables were summarised as means; differences between groups were expressed as the mean difference and standard deviation; and the Student's *t* test was used to test the null hypothesis that the mean difference did not differ from zero. Linear regression models were used to further examine the relationship between socioeconomic status and birthweight for Indigenous and non-Indigenous infants, and the competing roles of smoking and socioeconomic status.

The Human Research Ethics Committees of the University of NSW and of Sydney South West Area Health Service (SSWAHS) Western Zone approved the study. The SSWAHS Aboriginal Health Service, Tharawal Aboriginal Corporation, and Aboriginal health workers supported the research and were involved in the development, analysis and interpretation of the study findings.

## RESULTS

During 2002, 1706 infants were born at the hospital to mothers residing in the LGA. Ninety of these infants were identified as being Indigenous.[14]

The birth outcomes and risk factors for Indigenous and non-Indigenous infants are compared in Box 1. The mean birthweight for Indigenous infants was lower than that of non-Indigenous infants, and the difference (127 g; 95% CI, 2–254 g) was statistically significant ($t_{1700} = 2.0$; $P = 0.05$). Also, a statistically significant higher proportion of Indigenous (compared with non-Indigenous) infants had birthweights less than 2500 g (Box 1). Apgar scores at 1 minute did not differ between Indigenous and non-Indigenous infants ($t_{1686} = -2.9$; $P = 0.8$). The proportion of infants admitted to the special-care nursery or neonatal intensive care unit did not differ significantly between the two groups. However, mothers of Indigenous infants were significantly more likely to be aged less than 20 years, to be a single parent, and to smoke during pregnancy than mothers of non-Indigenous infants.

The distribution of Indigenous and non-Indigenous infants by socioeconomic status (based on SEIFA scores) is shown in Box 2. Indigenous infants were more likely to reside in the most socioeconomically disadvantaged areas (Quintile 1) than non-Indigenous infants. Notably, Indigenous infants and their families were found in all five quintile groups.

**3 Comparison of birth outcomes and risk factors (showing 95% CIs) between Indigenous infants and non-Indigenous infants residing in the most socioeconomically disadvantaged areas (Quintile 1) born at an outer urban hospital in 2002 to mothers residing in the hospital's local government area**

| Outcome or risk factor | Indigenous | | | Non-Indigenous |
|---|---|---|---|---|
| | Quintile 1 | Other Indigenous | Total | Quintile 1 |
| No. of infants | 42 | 48 | 90 | 321 |
| Mean birthweight | 3101 g (2868–3333 g) | 3413 g (3254–3572 g) | 3268 g (3129–3406 g) | 3305 g (3240–3370 g) |
| Birthweight < 2500 g | 16.7% (5.4%–28.0%) | 6.3% (0–13.2%) | 11.1% (4.6%–17.6%) | 7.2% (4.4%–10.0%) |
| Special-care nursery or neonatal intensive care unit | 21.4% (9.0%–33.8%) | 12.5% (3.1%–21.9%) | 16.7% (9.0%–24.4%) | 10.4% (7.1%–13.7%) |
| Mother aged < 20 years | 23.8% (10.9%–36.7%) | 10.4% (1.8%–19.0%) | 16.7% (9.0%–24.4%) | 10.9% (7.5%–14.3%) |
| Single mother | 50.0% (34.9%–65.1%) | 45.8% (31.7%–59.9%) | 47.8% (37.5%–58.1%) | 33.3% (28.1%–38.5%) |
| Mother smoked | 66.7% (52.4%–81.0%) | 31.3% (18.2%–44.4%) | 47.8% (37.5%–58.1%) | 43.6% (38.2%–49.0%) |

**4 Univariate and multivariate regression coefficients for relationship between study factors and birthweight for Indigenous and non-Indigenous infants**

| | Univariate | | Multivariate | |
|---|---|---|---|---|
| Independent variables | β (95% CI) | *P* | β (95% CI) | *P* |
| Indigenous (compared with non-Indigenous) | −127.7* (− 253.8 to −1.5) | 0.05 | −53.9 (−180.2 to 72.5) | 0.4 |
| Mother aged < 20 years (compared with ⩾ 20 years) | −89.6 (−195.2 to − 1.5) | 0.1 | −17.4 (−126.3 to 91.6) | 0.8 |
| Single mother (compared with married/de facto) | 104.4 (39.4 to 169.5) | 0.002 | 25.8 (−43.5 to 95.1) | 0.5 |
| Mother smoked (compared with did not smoke) | −247.8 (−309.4 to −186.2) | < 0.001 | −222.8 (−287.7 to −158.0) | < 0.001 |
| Quintile 1 (compared with Quintiles 2–5)† | −135.9 (−204.7 to − 67.2) | < 0.001 | −80.73 (−150.9 to −10.5) | < 0.001 |

* β of −127.7 is equivalent to a reduction in birthweight of 127.7 g for Indigenous infants compared with non-Indigenous infants. † Mothers' suburbs of residence were ranked into five quintiles according to level of socioeconomic disadvantage, ranging from Quintile 1 (most disadvantaged) to Quintile 5 (least disadvantaged).[10] ◆

The birthweights of both Indigenous and non-Indigenous infants in Quintile 1 were lower than infants in the other quintiles, and maternal demographic characteristics suggested greater vulnerability. The mean birthweight for non-Indigenous infants in Quintile 1 was 112 g (95% CI, 40–184 g) less than for other non-Indigenous infants (3305 g v 3418 g; $t_{1610} = 3.1$; $P = 0.002$). Mothers of non-Indigenous infants in Quintile 1 were significantly more likely to be aged less than 20 years (10.9% v 6.3% of other mothers; $\chi^2_1 = 8.0$; $P = 0.005$); more likely to be a single parent (33.3% v 21.3% of other mothers; $\chi^2_1 = 20.6$; $P < 0.001$); and more likely to smoke during pregnancy (43.6% v 21.3% of other mothers; $\chi^2_1 = 49.6$; $P < 0.001$).

Box 3 shows that there were no differences in birthweight between Indigenous infants in all quintiles and non-Indigenous infants in Quintile 1. However, the mean birthweight of Indigenous infants in Quintile 1 was 204 g (95% CI, 6–402 g) lower than that of non-Indigenous infants in this quintile (3101 g v 3305 g; $t_{360} = 2.0$; $P = 0.04$). In addition, Indigenous infants in Quintile 1 were more likely to have a low birthweight (< 2500g) than non-Indigenous infants in Quintile 1 ($\chi^2_1 = 4.4$; $P = 0.03$), and to require admission to special-care nursery or neonatal intensive care unit ($\chi^2_1 = 4.4$; $P = 0.04$). Mothers of Indigenous infants from Quintile 1 were significantly more likely than mothers of non-Indigenous infants from this quintile to be single ($\chi^2_1 = 4.5$; $P = 0.03$), to be aged less than 20 years ($\chi^2_1 = 5.7$; $P = 0.02$), and to smoke during pregnancy ($\chi^2_1 = 8.0$; $P = 0.005$).

Finally, linear regression models were constructed to further explore risk factors for reduced birthweight (Box 4). In univariate models, lower birthweight was associated with infants' Indigenous status, and mothers' single-parent status, smoking and residence in particularly disadvantaged suburbs, but not with mothers' age of less than 20 years. When all variables were included, lower birthweight was associated with mothers smoking and residing in particularly disadvantaged suburbs, but not with infants' Indigenous status or mothers' single-parent status. Interactions between infants' Indigenous status, mothers' smoking and mothers' residence in particularly disadvantaged suburbs were not statistically significant.

## DISCUSSION

To our knowledge, this is the first study in an urban setting on the eastern seaboard to examine the impact of socioeconomic status on birth outcomes of Indigenous infants, and to compare these findings with those for non-Indigenous infants on the basis of administrative population data containing systematically collected details of maternal and paternal Indigenous health status. The birth outcomes for Indigenous infants and non-Indigenous infants with low socioeconomic status were similar. However, within the most socioeconomically disadvantaged quintile determined by mother's place of residence, Indigenous infants weighed less than non-Indigenous infants and were more likely to be admitted to the special-care nursery or neonatal intensive care unit. This suggests that the observed differences in birth outcomes between Indigenous and non-Indigenous infants cannot solely be explained by socioeconomic disadvantage.

This was an exploratory study designed to evaluate the feasibility of identifying Indigenous infants from a population-based clinical record system and extracting the clinical records. There were a number of limitations. First, limited reliable data on socioeconomic status were available. The SEIFA index[10] was an ecological summary measure of the area, and may not reflect individual variation in socioeconomic status. While the 1996 index was used for this study,[10] our subsequent work with later indices showed that the three suburbs that we included in Quintile 1 did not change. Because of the relatively small size of our study and other data-quality issues relating to the data source, there was limited statistical power to include an extensive range of study and outcomes factors.

Our findings suggest that socioeconomic status does not completely explain the poorer birth outcomes for Indigenous infants. Despite being represented in all five SEIFA Quintiles, Indigenous infants overall had similar outcomes to those of non-Indigenous infants from Quintile 1, and Indigenous infants in Quintile 1 had significantly worse outcomes. These findings concur with those of other Australian research showing differences in mortality rates between Indigenous and non-Indigenous Australians at every socioeconomic level.[1,6,15] International research has also indicated that some minority populations, such as African Americans, Inuit, Māori and Scandinavian Sami, are disadvantaged in terms of health at every level of socioeconomic status, regardless of how this is measured.[2,11-13,16]

Maternal sociodemographic factors, including socioeconomic status, younger age, smoking status and single-parent status, also have a role in birth outcomes.[2,3,9] In this study, when we controlled for these factors in multivariate analysis, the association with lower birthweight for Indigenous infants disappeared, suggesting that, superficially, these factors (rather than Indigenous status) explained the observed difference between Indigenous and non-Indigenous

birthweights. We suggest that caution is required in interpreting these results, as higher rates of smoking, disadvantage and single-parent status were observed among mothers of Indigenous infants. In controlling for the impact of these factors, we may have inadvertently controlled for more subtle factors associated with being Indigenous that were not measured in the data.

There are also issues specific to Indigenous communities that may explain the differences in birth outcomes between Indigenous and non-Indigenous infants.[9] Dispossession has been the subject of an emerging debate, with sociopolitical explanations such as discrimination, sense of control and power, identity, and stress possibly being critical.[10,11] Informal discussions with local Indigenous health workers after we analysed the data elicited perceptions of high chronic stress levels among mothers of Indigenous infants, resulting from feelings of disempowerment, complex identity issues and social isolation.

Our study makes several useful contributions. First, it shows that using electronic clinical record data for this research was feasible and allowed us to identify Indigenous infants. Second, our findings have implications for the development of interventions to address birth outcomes of Indigenous infants. It suggests that multifocused interventions tackling social, economic and behavioural factors would be the most effective way to improve birth outcomes for Indigenous infants.

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## COMPETING INTERESTS

None identified.

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