Is birthweight an appropriate health-outcome measure for Torres Strait Islander babies?

Abstract

Background: Although Torres Strait Islanders (TSIs) are often combined with Aborigines, they are a distinct group and would prefer to be considered separately. The Queensland Perinatal Data Collection (QPDC) has been the only population-based, perinatal collection in Australia that has distinguished between Aboriginal and TSI mothers. It provided a unique opportunity to compare outcome measures based on birthweight in the TSI, Aboriginal and white populations. TSIs were of particular interest because recent research from overseas suggests that in groups with high rates of obesity and diabetes, birthweight is not a valid outcome measure. This is of concern because outcome measures based on birthweight have been proposed as a way of monitoring the neonatal health of Indigenous Australians.

***Methods*:** Retrospective analysis of 10 years of routine data from the QPDC.

***Results*:** TSIs had a birthweight distribution similar to that of whites, but mortality rates similar to those of Aborigines. For birthweights between 2500g and 4000g, TSIs had mortality rates that were 2.5 times higher than those for whites (95% *CI*: 1.3 to 4.2).

***Conclusions*:** Although birthweight is widely used, it is not necessarily a valid outcome measure in all populations. For TSIs, maternal conditions such as obesity and diabetes might cause changes in the uterine environment that produce heavier, but not healthier babies.

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Enthusiasm for health-outcome measures is based on the premise that they can support changes in policy and practice.[1] Ideally, the measures should be based on detailed clinical information, but the cost of acquiring such information is often prohibitive and they are often based on routinely collected data.[2] Although inexpensive, using such data for outcome measures raises major questions about the validity of the conclusions reached and the justice and equity of any policy decisions that may follow.[3]

This study examined the validity of using birthweight to monitor the neonatal health of Torres Strait Islander (TSI) babies. Birthweight has a long history as a measure of the neonatal health of populations and is still commonly used both overseas and in Australia.[4] The relationship between lighter birthweight and higher risk of neonatal morbidity and mortality has led to the use of birthweight as a measure of newborn health status and program effectiveness, particularly prenatal care and other health and nutritional services. For example, the Australian Health Ministers Advisory Council (AHMAC) chose the low-birthweight proportion to be one of the outcome measures for Indigenous health.[5]

However, there is evidence from overseas that a shift in distribution of birthweight towards heavier values does not necessarily mean healthier babies. For example, the average birthweight for Pacific Islanders in Hawaii is similar to that for white Americans, but their rate of neonatal mortality is two times higher.[6] Researchers have reported a similar pattern for babies born to North African mothers who have migrated to Europe.[7] For these groups, maternal conditions such as diabetes and obesity, rather than birthweight, might be the primary mediators of the risk of neonatal morbidity and mortality. This might also be important for TSIs because they are believed to have rates of obesity and diabetes that are even more extreme than the high rates found in some Aboriginal populations.[8] For example, a recent study at Cairns Base Hospital found that, for 1996, the proportion of TSI mothers with gestational diabetes was 14.4%, compared with 7.0% for Aboriginal mothers and 3.6% for white mothers.[9]

TSIs are a distinct group and would prefer to be considered separately from other Indigenous Australians, however, they are often ignored or grouped with Aborigines.[10] The Queensland Perinatal Data Collection (QPDC) has been the only population-based, perinatal collection in Australia that has distinguished between Aboriginal and TSI mothers.[10] It provided a unique opportunity to compare outcome measures based on birthweight in the TSI, Aboriginal and white populations. The results of this study show that policy makers should not assume that birthweight is a valid outcome measure in all populations.

Methods

Data were obtained from the QPDC for 1988 to 1997. Ten years of data were used in an attempt to minimise the effects of random variation. In line with the measure proposed by ARMAC, only live births were considered.[5] It is well known that the

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Table 1: Outcomes based on birthweight or gestational age by maternal ethnicity.

Outcome	Whites		TSIs			Aborigines		
	No.	%	No.	%	Risk ratio[a] (95% CI)	No.	%	Risk ratio[a] (95% CI)
Very low birthweight (<1,500 g)	2,984	0.8	59	1.2	1.6 (1.2-2.0)	291	1.7	2.3 (2.0-2.5)
Low birthweight (<2,500 g)	17,957	4.6	312	6.3	1.4 (1.2-1.5)	1,874	11	2.4 (2.3-2.5)
Moderately high birthweight (4,000+ g)	49,213	12.5	584	11.8	0.9 (0.8-1.0)	1,317	7.7	0.6 (0.5-0.7)
Very high birthweight (4,250+ g)	20,110	5.1	265	5.4	1.0 (0.9-1.2)	564	3.3	0.7 (0.6-0.8)
Extremely high birthweight (4,500+ g)	7,273	1.9	123	2.5	1.3 (1.1-1.6)	210	1.2	0.6 (0.5-0.8)
Very pre-term (<28 weeks)	1,243	0.3	34	0.7	2.2 (1.6-3.1)	147	0.9	2.7 (2.3-3.2)
Pre-term (<37 weeks)	22,171	5.6	408	8.3	1.5 (1.3-1.6)	2,004	11.8	2.1 (2.0-2.2)
Post-term (42+ weeks)	13,852	3.5	164	3.3	0.9 (0.8-1.1)	439	2.6	0.7 (0.7-0.8)

Note:
(a) Ratio of the risk of the outcome in TSIs (or Aborigines) compared with the risk in whites.

pattern of birthweight and neonatal mortality for multiple births is different from that for singleton births;[11] consequently, multiple births were excluded from the analysis.

The distributions of birthweight were examined using univariate kernel density estimation. Statisticians regard this method as preferable to frequency polygons or histograms for describing the shape of a distribution.[12] A resistant non-linear smoothing method, called *4325H twice*, was used to dampen irregularities in the plot of median birthweight by gestational age.[13] The analyses were done using the statistical package Stata.[14]

The analyses presented in this paper are for both sexes combined. Separate analyses for males and females (not presented) showed that differences in the sex distribution for the three ethnic groups could not confound any of the racial differences in birthweight or mortality.

The QPDC runs comprehensive edit-checks on both birthweight and gestational age. If the reported birthweight is implausible for the reported gestational age or information is missing, query-reports are sent to the hospital. Consequently, for this study, only three of the records for TSI babies had information set to missing for gestational age, three had missing information for birthweight and one had missing information for both. For Aborigines, the numbers were 28, 8, 3 and for whites the numbers were 105, 199, 8. These records were excluded from the analyses.

The QPDC requests that hospitals report the best clinical estimate of gestational age whether based on the date of the last menstrual period (LMP), ultrasound in early pregnancy or maturity scoring of the neonate at birth. The method (or methods) used is (are) not recorded. Gestational age is prone to measurement error and studies from overseas show that this is especially the case among economically disadvantaged groups such as TSIs and Aborigines.[15] Consequently, this study (like many previous studies) concentrated on birthweight, rather than gestational age.

For 1988 to 1997, the QPDC classified babies according to the self-ascribed *ethnic origin* of the mother using the categories Aboriginal, TSI, white, Asian and other.[16] Records in which the ethnicity of the mother was reported as Asian (3.0%) or other (3.5%) were excluded from the analysis. The QPDC queries any records where the mother's ethnic origin is reported as Aboriginal or TSI, but the country of birth is overseas. If the hospital cannot explain or remedy this apparent inconsistency, the ethnic origin is set to missing. Fewer than one in 1,000 records (384 live births) had missing information for ethnic origin (for whatever reason) and these were excluded. After 1997, the QPDC no longer collected ethnic origin and changed to collect Indigenous status in line with national standards.[17]

Results

For the 10 years 1988 to 1997, nearly 5000 live births to TSI mothers were reported to the QPDC. This represent 22% of all Indigenous live births (TSIs and Aborigines) and 1% of all live births in Queensland.

The low-birthweight and pre-term proportions were more favourable for TSIs than Aborigines; whites had lowest proportions (Table 1). For example, the proportion of live births who were of low birthweight (<2,500 g) was 6.3% for TSIs, 11.0% for Aborigines and 4.6% for whites.

When birthweight was treated as a continuous variable, the pattern was similar. The modal birthweight for TSIs was only 50 g less than that for whites (3,360 g compared with 3,410 g), whereas the modal birthweight for Aborigines (3,200g) was 210 g lighter than for whites (see Figure 1). Similarly, in the plot of median birthweight by gestational age (see Figure 2), the curve for TSIs was similar to that for whites, whereas, after about 35 weeks gestation, the median birthweights for Aborigines were about 200 g lighter. Medians are not provided for gestational ages younger than 32 weeks because of the small number of babies born to TSI mothers.

In spite of the more favourable distribution of birthweight for TSIs, their overall mortality rate is similar to that of Aborigines (8.7 vs. 9.6 per 1,000 live births). For birthweights between 2,500 g and 4,000 g, TSIs had mortality rates that were 2.5 times higher that those for whites (95% CI 1.3-4.2), (see Table 2). Note that

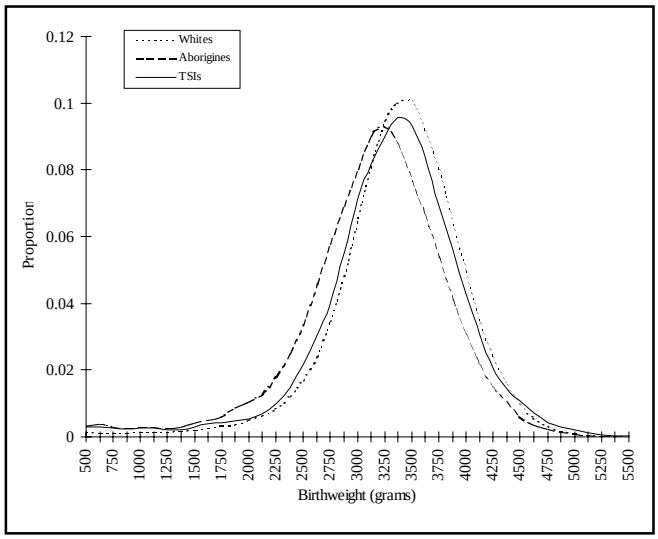

Figure 1: Distribution of birthweight by maternal ethnicity.

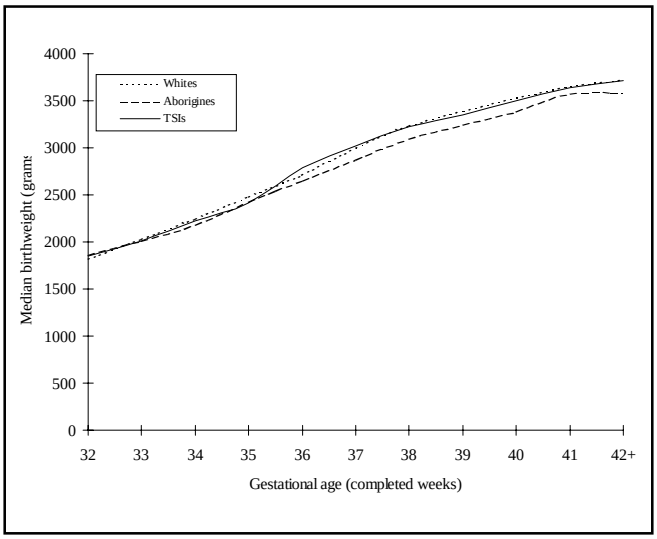

Figure 2: Median birthweight by gestational age and maternal ethnicity.

for birthweights 4,000 g or heavier, only one TSI death occurred during the 10 years. Consequently, the corresponding rate and rate ratio were extremely imprecise.

Discussion

This study found that TSI neonates had a risk of death similar to that for Aboriginal neonates in spite of having a birthweight distribution similar to whites. This raises doubts about whether birthweight is an appropriate outcome measure in this population.

A possible limitation of this study is uncertainty about the quality of the information on ethnic origin. The problems are not unique to Queensland or Australia, but also occur overseas, including Britain and the United States.[18-20] Measuring the size of the problem is difficult because there is no gold standard for comparison. Specifically, a person's self-ascribed ethnic origin can change according to the social situation or what the person believes will be done with the information.[19]

A study of the perinatal collection in Victoria found that midwives were reluctant to ask about ethnic origin.[21] The situation in Queensland is likely to be similar and it is possible that the ethnicity reported to the QPDC might be a clerk's or midwife's assessment of the mother's ethnicity based on her physical appearance. Another problem is that the father's ethnic origin is ignored. Some authorities have expressed concern that this could lead to "blurring of differences in outcomes" (i.e. low birthweight, pre-term birth, neonatal death) among ethnic groups.[22]

For this present study, one might argue that the similarity of the distributions of birthweight for the TSI and whites groups is due to misclassification of white babies as TSIs. However, this seems unlikely because the mortality rate for the group of babies identified as TSIs is so high. Similarly, the high mortality rate for the TSI group might be due to misclassification of Aborigines as TSIs. However, the distribution of birthweight for the TSI group is more like that for whites than Aborigines. In short, for this present study, it is difficult to think of a simple type of misclassification that could have produced the observed pattern for both birthweight and mortality.

Using routine data for health-outcome measures is attractive because there is no extra or visible cost involved in obtaining the data and time-trend studies are easy to perform.[23] Some might argue that birthweight could become a more useful measure if used in combination with other measures available from routine

Table 2: Neonatal mortality rates by birthweight and ethnicity.

Birthweight (g)	Whites			TSIs				Aborigines			
	Deaths	Live births	Rate[a]	Deaths	Live births	Rate[a]	Rate ratio (95% CI)[b]	Deaths	Live births	Rate[a]	Rate ratio (95% CI)[b]
<1,500	707	2,984	236.9	28	59	474.6	2.0 (1.3-2.9)	109	291	374.6	1.6 (1.3-1.9)
1,500-2,499	220	14,973	14.7	1	253	4.0	0.3 (0.01-1.5)	26	1,583	16.4	1.1 (0.7-1.7)
2,500-3,999	428	326,203	1.3	13	4,042	3.2	2.5 (1.3-4.2)	28	13,822	2.0	1.5 (1.0-2.2)
4,000+	32	49,213	0.7	1	584	1.7	2.6 (0.1-15.8)	1	1,317	0.8	1.2 (0.3-6.5)
Total	1,387	393,373	3.5	43	4,938	8.7	2.5 (1.8-3.3)	164	17,013	9.6	2.7 (2.3-3.2)

Notes:
(a) Per 1000 live births.
(b) Ratio of the neonatal mortality rate for TSIs (or Aborigines) compared with the rate for whites.

data such as morbidity or mortality. Unfortunately, routine data on maternal and neonatal morbidity are considered unreliable.[24] For example, data on maternal diabetes from the QPDC were considered incomplete and were not included in this present study.

Although mortality is more completely collected than morbidity, the numbers are too small for it to be used as an outcome in all but the largest population groups. In this present study, 10 years of data were needed to obtain reasonably precise estimates of mortality among TSI babies. Small numbers also mean that time series studies are problematic. One reason measures based on birthweight are attractive is that the outcomes are more common than mortality and hence subject to less random variation.

But convenience and statistical precision are of secondary importance. If outcome measures are to support changes in policy and practice, they must be valid. For TSIs, birthweight does not fulfil this criterion.

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