Size for gestation in Aboriginal babies: a comparison of two papers

Dorothy Mackerras
Menzies School of Health Research, Northern Territory

ABSTRACT

OBJECTIVE: Two recent papers examining low birthweight in Aboriginal infants came to different conclusions about the role of size for gestation and preterm delivery in influencing the low birthweight proportion. As the two studies used different methods to estimate the infants' gestational age and to analyse the data, the results cannot be compared directly. This analysis combines the methods of both earlier studies.
METHOD: Data collected in 6 Top End communities were analysed to calculate the proportion of infants who were small for gestational age.
RESULTS: Despite the high overall prevalence of preterm delivery from the midwives' estimates, 31.4% of infants fell below the 10th centile of weight for gestational age and sex. The majority of these infants were not low birthweight.
CONCLUSIONS: The earlier report from the Top End of high proportions of small-for-gestational age infants cannot be dismissed as an artefact due to the method of estimating gestational age.
IMPLICATIONS: Intervention programs to improve birth weights in Aboriginal infants need to address both conditions – small size for gestational age and preterm delivery – and need to target the whole population rather than high risk pregnancies.

Introduction

Low birthweight (<2500g) infants are not a homogeneous group. An infant might be born preterm (before 37 completed weeks) but have an appropriate size for gestational age. Alternatively, an infant may be small for gestational age (SGA) and this is usually defined as being less than the 10th centile for gestational age and sex. Some infants may be both preterm and SGA. As the 10th centile for weight for a 37 week girl is 2500g,[1] there will always be some low birthweight infants who are simply part of the normal distribution. In addition, an SGA infant could be neither preterm nor low birthweight. While there are some common risk factors for preterm delivery and SGA, there are also a number of different risk factors.[2] Hence, the focus of intervention strategies would depend on the relative frequency of these conditions and their risk factors in a particular population. At the population level, the presence of SGA can be investigated by comparing the distribution in birthweight or birthlength to a gestational age- and sex-specific reference chart. Two recent studies in the *Journal* examining size at birth in Aboriginal infants came to very different conclusions about whether programs should target small size or preterm delivery.

Sayers and Powers assessed gestation of 503 infants of Aboriginal women born in Royal Darwin Hospital between 1987-90 (table 1).[3] Infants with SGA (called intra-uterine growth retarded in the paper) were defined as those with weight less than the 10th centile for their sex and gestational age according to the charts of Guaran et al.[4] Mean birthweight was 3080g (SD: 606g). Of the 13.9% who were low birthweight, 70% were SGA, 47% were preterm and 18.6% were both preterm and SGA. The authors also presented the preterm and SGA data for babies who were not low birthweight (table 1b). Overall, 25% were SGA (compared to an expected prevalence of 10% by definition) and the majority of SGA infants were not low birthweight. The overall

TABLE 1: CROSS-CLASSIFICATION OF BIRTHS TO 503 ABORIGINAL WOMEN, ROYAL DARWIN HOSPITAL, 1987-90 (FROM SAYERS AND POWERS, 1997)

		a) with low birthweight			b) not low birthweight			
		SGA	not SGA	total		SGA	not SGA	total
preterm	n	13	20	33	preterm n	0	4	4
	%*	*18.6*	*28.6*	*47.1*	%*	*0*	*0.9*	*0.9*
not preterm	n	36	1	37	not preterm n	77	352	429
	%	*51.4*	*1.4*	*52.9*	%	*17.8*	*81.3*	*99.1*
total	n	49	21	70	total n	77	356	433
	%	*70*	*30*	*100*	%	*17.8*	*82.2*	*100*

** percentages in the cells of 2x2 tables sum to 100, as do each of the row and column totals*

Correspondence to:
Dr Dorothy Mackerras, Menzies School of Health Research, PO Box 41096, Casuarina, NT 0811
Fax: (08) 8927 5187. Email: dorothy@menzies.edu.au

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TABLE 2: CLASSIFICATION OF BIRTHS LESS THAN 42 WEEKS GESTATION TO ABORIGINAL WOMEN, QUEENSLAND PERINATAL COLLECTION 1988-92 (FROM COORY, 1997)

		N	%
Low birthweight	preterm	594	8
	not preterm	277	3.7
Not low birthweight		6581	88.3
Total		7452	100

prevalence of preterm delivery was 7.4%, most of whom were low birthweight. Coory examined the Queensland Perinatal Collection for 1988-92 and found that 68% of the low birthweight infants born to Aboriginal women were preterm (table 2) and concluded that preventive programs should focus on reducing prematurity.[5] In making this conclusion, he was implicitly assuming that not more than 32% of low birthweight babies were SGA and also that all SGA babies were low birthweight. He argued that the Darwin and Queensland data could not be reconciled unless it were assumed that more than half of the truly full-term low birthweight infants were incorrectly classified as preterm. He thought that this bias would be unlikely and postulated that the Dubowitz method used by Sayers and Powers[3] overestimated gestational age which would increase the apparent prevalence of SGA.[5] Other explanations are that the bias does exist or that the preterm proportion in Aboriginal infants is different in Queensland and the Northern Territory.

The important differences between these studies are the method used to determine infant gestational age and the way the data were analysed and these lead to different conclusions about the prevalence of SGA. Coory used gestational ages estimated by many different midwives and did not look at SGA directly.[5] By contrast, Sayers and Powers used gestational ages estimated by one person using a single method and they examined SGA proportions directly.[3] As there are two differences between the two studies, it is not possible to determine which difference led to the discrepancy in conclusions. In this paper, one of the differences is removed by using hospital midwives' estimates of gestation like Coory[5] but cross-classifying in the manner of Sayers and Powers[3] to examine the SGA proportion. Gestation- and sex-specific birth size distributions are also examined.

Data source and results

Following a study by Rae into the antecedants of low birthweight in the Top End,[6] all births occurring in five large communities in 1990-91 (n=371) were identified and data

TABLE 3: CROSS-CLASSIFICATION OF THE SIZE OF ABORIGINAL INFANTS BORN IN 1990-1 IN SIX COMMUNITIES BY PRETERM DELIVERY AND LOW BIRTHWEIGHT STATUS

(i) Classification of SGA#

		a) with low birthweight			b) not low birthweight			
		SGA	not SGA	total		SGA	not SGA	total
preterm	n	13	30	43	preterm	0	23	23
	%*	*18.6*	*42.9*	*61.4*		*0*	*7.5*	*7.5*
term	n	27	0	27	term	78	205	283
	%	*38.6*	*0*	*38.6*		*25.5*	*67*	*92.5*
total	n	40	30	70	total	78	228	306
	%	*57.1*	*42.9*	*100*		*25.5*	*74.5*	*100*

(ii) Classification of shortness#

		short	not short	total		short	not short	total
preterm	n	7	23	30	preterm	1	22	23
	%*	*13*	*42.6*	*55.6*		*0.3*	*7.5*	*7.8*
term	n	19	5	24	term	49	222	271
	%	*35.2*	*9.3*	*44.4*		*16.7*	*75.5*	*92.2*
total	n	26	28	54	total	50	244	294
	%	*48.1*	*51.9*	*100*		*17*	*83*	*100*

(iii) Classification of small head circumference #

		small head	not small head	total		small head	not small head	total
preterm	n	6	26	32	preterm	0	22	22
	%*	*10.5*	*45.6*	*56.1*		*0*	*7.6*	*7.6*
term	n	13	12	25	term	51	218	269
	%	*22.8*	*21.1*	*43.9*		*17.5*	*74.9*	*92.4*
total	n	19	38	57	total	51	240	291
	%	*33.3*	*66.7*	*100*		*17.5*	*82.5*	*100*

Notes:

 # SGA, shortness and small head circumference are all defined as being below the 10th centile on the gestational-age and sex-specific charts of Beeby et al.[1]

** percentages in the cells of 2x2 tables sum to 100, as do each of the row and column totals*

TABLE 4: MEAN WEIGHT, LENGTH AND HEAD CIRCUMFERENCES AT BIRTH FOR INFANTS WITH GESTATIONAL AGES OF 35-41 WEEKS EXPRESSED AS A Z-SCORES USING THE GESTATIONAL AGE AND SEX-SPECIFIC DATA OF BEEBY ET AL[1]

Gestational age	Weight			Length			Head circumference		
(weeks)	N	Mean	SD	N	Mean	SD	N	Mean	SD
35	15	0	1.1	14	-0.1	1.0	14	0.3	1.2
36	27	-0.4	1.3	23	0.0	1.3	25	0.1	1.2
37	34	-0.5	1.2	32	-0.4	1.1	31	-0.1	1.0
38	55	-0.7	1.0	51	-0.5	1.0	50	-0.5	1.2
39	69	-0.7	1.0	69	-0.5	1.2	68	-0.4	1.1
40	110	-0.7	1.1	101	-0.6	1.3	103	-0.5	1.3
41	29	-0.7	1.0	29	-0.5	0.9	29	-0.4	1.1

extracted from the clinic records, including the infant gestations, weights, lengths and head circumferences written on the hospital discharge form, usually by the midwife, who uses the available information to assess gestation. This information was fed back to the communities and two of them volunteered to take part in the pilot phase of the Strong Women Strong Babies Strong Culture program.[7] A sixth, smaller community requested to join the program and data about 28 births occurring there in the same years were subsequently abstracted. Virtually all infants were born in either Royal Darwin Hospital or Gove District Hospital. The weight and gestational age data become part of the NT Midwives Collection but this dataset was used in preference to the larger Collection as it included the lengths and head circumferences.

Infants were classified as SGA, short or with small heads if their birthweight, length or head circumference respectively was less than the 10th centile for gestational age and sex according to the charts of Beeby et al.[1] Z-scores were also calculated from these charts. These are the most recent Australian charts which contain all three measures. An additional analysis was done using the more recent weight charts of Roberts and Lancaster based on national birth data.[8] In the range 35-41 weeks, there were 15 or more infants for each week and the association between age- and sex-specific weight, length and head circumference z-score and gestational age was examined using a simple regression. For these calculations, an age of 40 weeks was assigned to the small number of infants described simply as 'term' on the discharge form because their mean weights and lengths matched those of the 40 week babies. The numbers vary slightly as some infant measurements were not recorded on the discharge form. The overall proportions in this population of low birthweight, preterm delivery and SGA were 18.6%, 17.6% and 31.4% respectively (table 3). One-third of the preterm infants were not low birthweight. Like Coory[5] a high prevalence of preterm delivery was seen among the low birthweight infants. However, the coexistence of SGA with preterm birth and the excess prevalence of SGA in full-term infants described by Sayers and Powers[3] were also seen. After allowing for the expected prevalence of 10% (by definition), the prevalence of SGA, preterm delivery and low birthweight were approximately the same. However while preterm delivery and low birthweight tended to occur in the same infants, the majority of SGA occurred in infants who were neither preterm nor low birthweight. Similar, although weaker, patterns were seen for shortness and small head circumference. Using the Roberts and Lancaster reference[8] did not alter the distribution within the low birthweight group, but moved an additional 9 non-low birthweight, term infants into the SGA category.

Compared to the reference curves, the weights, lengths and head circumferences of this population diverged increasingly with gestational age (table 4). Using the Roberts and Lancaster[8] reference for birthweight slightly reduced all mean z-scores and also the standard deviation (not shown). The standard deviations are all close to 1.0, which suggests that the entire distributions are shifted down, rather than the presence of a subgroup with low values occurring within a population of normal values.

Discussion

The prevalence of SGA in this dataset with gestation based on midwives' estimates was higher than the prevalence reported by Sayers and Powers[3] even though the proportion of preterm delivery among low birthweight infants was similar to that reported by Coory.[5] It is clear that the high level of SGA reported by Sayers and Powers[3] cannot be dismissed as an artefact due to their method of assessing gestational age. The prevalence of low birthweight is even higher in this study than reported by Sayers and Powers.[3] This is not surprising as many of the communities were in the Nhulunbuy ATSIC region which has the highest low birthweight proportion in Australia.[11] Overall, it seems that the prevalence of SGA in the Top End in the early 1990s was 25-31% or greater compared to 10% expected by definition.

It is evident that the argument about the relative roles of SGA and preterm birth in contributing to low birthweight revolves around the classification of only 15-20% of low birthweight infants. This argument distracts attention away from the fact that the remaining 80% of low birthweight in Aboriginal infants is almost equally divided between SGA and preterm and that a high prevalence of SGA exists in the non-low birthweight group. Given the high rates of smoking and genital infections in Aboriginal women, there is probably a higher preterm proportion than in the general population. However, the current analysis shows that simply calculating the proportion of low birthweight infants

who were preterm does not allow the prevalence of SGA in the population to be inferred.

Dichotomising birthweight implies that infants who are not designated as 'low' have 'normal' birthweights. This is clearly not the case in this population. Others have also reported that mean weight at 35 weeks is the same in Aboriginal infants as the general population and that it is after this age that the divergence occurs.[8,9] The same trend is apparent for length and head circumference in the current population - although it appears to start a week later, the very small numbers should be borne in mind. One possibility is that this trend is a sign that systematic undercalling of the gestation of small infants does occur and, by inflating the mean birthweights at earlier gestations, leads to the appearance of growth retardation starting later than it truly does. This possibility is supported by an earlier study in Darwin which found that, at all birthweights up to 2500g, Aboriginal infants were more likely to survive the neonatal period than non-Aboriginal infants, indicating that they were older.[10] Alternatively, growth restriction might not start until very late in pregnancy in Aborigines. Until more work is done on the dating of pregnancies in Aboriginal women, the true reason behind this trend cannot be determined. The large proportion of preterm infants who are not low birthweight is another feature of the data indicating that there may be bias towards underestimating infant gestation. If so, then the prevalence of SGA in this population has been underestimated. An alternative explanation might be the frequency of a condition such as maternal diabetes which increases both infant weight and the likelihood of pretem delivery.

There is great debate about the accuracy of various methods of estimating gestational age. The gestational estimates of Aboriginal infants provided to the Perinatal Collection, used by Coory[5] and in the current analysis, are known to be inaccurate.[11] It is worth noting that in the subset of 228 infants in this population who formed part of the pre-phase of the Strong Women Strong Babies Strong Culture program evaluation, only one woman had had an ultrasound performed prior to 20 weeks and 9 after 20 weeks.[12] Fundal height featured prominently in the clinic records as the basis of pregnancy estimation and so it is not clear what the midwives' estimates of infant gestation were based on or how accurate they were. Although the true prevalence of preterm delivery cannot be determined, the current analysis and the earlier study[3] show that it fell in the range 7.3%-17.6% in the early 1990s.

These results show that SGA and preterm delivery are both important contributors to low birthweight in Aboriginal infants in the Top End. Moreover, there is a high prevalence of SGA in term infants who are not low birthweight. Improvements in the birthweight of Aboriginal infants in remote parts of the Top End requires shifting the entire distribution up, not focussing on women who are at particularly high risk of a low birthweight infant. Intervention programs should address the causes of both problems and further work investigating the biases in estimating gestational age in Aboriginal infants is also needed.

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