Re: 'Birthweights and growth of infants in five Aboriginal communities'

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The paper by Smith et al., 'Birthweights and growth of infants in five Aboriginal communities', examines the effect of an intervention on two important characteristics – birthweight and child growth.[1] Various aspects of this paper are worth commenting on.

Although there is much discussion of the differences in growth between term and preterm children, the authors could rarely determine the actual basis of the gestational age estimate.[1] In the pre-intervention phase, the mean birthweight of term non-low birthweight girls was 30 g higher than boys, which is unusual. There were also twice as many preterm girls as boys when there should be no association between sex and preterm delivery.[2] These observations suggest misclassification of small babies as preterm. However, the debates surrounding the determination of gestational age in Aboriginal infants in rural and remote locations cannot be resolved using routinely collected data, such as the Perinatal Collection, with estimates made by many different individuals using unstated methods.

The presentation of the growth data and the various comparisons discussed by the authors are difficult to follow owing to the multiplicity of tables and small graphs. Because weight is used, separate charts and tables are needed for boys and girls. The authors reject z-scores based on the NCHS reference because this reference probably does not reflect the growth of breastfed children in the first months very well. Despite this, they compare their population to the centiles based on the NCHS reference. Although the mean weights are also plotted against the proposed World Health Organization interim chart for breastfed infants, there is no direct comparison of the results from the two references.

Z-scores are preferable as they allow direct comparison of different groups, such as boys and girls.[3] Using the average weights for age in the pre-intervention phase given in the tables, we calculated z-scores for term non-low birthweight boys and girls (n=158) using both the NCHS reference (available in the EpiInfo software package) and the interim World Health Organization reference,[4] and also for the pre-intervention preterm infants (n=43) using the NCHS reference (see Figure 1). Figure 1 has two vertical axes: z-scores are shown on the left-hand side and the centile scale on the right-hand side for those who are less familiar with z-scores (e.g. the 25th centile is –0.675 z-scores). If the study population had had a growth pattern exactly the same as the reference, then its average z-score would be plotted as a horizontal line at 0 (i.e the 50th centile).

Compared to the NCHS reference, term non-low birthweight boys and girls gain more weight than expected for a few months and then have a period of prolonged declining z-scores (and centiles), indicating that they are gaining less weight than expected for their age. The horizontal line at about –1.2 z-scores (10th centile) after about 15 months indicates that although they are now gaining the expected amount of weight for age there is no catch-up growth. The peak in the first six months is commonly seen in breastfed populations and is regarded as a normal difference between breastfed and artificially fed infants. If this were the sole explanation of the peak in the study population, then the line should be flat in the first few months when calculated against the interim World Health Organization curve. As shown, the peak is still present in these children, which may indicate catch-up occurring after antenatal growth restriction. Growth in the second six months declines when compared to the World Health Organization curve, although not to the same extent as when compared to the NCHS curve. This would suggest that some of the poor growth diagnosed when the NCHS curve is used is an artefact, but that growth failure still occurs in the term children.

Up to 15 months of age, the preterm children also lose z-scores, although not quite to the same extent as the term children. After 15 months, there may be some catch-up growth as there appears to be little difference in the size of term and preterm children after 24 months. This is difficult to assess as the authors do not describe their loss to follow-up. Assuming that fertility was approximately constant during the pre-intervention phase, there should be about the same number of children in each year of age. Growth data were available on two to three times more children aged under 12 months than aged 24-36 months in the pre-intervention phase, whereas the numbers were fairly similar in the intervention phase. Hence the representativeness of the growth of older term and preterm children plotted in the figure is uncertain.

Failure-to-thrive (FTT) was a focus in this study. The definition of FTT used was dependent on presentation, diagnosis and documentation of an episode at the clinic. Hence, it was not necessarily assessed equally for all children. A better way of assessing FTT would have been to examine the slope of the z-score for different age ranges. As shown in Figure 1, growth failure occurs at the population level in both term and preterm children. The authors commented that depressed weight-for-age up to three years in preterm infants indicated chronically impaired growth, but ignored the same finding in the term children. Therefore, we

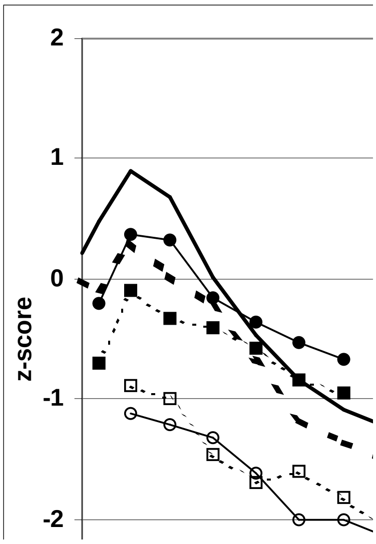

Figure 1: Mean z-scores and centiles for term, non-low birthweight children according to two different reference curves, and preterm children according to the NCHS reference, pre-intervention phase data (redrawn from Smith et al.[1]).

disagree with the conclusion that preterm infants were the numerically predominant component to FTT.

One measure of program efficacy was a comparison of the rate of growth from 12 to 36 months of age in the two phases. As the intervention lasted only 14 months, virtually all the children will have been in this age range in both the pre-intervention and intervention phases. The authors did not describe if, or how, they allocated the observations between the two phases. Failure to do this will reduce their ability to detect a difference in the rate of growth, if it truly occurred.

The authors excluded low birthweight term infants when calculating average birthweights for term infants. While this may be reasonable when specifically comparing against the interim World Health Organization curve, it is not appropriate for describing the population or for comparing against the NCHS reference which includes them. The small sample sizes are also worth noting because this limits the interpretation of many findings. Growth in preterm children was based on six to 18 children at any point which makes the calculation and presentation of the 10th and 90th centiles questionable. As there were only six preterm children in the intervention phase, misclassification of only one child would have had a large impact on the calculated birthweight proportions and also makes changes in growth over time difficult to detect.

References

1. Smith RM, Smith PA, McKinnon M, Gracey M. Birthweights and growth of infants in five Aboriginal communities. *Aust N Z J Public Health* 2000;24:124-35.
2. Kramer MS. Determinants of low birthweight: methodological assessment and meta-analysis. *Bull World Health Organ* 1987;65:663-737.
3. WHO Working Group. Use and interpretation of anthropometric indicators of nutritional status. *Bull World Health Organ* 1986:929-41.
4. World Health Organization Working Group on Infant Growth. An evaluation of infant growth: a summary of analyses performed in preparation for the WHO Expert Committee on 'Physical Status: the use and interpretation of anthropometry'. Doc WHO/NUT/94.8. Geneva: World Health Organization, 1994.

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Richard M. Smith's response:

The re-presentation of our results in z-score format by Mackerras and Sayers affords an opportunity both to reaffirm our conclusions and to emphasise the nature and magnitude of the paradigm shift now needed to assess the growth of Aboriginal infants who are mainly breastfed. When the z-score process is correctly carried out and properly interpreted, the same conclusions should emerge as from a weight-for-age presentation. With two important exceptions this is true of the figure presented. The exceptions are the intervention results for WHO-term girls and WHO-term boys. Although the authors state that these are based on the WHO reference cited, manual calculations derived from that reference (p21) yield quite different values. WHO z-scores for 0.75, 2.25, 4, 6, 8,10 and 12 months respectively are for WHO-girls, -0.43, +0.35, +0.02, +0.12, +0.18, +0.24 and +0.11 respectively and for WHO-boys are -1.12, -0.47, -0.87, -0.08, -0.70, -0.66 and -1.10 respectively. For girls these show, as we claimed, that growth for the first 12 months was close to but slightly above that of the WHO interim standard (mean z-score +0.08) and for boys that growth was at a lower level (mean z-score -0.71) but otherwise similar. Combined with the highly significant (p=0.001) increase in growth from 12 to 36 months of the combined sexes as compared with the pre-intervention cohort the results demonstrate a potential to achieve normal growth in full-term, breastfed Aboriginal infants provided the appropriate growth standards are used. The WHO full-term Z-scores in the figure appear to be derived from NCHS standards and, despite the removal of LBW infants, the results for girls still show both the initial excess and the later progressive deficit that chacterises breast-fed versus bottle-fed infants. That curve approximates normal growth in the NCHS format.

Other points raised relate to failure to thrive (FTT), removal of low birth weight (LBW) infants before certain calculations, the age structure of the cohorts and assignment of gestational age. As discussed on p132 of our paper, 70% of diagnosed FTT-infants were full-term non-LBW. We suggested that the growth pattern of preterm LBW-infants was such that they should be regarded as FTT whether or not so diagnosed. LBW infants were taken out of the data set for full-terms only for the regressional analysis (Table 6) or where the objective was a comparison with WHO interim standards. The composition of the cohorts is fully described under Methods; the age structure noted is a logical consequence. Reliability of gestational ages is exhaustively discussed in our paper. As presented there three very large studies of Aboriginal birth weights, all based on centralised data banks, have established and reaffirmed that about two-thirds of Aboriginal LBW is attributable to preterm birth. Our information on gestational age is entirely comparable and we found an even higher proportion (84%) of LBW to be preterm.

The causes of such high rates of preterm birth (20%) were not addressed in our study, but we pointed out that ascending infections from the uro-genital tract, including those from sexually transmitted diseases (STD), are now widely recognised as a major cause of preterm birth. We now draw attention to the fact that during the currency of the pre-intervention phase (in 1992-93) the rates of notifiable STDs among females in the Northern Health Region (where the study took place) were 6 to 60 times higher than those in other Western Australian regions and that the rates among Aborigines aged 15 to 35 years were 37 times higher than those among non-Aborigines[1]. It would be remarkable if there were not an associated elevation in the incidence of preterm birth.

Reference

1. Somerford PJ, Fitzgerald P, Gattorna L et al. *Our state of health, 1995 : An overview of the health of the Western Australian population*, pp 7.8, 7.9. Perth, Health Department of Western Australia, 1995.