Persistence of lower birth weight in second generation South Asian babies born in the United Kingdom

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Objective: To assess differences in birth weight between all first and second generation South Asian babies born in Southampton, and trends since 1957.

Design: Retrospective, cohort study.

Setting: Birth records for babies born in Southampton from 1957 to 1996 were searched to identify all babies born of South Asian origin (including from the Indian subcontinent, East Africa, and elsewhere).

Main outcome measures: All information recorded in the birth record about the mother and baby was extracted.

Results: 2395 full term (>37 weeks; mean birth weight 3110; 95% CI 3092 to 3129) singleton births were identified. Detailed analysis was restricted to mothers either born in the Indian subcontinent (India, Pakistan, or Bangladesh (1435)) or United Kingdom (283). Mean birth weight and % low birth weight (<2500 g) were 3133 g (95% CI 3108 to 3157) and 7.5%, for first generation babies and 3046 g (2992 to 3099) and 11.7% for second generation babies. There was no trend over time to increased average birth weight in either first or second generation babies. Adjusting for other factors that were statistically significantly related to birth weight (gender, gestational age, mother’s age, maternal weight at 15 weeks, parity, and mother’s ethnic group) did not alter the trends.

Conclusions: For that group in the UK who derive from the Indian subcontinent, average birth weight is significantly less than the national average. There has not been any increase in the average birth weight over the past 40 years, and the birth weight of babies of women who were born in the UK are no greater. The persistence of lower than desirable birth weight may result long term in higher than average rates of diabetes and heart disease in these groups.

The weight at birth for babies in developing countries tends to be lower than that for the general population in developed countries. For babies born in the UK to mothers from the Indian subcontinent, weight at birth is greater for babies born in India (by about 300 g), but lower than for the general population in the UK (by about 300 g). Within India, socioeconomic circumstances have an effect on birth outcome such that babies born to better off mothers are of comparable weight to the general population in the UK. Although few data are available, it is likely that environmental stresses, such as infection or poor nutrition, before and during pregnancy are important factors that contribute to lower birth weight in the Indian subcontinent.

Birth weight has been used as a general proxy for wellbeing, as there is a continuous positive (linear) relation between birth weight and improved markers of health in both the short and long term. With the exception of fetal macrosomia, across the normal range of birth weight babies that are born heavier and longer, tend to have fewer health problems in early life and are at lower risk of hypertension, coronary heart disease, and type II diabetes during adult life.

If the quality of the environment is important for fetal development, it would be expected that when families move from a location of lower than average birth weight to one of higher than average birth weight, there will be a shift to higher birth weight in time. This would mean that with time, or after one or two generations, the birth weight of the migrating population would approximate that of the host population. There are two studies in which birth weight has been compared between first and second generation babies for migrants from South Asia to the UK. In a smaller study, the birth weight of second generation babies was found to be significantly greater than for the first generation. By contrast, in a larger study, no difference could be identified. There are no studies in which trends over time have been reported. This study aimed to assess the trends in birth outcome over time in first and second generation babies of South Asian origin, born in Southampton, UK, since 1957. The initial hypothesis was that with time birth weight would increase and that babies born to second generation mothers would be bigger than babies born to first generation mothers approximating the birth weight of the general population trends.

METHODS

We have carried out a search for information in the birth record for all those of South Asian origin who gave birth in Southampton from 1957 to 1996. All the data for the mother and baby in the birth record were extracted and computer coded. The birth records for babies born in Southampton from 1957 to 1996 were checked to identify all babies of South Asian origin. The medical records of patients from the maternity unit of the Southampton General Hospital (now the Princess Anne Hospital) are sent to the District Inactive Library (DIL) after three years. After a further three years the records were stored on microfilms (or microfiche) or more recently the records have been entered on a computerised database. Birth records for the 1990s that have not been microfilmed or entered into the database are kept in their clinic folders and stored in boxes at the DIL. All information recorded in the birth record for the mother and baby were extracted and computer coded.

South Asian people were defined as that group who were resident in Britain and who originally came from the Indian subcontinent, or were the descendants of people originally from the Indian subcontinent (Bangladesh, India, and...
Pakistan). South Asian names were identified from the birth records using the approach of Henley and with guidance from the local community. By using both first and second names it is possible to correctly classify 98.5% of the South Asian people, compared with a reference judgement. The later records contained information on the mothers’ place of birth, which reduced uncertainties about ethnicity. The analyses in this paper have been restricted to singleton births delivered at term (greater than 37 weeks gestation). The total number of singleton births was 2683 and 46 twin births were excluded. Of the singleton births, there were 210 pre-term births; 77 babies without data on gestational age or birth weight, and three babies without a recorded gender, all of whom were excluded. The number of births available for subsequent analysis was 2395.

Table 1 presents the overall mean birth weight for all subjects in the study, as well as mean levels broken down by place of birth, religion, and gestational age. Birth weight tended to be greater in babies born to mothers from Pakistan and Fiji. The lightest babies were likely to be born from mothers from East Africa or the UK. Babies of Muslim mothers tended to be heavier than babies of either Sikh or Hindu mothers. There was an increase in birth weight with gestational age, even though all of the babies included in the study were born at a gestation longer than 37 weeks.

The rest of the analyses presented in this paper will be restricted to mothers either born in the Indian subcontinent (first generation, 1435) or the UK (second generation, 283).

Table 2 presents mean data on booking age, parity, maternal height and weight, as well as birth weight and head circumference broken down by whether the baby was born to a first or second generation mother. First generation mothers were statistically significantly older at age of booking and had more children than second generation mothers. There was no statistically significant difference in maternal height between generations, but first generation mothers tended to be heavier at booking than second generation mothers. Unadjusted birth weights were greater in babies born to first, rather than second, generation mothers; however, the difference between generations was only present between girl babies (who were also lighter than boy babies of either generation). Of babies born to first generation mothers from the Indian subcontinent, 7.5% were classified as low birth weight (less than

| Table 1 | Mean birth weight by descriptive characteristics of mother, includes all mothers in study |
|---------|---------------------------------|-----------------|----------|
|         | Number | Mean | 95% confidence interval |          |
| All mothers | 2395 | 3110 | 3092 to 3129 |          |
| Mother’s place of birth |          |          |          |          |
| India | 800 | 3077 | 3046 to 3108 |          |
| Pakistan | 389 | 3235 | 3187 to 3283 |          |
| Bangladesh | 247 | 3161 | 3101 to 3220 |          |
| East Africa | 194 | 3035 | 2978 to 3093 |          |
| Fiji | 27 | 3242 | 3026 to 3458 |          |
| Other outside UK | 17 | 3230 | 3035 to 3424 |          |
| UK | 283 | 3043 | 2989 to 3096 |          |

Religion |          |          |          |          |

| Gestational age |          |          |          |          |
| 37–38 [1] | 157 | 2838 | 2769 to 2908 |          |
| 39–40 [3] | 530 | 3085 | 3031 to 3119 |          |
| 40–41 [4] | 930 | 3181 | 3152 to 3210 |          |
| 41–42 [5] | 289 | 3287 | 3236 to 3338 |          |
| 43+ [7] | 16 | 3162 | 2936 to 3389 |          |

*438 mothers no known place of birth; †includes Malaysia, Singapore, Mauritius, Sri Lanka, South America; 113 women with other religions, 8 missing; Post hoc analysis of variance; LSD-groups with the same superscript letters are statistically significantly different from each other p<0.005; $number in [ ] used for summarising significant multiple comparisons; 1 v. 3,4,5,6; 4 v. 1,2,3,5; 5 v. 1,2,3,4; 6 v. 1,2,3; 7 v. 1,2.
Table 3 Adjusted trends in birth weight (mean and 95% CI) by generation, based on full term births and only for mothers born in the Indian subcontinent (first generation) or the UK (second generation)

<table>
<thead>
<tr>
<th>Year</th>
<th>First generation</th>
<th>Second generation</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Number</td>
<td>Adjusted mean*</td>
</tr>
<tr>
<td>&lt;1965</td>
<td>18</td>
<td>3192</td>
</tr>
<tr>
<td>1966–1970</td>
<td>141</td>
<td>3072</td>
</tr>
<tr>
<td>1971–1975</td>
<td>49</td>
<td>3133</td>
</tr>
<tr>
<td>1976–1980</td>
<td>102</td>
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<tr>
<td>1981–1985</td>
<td>311</td>
<td>3126</td>
</tr>
<tr>
<td>1986–1990</td>
<td>370</td>
<td>3145</td>
</tr>
<tr>
<td>1991 and above</td>
<td>283</td>
<td>3154</td>
</tr>
</tbody>
</table>

*Adjusted for: sex of baby; mother’s ethnic group and place of birth; gestation recalculated (weeks); mother’s age at booking, parity, weight at booking adjusted to 15 weeks.

Key points
- There has been no secular trend over the past 40 years to increased birth weights for babies born in Southampton, UK, to mothers from the Indian subcontinent.
- Birth weights of babies of mothers from the Indian subcontinent are still well below the UK general population average.
- Second generation babies are no bigger than first generation babies.

We have used the data contained in the 1991 census to determine that the data presented here represent a fairly complete record of all South Asian babies born in Southampton. Using the age specific census estimates, we conclude that the observed number of births was very close to that expected, suggesting that the sample in this study is a reasonable reflection of the population. The clinic data used in the study were collected routinely and therefore it is likely that some errors will have occurred. The data were thoroughly checked to eliminate obvious coding errors, but it is not possible when using retrospective material to check the accuracy of the data. We have had to assume that any errors that have occurred are randomly distributed, and that errors were not systematically related to year of study such that an underlying trend was obscured by error. The staff in the clinics where the maternal anthropometry was carried out were not the same as those who made the measurements in the newborn babies, making it unlikely that any errors would be correlated. Any uncertainty around the dates of the LMP and hence in the estimation of gestational age, might have occurred in the earlier records before ultrasound scanning became a routine procedure, but is unlikely to have been consistent in nature. It was assumed that any estimate of gestational age of more than 44 weeks was probably attributable to an incorrect LMP, and therefore these cases were excluded from the main analysis.

There are two other studies that have looked at intergenerational effects on birth weight, for people from the Indian subcontinent, in the UK. One study, based upon 111 second generation births, showed an increase in birth weight from first to second generation babies. By contrast, another study based upon 778 second generation births, showed no intergenerational increase in birth weight. Our results, based on 283 second generation births, conform with the findings in the latter study and we were not able to demonstrate any change in birth weight across the generations. Furthermore, we were not able to identify any pattern of change towards increased birth weight in time for the population as a whole or any sub-group within the population. It is possible that either selection and information bias may be present in all three studies, but we are not able to explain how any bias that might have
occurred is likely to lead to the patterns present in our study. We estimate that random error could account for a variation in birth weight of about 100 g in our sample. Thus, given the size of our study we would expect to be able to detect differences between year groups of about 100 g. Therefore, it seems unlikely that if a true increase in birth weight exists, either over time or between generations, it has been masked by error.

The birth weight of South Asian babies born in Southampton, is not different to that for South Asian babies born elsewhere in the UK. 2,10 The birth weight for infants born in the UK whose mother comes from the Indian subcontinent is higher than the average birth weight in the Indian subcontinent (by about 300 g), but when compared with the general population in the UK is some 300 g lighter. 2,10

It may be that much of the obvious difference in birth weight between South Asian babies born in the Indian subcontinent and the UK is most readily explained by environmental factors that lead to a higher infectious load and a poorer quality of diet during pregnancy. Hence, an immediate consequence of an improved environment, allows birth weight to increase by about 300 g. Whereas a change of this sort might be adequate to explain an initial improvement in birth weight, it is not sufficient to explain the continued difference in birth outcome between people from South Asia and the general population. Nor does it adequately address the difference in birth outcome between people from South Asia born in the UK and the general population. Nor does it adequately address the apparent lack of intergenerational improvement. Indeed, in the study conducted by Draper the suggestion was that by the third generation the situation was, if anything, worse. 19 In our analysis we sought to explain the difference by adjusting for other factors that are known to affect birth weight, but we were not able to influence the lack of increase in birth weight over time.

There are two important underlying assumptions in this work; firstly that there is no biological reason why babies born to mothers of South Asian origin should not have the same potential as the general UK population. If this assumption is correct, the birth weights reported here represent a marker of constrained growth. Secondly, that babies who are born smaller than they should be, carry both a short and long term risk to their health, and that it is therefore important to do something about it. 19 Balarajan and Raleigh 20 have shown that perinatal mortality is higher in babies born to mothers from the Indian subcontinent, which they attribute, at least partly, to low birth weight associated with poor nutrition.

Heart disease and diabetes are much more common in immigrants from the Indian subcontinent than the general UK population. 19 Is this in some way related to their lower birth weight? Research in India, UK, and elsewhere, suggests that there is a close link between size, shape, and body composition at birth and subsequent risk of diabetes and heart disease, which can be moderated by changes in lifestyle, but not completely removed. 21 Based on our findings, the predicted decline in diabetes between first and second generation immigrants, based on improved early nutrition and environment may not materialise, because in fact the environment has not improved or at least has not yet affected fetal growth. Our data would suggest that it would not be appropriate to adopt a complacent approach that assumes simply that the problem will resolve itself in time as social circumstances improve. The persistence of low birth weight within this group of the population requires a focused approach for further research, to determine the specific biological factors that lead to constrained fetal growth. Identifying specific factors that may be amenable to intervention, and that hasten the process of achieving a more desirable, or optimal, birth weight should be an important component of the research agenda.

Policy implications box

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Conflicts of interest: none.

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