The feasibility of using a postal survey method to assess the health and development of 7 year old children of different birth weight

F Alderdice, T Petty, A Johnson, A Macfarlane

Abstract

Study objective—To test the feasibility of using a postal survey to assess health and development in 7 year old children of different birth weights and to examine the response and any resulting response bias.

Design—A multi-stage postal survey, using a sample stratified by birth weight.

Setting—The four counties of Oxfordshire, Buckinghamshire, Berkshire, and Northamptonshire, which make up the former Oxford NHS Region.

Sample—All children born in 1985 to the residents of the former Oxford region who weighed either under 1500 g or over 5000 g at birth and all those with unstated birth weight were included. Samples of approximately 130 live births were randomly selected from each 500 g birth weight band between 1500 g and 5000 g. The total sample size was 1319.

Methods—The children in the sample were identified from birth registration and traced through the National Health Service Central Register (NHSCR). Self administered questionnaires were sent through the relevant Family Health Service Authority (FHSA) and then via the child’s general practitioner (GP) to the child’s parent(s). When parents’ permission was given, self administered questionnaires were also sent to the child’s GP and teacher.

Main results—Of the 1319 children, 1169 were alive at the age of 7 and were successfully traced. Questionnaires were forwarded by GPs to parents of 1071 children and completed questionnaires were obtained from parents of 805 children. Parents of 753 children gave permission to approach the child’s teacher and replies were received for 695. Parents of 770 children gave permission to send a questionnaire to the child’s GP and 724 were returned completed. Response bias was assessed for the parents’ questionnaire using data recorded about all births at birth registration. Response rates varied by sex of child, social class, and country of birth of the father. In addition, parents with a child with a serious motor or sensory deficit appeared to be more likely to respond.

Conclusions—Response rates at each stage of the survey were good. The bias in response to the parents’ questionnaire needs to be taken into consideration in future work. The method was found to be feasible and could be applied more widely than in monitoring child health.

The continuing increase in the survival rates of babies who were born too soon or too small raises questions and concerns about the health of the children who survive. At present there is no way of monitoring this routinely. While data about the health of the population as a whole, including children, are being collected through the health surveys for England, Scotland, and Wales, these are based on a sample of the population as a whole and thus include few children who were low birthweight babies. Although detailed studies based on cohorts of people born during one week in 1946, 1958, and 1970 continue, there is no system that collects data routinely on the health of children and adults and monitors their health status in relation to circumstances at birth.

Most of the data currently available about the association between birth weight and later health status come from special studies, most of which are hospital based. The traditional type of follow up based on neurodevelopmental assessment and psychometric testing is costly. More crucially, the findings are impossible to generalise to the population as a whole with confidence. This is because of selection biases, small sample sizes, and the way the various studies use different measures at different ages. There have been relatively few attempts to measure outcome consistently on a population basis and even fewer to monitor outcome consistently over time. Finally, there have been very few studies of the larger group of children born slightly pre-term or weighing between 1500 g and 2499 g.

There is therefore a need for a relatively inexpensive population based system of monitoring rates of impairments, ill health, educational and behavioural problems in childhood over time and in relation to birth weight.

We have done a feasibility study to test a method that entails sending questionnaires to parents, teachers, and general practitioners of 7 year old children who are identified from birth registration and traced through the National Health Services Central Register. It used a geographically based sample of children born in 1985 to mothers resident in the four counties of the former Oxford Region. The age of 7 years was chosen so that educational and behavioural problems could be detected as well as motor and sensory disorders. Because of the...
Table 1 Birthweight characteristics of the sample

<table>
<thead>
<tr>
<th>Birth weight (g)</th>
<th>Total live births Oxford Region 1985</th>
<th>Total number in sample</th>
<th>Percentage of all births in group</th>
</tr>
</thead>
<tbody>
<tr>
<td>Under 1500</td>
<td>271</td>
<td>271</td>
<td>100.0</td>
</tr>
<tr>
<td>1500–1999</td>
<td>383</td>
<td>122</td>
<td>31.9</td>
</tr>
<tr>
<td>2000–2499</td>
<td>1495</td>
<td>130</td>
<td>8.7</td>
</tr>
<tr>
<td>2500–2999</td>
<td>5899</td>
<td>129</td>
<td>2.2</td>
</tr>
<tr>
<td>3000–3499</td>
<td>12 677</td>
<td>129</td>
<td>1.0</td>
</tr>
<tr>
<td>3500–3999</td>
<td>9400</td>
<td>130</td>
<td>1.4</td>
</tr>
<tr>
<td>4000–4499</td>
<td>2465</td>
<td>128</td>
<td>5.2</td>
</tr>
<tr>
<td>4500–4999</td>
<td>331</td>
<td>130</td>
<td>39.3</td>
</tr>
<tr>
<td>5000 or more</td>
<td>32</td>
<td>32</td>
<td>100.0</td>
</tr>
<tr>
<td>Not recorded</td>
<td>117</td>
<td>117</td>
<td>100.0</td>
</tr>
<tr>
<td>Total</td>
<td>33 070</td>
<td>1319</td>
<td>4.0</td>
</tr>
</tbody>
</table>

Focus of the study, the sample was stratified by birth weight. In this paper we describe the method and issues that arose in sampling and tracing the children, the response rates, and response bias. The findings from the questionnaires are reported separately.

Methods

SAMPLE SELECTION

The sample was based on birth records held by the Office of Population Censuses and Surveys (OPCS), which is now part of the Office for National Statistics. The sampling frame used for this project was the OPCS birth primary file containing a record for each birth registered in England and Wales in 1985. The sample was drawn from children born alive to residents of the former NHS Oxford Region in 1985. The sample was designed to test the method of the survey rather than to ensure that the sample size was large enough to estimate particular prevalence rates.

It was disproportionately stratified by birth weight as table 1 shows. All children who weighed either under 1500 g or 5000 g or more at birth and all those with unstated birth weight were included. Samples of approximately 130 live births were selected randomly from each 500 g birthweight band between 1500 g and 5000 g. As table 1 shows, this gave a sample of 1319, which is 4 per cent of all births in 1985 in the former Oxford Region.

There were 706 boys in the sample and 613 girls, with boys dominating the larger birthweight groups and accounting for 53 per cent of the 1319 children in the sample. Of the babies in the sample, 239 or 18 per cent were known to have one or both parents born outside the UK. The median age of the children at the time of data collection was 7.5 years with a range of 6 years 11 months to 8 years 5 months, and 92 per cent had passed their seventh birthday at the time their parents returned the questionnaire.

TRACING THE CHILDREN

The registration district, sub-district, and entry number for each child in the sample was used within OPCS to obtain copies of the “draft entries” children’s birth registration. These include the name of the child and information from which the child’s National Health Service (NHS) number was derived. This information was sent to the NHS Central Register to establish whether the child was still registered with an NHS general practitioner, had died, or had emigrated. United States (US) forces families were also identified from information obtained. If the child was still registered with a general practitioner, the relevant Family Health Service Authority (FHSA) was identified.

The children who had emigrated or who were members of US forces families were not followed up further. Attempts were made to trace all children whose FHSA could not be ascertained through the NHSCR or who were lost at subsequent stages. Efforts were made to trace children through their hospital of birth, community health records, the Soldiers, Sailors and Airmen’s Family Association (SSAFA), and health visitors working with travelling families.

QUESTIONNAIRE FORWARDED TO PARENTS THROUGH THE FHSA AND GENERAL PRACTITIONER (GP)

A questionnaire and covering letter to the GP were then sent to the relevant FHSA for forwarding to each child’s GP. The FHSA was asked to return a receipt to us to confirm that the questionnaire had been forwarded, and giving a forwarding address, if possible. The child’s GP was then asked to forward the questionnaire to the parents unless they thought it was inappropriate, and also to return a receipt to us. If the GP considered it was inappropriate to forward the questionnaire for some reason they was asked to return it with an explanation. When the parents received the questionnaire they were asked to complete it and give consent for the child’s GP and teacher to be contacted.

FURTHER INFORMATION OBTAINED FROM THE GP AND TEACHER

If consent from the parents was obtained, further questionnaires were sent directly to the child’s general practitioner and to the teacher via the head teacher.

QUESTIONNAIRES

A 16 page questionnaire was sent to parents. This covered a wide range of questions on health and development and there were separate versions for boys and girls. The GP questionnaire included a list of 12 main illness categories. The GP was asked to tick whether or not the child had problems in any of the categories listed and to give a brief description where appropriate. The teachers’ questionnaire was four pages long with questions about the nature of any additional educational help the child may have had, National Curriculum test results, the teacher’s rating of the child’s school performance, the child’s behaviour recorded on a standard rating scale, and details of pre-school education.

APPROVAL FROM ETHICS COMMITTEES AND CONFIDENTIALITY

Ethics approval was sought and received from the eight district health authority ethics committees in the former Oxford region. To ensure confidentiality, a separate slip bearing the child’s name, date of birth, and NHS number...
Figure 1

Numbers of children “lost” from the original sample at each stage of the tracing process.

- **In sample 1319**
  - 83 died
  - 7 emigrated
  - 33 forces children

- **Eligible for followup 1196**
  - 27 not registered at NHSCR

- **Traced by NHSCR 1169**
  - 98 questionnaires not forwarded by GPs to parents

- **GPs sent questionnaires to parents 1071**
  - 266 parents did not reply

- **Questionnaires returned by parents 805**
  - 52 refused permission to contact teachers

- **Questionnaires returned to teachers 753**
  - 58 did not reply

- **Questionnaires returned from teachers 695**

Results

**Checks on the reliability of the method of sampling**

To check the reliability of the sampling method, the sample was compared with two other studies that should have contained a subset of the sample babies. The first of these was the Oxford Low Birthweight Study (OxLBW), in which all babies who were born alive in 1985 to mothers resident in the former Oxford NHS region and who weighed less than 1000 g or were born before 29 weeks of gestation were enrolled into a follow-up study. Comparison with the 131 babies enrolled in OxlBW study showed that 128 or 98 per cent were included in the sample. The records of the births of three babies included in the OxlBW Study were not available on the OPCS birth primary file. Of these, two had died; one was born at 23 weeks of gestation and died within a few hours of birth and the second died at the age of 20 days. The third baby survived the neonatal period but was overseas at the time of follow-up in the OxLBW Study.

The other was the Oxford Register of Early Childhood Impairment (ORECI), which started in 1984. This has information on children who were born to mothers resident in the former Oxford NHS region at the time of delivery and were identified as having cerebral palsy, severe vision loss, or sensorineural deafness. The ORECI office also obtains copies of death certificates of children of residents who died before the age of 5 years. It therefore would be expected that all babies weighing less than 1500 g and whose deaths were ascertained by the ORECI office would be in the sample and that such deaths would be correctly identified by NHSCR. The ORECI office had information on 70 babies born in 1985, who weighed less than 1500 g and who died. There was no record of birth on the OPCS birth primary file for three of these babies; all of these were extremely preterm. It is possible that these three babies were not registered at all, were registered as a stillbirth or that birth registration occurred very late and the births were not included in the 1985 file. Of the 67 babies who had died and were included in our sample, NHSCR correctly identified 66 of them as having died. One child who was not recorded as dead by NHSCR was reported as having no record of registration with an NHS doctor.

**Response**

Figure 1 shows the numbers of children “lost” from the original sample at each stage of the tracing process.

**FHSA identified for each child**

Relevant details of the 1319 babies in the sample obtained from OPCS were sent to NHSCR with a request to identify the FHSA where each child was currently registered. Of these, 1319 children 83 were found to have died. Forty children could not be followed up further. Thirty three children had never been registered with an NHS doctor and were later identified as children of USAF personnel, and seven had emigrated. This meant that 9.3 per cent of the

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**STATISTICAL ANALYSIS**

Response was tabulated by birthweight group, sex of the child, social class based on the father’s occupation at the time of the child’s birth, and country of birth of the child’s parents to identify sources of potential bias. Much of this information is not routinely released outside OPCS premises. Our data file was therefore taken to OPCS and linked with a file containing particulars that are confidential under the Population Statistics Acts. Response was also assessed by presence or absence of impairment for a group of extremely low birthweight babies. A $\chi^2$ test was used to analyse trend and as the sample was stratified by birth weight, the Cochran-Mantel-Haenszel $\chi^2$ statistic was used when analysing response rates for other factors. CATMOD a categorical data modelling procedure was used to carry out a logistic regression analysis of response.
Table 2  Children not traced at National Health Service Central Register (NHSCR)

<table>
<thead>
<tr>
<th>NHSCR status</th>
<th>Number</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Information sent to NHSCR</td>
<td>1319</td>
<td>100.0</td>
</tr>
<tr>
<td>Lost to follow up</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Dead</td>
<td>83</td>
<td>6.3</td>
</tr>
<tr>
<td>Emigrated</td>
<td>7</td>
<td>0.5</td>
</tr>
<tr>
<td>No posting*</td>
<td>33</td>
<td>2.5</td>
</tr>
<tr>
<td>All</td>
<td>123</td>
<td>9.3</td>
</tr>
<tr>
<td>Required tracing</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Service Medical Officer</td>
<td>4</td>
<td>0.3</td>
</tr>
<tr>
<td>Cancelled</td>
<td>7</td>
<td>0.5</td>
</tr>
<tr>
<td>No posting</td>
<td>16</td>
<td>1.2</td>
</tr>
<tr>
<td>All</td>
<td>27</td>
<td>2.0</td>
</tr>
<tr>
<td>FHSA identified</td>
<td>1169</td>
<td>88.6</td>
</tr>
</tbody>
</table>

*Identified by the project office as US forces.

Table 3 Parents’ response to questionnaire by child’s birth weight

<table>
<thead>
<tr>
<th>Birth weight (g)</th>
<th>Total sent to parents</th>
<th>Number not returned</th>
<th>Number returned unanswered</th>
<th>Number returned completed</th>
<th>Percentage returned completed</th>
</tr>
</thead>
<tbody>
<tr>
<td>Under 1500</td>
<td>178</td>
<td>27</td>
<td>7</td>
<td>144</td>
<td>80.9</td>
</tr>
<tr>
<td>1500–1999</td>
<td>104</td>
<td>21</td>
<td>2</td>
<td>81</td>
<td>77.9</td>
</tr>
<tr>
<td>2000–2499</td>
<td>116</td>
<td>33</td>
<td>7</td>
<td>76</td>
<td>65.5</td>
</tr>
<tr>
<td>2500–2999</td>
<td>115</td>
<td>23</td>
<td>4</td>
<td>88</td>
<td>76.5</td>
</tr>
<tr>
<td>3000–3499</td>
<td>114</td>
<td>25</td>
<td>6</td>
<td>83</td>
<td>72.8</td>
</tr>
<tr>
<td>3500–3999</td>
<td>120</td>
<td>17</td>
<td>9</td>
<td>94</td>
<td>78.3</td>
</tr>
<tr>
<td>4000–4499</td>
<td>111</td>
<td>20</td>
<td>4</td>
<td>87</td>
<td>78.4</td>
</tr>
<tr>
<td>4500–4999</td>
<td>110</td>
<td>26</td>
<td>1</td>
<td>83</td>
<td>75.5</td>
</tr>
<tr>
<td>5000 and over</td>
<td>28</td>
<td>9</td>
<td>1</td>
<td>18</td>
<td>64.3</td>
</tr>
<tr>
<td>Unknown</td>
<td>75</td>
<td>20</td>
<td>4</td>
<td>51</td>
<td>68.0</td>
</tr>
<tr>
<td></td>
<td>1071</td>
<td>221</td>
<td>45</td>
<td>805</td>
<td>75.2</td>
</tr>
</tbody>
</table>

χ²=31.08, 27 df, p=0.27.
Discussion

The use of a postal survey method to assess the health status of children in relation to their weight at birth was suggested to us by the late Abe Adelstein, and was inspired by the methodology used in a follow up study of infectious diseases in pregnancy. This study identified those known to have been exposed to viral infections in utero in the early 1950s. Together with a control group, they were traced through the National Health Service Central Register in the early 1980s and a one page questionnaire was sent to their general practitioners. This asked about their health status at that time and contained a check list of 14 conditions. Dr Adelstein encouraged us to think about using this method to develop a system for monitoring the later health of children who had been born too soon or too small, in relation to that of other children. The surveys could be repeated at regular intervals to monitor changes over time.

In this study, the postal method was extended and included questionnaires to parents and teachers. Another innovation was to ask the parents’ consent before a questionnaire was sent to the child’s general practitioner. A sample was selected directly from OPCS’s birth registration files, whereas in the earlier study, a variety of sources of information recorded at or around the time of birth were used to select people born in the early 1950s. Both studies differ from those in which children are identified at birth and “flagged” at the National Health Service Central Register for subsequent follow up, as in the MRC National Survey of Health and Development that follows up a sample of children born during a week in March 1946. These birth cohort studies are designed to collect detailed information about a preselected sample of people whereas this method was intended to collect a relatively restricted range of information about successive cohorts of 7 year olds and monitor trends over time.

Using this method of sampling and follow up, it was important to identify children who had died as it would be very distressing for parents if they were approached about a baby who had died some years previously. It was reassuring, therefore, that all but one of the deaths among babies in the sample had been correctly identified by NHSCR. If this had not happened, our initial approach to the GP provided a safeguard against contacting parents whose child had died, or who had other problems that might be aggravated by a request to take part in the survey.

At first sight, the overall response rates in figure 1 seem deceptively low. Closer inspection shows that at each stage of the survey, response rates were good and in keeping with the findings of surveys in general populations and professional groups.

The response rate of 94 per cent from the 770 GPs who were sent questionnaires was particularly high and may be attributed to two factors. Firstly, the accompanying letter was structured so that a brief section outlining what was being asked of them was clearly highlighted. Further information was also provided for those who wanted to know more about the background of the study. This allowed the GPs to choose their level of involvement. Secondly, and very importantly, the questionnaire itself was brief, and could be completed by putting ticks in boxes.

The teachers’ response rate was also remarkably good. It was anticipated that the extra work load resulting from the National Curriculum assessment would affect the teachers’ response rate. Nevertheless 92 per cent of the 753 teachers’ questionnaires were returned and completed. In addition many teachers responded to a request for comments on the structure of the questionnaire.
The parents’ response rate at 75 per cent was the lowest of those in the study. There is no general agreement about what a “good” response rate is. One standard text states that as a rough rule of thumb “a response rate of 70 per cent is very good”, as a rough rule of thumb “a response rate of 70 per cent is very good”,13 while another suggests that with well constructed postal surveys of the general population a response of 60–75 per cent response can be expected.14 Even with good response rates, non-response can lead to an unacceptable reduction in sample size and to bias. This is particularly true of a multi-stage survey where despite good response rates at each stage, a cumulative loss of the sample can lead to considerable reduction in the final sample size. The initial sample size should therefore be large enough to allow for reduction in sample size because of non-response.

This will not solve the more serious problem of bias, however. It is clear that there is some response bias in this survey and this could lead to problems in interpretation of data. For example, if the biases found in the low birthweight subset were present in the whole sample, the prevalence of severe motor impairment would be overestimated in this survey. This is particularly important in one off cohort studies or longitudinal studies. The problem is less serious however when monitoring change over time in repeated cross sectional studies, as are proposed here, providing the direction and size of the bias remains constant. Response bias can be taken into account by appropriate adjustment of the sample, for example by “reweighting” various groups to reduce the effects of the bias.

Overall, this method has great potential and could be used to tackle persisting concerns about serious morbidity in childhood in relation to birth weight. It also has the potential to be applied much more widely. For example, the sample could be stratified by other information recorded at birth registration, or by information from other routine sources of data about birth linked to birth registration. Further work is needed to improve response rates among families where parents may have problems with questionnaires in English or with literacy in general. Questionnaire translation and modification, follow up visits instead of letters for non-responders, and other methods of targeting could be considered to improve response rates. Further exploration of factors influencing non-response may be beneficial. Seeking further information on non-responders, however, raises wider issues for debate about the appropriateness of further pursuing people who have already indicating, by not responding, that they do not wished to participate in a research project. Finally, further work is also needed to assess the validity of the information collected in this way.

We are very grateful to all the parents, teachers and general practitioners who participated in this study. We also thank staff at OPCS, at NHSCR and at FHSAs throughout the former Oxford Region, for their cooperation.

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