

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.

(J Epidemiol Community Health 1998;52:439-444)

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,¹ Scotland,² and Wales,³ 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,⁴ 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 neuro-developmental 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.⁵ 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

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

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.⁶

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 were 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

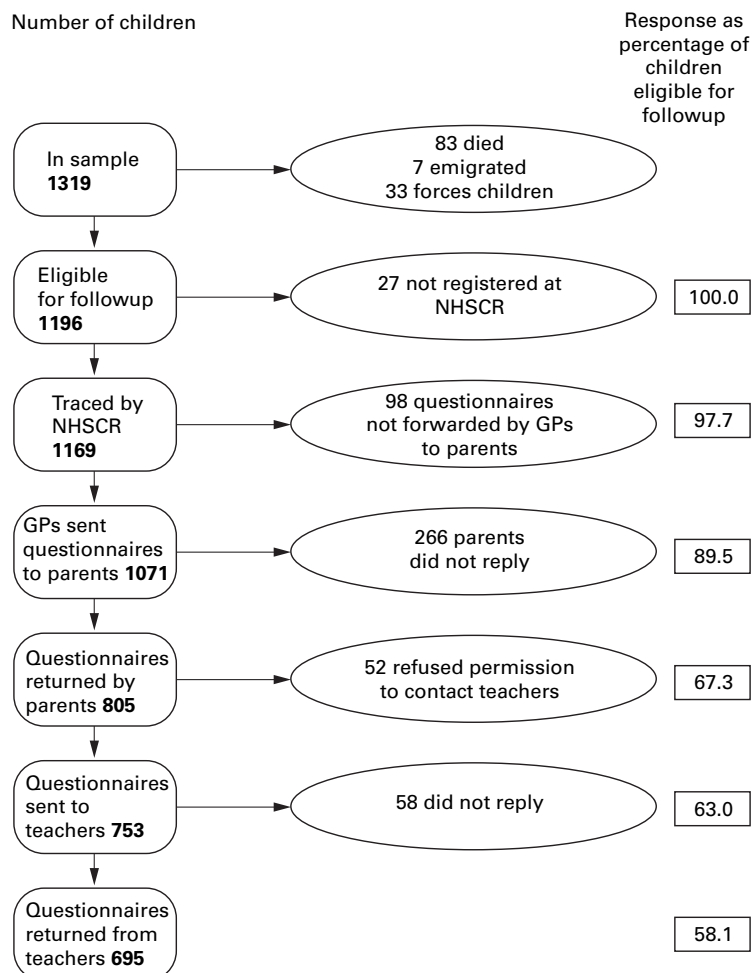


Figure 1 Numbers of children "lost" from the original sample at each stage of the tracing process.

was attached to each questionnaire. Doctors, teachers, and parents were asked to remove the slip before returning the completed questionnaire. The returned questionnaire was identified only by study number. This allowed us to keep the information obtained in the survey separate from the child's personal details.

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 χ^2 test was used to analyse trend and as the sample was stratified by birth weight, the Cochran-Mantel-Haenszel χ^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.

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),⁷ in which all babies who were born alive in 1985 to mothers resident in the former Oxford NHS region and 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 1984.⁸ 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

Table 2 Children not traced at National Health Service Central Register (NHSCR)

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

*Identified by the project office as US forces.

children in the sample were therefore lost to follow up through attrition at this stage (table 2), leaving an eligible sample of 1196.

For a further 27 children, the current FHSA could not be identified. Further attempts were made to trace them. Four were known to be under the care of a service medical officer (SMO) and seven were categorised as "cancelled" as they had not been re-registered with an NHS doctor. A further 16 were categorised as "no posting" as they had never been registered with an NHS doctor. Six of the 27 children were subsequently traced and questionnaires were sent directly from the project office to each child's general practitioner.

FROM FHSA TO GENERAL PRACTITIONERS

The NHSCR sent information about the current FHSA of 1169 children to the project office. These accounted for 88.6 per cent of the 1319 children in the original sample and 97.7 per cent of the 1196 children in the eligible sample. Questionnaires and covering letters were sent to the appropriate FHSA for each of these children. Of these 1169 children with a known FHSA, 82 per cent were still living in one of four FSAs that approximate to the boundaries of the Oxford Region. The remaining 208 or 18 per cent lived outside the former Oxford region.

Of the 1169 questionnaires sent to FSAs, receipts indicating that the questionnaire had been forwarded to GPs were received for 1162, over 99 per cent. Six questionnaires were returned to us because the child was not known to the FHSA and attempts were made to trace these children through the other methods available. For only one child, neither the receipt or questionnaire were returned. This was for a child now attached to an FHSA outside the region.

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

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

$\chi^2=31.08$, 27 df, $p=0.27$.

FROM GENERAL PRACTITIONERS TO PARENTS

In all, 1162 questionnaires were sent to GPs from FSAs. A further six questionnaires were sent direct from the project office, for children who were traced through other methods, making a total of 1168. Of these, 1071 or 92 per cent were forwarded to parents. Of the 97 questionnaires not forwarded, 41 were returned to the project office giving a reason why the GP had been unable to forward it. These reasons included 10 where the GP did not know where the child presently lived, two where the child was no longer in the practice, five where the child was no longer living in the UK, four where the GP was "too busy", and others where there were family problems such as parent illness, death of a parent, child abuse. Where appropriate, attempts were made to locate families whose address was not known. No receipt was received for a further 56 questionnaires. The reasons why these were not forwarded to parents are not known.

QUESTIONNAIRE RETURNED BY PARENTS

Of the 1071 parents who were sent questionnaires, 805 or 75 per cent completed and returned them. Of the 266 parents who failed to return a completed questionnaire, 36 opted out of the study by signing an opt out section at the end of the questionnaire and returning it, and nine were returned by the Post Office as "not known at this address". The reasons why the remaining 221 parents did not return questionnaires are not known. As this was the largest level of non-response, this group of non-responders was studied further to assess whether or not any response bias was present.

RESPONSE BIAS IN THE PARENTS' QUESTIONNAIRE

While the parents of the under 1500 g group were the best responders as table 3 shows, the difference between groups was no greater than would be expected by chance. There was a higher response rate among parents of girls. This was 79.8 per cent compared with 71.4 per cent parents of boys. The Cochran-Mantel-Haenszel statistic was 7.8, $p=0.005$. There is no clear explanation for the excess of boys in the total study population.

As expected, response rates differed by social class group as defined by the occupation of the father. There was a higher response rate when fathers were in non-manual occupations as table 4 shows. There was also a lower response rate of 62 per cent among families where the father was born outside UK or his birthplace was not stated compared with 77.5 per cent among families where the father was stated to be born in UK. This had a Cochran-Mantel-Haenszel statistic of 8.1, $p=0.004$. There was no such difference when response rates were tabulated by the mother's country of birth.

The interaction between birth weight, social class, sex of child, and the country of birth of the parents was further explored using a logistic regression analysis of the response. When the social class of the father was taken into account, the remaining factors did not significantly affect the model.^o

Table 4 Parents' response to questionnaire by social class of father

Social class of father	Total sent to parents	Number not returned	Number returned unanswered	Number returned completed	Percentage returned completed
I	154	21	4	129	83.8
II	275	39	13	223	81.1
IIIN	96	12	2	82	85.4
IIIM	341	94	16	231	67.7
IV	90	20	2	68	75.5
V	35	13	3	19	54.3
Other	32	9	2	21	65.6
Sole registration	48	13	3	32	66.6

Cochran-Mantel-Haenszel statistic=12.9, 4 df, $p=0.002$. I=Professional, II=executive, IIIN=skilled non-manual, IIIM=skilled manual, IV=semi-skilled, V=unskilled, Other=Armed Services, student, unemployed.

There is concern that children of non-responders may show higher levels of impairment than responders.⁹ Comparisons were made within a subset of the sample. This consisted of 58 children who had been seen at the age of four years as part of the OxLB Study, that is, babies who weighed less than 1000 g at birth or who were born before 29 weeks of gestation.⁷ In our survey, parents had completed and returned questionnaires for 44 of these children. The four year findings in the 44 responders were compared with those for the 14 non-responders. All but one of the 11 parents of children with a serious motor deficit and all of the parents of children with sensory deficits responded in comparison to 33 of the 44 parents of children who had normal functioning at age four. The numbers were small, however, and the difference was no greater than would be expected by chance.

FURTHER INFORMATION FROM GP AND TEACHER

Ninety six per cent or 770 of the 805 parents who responded agreed to let us approach the child's GP for further information. Of the 770 questionnaires sent to GPs, 724 or 94 per cent were completed and returned. Seven were returned incomplete, and 39 GPs did not return the questionnaire. Ninety four per cent or 753 of the 805 parents allowed us to approach the child's teacher. Of the 753 questionnaires sent to teachers, 695 or 92 per cent were completed and returned. Ten were returned incomplete, and 48 teachers did not return the questionnaire. Teachers responded well irrespective of whether the children attended a normal or special school.

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.¹⁰ 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' 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 1946.⁴ 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 populations¹¹ and professional groups¹².

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 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",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 wish 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.

Funding: Fiona Alderdice and Tracey Petty were funded by Action Research. Ann Johnson and Alison Macfarlane were funded by the Department of Health.

Conflicts of interest: none.

- 1 Calhoun H, Prescott Clarke P, eds. *Health Survey for England 1994*. London: HMSO, 1995.
- 2 The Scottish Office. *Scotland's Health. A challenge to us all. A policy statement*. Edinburgh: HMSO, 1992.
- 3 Welsh Health Survey. Cardiff: Welsh Office, 1996.
- 4 Wadsworth MEJ, *The imprint of time*. Oxford: OUP, 1991.
- 5 Mutch L, Johnson A, Morley R. Follow-up studies: design, organisation and analysis. *Arch Dis Child* 1989;64:1394–482.
- 6 Middle C, Johnson A, Alderdice F, et al. Birthweight and health and development at the age of 7 years. *Child Care Health Dev* 1996;22:55–71.
- 7 Johnson A, Townshend P, Yudkin PL, et al. Functional abilities at age 4 years of children born before 29 weeks of gestation. *BMJ* 1993;306:1715–18.
- 8 Johnson A, King R. A regional register of early childhood impairments: a discussion paper. *Community Medicine* 1989;11:352–63.
- 9 Wariyar UK, Richmond S. Morbidity and preterm delivery: Importance of 100 per cent follow-up. *Lancet* 1989;i:386–7.
- 10 Fine PEM, Clarkson JA, Snowman J, et al. *Infectious diseases in pregnancy. A follow-up study of the long term effects of exposure to viral infections in-utero. Studies on Medical and Population Subject No 49*. London: HMSO, 1985.
- 11 White A, Freeth S, O'Brien M. *Infant feeding 1990*. SS1299. London: HMSO, 1992.
- 12 Jacoby A. Possible factors affecting response to postal questionnaires: findings from a study of general practitioner services. *J Public Health Med* 1990;12:131–5.
- 13 Babbie E. *The practice of social research*. 5th ed. California: Wadsworth Publishing, 1989:42.
- 14 Dillman DA. *Mail and telephone surveys: the total design method*. New York: Wiley, 1978.