

COHORT PROFILE

Cohort Profile: The Aberdeen Children of the 1950s Study

David A Leon,^{1*} Debbie A Lawlor,² Heather Clark³ and Sally Macintyre⁴

How did the study come about?

The Aberdeen Children of the 1950s cohort study¹ was established in 1999. It is a follow-up into adult life of 12 150 individuals born in Aberdeen 1950–56, and is based on the Aberdeen Child Development Survey (ACDS).

The ACDS was a population-based cross-sectional study of 14 939 Aberdeen school children conducted 1962–64 to estimate the prevalence of mental subnormality in childhood and to investigate its aetiology in a well-defined community. It was funded by a US charity: the American Association for the Aid of the Crippled Child (AAACC). They had been searching for a suitable site to research the causes of cognitive problems in childhood. In the 1950s there was considerable public health and scientific interest in the fetal and obstetric determinants of 'mental disorders' and 'mental retardation' in particular.^{2,3} Aberdeen had been chosen by the AAACC as the location for the study because of the high standard of educational and obstetric records that would form an important source of data in the study. Foremost was the world-renowned obstetric database—the Aberdeen Maternal and Neonatal Databank—established by Dugald Baird in 1948. Since its inception, this depository had collected research-standard data on the course of pregnancy and birth outcomes for at least 85% of women delivering their babies in the city of Aberdeen.^{4,5} Under the direction of Dugald Baird, the Medical Research Council's (MRC) Obstetric Medicine Research Unit based at the Aberdeen Maternity Hospital used these and other data to conduct wide-ranging medical investigations to elucidate factors influencing the course and outcome of pregnancy. There was also a Scandinavian-like tradition in the city of recording and archiving information on its inhabitants, including home visitor and school records which contained data on childhood growth, illness, immunization, and social background.

The ACDS field work was undertaken by a multidisciplinary team of British and American investigators. It required the co-operation of city health and education officials and was co-ordinated in Aberdeen by Raymond Illsley based in the MRC's Obstetric Medical Research Unit (directed by Dugald Baird). Upon Baird's retirement, departmental responsibility for completion of

the dataset and its computerization became that of the MRC's Medical Sociology Unit (latterly the MRC Social and Public Health Research Unit, Glasgow), then directed by Illsley.

The main results of analyses of the original data on the determinants of mental subnormality were published in 1970 in a book co-authored by the senior researchers on the project.⁶ A description of the design and conduct of the ACDS was published as a book chapter in 1981.⁷ A very detailed follow-up in to early adult life of 221 cases of those classified as mentally subnormal was conducted by Richardson, one of the original researchers. The results were published as a book in 1996.⁸ In the 1990s a 20% random sample of the original ACDS was followed-up to look at the long-term respiratory sequelae of wheeze in childhood.^{9–14} Most recently Illsley has used the ACDS data to look at the influence of familial factors on educational attainment.¹⁵

In 1999 a collaborative group of researchers from the London School of Hygiene & Tropical Medicine and the universities of Aberdeen, Glasgow and Bristol, led by David Leon, obtained funding from the UK MRC to follow-up all 12 150 members of the ACDS who had been born in Aberdeen. This was motivated by the rapidly growing interest in life-course determinants of adult disease that was developing in this period. The revitalization of the cohort was made possible by Raymond Illsley who provided us with a copy of the original ACDS data, and the fact that the MRC Unit now in Glasgow had retained a copy of the hard bound registers with the names and addresses of the original sample. More recently, the Scottish Chief Scientist Office has provided support for studies of cognition and health.

It should be noted that in the early 1960s there was contact between the researchers working on the Aberdeen study and those working on cohorts being established around the same time in Copenhagen and Stockholm, both of which are described in other cohort profiles in this issue of the *International Journal of Epidemiology*.

What does it cover?

The original ACDS collected detailed information from a number of domains: (i) perinatal data on the births of study members and their mothers' obstetric histories; (ii) height and weight in primary school; (iii) routine cognitive test scores conducted at ages 7, 9, and 11 years together with various reading test scores conducted at the time of the 1962 survey and teachers' assessments of behaviour; (iv) socio-demographic information on families of study members derived from birth certificates and questionnaires in 1962; (v) socio-metric data; (vi) for a

¹ London School of Hygiene & tropical Medicine, Keppel St, London WC1E 7HT.

² Department of Social Medicine, University of Bristol.

³ Dugald Baird Centre, University of Aberdeen.

⁴ MRC Social & Public Health Sciences Unit, University of Glasgow.

* Corresponding author. E-mail: david.leon@lshtm.ac.uk

random 1 in 5 sample of subjects detailed information on family circumstances, attitudes, and behaviour from interviews with mothers.

The follow-up of the sub-set of 12 150 subjects born in Aberdeen (the Children of the 1950s cohort) has supplemented this original data with the following: (i) mortality by cause of death to the present time; (ii) information on hospital admissions (acute, obstetric, psychiatric) and cancer registrations in Scotland since the early 1980s; (iii) self-reported information on health, behaviours and socio-demographic trajectory, and current status; (iv) enhanced area-level information on place of residence in childhood.

Who is in the sample?

The Children of the 1950s cohort is comprised of all 12 150 individuals (6282 males, 5868 females) born in Aberdeen 1950–56 who were in primary school in Aberdeen in December 1962 when they were aged 6–12 years. There were no restrictions placed on who should be included beyond these basic criteria. Unlike the Stockholm and Copenhagen studies described in this issue of the *International Journal of Epidemiology*, and the UK birth cohorts, the Children of the 1950s includes siblings. The 12 150 individuals are born of 9422 mothers, with 5048 of the study subjects having one or more sibs in the Children of the 1950s study population.

How often have they been followed up?

The only direct face-to-face contact with the cohort members for purely research purposes was at the time of the original survey in the early 1960s. All of the other data on cohort members has come from routinely collected information (linked manually or by computer) or from a postal questionnaire survey conducted 2001–02. It is interesting to note that almost none of the 7183 respondents to this questionnaire remembers taking part in the original survey when they were in primary school.

In 1999 we traced the surviving members of the cohort still resident in the UK using the National Health Service Central Registry. This exercise also provided us with information on subjects who had died since the ACDS. Record linkage procedures have been used to provide us with anonymized information about hospital admissions occurring since the early 1980s. Between 2001 and 2003 we conducted a postal questionnaire of all surviving members of the cohort resident in the UK. Those people who responded to the questionnaire have been sent a Christmas card each year thanking them for their participation in the study and asking them to send us their updated address if this has changed.

What has been measured?

The information available on study subjects is summarized in Table 1.

What is attrition like?

Of the 12 150 subjects we were able to trace 99% (12 013/12 150) of study members through the General Register Office (GRO)

(Scotland). Flagging of all traced study members at the National Health Service Central register has resulted in notification of 611 deaths (with cause) by end of September 2005. In addition we have identified 7080 second generation births (in Scotland) to 4997 female members of the cohort through linkage to the Aberdeen Maternal and Neonatal and Databank and SMR2 (national Scottish discharge data on births). Linkage of cohort members to SMR1 (acute hospital admissions), SMR4 (psychiatric admissions) and SMR6 (cancer registrations) at the end of November 2005 identified 36 515, 1203 and 800 episodes respectively.

The postal questionnaire sent through the NHS at 'arms length' on our behalf to all subjects with an address in Scotland or England and Wales, achieving a response of 64% (7183/11 282). Responses were highest among females, and those whose parents were married at birth, were in a non-manual social class at birth or in childhood, had fewer siblings, were taller and heavier in childhood for their age and had lower Rutter B behavioural scores. Childhood cognitive test scores at each age (7, 9, and, 11 years) were strongly and positively related to responding to the postal questionnaire, independent of other early life factors, and monotonically across the entire range of test scores. Of those in the bottom fifth of the distribution of cognitive test scores at age 11 years, 49% responded while 75% of those in the top fifth of the distribution responded. Further information on the conduct of the postal questionnaire and factors that influenced response have been reported elsewhere.¹⁶

What has it found? Key findings and publications

A paper providing a very detailed description of the setting up and conduct of the Children of the 1950s study design has been previously published.¹ Details of the questionnaire survey and an analysis of response rates have also been published elsewhere.¹⁶ Other papers on methodological aspects of the study include an investigation of the validity of linkage to offspring of female members of the cohort,^{17,18} and an analysis of validity of adult recall of childhood paternal social class.¹⁹

The study has proved to be particularly fruitful for looking at the determinants²⁰ and long-term consequences of cognition in childhood. Findings include cross-cohort confirmation of a link between childhood cognition and age at menopause²¹ and the demonstration that twins have reduced IQ compared with singletons within the same family.²² Early life determinants of cardiovascular risk factors and disease have also been studied. Importantly, we have found that the inverse association of birth weight with coronary heart disease and stroke is confirmed in this cohort—the first time that this has been demonstrated in a cohort of people born into the relative affluence of the second half of the 20th century in a high income country.²³ In addition we have found that contrary to expectations, there is very little association between obesity or overweight in childhood in this cohort and risk of later coronary heart disease.²⁴ We have also contributed to the debate about the influence of childhood socioeconomic circumstances on adult cardiovascular disease risk factors²⁵ and pregnancy-induced hypertension.²⁶ The study has also advanced our understanding of the link between body mass index in childhood and age at menarche,²⁷ and has made observations on the possible association between growth *in utero*

Table 1 Summary of what has been measured

Phase	Source	Measurement/information
Aberdeen Child Development Survey (1962–64)	Survey of primary school children aged 6–12 years conducted in December 1962	Identification details, father's occupation, number older and younger siblings, scores from 3 kinds of reading tests
	School records 1962–64	IQ at 7, 9 and 11 years
	Aberdeen Maternity Hospital (AMH) obstetric records and birth certificate	Details of course of pregnancy, type and duration of delivery, birth weight, gestational age, multiplicity, occupation of mother, father and mother's premarital education, marital status and age at marriage
	School medical records	Height, weight, visual and hearing acuity at primary school entry. Also laterality (handedness)
	Teachers' questionnaires conducted March 1964	Scale of minor behavioural problems (Rutter B scale)
	Brief questionnaire to children March 1964	Socio-metric data—each child being asked to nominate three other children in their class that they liked the most
Record linkages carried out since 1999	National Health Service Central Registry	Date of death and copy of death certificate (1962 onwards)
	Scottish Morbidity record systems: (SMR01—acute admissions); (SMR04—psychiatric); (SMR06—cancer registration)	Anonymised data on date and diagnostic codes (up to six diagnoses relating to each admission) for hospital admissions from these sources from the early 1980s onwards
	SMR02 (obstetric) hospital admissions and Aberdeen Maternity and Neonatal Databank	Anonymised linkage of all deliveries to female cohort members occurring in Scotland and Aberdeen. Information includes socio-economic data at time of pregnancy/delivery, height and gestational age and birth weight of offspring
Postal questionnaire conducted 2001–03	Questionnaire mailed by third parties (ISD Scotland, Health Authorities in England and Wales) to current addresses	Self-reported health, height, weight, doctor diagnosed diseases, symptoms, smoking, drinking, number of children, occupation, education, income, date of menarche and menopausal information, information about family circumstances in childhood

and later psychological distress²⁸ and the affect of school on self-reported health and risk factors in adult life.²⁹ The potential for the study to contribute to cross-cohort analyses is exemplified both in the work already alluded to on cognition and age at menopause, and in a study alongside two other British cohorts looking at socioeconomic determinants of rates of hysterectomy.³⁰

Several rather unique areas of the study are likely to produce new insights over the next few years. These include making further use of the family structure of the dataset (as already illustrated by the twins and IQ paper²² and a recent paper comparing the association of birth weight with childhood intelligence within sibling-pairs to that between siblings from different families³¹), analyses of inter-generational influences on birth outcome,³² and extensions of work on classroom peer status on behaviour in childhood³³ to adult health outcomes. A full list of publications can be found on the study web-site whose URL is given below.

What are the main strengths and weaknesses?

One of the main strengths of the study is that it represents a complete population cohort of all subjects who lived in a

well-defined city in the early 1960s with very high rates of follow-up for routine record linkages. Unlike many other cohorts of comparable size, particularly from the UK, it also has the strength of containing an appreciable number of sibships—which can be made good use of when trying to deal with potential confounding effects of family circumstances.^{22,31} Finally, the cohort is unusual in having extensive information on the offspring of female cohort members.

The main weaknesses for a life-course cohort are the absence of prospectively collected serial information on many different aspects of growth and development between primary school years and middle age. In addition, at the current time we do not have any biomedical data derived from physical examinations other than perinatal data from the AMND and height and weight in childhood. Finally, although not atypical, the 63% response to the postal survey in middle age means that particular care must be taken in interpreting results based on the questionnaire.

An additional strength that should be noted is that the cohort has a very effective searchable web-based documentation system that describes each variable and provides facsimiles of most of the data collection instruments. This is accessible to bona fide researchers (see below for details of how to apply for access to this and subsets of the data).

Can I get hold of the data? Where can I find out more?

We welcome and encourage researchers wishing to use these data to contact us. The Aberdeen Children of the 1950s study has a steering group whose remit includes approving requests for anonymized subsets of the data. For further details about the study and the procedure for applying to use it to either email the corresponding author (D.A.L.) or go to the study's public website: <http://www.abdn.ac.uk/~ogy200/index.htm>.

References

- ¹Batty GD, Morton SMB, Campbell D, Clark H, Davey Smith G, Hall M *et al*. The Aberdeen Children of the 1950s cohort study: background, methods and follow-up information on a new resource for the study of life-course and intergenerational effects on health. *Paed Perinat Epidemiol* 2004;**18**:221–39.
- ²Pasamanick B, Lilienfeld AM. Association of maternal and fetal factors with development of mental deficiency. I. Abnormalities in the prenatal and paranatal periods. *JAMA* 1955;**159**:155–60.
- ³MacMahon B, Sawa JM. Physical damage to the fetus. *Milbank Mem Fund Q* 1960;**39**:14–73.
- ⁴Thompson B, Samphier M, Hall MH. The Aberdeen Obstetric Data Bank. *Acta Genet Med Gemellol (Roma)* 1979;**28**:375–76.
- ⁵Samphier M, Thompson B. Longitudinal studies in Aberdeen, Scotland. B. The Aberdeen Maternity and neonatal data bank. In: Mednick S, Baert A, Bachmann B (eds). *Prospective Longitudinal Research. An Empirical Basis for the Primary Prevention of Psychosocial Disorders*. Oxford: Oxford University Press, 1981, pp. 61–65.
- ⁶Birch HG, Richardson SA, Baird D, Horobin G, Illsley R. *Mental Subnormality in the Community: A Clinical and Epidemiologic Study*. Baltimore: Williams & Wilkins Co., 1970.
- ⁷Illsley R, Wilson F. Longitudinal studies in Aberdeen, Scotland. C. The Aberdeen child development. In: Mednick S, Baert A, Bachmann B (eds). *Prospective Longitudinal Research. An Empirical Basis for the Primary Prevention of Psychosocial Disorders*. Oxford: OUP, 1981, pp. 66–68.
- ⁸Richardson SA, Koller H. Twenty-two years—causes and consequences of mental retardation. Cambridge, MA: Harvard University Press, 1996.
- ⁹Bodner C, Ross S, Douglas G, Little J, Legge J, Friend J *et al*. The prevalence of adult onset wheeze: longitudinal study. *BMJ* 1997;**314**:792–93.
- ¹⁰Bodner CH, Ross S, Little J, Douglas JG, Legge JS, Friend JAR *et al*. Risk factors for adult onset wheeze. *Am J Respir Crit Care Med* 1998;**157**:35–42.
- ¹¹Christie GL, Helms PJ, Ross SJ, Godden DJ, Friend JA, Legge JS *et al*. Outcome of children of parents with atopic asthma and transient childhood wheezy bronchitis. *Thorax* 1997;**52**:953–57.
- ¹²Godden DJ, Ross S, Abdalla M, McMurray D, Douglas A, Oldman D *et al*. Outcome of wheeze in childhood. Symptoms and pulmonary function 25 years later. *Am J Respir Crit Care Med* 1994;**149**:106–12.
- ¹³Ross S, Godden DJ, Abdalla M, McMurray D, Douglas A, Oldman D *et al*. Outcome of wheeze in childhood: the influence of atopy. *Eur Respir J* 1995;**8**:2081–87.
- ¹⁴Ross S, Godden D, McMurray D, Douglas A, Oldman D, Friend J *et al*. Social effects of wheeze in childhood: a 25 year follow up. *BMJ* 1992;**305**:545–48.
- ¹⁵Illsley R. A city's schools: from equality of input to inequality of outcome. *Oxford Review of Education* 2002;**28**:427–43.
- ¹⁶Nishiwaki Y, Clark H, Morton SM, Leon DA. Early life factors, childhood cognition and postal questionnaire response rate in middle age: the Aberdeen Children of the 1950s study. *BMC Med Res Methodol* 2005;**5**:16.
- ¹⁷Nitsch D, Morton S, de Stavola B, Clark H, Leon DA. How good is probabilistic record linkage to reconstruct reproductive histories? Results from the Aberdeen Children of the 1950s study. *BMC Med Res Methodol* 2005; (In press).
- ¹⁸Nitsch D, De Stavola BL, Morton SMB, Leon DA. Linkage bias in estimating the association between childhood exposures and propensity to become a mother: An example of simple sensitivity analyses. *JRSS(A)* 2005; (In press).
- ¹⁹Batty GD, Lawlor DA, Macintyre S, Clark H, Leon DA. Accuracy of adults' recall of childhood social class: findings from the Aberdeen children of the 1950s study. *J Epidemiol Community Health* 2005;**59**:988–903.
- ²⁰Lawlor DA, Batty GD, Morton SM, Deary IJ, Macintyre S, Ronalds G *et al*. Early life predictors of childhood intelligence: evidence from the Aberdeen children of the 1950s study. *J Epidemiol Community Health* 2005;**59**:656–63.
- ²¹Kuh D, Butterworth S, Kok H, Richards M, Hardy R, Wadsworth ME *et al*. Childhood cognitive ability and age at menopause: evidence from two cohort studies. *Menopause* 2005;**12**:475–82.
- ²²Ronalds GA, De Stavola BL, Leon DA. The cognitive cost of being a twin: evidence from comparisons within families in the Aberdeen children of the 1950s cohort study. *BMJ* 2005;**331**:1306–09.
- ²³Lawlor DA, Ronalds G, Clark H, Smith GD, Leon DA. Birth weight is inversely associated with incident coronary heart disease and stroke among individuals born in the 1950s: findings from the Aberdeen Children of the 1950s prospective cohort study. *Circulation* 2005;**112**:1414–18.
- ²⁴Lawlor DA, Leon DA. Association of body mass index and obesity measured in early childhood with risk of coronary heart disease and stroke in middle age: findings from the Aberdeen children of the 1950s prospective cohort study. *Circulation* 2005;**111**:1891–96.
- ²⁵Lawlor DA, Batty GD, Morton SM, Clark H, Macintyre S, Leon DA. Childhood socioeconomic position, educational attainment, and adult cardiovascular risk factors: the Aberdeen children of the 1950s cohort study. *Am J Public Health* 2005;**95**:1245–51.
- ²⁶Lawlor DA, Morton SM, Nitsch D, Leon DA. Association between childhood and adulthood socioeconomic position and pregnancy induced hypertension: results from the Aberdeen children of the 1950s cohort study. *J Epidemiol Community Health* 2005;**59**:49–55.
- ²⁷Pierce MB, Leon DA. Age at menarche and adult BMI in the Aberdeen children of the 1950s cohort study. *Am J Clin Nutr* 2005;**82**:733–39.
- ²⁸Wiles NJ, Peters TJ, Leon DA, Lewis G. Birth weight and psychological distress at age 45–51 years: results from the Aberdeen Children of the 1950s cohort study. *Br J Psychiatry* 2005;**187**:21–28.
- ²⁹Dundas R, Leyland AH, Macintyre S, Leon DA. Does the primary school attended influence self-reported health or its risk factors in later life? Aberdeen children of the 1950s study. *Int J Epidemiol* 2005;doi:10.1093/ije/dyi239.
- ³⁰Cooper R, Lawlor DA, Hardy R, Ebrahim S, Leon DA, Wadsworth ME *et al*. Socio-economic position across the life course and hysterectomy in three British cohorts: a cross-cohort comparative study. *BJOG* 2005;**112**:1126–33.
- ³¹Lawlor DA, Clark H, Davey Smith G, Leon DA. Intrauterine growth and intelligence within sibling-pairs: findings from the Aberdeen Children of the 1950s cohort. *Pediatrics* 2006; (In press).
- ³²Morton SMB, Leon DA, De Stavola BL. Transgenerational influences on inequalities in size at birth. *J Epidemiol Comm Health* 2000;**54**:774.
- ³³Ostberg V. Children in classrooms: peer status, status distribution and mental well-being. *Soc Sci Med* 2003;**56**:17–29.