

STUDY PROFILE

Focussing and funding a birth cohort study over 20 years: the British 1946 national birth cohort study from 16 to 36 years

Michael Wadsworth

Emeritus Professor, Department of Epidemiology & Public Health, University College London Medical School; Honorary Senior Scientific Staff, MRC Unit for Life Long Health & Ageing.

(mejw@btinternet.com)

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Abstract

The first British national birth cohort study was initially concerned principally with health at the birth of its sample in 1946. Throughout its first fifteen years it received only short-term financial support, but still managed to undertake ten follow-up data collections and broaden its focus to include educational and cognitive outcomes. Then in 1962, when cohort members were aged 16 years, the Medical Research Council (MRC) agreed to be the principal funder. Over the next twenty years, during the cohort's adolescence and early adulthood, discussion about the study's focus was influenced by the funding source, the cohort's age, the data, current policy concerns, and current thought and innovations in measurement in epidemiology. That period began with pessimism about the study's future. However, towards the end of the twenty years, the MRC review of options for continuation revealed new epidemiological questions on mental health and ageing that required life course data. Consequently the study was continued, and extensively revised health outcome indicators and methods of data collection were first used at age 36 years. They provided new baselines against which to measure future health change with age, and new outcomes with which to test life course effects of hypothesised earlier life exposures, experiences and health. This paper shows how the focus of the study was changed and developed by internal and external pressures and influences between 1962 and 1982, when the cohort was aged 16 to 36 years.

Keywords: research funding; longitudinal birth cohort study; data collection; ageing; history of epidemiology; history of social science

Introduction

Longitudinal studies that continue over many years of their subjects' lives must inevitably adjust their focus, in terms of aims and measures as the sample ages, and as the scientific, policy, and socio-economic contexts change. Such adjustment is conditioned also by the nature of the data already collected, and the longer the study continues the more some existing

data may deviate from current standards. Consequently, long-term continuation can be difficult to maintain, even though if achieved it can offer unique and valuable research opportunities. In the United States these problems were experienced by many of the long-running multi-disciplinary studies of child growth and development, set up between 1927 and 1932 to assess the impact of the Great Depression

on children; the Fels study is a notable example (Roche, 1992).

Inevitably such questions had to be addressed and resolved in the first of the British national birth cohort studies, the MRC National Survey of Health and Development. It began at the birth of its 5,362 subjects in 1946, and has continued, with the most recent data collection at age 60-64 years (Kuh et al., 2011). An earlier paper showed how the study's aims were shaped during its first fifteen years by contemporary science and policy concerns, and by its director's scientific and policy interests (Wadsworth, 2010). After an initial concentration on survival, health, growth, and health care, the aims were broadened in the school years to include mental development, and educational attainment. The end of the years of compulsory schooling was a second significant change point for the study's aims. By then the cohort's age, the current policy questions, and the existing data, argued for new measures to include employment, development of occupational skills, adjustment to independence through adolescence to early adulthood, and the development of health-related habits such as smoking, exercise, nutrition, and changes in body shape.

This paper describes the range of influences that actually and significantly affected the study's focus during the twenty year period when cohort members were aged 16 to 36 years (1962 to 1982). Rather than reviewing the research which used the study data, the intention is to show the sources of influence which concentrated the study's aims on mental and physical health. Those influences moved the study's focus towards a programme of research on the processes of ageing, which remains its primary concern (Kuh et al., 2011; www.nshd.mrc.ac.uk).

Methods and sources

Four sources of information were used, namely: 1) the Medical Research Council (MRC) committee papers stored at the National Archive; 2) the study's publications and papers kept by the MRC Unit for Life Long Health & Ageing, which now continues the study; 3) publications describing contemporary scientific and policy concerns; and 4) the author's experience as a member of the study staff during part of the period (1968 to 1979), as co-principal investigator from 1979 until the end of the period studied here (1986), and then director until retirement in 2006.

Redefining the study's research focus for late adolescence and early adulthood

The contemporary research environment

In 1961 the study was at a decision point about the future because a) participants were at the end of compulsory education; b) the principal investigator who had started and maintained the study was at a decisive career point;ⁱ and c) because each of the previous eleven data collections during the study's fifteen years had been individually funded. James Douglas (the principal investigator and study director was a physician) and David Glass (its founder who was a demographer and holder of the Martin White Chair of Sociology at the London School of Economics) decided that more consistent funding was required if they were to continue the study.

The legacy of data from earlier times included a remarkably sensitive characterisation of the cohort members' growth, cognitive development, illness, educational experience and attainment, behaviour and aspirations at school, and the home environment and parental influences from birth to age 15 years. Much additional data had been collected on family and school circumstances, and on cohort members' behaviour and aspirations, for use in the analysis of the main topics, and as topics in themselves. Further follow-up into young adulthood would provide a unique opportunity to capitalise on what had already been achieved, and to contribute to current research and policy concerns in the social sciences and health.

From the point of view of social science research and socio-economic policy in 1961, there were good arguments for continuing. It was the beginning of the era when factually accurate data was first recognised as essential and attainable for the formation and evaluation of policy (Titmuss, 1957; Marwick, 1982). There was concern to understand the wide extent of social change in terms of work, marriage and family life, social behaviour, the rise of the consumer society, and the institutional, political and individual means of escaping poverty (Young & Willmott, 1957; Hoggart, 1957; Stacey, 1960; Wootton, 1959). The question of whether social mobility had increased in relation to the new educational opportunities provided in the post-war years was particularly relevant (Glass, 1954). Yet the 1946 birth cohort study was still the only British

national birth cohort study and remained so until it was 12 years old in 1958, when the first data collection took place in what was to become the second national birth cohort study, the National Child Development Study (www.cls.ioe.ac.uk/mcs). The third national birth cohort study, the Child Health and Education Study, was to follow in 1970 (www.cls.ioe.ac.uk/mcs).

From the point of view of health, arguments for continuing were also robust. From before the Second World War there had been a flourishing research interest in the impact of social factors and related effects such as malnutrition, on the risk of disease and its care (Morris & Titmuss, 1942, 1944; Morris, 1967; Martin, Gunnell, Pemberton, Frankel, & Davey Smith, 2005), which was reflected in the establishment of the Society for Social Medicine in 1956 (Pemberton, 2002). The value of integrating the teaching of social and preventive medicine with clinical studies had been recognised (Murphy, 1999), and there was growing interest in extending population screening for early signs of illness. By 1961 two other longitudinal population studies of child health had been started, and each still continues. One was the Thousand Families Study in Newcastle-upon-Tyne, a study of child health begun in 1947 to investigate the high incidence of infectious disease in the first year of life (Spence, Walton, Miller, & Court, 1954; Pearce, Unwin, Parker, & Craft, 2009). The other was the 1958 national birth cohort study, designed initially to show, in comparison with the 1946 study findings, the impact of the new National Health Service (begun in 1948) on the health and survival of infants and mothers in the first week of life (Butler & Bonham, 1963; Power & Elliott, 2006). That study became a longitudinal investigation in 1965, at the time of the first follow-up data collection.

New funding and organisation

Sources of long-term funds were much less well established for social science than for medical research in 1961. Empirical social science research in Britain was then mostly undertaken by individuals, or single university departments; the exception was the Institute of Community Studies inaugurated by Michael Young and Peter Willmott in 1954.ⁱⁱ Although the British Sociological Association had been founded in 1951, still in 1961 most social science research was funded by single grants from philanthropic and charitable sources;

the Social Science Research Council, forerunner of the present Economic & Social Research Council, was not established until 1965, and Social and Community Planning Research, forerunner of the National Centre for Social Research, began in 1969.

The Medical Research Council (MRC) had, by contrast, been established in 1913. It funded research units as well as projects, and in 1961 was already extensively concerned with the social, psychological and illness interface. In 1948 it had established a Social Medicine Research Unit to investigate 'the incidence and causation of various diseases in relation to social conditions including occupations' (Murphy, 1999). The MRC Unit for Research in Occupational Adaptation was also created in 1948 and became the MRC Social Psychiatry Research Unit. The MRC Obstetric Medicine Unit was established in 1955 to study how poverty affected reproductive health and birth. There was also concern that medical education should include the social sciences, as advised by the Goodenough (1944) enquiry. The Royal Commission on Medical Education, established in 1965, recommended the inclusion of social science in medical school teaching (Royal Commission, 1968).

For Douglas as a physician and Glass as a demographer, who had together set up this national birth cohort study (Wadsworth, 2010), the Medical Research Council (MRC) must have seemed, in 1961, the obvious and only potential source of stable funding for the continuation of the study.

Their bid was successful and guaranteed funding for an initial five years and possibly thereafter, subject to review at five yearly intervals. Funding began in 1962 for the new MRC Unit for Research on the Environmental Background of Mental and Physical Illness, based in Glass's research group (the Population Investigation Committee, which had initiated the study) at the London School of Economics, with Douglas as study director; it continued there until Douglas retired in 1979.

The study's research programme was overseen by a steering committee. Initially, in 1962, this consisted of academic specialists in mental health, paediatrics, statistics, occupational psychology and education. Later the committee also included representatives from government departments (the Home Office, General Register Office, Department of Health) and relevant professional bodies (e.g.,

the Health Visitors Association, Society of Medical Officers of Health).

Additional funding was obtained for specific analyses from the Social Science Research Council, and some government departments, including the Home Office, Department of Industrial and Scientific Research, and Department of Health and Social Security.

Initial definition of aims

Glass and Douglas pitched their bid for a research unit to appeal to the MRC's concerns, and allay possible anxieties about commitment to a long-term study. They emphasised the value of a unit because it could train medical and social science graduates to 'become effective research workers in such new fields as the epidemiology of mental disorder' (Glass, 1960). About the study itself they did 'not think that there should be any commitment to an extension...beyond the five year period.It would be more useful to study specific sections of the sample after the first five years than to continue general studies of the sample as a whole' (Glass, 1960). However, the committee reviewing the application commented that the study 'was of unique value and should be continued for as long as possible' (Medical Research Council, 1961a). In the confirmation letter the MRC 'were glad to know that clinical facilities which are essential if the Unit is to carry out the remit as effectively as possible, would be available at the Maudsley hospital' (Medical Research Council, 1961b)ⁱⁱⁱ. The strength of the Department of Statistics at the London School of Economics was also favourably noted (Medical Research Council, 1961c).

In partial fulfilment of the MRC requirement for clinical relevance Douglas, with others at the Maudsley hospital and the Institute of Child Health, began two new observational studies of child and maternal behaviour. These were known as the child behaviour studies, and they were intended to look more deeply into some of the findings from the birth cohort study. A psychiatrist reviewer noted to the MRC that 'Dr. Douglas's group have pioneered survey methods but they seem now to be making a large leap from a relatively superficial study of large numbers of children' (Miller, 1964). The new observational studies used video recordings and electronic monitoring methods, developed in the electronics laboratory set up in the unit, to study

the interaction of mothers and their twin babies in early life. These were important aspects of the unit's work, and Douglas directed them as well as the birth cohort study. His commitment to this work is shown by his request to the five-yearly review committee in 1970 to re-name the unit the 'MRC Unit for Child Development and Behaviour' (Medical Research Council, 1970a).

The initial focus of the birth cohort study was agreed by its steering committee to be a) vocational education and technical training; b) maladjustment and delinquency; and c) education of the survey members who were still at school. However, following MRC concern that 'a good deal of the work...could be considered rather marginal to the Council's interests' (Medical Research Council, 1962), Douglas and Cooper (1964) added new aims concerned with a) the health of those of lower birth weight and those who had many childhood accidental injuries, asthma, eczema, or chronic illness; b) work and marriage histories in relation to earlier education, training, teachers' assessments of behaviour and life chances, and psychological and behavioural problems including delinquency; and c) use of health services. In line with Douglas and Glass's view, expressed in their initial application to the MRC, that the birth cohort study had a time-limited useful life, the second meeting of the steering committee in October 1964 agreed that there should be two final interviews with the cohort, one in 1967 and the other in 1971.

Data collection methods

Initially, the new research unit's data collections addressed the steering committee's initial concerns with social and educational outcomes. Youth Employment Officers interviewed those who had left school at the earliest opportunity, to collect information about employment experience and intentions. Douglas and his colleague Jean Ross interviewed those who had gone on to university. In all topic areas it was thought possible to obtain good quality data during the cohort's late adolescence and early adulthood through monitoring information collected by service providers, rather than relying on self-reports. While negotiations took place with government departments concerned with higher education, employment, social welfare and health, as well as the National Health Service and professional bodies, the study returned to earlier forms of data

collection to maintain the collection of information about health and social circumstances. Health visitors undertook a data collection in 1965, and postal questionnaires were used in 1966 and 1968. However, it became clear that the only viable data sources were (a) the National Health Register, which agreed to provide data on dates and causes of death, and (b) hospital records which could, with the agreement of each hospital and each consultant, permit study staff to follow-up cohort members' reports of admissions in order to add details of diagnoses and treatments. These options were taken up.

It was decided that the final data collection should be by a home interview in 1972 (at age 26 years), preceded by a postal questionnaire to establish addresses and trace missing study members. Douglas asked the Government Social Survey to undertake that home interview data collection, using their national panel of interviewers, but eventually, after much indecision, they declined because of the sample's geographical spread and the prospect of much evening interviewing (Medical Research Council, 1970b). Consequently, a bid was accepted from Social and Community Planning Research (two other firms were bidding), and they undertook the work in 1972-3.^{iv} Following that data collection, all reported hospital care was checked with hospital records, and reported deaths were monitored through the National Health Service Central Register.

An additional dimension to the study began in 1969, when data was first collected at home interviews to study cohort members' upbringing of their first born, and the birth, health, growth, cognitive development and education of that child.^v Data collection was completed in 1981.

Concerns about the long-term

Within two years of the new research unit's inauguration Douglas affirmed to the steering committee that 'the National Survey would for practical purposes cease after 1971, but it was recognised that it would be extremely valuable to maintain contact for as long as possible'(Douglas, 1964a). Five years later an MRC review concluded that the study's aim should be the establishment of 'groups of medical interest' who might be examined at a later date 'to determine for example lung function or the extent of specific disabilities' (Medical Research Council, 1969), reflecting the

argument put forward in the original application (Glass, 1960). In their review in 1972, the MRC agreed with the proposal that the data collection in that year should be the last, because 'returns in sociological, developmental and medical information obtained from the NSHD cohort during the next two decades are likely to be low and the cost of maintaining contact with the subjects increasingly high' (Medical Research Council, 1972). Nevertheless, a short postal questionnaire was used in 1977 to maintain contact and the collection of information about health and social circumstances, and the MRC agreed to continue the unit until Douglas's retirement in 1979.

Modifications of long-term aims

Despite Douglas's earlier doubts about the continuation of the study, however, new ideas were emerging. Glass, who had initially been pessimistic about the long-term future of the study (Glass, 1960), became convinced that it should continue (Glass, 1970), and arguments in favour of continuation were made in relation to policy and science.

During this period there were two expressions of interest in continuation of the study for policy purposes. The first source of interest developed from the unit's research that had been funded by grants from government departments and sources other than the MRC on, for instance, occupation and training and their associations with health (Cherry, 1974a and b, 1976; 1978), housing deprivation (McDowell, 1979), delinquency (Wadsworth, 1979), and social mobility (Kerchoff, 1974). The second source of policy interest was the largely positive response to the Government Social Survey's request to government departments in 1969, indicating their interest in continuation of the study.^{vi} Consequently, in December 1974, the Central Statistical Office (CSS) emphasised to the MRC that they saw 'this survey as a valuable source of longitudinal data', and suggested that at a minimum the study's records should be preserved, and ideally a live address list 'should be kept so that cohort members could be contacted for further surveys' (Boreham, 1974). The CSS thought the data on transition from home to school, and from school to employment, 'likely to be useful as a means of comparing different generations', and highly relevant to the current Social Science Research Council and Department of Health and Social

Security joint project on transmitted deprivation (Medical Research Council, 1974). However, some government departments were not enthusiastic because of the relatively small sample available for their purposes (e.g., studies of drug use). Although one academic social scientist was unenthusiastic about the quality of the data on income and earnings (Medical Research Council, 1971), the Royal Commission on Income and Wealth showed a strong interest in the potential value of the study for their purpose (Boreham, 1975). The Central Statistical Office convened a new meeting of representatives from the Royal Commission, the Social Science Research Council and government departments, which concluded that the study had 'enormous potentiality for providing information about longer term social and socio-biological interrelations whose understanding is fundamental to the development of social policy' (Central Statistical Office, 1975).

There were also new expressions of interest by health scientists in maintaining the study. In June 1974 the MRC noted that interest in the cohort was likely to increase after 1979, and 'although the 1972 follow-up was intended to be the final one, this was stated after most of the earlier sweeps, and opinions may again change'. Douglas recommended to the 1974 MRC five yearly review committee that the next data collection should be when cohort members were in their early forties (i.e. in 1986-1990), and should focus on 'psychiatric state, respiratory illness, marriage, fertility, employment, earnings and criminal records. Respiratory function and other physiological tests would also be desirable' (Douglas, 1974). The MRC Environmental Medicine Committee noted in 1975 that 'there was a strong case for maintaining an active up-dating of the Survey', and considered it 'essential that the medical aspects of the survey should be maintained for the future, particularly with a view to obtaining data relevant to the diseases of middle life' (Medical Research Council, 1975).

In 1976 the MRC set up an Advisory Group on the future of the study after Douglas's retirement, and also asked ten specialists for their views. The Advisory Group did not reach a consensus. Some reviewers were against continuation on the grounds of sample size in relation to expected illness incidence, including the British lead researcher on smoking and lung cancer (Doll, 1970). A social scientist argued against continuation, because in such studies 'there tends to be a somewhat

haphazard searching for problems that can be tackled by the existing data base.... The danger faced by such cohort studies stems from lack of theory-from narrow and atheoretical measures that become locked into the overall design' (Brown, 1979). Others had already argued for continuation in order to study the outcomes of childhood illness (Woolf, 1974) and the impact of adult illness (Rose, 1977). Douglas argued for continuation to study life-long etiology of mental and physical illness, socio-economic differences in illness prevalence and its impact on the family, inter-generational variation of illness risk, and the cohort's blood pressure, respiratory function, body shape, experience of stress, exercise, alcohol consumption and smoking habits (Douglas, 1977). A mental health reviewer argued in favour of continuation because of the study's potentially important contribution to current hypotheses that required life history data, and because of newly developed methods of measuring mental health in the general population (Cawley, 1978).

In the end the MRC concluded that 'the Survey should concentrate primarily on medical objectives, and in particular the diseases of middle age over the next decade, but social data should continue to be collected' (Medical Research Council, 1977). The Department of Epidemiology at the London School of Hygiene was invited to submit detailed scientific plans for continuing the study. Their proposals were for new data collections and studies on: a) psychiatric disorder; b) other chronic disease and c) health and ageing (Alberman & Marmot, 1978). However, the MRC rejected the proposals, which they saw as a 'substantial departure from the recommendations made by the Advisory Group and from the Board's own expressed view', mainly because they included recruitment of an ethnic minority comparison sample, and considerable expansion of staff numbers (Medical Research Council, 1978). The Board then invited, and eventually accepted, proposals from Bristol University's Department of Social Medicine (Colley, 1978). Concern about the proposed extensive coverage of health topics, described by one reviewer as 'so large as to make strong men feel weaker', prompted the Board to wish to see detailed proposals for the next data collection 'before coming to a final decision on the level of support needed', whilst nevertheless agreeing to relocate the study to Bristol (Medical Research Council, 1979).

Continuation after the first principal investigator retired

New funding and organisation

Following Douglas's retirement in 1979, only one member of his staff (Wadsworth) moved to Bristol. The MRC funded the head of the Bristol University Department of Social Medicine, Professor John Colley (as honorary director), to establish a small external scientific staff team^{vii} and to make detailed new proposals and an application for funding a new data collection. Support staff and two scientific staff were initially appointed (an epidemiologist and a psychiatrist), and others were later funded by the data collection grant successfully applied for in 1981.

Establishing a new focus

The Bristol team's thinking about aims and methods of a new data collection was influenced by six new kinds of ideas:

- Recent research had shown that, over extended periods of the life course, adverse interactions of temperament and behaviour with social and/or occupational environment were associated with increased risk of depression (Brown & Harris, 1978) and cardiovascular illness (Marmot, Syme, & Kagan, 1975; Haynes, Levine, Scotch, Feinleib, & Kannel, 1978a, 1978b).
- There was evidence, some from ongoing longitudinal studies, for the adverse effects of poor health-related behaviour over long periods (e.g., smoking, poor nutrition, and little or no physical exercise) on risk of specific illnesses, for example lung cancer (Doll & Hill, 1964) and cardiovascular disease (Kannel, 1978).
- An MRC trial of treatment of mild hypertension at ages 35 to 64 years showed that blood pressure change in young adulthood had predictive value for future illness and could be effectively treated (Miall & Chinn, 1974).
- Although the model of the life-long effect of early growth on physical health would not be put forward for another twelve years (Barker, 1991), the beginnings of new ideas about early established vulnerability were already evident in epidemiological research. Reid (1966) had suggested that typical mid-life onset of chronic bronchitis might be associated with a vulnerability established in childhood. Illsley and Kincaid (1963) used data from the 1958 perinatal mortality study (which became the 1958

national birth cohort study) to show that mothers who grew up in poverty in the pre-war economic depression were at greatest risk for having a child die in the first week of life. They attributed this to the mother's poor childhood nutrition, which led to poor skeletal growth, and restricted pelvic size in adulthood. In the United States a bacteriologist, a psychologist and a physician reviewed animal and human studies of factors that promoted or retarded growth in early life, and concluded that early life health and environmental influences were strongly associated with adult health (Dubos, Savage & Schaedler, 1966).

- The suggestion that the study had a potentially valuable role in research on health change with age had been put forward both by Douglas and his staff (1974) and Alberman and Marmot (1978).
- Wing (1978) suggested that the study should use the Present State Examination, a clinically validated method of screening for psychiatric illness, which could be used by lay interviewers to assess 'caseness' on a wide range of symptoms^{viii}

Consequently, the new team decided to measure the health of every member of the cohort (rather than relying on self-reported illness and treatment, and self-assessed state of health, even though they had been checked with clinical records where possible), and to do so by measuring physical function, and state of mental health. Together with data on health-related behaviour, those functional measures would be valuable as outcomes of hypothesised earlier life effects and exposures, as indicators of future health potential, and as baselines against which to measure subsequent change. The grant application for funding the new data collection exemplified the importance of these functional measures by referring to the future value of an established baseline from which to measure the trajectory of 'blood pressure change with age' (Medical Research Council, 1981a). The MRC review board particularly commended mental health aspects of the proposal (Medical Research Council, 1981b)^{ix}.

This was a fundamental change in the study's concept and measurement of health, which had until then been assessed in the cohort in terms of a) physical growth as measured by nurses and doctors; b) disability and signs of health problems as

assessed by school medical officers, and c) self-reports of illness, injury, disability, health care (hospital admissions were checked with hospital records), smoking and exercise habits. The new team's first data collection added measures of function (blood pressure, respiratory function, pulse rate), a clinically validated measure of mental health, measures of shape (height, weight, and upper arm and abdomen circumference), a 7-day diet diary (with the MRC Dunn Nutrition Unit as collaborators), reports of prescribed medication, and detailed validated questions about exercise, functional physical impairment, and smoking. Means of measuring exercise under stress and carotid artery blood flow were explored but not found to be viable for home interview use. An attempt to include replication of Brown and Harris's (1978) hypothesis on social origins of depression was not possible because of the long time required for interviews.

The grant for data collection was awarded in 1981 (Medical Research Council, 1981b) and fieldwork was undertaken in 1982, when cohort members were aged 36 years.

Data collection methods

Some contemporary developments in methods of data collection and measurement, and the team's earlier experience, made it possible to measure function and mental health at home visits. They were:

- the random zero sphygmomanometer, developed for the measurement of blood pressure in population studies with minimum observer measurement bias;
- the mini Wright peak flow meter for measuring respiratory capacity;
- the Present State Examination screening of mental health symptoms (Wing, Cooper, & Sartorius, 1974);
- new methods of collecting reliable data on diet and exercise and new methods of coding such information;
- the availability in many parts of the country of research nurses who had recently worked on the MRC mild hypertension study;
- the team's experience in selecting interviewers, teaching them data collection methods, and managing all aspects of fieldwork administration of home visit data collection for the study of cohort offspring.

The research team undertook all aspects of the fieldwork in the data collections at ages 36 years (in 1982) and 43 years (in 1989). Fifty six nurses were recruited and employed as data collectors because they were familiar with the measures and could be provided with professional indemnity insurance to undertake the measures: they collected information completing questionnaires by hand. The research team and their nutritionist collaborators recruited the nurses, trained them on regionally-based five day courses, and undertook all aspects of the fieldwork administration, quality control and coding, using the experience gained in the study of cohort offspring. At age 53 years (in 1999), the National Centre for Social Research was contracted to collect data using nurses (trained by the research team) and computer-based questionnaires.

Each of these three adulthood data collections included an extensive series of questions about family life and personal relationships, occupation, leisure time activities, social life and social engagement, as well as measures of physical and mental health and function, and health-related behaviour. Over these collections the range of health data was expanded to include cognitive function, measures of muscle strength, muscle power and balance, and a source of DNA (Wadsworth, Kuh, Richards, & Hardy, 2006). Since then data collection has been undertaken in research clinics, at ages 60-63 years, and the range of health information has continued to be expanded (Kuh et al., 2011).

Discussion

The twenty years reviewed here were preoccupied with concerns about the future purpose of the study. At the beginning of the period reviewed the study's work was clearly focussed on health. The most recent book at that time (*Children under five*. Douglas & Blomfield, 1958) and most papers, were about health^x. The Medical Research Council (MRC) were approached for funding because they were thought likely to be interested, and they were then the only national source of funding for a research unit. When they agreed to funding, the MRC had been optimistic about the future value of the study for health research. However, once the new research unit began work in 1962, the MRC had concerns about the low emphasis on health, and they may have been disconcerted by the publication two years later of what was to become a well-publicised book about

the cohort's educational experience (*The home and the school*. Douglas, 1964b)^{xi}, followed by another, four years later (*All our future*. Douglas, Ross, & Simpson, 1968).

The research unit struggled during the 1960s and 1970s with possible options for the study's future. Health research then commonly used illness as its outcome, but the sample size, and low incidence of illness in adolescence and early adulthood, would in that case restrict the future of the study to comparisons of sample members who had illnesses with selected sample members who did not, i.e., controls, as proposed in Glass's (1960) original request for MRC funding. For that purpose Douglas proposed to maximise the quality of data on illness by using clinical record sources, but that proved to be possible on only a limited basis.

A second possible future focus was to use the unique value of the study's findings based on longitudinal data to explore in much greater depth, in new investigations, the questions revealed. Douglas attempted to do that by designing two new detailed observational studies of child development, separate from the birth cohort study. The MRC funded those studies which, in practice, took up a great deal of the unit's and Douglas's time, as shown by the notes of the five-yearly reviews. Undoubtedly these new studies were for him a distraction from the birth cohort study.

A third future possibility became clear as a result of the unit's work on socio-economic and educational outcomes, and the enthusiasm for the study expressed by some government departments when asked whether the Government Social Survey should undertake a data collection for the study^{xii}. Government departmental interests were reflected also in government grants for study staff to undertake analysis, and in the range of departmental representatives who, later in the period studied, joined the academics and clinicians on the steering committee.

That evidence of a wider interest, together with a high response rate in what was intended to be the final data collection (at age 26 years in 1972), began to challenge the pessimism of Douglas and the MRC about the study's future. As Douglas's retirement approached, an MRC-initiated review of possibilities for the future revealed new thinking about the development of risk in the individual for some mental and physical illnesses, which required longitudinal, and ideally life course data to explore

and verify. It also revealed the study's potential and unique value for developing new ideas about and new research into the processes of ageing.

Consequently, the MRC agreed to short-term funding for a small and essentially new team to develop ideas for the future. The team re-defined the study's health outcomes in line with new epidemiological ideas and with the study's existing data, and developed new continuous measures of physical and mental state of health which were undertaken at home visits in 1982 (at age 36 years) to all cohort members.

Thus by the end of the twenty years reviewed here the study had found a new focus appropriate to contemporary concerns in health sciences. That new focus was determined by internal factors (the sample's age, the existing data, and the scientific concerns of its staff), as well as by external factors (thinking and changes in thinking in the science and policy communities, developments in data storage and processing^{xiii}, innovation in measurement techniques, and available funding options).

In a similar way the study had found a new policy focus in its concern with the processes of mental and physical ageing. That came to be recognised in due course as a question for which longitudinal data on health was essential (House of Lords, 2005). Both the new scientific and the new policy concerns were built on the sufficiently detailed base of existing data. For example, the cognitive data collected in the cohort's school years for studies of cognitive development and educational attainment, became of value for research and policy studies of ageing when supplemented with new data on adult cognitive function (Richards, Shipley, Fuhrer, & Wadsworth, 2004). Similarly, weight at birth, collected originally for studies of child health, became valuable in studies of how pathways of risk to adult health develop throughout the life course (Wadsworth et al., 2006; Kuh et al., 2011).

During the period reviewed, large-scale longitudinal studies had a low profile in Britain compared with today. They tended to be regarded as too broadly focussed and too expensive of research resources for the returns they provided (Welshman, 2012). The view that such studies suffered from lack of theory (predominantly expressed by social scientists, exemplified here by Brown, 1979) and should be more specifically hypotheses-driven (mostly expressed by

epidemiologists, exemplified here by Wing, 1978^{xiv}) than they generally were, was challenged by Douglas. In his final report to the MRC he concluded that 'We did not set out to test specific hypotheses because of the sad fate of the American longitudinal studies of the twenties and thirties... (which) were then largely written off, and their recent resurrection as the only source of reliable data linking early childhood experience with adult health and behaviour was not yet foreseen. ... The requirements for a successful longitudinal study seem to be a large sample, national coverage (to avoid loss from internal migration), general rather than specific hypotheses, the avoidance of high technology, and the recruitment of staff with wide interests.' (Douglas, 1979). Douglas's comment here on hypotheses, is concerned with study designs which focus on a specific hypothesis; the study under Douglas, and since, has been designed to explore a range of hypotheses.

This paper could have also described how, during the period reviewed, the birth cohort studies

gradually came to be regarded as cost-effective and increasingly valued as longitudinal data sources (Social Science Research Council, 1970), (see 'Modification of long-term aims' above). That must be the subject of another paper. After the period reviewed here (1962 to 1982) new questions arose about research ethics, data access and sharing, and national funding strategies, as the potential value of large-scale longitudinal studies for science and policy purposes became much more widely understood and encouraged in Britain. That is shown by reviews of their aims and future development (Medical Research Council, 1992; Economic and Social Research Council, 1993; 2002; 2006), by investment in three new, large-scale longitudinal studies beginning in early life (the ALSPAC study in 1991-2 www.bristol.ac.uk/alspac; the Millennium Study in 2000-1 www.cls.ioe.ac.uk/mcs; the Life Study which begins in 2014 www.lifestudy.ac.uk), by the development of similar studies in other countries, and by the continuation of the study described here.

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Endnotes

ⁱ Douglas took the study to the Department of Public Health and Social Medicine at Edinburgh University in 1954. After another candidate was appointed to the Chair in that Department in 1956 Douglas decided to concentrate on the birth cohort study rather than pursuing a conventional academic career.

ⁱⁱ In the Foreword to *Family and Kinship in East London*, Young and Willmott (1957) wrote "We were able to establish the Institute for Community Studies and to start the research reported in this book on the strength of a grant made by the Elmgrant Trust, which was supplemented by Professor Edward Shils out of monies made available to him by the Ford Foundation. At a later stage, we received a welcome grant direct from the Ford Foundation."

ⁱⁱⁱ This hospital cares for mental health and is attached to London University's Institute of Psychiatry. Professor Sir Aubrey Lewis held the first chair of psychiatry at the Institute of Psychiatry and had worked with Douglas during the Second World War, before the study began (see Wadsworth 2011). He chaired the study's steering committee during part of the period reviewed.

^{iv} Social and Community Planning Research was an independent not-for-profit organisation, which later became the National Centre for Social Research.

^v The Second Generation Study, designed and run by Wadsworth, was concerned with cohort members as parents. Interviewers, recruited and trained by the study, collected data at home interviews (when the first born children were aged 4 years and again at 8 years) on child rearing methods, parental aspirations for education, and health of the child. At 8 years the child took the same cognitive test as the cohort member parent had at that age, and teachers completed a postal questionnaire about the child's behaviour, attitudes, and attainment (Wadsworth, 1986; Byford, Kuh, & Richards, 2012). Details of the birth of the children were also recorded (Kuh et al., 2008). The aims were (a) to investigate in greater detail the finding in the cohort generation that educational attainment was consistently associated with parental concern for the child's education (Douglas, 1964); and (b) to compare cognition, educational attainment, growth and health in infancy and childhood in the two generations.

^{vi} The departments included the General Register Office, the Home Office, and the Departments of Health & Social Security, Education & Science, Employment & Productivity

^{vii} MRC External Scientific Staff appointments were generally offered to those who had been members of MRC Units, and were made and funded on an individual basis.

^{viii} Wing suggested to the MRC that he should run a separate data collection for this purpose. However, the Bristol team agreed to use the method but to undertake data collection and analysis with the help of a psychiatrist, Dr Sheila Mann, newly appointed to the Bristol team.

^{ix} It was regrettable that Douglas had declined Goldberg's request to include an early version of his General Health Questionnaire (Goldberg & Williams, 1988) in the data collection in 1972 at age 26 years, since it was designed to identify minor psychiatric disorders in the general population. The decision was taken because of pressure on time at interview, and because Douglas had doubts about the reliability and validity of what was a relatively new method.

^x Up to and including 1961, the unit had published 1 paper on methodology, 2 on social and demographic topics, and 24 papers and 2 books on health.

^{xi} *The home and the school* (Douglas 1964b) was reprinted 3 times and re-issued in paperback, which was reprinted 5 times. *All our future* (Douglas, Ross & Simpson 1968) was also re-issued as a paperback.

^{xii} The study might have changed under this influence to become much more responsive to government policy requirements for longitudinal data. However, the inclination of Douglas and his staff was to maintain the study's independence. After discussion, the steering committee agreed 'that every effort should be made to preserve the identity of the Unit as a research rather than a service organisation' (Medical Research Council, 1964).

^{xiii} The period studied began with all data held on punched cards, and analysis undertaken on card sorting machines and mechanical calculators, and ended with all data held in electronic files and analysis undertaken using computers and electronic calculators. Similarly, over the same period, the original data was copied from paper documents onto microfiches, for preservation purposes. The extent and demands of those changes, undertaken mostly by study staff, were considerable.

^{xiv} In the mid-1980s a clinical epidemiologist research director suggested to the author that the study should become a clinical trial for long-term blood pressure treatment.