The influential intellectual legacy of Dr JWB Douglas: originator and developer of the large birth cohort study research method

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Introduction

In the years before the Second World War there was concern about the trends in national rates of fertility and infant mortality. Fertility had fallen continuously since the late nineteenth century, and it seemed possible that it would fall below the replacement rate. That 'led many authorities to conclude that, with a continuance of the present pattern of differential fertility, a decline in national intelligence is threatened' (Glass 1946). The anxiety is evident in the titles of contemporary publications that included *Twilight of parenthood* (Charles 1934), later reissue as *The menace of under population*, Beveridge's (1925) *The fall of fertility among European races*, and *Parents revolt* (Titmuss & Titmuss 1942). The latter title reflects the fear that fertility was falling because of the cost of child bearing.

Infant death rates in the United Kingdom fell consistently from 1870 (150 per thousand live births) until a period of little change, between 1930 (67 per thousand) and 1937 (61 per thousand). By the Second World War there were two schools of thought about whether anything needed to be done about infant mortality. One side believed that the rate may have reached an irreducible minimum, and in 1940 the president of the Royal College of Physicians wondered whether the stinting production and careful saving of infant lives today is really, biologically speaking, as wholesome as the massive production and lavish scrapping of the last century' (quoted by Titmuss 1943). On the other side were those who believed that further reduction was possible and that the socio-economic differences in rates were also reducible.[1]

As a consequence of concerns over fertility and infant mortality a Royal Commission on Population was appointed in 1944 (Royal Commission 1949). The Population Investigation Committee (PIC), a research group that strongly influenced the appointment of the Commission, began work on the problem in the pre-war period in a pilot study of the cost of maternity, but that was curtailed by the outbreak of war. Nevertheless the PIC continued to be concerned about the question, and gradually evolved a plan to undertake a national study of maternity to address the problem and inform plans for the proposed post-war National Health Service.

The Royal College of Obstetricians and Gynaecologists, the Society of Medical Officers of Health, and the Midwives and Health Visitors Association joined the PIC's planning committee for the maternity study. The Nuffield Foundation agreed to fund most of the costs of data collection and analysis, and the National Birthday Trust Fund also contributed (Joint Committee 1948, Wadsworth 2010).

[1] The infant mortality rate in England and Wales in 1940-42 was 62.0 per thousand live births in males and 48.0 in girls compared with rates of 5.3 in males and 4.3 in females in 2007.

The maternity study

It was clearly necessary for the study to be national in scope and to include a population of sufficient size to study geographical and socio-economic differences in the outcomes. The aims were to find:

- the availability of maternity services to different social classes, in different parts of the country
- the use made of these services
- the effectiveness of the services in educating mothers, and in reducing mortality among mothers and infants
- the extent of the need for domestic help during pregnancy and the puerperium
- the nature and extent of expenditure on child-birth

Dr James Douglas was appointed to complete the study design, working with the PIC, and to undertake the study and analyse the data. Douglas had qualified in medicine in 1939 and worked and published with Dr Solly Zuckerman initially on primate behaviour and later on air raid casualties. He worked in Zuckerman's Department of Human Anatomy at Oxford University, and during the war in the Ministry of Home Security. The casualty study was concerned with a large population (approximately 20,000), and a wide range of data was collected on injuries (from post-mortem examinations) and on the impact of bombing on population morale, through interviews with survivors, patterns of work absence, police sickness, rail and road passenger traffic, patterns of use of libraries, cinemas, baths and wash-houses, and essays written by children aged 10-16 years. About 8,000 interviews were undertaken by psychiatric social workers, psychiatrists and members of the research team, and about 2,000 essays were delivered (Wadsworth 2010). Psychiatrists and psychologists had been consulted and collaborated with on these studies. Douglas was evidently well experienced in the kinds of work that would be necessary in the course of the maternity study.

It was decided that the sample for the maternity study would comprise all births during one week in March 1946. Data collection would be undertaken by midwives and health visitors, using questionnaires with mothers 8 weeks after the birth, and five areas were visited where interviews were undertaken with the health service staff. During the chosen week 16,695 babies were born and of the 15,130 births notified in time for inclusion in the study 13,687 mothers (91 per cent) were interviewed.

Douglas published the findings in *Maternity in Great Britain* (Joint Committee 1948), which showed extensive geographic and social class differences in health and survival of babies and their mothers, and in the availability and use of services. For instance pain relief was given to 20 per cent of mothers who gave birth at home (46 per cent of all births were home deliveries) and to 52 per cent of the mothers who gave birth in a hospital or nursing home. Costs of maternity (health care which cost about one third of expenditure and clothing and equipment) amounted on average to approximately 6 weeks net income for all socio-economic groups, and were proportionately greater for those where the father was in manual employment (on average 16 per cent of income) as compared with those where the father was in non-manual employment (on average 9 per cent of income).

Follow-up data collections

Douglad decided that a follow-up study would be important to investigate the extent to which those disadvantaged at birth caught up in developmental terms, and the causes of any catch-up. He later noted that 'It had not originally been intended to continue research beyond the 1946 study. But the potential value of a follow-up study was so evident' (Douglas 1964 p.12). Because of the cost of follow-up and the contemporary data handling and analysis methods (on punched cards) a sample was selected for follow-up. The sample was stratified by socio-economic groups and the geographical representation was maintained (Douglas and Blomfield 1958). Douglas continued his follow-up studies until his retirement in 1979.

At first the scientific aspects of the study concentrated on studies of the children's health and physical development (at ages 2 and 4 years). Policy aspects were concerned with the extent to which the work of health visitors was associated with improvement in child health and narrowing of the socio-economic intervals of health and development (Douglas and Blomfield 1958).

During the school years the study also addressed the policy question of how well the 1944 Education Act enabled, in practice, intelligent children in disadvantaged families to have educational attainments and opportunities equivalent to those of similar children from advantaged socio-economic groups. For that purpose Douglas measured intelligence and educational attainment at ages 8, (3 years before the examination for entry to selective schools), 11 years and 15 years (the school leaving age), and asked teachers to assess the attitudes to education of the study children and their parents. Measurement of growth and collection of data on health continued throughout, measures of behaviour were added, and all hospital admissions were checked with hospital notes, so that scientific studies of physical and mental health and development and behaviour continued.

After the statutory school leaving age, then aged 15 years, the study continued to collect data on health and hospital care, and on further and higher education, work and training, partnership, marriage and family formation.

Funding from 1948 to 1961 was sought separately for each data collection from a range of Foundations, and from the Research Councils and Government Departments. From 1962 onwards the study funding was provided from the Medical Research Council for the study to become the MRC Unit for the Study of Environmental Factors in Mental & Physical Development.

Following James Douglas's retirement the study continued as an MRC External Scientific Team until 2006, and data continued to be collected.[2] Since 2007 the study forms the MRC Unit for Lifelong Health and Ageing, established to continue research on the cohort.

[2] The study was based in the Department of Community Health at Bristol University from 1979 until 1984, and Professor John Colley was the honorary director and Dr Michael Wadsworth principal investigator in the MRC External Scientific Staff Team. The team then moved to the Department of Epidemiology and Community Health at University College London Medical School, being led by Professor Michael Wadsworth until his retirement in 2006. The study then formed the MRC Unit for Lifelong Health & Ageing directed by Professor Diana Kuh, still at the same Department at University College London. Wadsworth (1991) gives a history of the study, and the findings in their context during the study's first 40 years.

The study's emphasis was changed for the data collection at age 36 years in order to concentrate on physical and mental function, and to begin research into the process of functional change with age.

For that data collection nurses were trained to measure blood pressure, respiratory function, height, weight and adiposity, and to use a clinically validated questionnaire on mental health, as well as collecting data on exercise and dietary habits, and social and economic circumstances. The range of data was expanded at age 43 years to include musculoskeletal and cognitive function, and at 53 years blood sampling was carried out principally for studies of cardiovascular risk as a source of DNA. All of these measures were also undertaken at the clinic visits at ages 60-64 years, which also included, for example, exercise and balance tests, bone and body composition scans, and echo-cardiographic scans.

The Douglas legacy

The Douglas legacy of a very long-term collection of data on a national sample since birth is of considerable scientific value as a unique source of information on growth, development, and educational attainment. It had great policy and scientific impact during the earlier years of the study[3] and is now of great value for studies of the processes of ageing and their lifelong environmental, developmental and genetic antecedents. Two aspects of the legacy should be distinguished.

Discovery of the long-term influence of health and development in early life

The Douglas legacy of lifetime data uniquely makes it possible to study the processes of physical and mental ageing throughout life. The lifelong data is being used in research on the influence of early life development on the physical and mental processes of ageing. Research asks how extrinsic factors (e.g. smoking habits, poverty) and intrinsic factors (e.g. experience of chronic stress, personality), and their variation throughout life, interrelate with one another and with genetic influences to determine the rate and nature of ageing and the risk of premature disability and death.

This new concern in epidemiology with the study of the development of individual risk and resilience requires interdisciplinary work and longitudinal data (Kuh and Ben Shlomo 2004) to show, for instance, how poor early life development is associated with increased risk in adulthood of premature ill-health and death (Baker 1994), how poor prenatal and slow postnatal development can initiate a cascade of risk towards schizophrenia (Jones et al 1998), and how sustained experience of chronic stress in adulthood affects physical health (Brunner and Marmot 2006).

[3] Douglas's (1964) book *The home and the school*, was reprinted three times and re-issued as a paperback that was reprinted five times. His book with Ross and Simpson (1968), *All our future*, was also re-issued as a paperback: both books were widely used in teacher training. His two books on health, *Maternity in Great Britain* (Joint Committee 1948) and *Children under five* (Douglas and Blomfield 1958), were also widely used. During Douglas's directorship the study also contributed directly to policy development work, for instance, of the Plowden Committee (1967) on primary schools, the Platt Committee (1959) on the welfare of children in hospital, and the Finer committee (1974) on the needs and welfare of one-parent families. See Wadsworth (1991) for more detail.

The development of new birth cohort studies

Douglas's national maternity study was first replicated in 1958 and again in 1970 in order to assess progress in maternity care, particularly in reducing risks of perinatal death. The first of these studies was begun by Professor WCW Nixon (Butler and Bonham 1963: Butler and Alberman 1969), and the second team led by Professor GVP Chamberlain (Chamberlain et al 1975). The findings from these two studies and the Douglas original study changed many aspects of care during pregnancy and at birth McFarlane and Mugford (2000). The samples of babies in the 1958 and 1970 studies continue to be followed-up extensively (see table).

Subsequently the Douglas birth cohort study model was further developed by Professor Jean Golding in the Department of Paediatrics at Bristol University in a new study which began in pregnancy (Golding et al 2001). That study (the Avon Longitudinal Study of Parents and Children ALSPAC) began in 1991, and is based in one area in order to make it easier to undertake more tests and measurements and to ensure good quality control with less difficulty than in a national study. That model was further developed in Millennium Study begun in 2000 which sampled areas to represent socio-economic and ethnic differences in the national population (Hansen et al 2009). The table gives details of all six large birth cohort studies.

The 6 large-scale British birth cohort studies

Study name and web address	Year of first data collection	Sample size at outset	Age at most recent data collection	Total number of follow-up data collections
MRC National Survey of Health & Development www.nshd.mrc.ac.uk/	1946	5,362	64 yrs	21
National Child Development Study www.cls.ioe.ac.uk	1958	17,414	50 yrs	8
British Cohort Study 1970 www.cls.ioe.ac.uk	1970	17,287	34 yrs	7
Avon Longitudinal Study of Parents & Children www.bristol.ac.uk/alspac	1991	14,541	17 yrs	42
Millennium Birth Cohort Study www.cls.ioe.ac.uk	2000	18,818	7 yrs	4

Life Study http://www.lifestudy.ac.uk/homepage	2014			

Comparison studies of child development and health across the British cohorts (e.g. Ferri et al 2003, Li et al 2008) show how health, growth and life chances have changed in cohorts born since the end of the Second World War.

The British model was directly followed in the North Finnish birth cohort studies of 1966 and 1986 (http://kelo.oulu.fi/NFBC/pub/), and the Dunedin study in New Zealand in 1972-73 (http://dunedinstudy.otago.ac.nz). Other birth cohort studies with subsequent follow-up data collections have been set up to study environmental and genetic influences on health, for example, in the Unites States National Children's Study (http://www.nationalchildrensstudy.gov), the Norwegian Mother and Child Cohort Study (www.fhi.no/morogbarn), and the Danish National Birth Cohort (www.ssi.dk/sw9314.asp).

Conclusions

Douglas's original study design has become the model of choice in Britain and elsewhere for the study of new hypotheses that encompass a wide range of developmental, environmental and genetic data, and aim to explain how they interrelate over a lifetime. In Britain the five large-scale birth cohort studies have also been extensively used in research into the effectiveness and impact of policy in health and education, and they have been influential in the development of new policy, such as the SureStart programme. James Douglas was awarded the British Paediatric Society's James Spence medal in 1984 for 'his outstanding contribution to paediatrics' (James Spence Medallist 1984).

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