

Appendix: **The nation's health as an asset**

Building evidence on the social and economic value
of health

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The Social and Economic Value of Health: research projects

The social and economic value of health from childhood to later life

This research project, led by University College London's Centre for Longitudinal Studies, will address the effects of physical and mental health on economic and social outcomes throughout the lifespan.

Through cross-cohort comparisons, this project aims to find out if the relationships between people's health and their social outcomes have changed between the generations, given major changes in factors that influence people's health, both positively and negatively. These factors include the prevalence of depression and obesity, smoking levels, inequalities in income and wealth, gender roles, the demographic composition of the UK, and policy climate over time.

The outcomes to be examined include:

- educational development and attainment – cognitive scores, qualifications
- economic outcomes – employment status, earnings, social class
- socioemotional outcomes – childhood behaviour, quality of life, social support, marital/partnership status.

The project will use nationally representative longitudinal UK datasets, including the Medical Research Council's National Survey of Health and Development, the National Child Development Study, the 1970 British Cohort Study, Next Steps, and the Millennium Cohort Study. Using an innovative modelling approach and sensitivity analysis, indicators of health status from childhood to mid-life will be used to predict subsequent outcomes and outcomes will be assessed from early childhood to later life (55–69 years of age).

Social and economic consequences of health status: causal inference methods and longitudinal, intergenerational data

Led by the University of Bristol, in partnership with Public Health Wales, the University of Bath and Cardiff University, this project will use causal-inference methods to assess how health status affects socioeconomic outcomes. The project will test how health status changes across the lifespan and between generations, and will use evidence-synthesis approaches to estimate the socioeconomic return on maintaining good health.

The data sources will be the Avon Longitudinal Study of Parents and Children, UK Biobank and the Early Prediction of Adolescent Depression study. The latter two datasets include repeated measures of mental and physical health factors and socioeconomic outcomes for parents and children. This project involves taking a broad view of health status, considering multiple factors including obesity, cardiovascular disease, asthma and depression.

The project team will use genetic data to examine the causal links between health status and socioeconomic outcomes and to assess whether effects change across the span of a person's life. This project will identify the times in people's lives when policy change

to maintain or improve population health status is likely to have the greatest effect. The project will also investigate whether parental health status affects the socioeconomic outcomes of children. Qualitative methods will be used to explore the mechanisms through which health status affects socioeconomic outcomes and potential intervention points.

Life course effects of health status on social and economic outcomes and transitions

Led by Loughborough University, this project aims to identify how variations in the mental and physical health of individuals shape their social and economic outcomes. It will involve analysing longitudinal data, looking at the effects of variations in changes in health status of individuals and how the health status of their household and peers affects their outcomes.

Social and economic outcomes that will be analysed include indicators of income and employment, financial situation, social connection and personal relationships. The project team will identify relevant data on the key inputs of health and socioeconomic outcomes. Data sources will include the British Household Panel Survey and Understanding Society: The UK Household Longitudinal Survey.

The datasets include repeated measurement of variables for the same individuals over time. This will allow the project team to analyse the causal role that changes in health status have on different ages and across household peers. Qualitative focus groups will be used to explore the relationships revealed in the quantitative work, such as what it is about someone's health that promotes social capital and engagement, or acts as a barrier.

Causal effects of alcohol and mental health problems on employment outcomes: Harnessing UK Biobank and linked administrative data

Led by the University of Glasgow, in partnership with the University of Bristol, this project will assess the causal effects of alcohol consumption and depression on social and economic outcomes, including employment, receipt of welfare benefits and income.

Mental illness is now the most common reason for receiving sickness and disability benefits, and is linked to worklessness and adverse social outcomes. However, the causal relationship between them remains unclear. Studying the relationship between mental health and social outcomes is challenging because the causal effects probably operate in both directions; for example, employment may improve mental health, and good mental health may make unemployment less likely.

This project will use UK Biobank data to estimate the causal effects of alcohol consumption and depression on social outcomes, thereby identifying the long-term benefits of maintaining mental health and wellbeing. Work and Pensions Longitudinal Study data will be confidentially linked to Scottish health datasets to understand the loss of economic output as a consequence of the erosion of mental health status after the development of depression or alcohol-related problems.

Two methodological approaches will be used: Mendelian randomisation (which uses genetic variants to test the causal effect of a risk factor on a health-related outcome) and regression analyses of linked health and welfare datasets. Qualitative methods will also be used to analyse policy discourse, key informant perspectives, and the experiences of people with mental health and alcohol problems.

The causal effects of health status on labour market outcomes: consequences for individuals and households

Led by the University of Sheffield, in partnership with the University of York and VU University Amsterdam, this research will estimate the causal effects of health status on labour market outcomes (eg employment, productivity, wages and absenteeism). The aim is to inform policymaking to maximise participation in employment by reducing the disability employment gap and sickness absence. The research will use econometric techniques (applying mathematical and statistical models to test economic hypotheses) to provide new UK evidence on the relationships between health status and work outcomes.

Deterioration in health is often a catalyst for people leaving the labour market, and people with poor health have a much lower employment rate than the rest of the population. This affects not only individuals and households, but employer performance, productivity levels and economic growth. With long-term conditions becoming more common in the working-age population, strategies are needed to maintain health status and workforce participation.

This project will involve establishing the role of physical and mental health in determining outcomes such as employment, hours and wages. It will also explore the influence of poor health on employer outcomes, such as productivity and absenteeism. The project team will primarily use data from the UK Household Longitudinal Study and the Quarterly Labour Force Survey to analyse the effects of factors such as age, gender, job/contract type, health status and household type on the relationship between an individual's health and their participation in work.

Does childhood obesity hinder human capital development?

Led by Imperial College Business School, in partnership with the University of Bristol and the World Obesity Federation, this project aims to establish the causal relationships between childhood obesity and human capital development and social outcomes. The project will focus on educational attainment, labour market outcomes and indicators of social participation in three UK cohorts. Its aim is to shed light on the direction of causality between obesity and social outcomes and on the role of known confounders, such as children's socioeconomic background.

Data from multiple birth-cohort studies will be used, including the Avon Longitudinal Study of Parents and Children, the British Cohort Study of 1970, and the 1958 National Child Development Study. The project will leverage biomarkers in the Avon Longitudinal Study of Parents and Children cohort and genetic information in all three cohorts to analyse causal pathways.

Table A1: Summary of research projects

Study	Lead organisation	Data source/cohort	Exposures	Outcomes
The social and economic value of health from childhood to later life	University College London's Centre for Longitudinal Studies	National Survey of Health and Development, 1958 National Child Development Study, 1970 British Cohort Study, Next Steps, Millennium Cohort Study.	Health status from childhood to mid-life	Cognitive scores, qualifications, employment status, earnings, social class, childhood behaviour, quality of life, social support, marital/partnership status
Social and economic consequences of health status: causal inference methods and longitudinal, intergenerational data	University of Bristol	UK Biobank, Avon Longitudinal Study of Parents and Children, Early Prediction of Adolescent Depression study	To be identified	To be identified
Life course effects of health status on social and economic outcomes and transitions	Loughborough University	British Household Panel Survey, Understanding Society	Variations in changes in health status of individuals, health status of household and peers	Employment status, income, financial situation, social connection, personal relationships.
Causal effects of alcohol and mental health problems on employment outcomes	University of Glasgow	UK Biobank, Work and Pensions Longitudinal Study data, linked to Scottish health datasets	Alcohol consumption, depression	Employment, receipt of welfare benefits, income.
The causal effects of health status on labour market outcomes: consequences for individuals and households	University of Sheffield	UK Household Longitudinal Study, Quarterly Labour Force Survey	To be identified	Employment, hours worked, wages, productivity, absenteeism.
Does childhood obesity hinder human capital development?	Imperial College Business School	1958 National Child Development Study, 1970 British Cohort Study, Avon Longitudinal Study of Parents and Children	Childhood obesity	Educational attainment, labour market outcomes, social participation.

Innovative research methods to establish causality

The gold-standard method for proving a causal relationship is the randomised, controlled trial. This type of experiment randomly allocates an intervention (a treatment or event) to one group and compares their outcomes with those of a control group, which receives another intervention or none at all. The aim of the random allocation is to eliminate confounding, as things that could cause a spurious association (known or unknown factors) should be evenly distributed amongst the groups being compared, and therefore not influence the overall outcome. Random allocation also eliminates the selection bias that arises when people self-select a treatment or intervention. For example, people who choose to exercise might be in better health overall than people who don't choose to exercise.

As it is not possible (or ethical) to randomly allocate people to different levels of health or different socioeconomic circumstances, study of the relationships between them relies on observational (rather than experimental) research. UK longitudinal cohort studies are a rich source of information about both health and socioeconomic factors. Many variables are measured at various time points across the lives of the individuals. This type of study has the advantage that, by following people throughout their lives, it is possible to look at the timings of different events. A necessary criterion for establishing a cause-and-effect relationship is that the cause precedes the effect. However, when two or more things change together and/or affect each other, it's difficult – if not impossible – to determine the causal effect of one thing on the other. A further barrier to the establishment of causality is that observational studies are subject to confounding by unmeasured or unknown factors that most statistical analyses can't take into account.

However, recent developments in analytical and statistical methods have strengthened the ability to infer causality from observational studies, addressing the difficulties presented by reverse or bidirectional causality and confounding. These developments include the use of 'instrumental variables': variables other than the exposure and outcome of interest, which are included in statistical analyses to help establish whether the exposure–outcome relationship is causal. Variables must meet the criteria of affecting the exposure variable but having no independent effect on the outcome variable (Figure A1). However, if a suitable instrumental variable is identified, this method is considered the next best thing to random allocation. It can, however, be difficult to identify an instrumental variable that meets all the necessary criteria.

Use of genetic and epigenetic data

The growing availability and understanding of genetic data is increasingly providing instrumental variables for observational studies (Mendelian randomisation). Genetic variants have been randomly assigned in the population, and a variant may be suitable as an instrumental variable if it is causally related to the exposure but does not directly cause the outcome of interest. See Figure A2 for an example.

Figure A1: Criteria for an instrumental variable

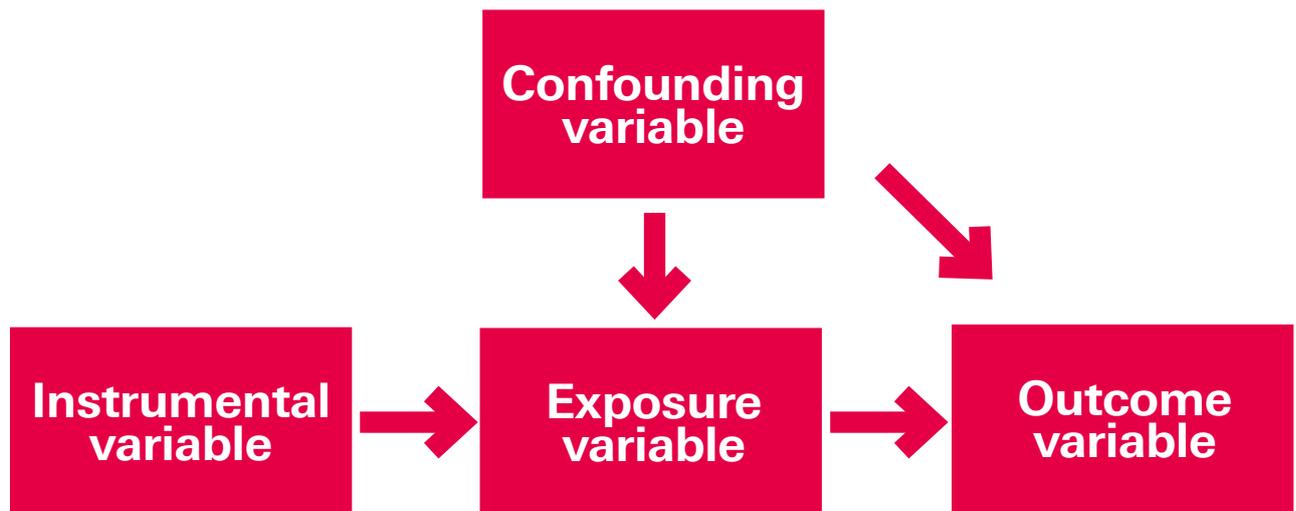
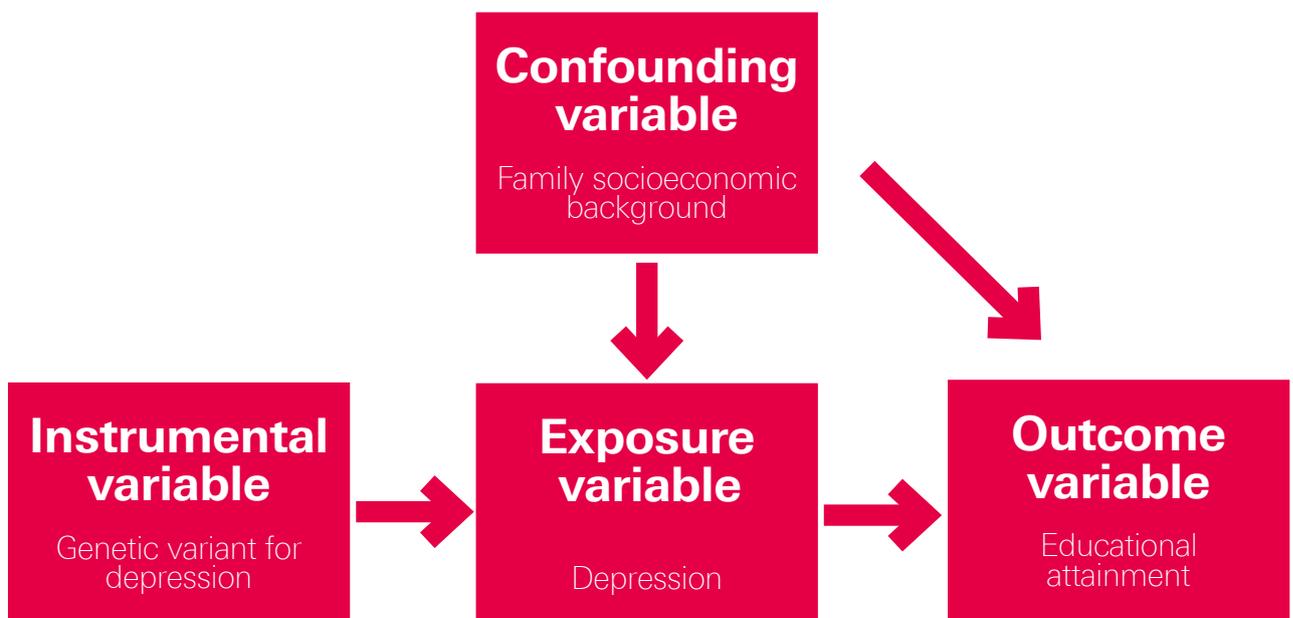


Figure A2: Mendelian randomisation – genetic variants as instrumental variables



Four of the six research projects will use genetic information from cohorts, strengthening their ability to establish causality by using novel Mendelian randomisation methods. Because of this, the research programme will contribute greatly to our understanding of the complex, multidirectional relationships between health and socioeconomic factors.

One project will use genetic data from both parents and children to use genetic predisposition towards a health condition as an instrumental variable. This will allow the researchers to assess whether parental health causally affects the socioeconomic outcomes of their children.

Another project will use epigenetic data. Epigenetics involves gene expression: whether a gene is ‘turned on’ or ‘turned off’, which is influenced by our environment and our behaviours. Understanding how our early environment influences biomarkers (through gene expression), and how these biomarkers are associated with social and economic outcomes in later life, will help the researchers to determine causality and confounding effects.

Cross-cohort comparisons

The socioeconomic context has changed greatly over recent decades, as have the leading causes of poor health in the UK. It is possible that the relationship between health and socioeconomic factors – including the causal effects of health – has changed over time. If this is the case, looking just at one cohort of people over time would make it difficult to separate the effect of point in the lifespan from the effect of the point in time at which things occur. University College London’s Cohort and Longitudinal Studies Enhancement Resources has harmonised key variables across some of the UK longitudinal, birth-cohort studies. This will allow the research projects to investigate whether the effects of health have changed over time, from the cohort born in 1958 to cohorts born in the 1990s.

Data linkage

Much of the data in the longitudinal cohort studies is self-reported survey data. Linking these individuals to data about them collected for separate administrative or routine purposes will allow the inclusion of a wider set of variables – often not relying on self-report – in analyses and, often, the ability to follow up long-term outcomes. Examples of data linkages in this research programme include:

- higher-education records linked to the Avon Longitudinal Study of Parents and Children data
- Scottish administrative health data linked to the Work and Pensions Longitudinal Study and to wider socioeconomic variables from census data
- linkage of genetic data to health, social and economic data through UK Biobank.

Complementary qualitative and quantitative research

Several of the projects will also employ a mixed-methods approach, incorporating qualitative research to better understand the mechanisms at play, the lived experience of individuals, and policy discourse about the subject.

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