Cohort Profile: The Health Survey for England

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Key messages

- The Health Survey for England is a health examination of a random sample of the free-living general population in England. A new sample has been recruited annually since 1991.
- Since 1994, consent has been requested to link adult participants to mortality and cancer registry data and since 2003, to Hospital Episodes Statistics data.
- Non-identifiable data are available to academics and public sector staff through the UK Data Archive. Non-archived data can sometimes be made available to researchers by the National Centre for Social Research (NatCen).

Summary (197 words)

To monitor the health of the public in England, UK, the Central Health Monitoring Unit within the UK Department of Health commissioned an annual health examination survey, which became known as the Health Survey for England (HSE). The first survey was completed in 1991. The HSE covers all of England and is a nationally-representative sample of those residing at private residential addresses. Each survey year consists of a new sample of private residential addresses and people. The HSE collects detailed information on mental and physical health, health-related behaviour, and objective physical and biological measures in relation to demographic and socio-economic characteristics of people aged 16 years and over at private residential addresses. There are two parts to the HSE; an interviewer visit, to conduct an interview and measure height and weight, then a nurse visit, to carry out further measurements and take biological samples. Since1994, survey participants aged 16 years and over have been asked for consent to follow-up through linkage to mortality and cancer registration data, and from 2003, to the Hospital Episode Statistics database, thus converting annual cross-sectional survey data into a longitudinal study. Annual survey data (1994-2009) are available through the UK Data Archive.

How did the study come about?

In 1988, a report on public health in England, UK, of the *Committee of Inquiry into the Future Development of the Public Health Function* chaired by Sir Donald Acheson, was published. This report identified a lack of specific focus at the centre with capacity to monitor the health of the population, and to feed the results of any analyses into the development of health policy, strategy and management. This led to the recommendation to establish a central unit within the Department of Health to monitor the health of the public with information being used to inform strategy, management and policy decisions across a broad range of health issues, and to evaluate outcomes (**1**). In 1989, the Central Health Monitoring Unit within the UK Department of Health was established for this purpose. To fill gaps in health information, this unit commissioned an annual survey of health and nutrition, initially concentrating on cardiovascular disease and associated factors (**2**). This became known as the Health Survey for England (HSE). The HSE has occurred every year from its inception.

Following a pilot survey conducted in 1991 by the Office of Population Censuses and Surveys (OPCS), the first full survey was completed in 1991 (**3**). The first three full annual surveys were conducted by OPCS, which is now part of the Office for National Statistics. The HSE has been conducted by the Joint Health Surveys Unit of the National Centre for Social Research (NatCen, formerly Social and Community Planning Research (SCPR)), and the Research Department of Epidemiology & Public Health, UCL, since 1994. Since April 2005, commissioning of the HSE was transferred from the English Department of Health to the NHS Information Centre for health and social care.

What does the study cover - and how has this changed?

The HSE collects detailed information on mental and physical health, health-related behaviour, and objective physical and biological measures in relation to demographic and socio-economic characteristics of people aged 16 years and over at private residential addresses. From 1995, the HSE also included children aged two years and over; from 2001, the lower age limit was removed. A maximum of two children per household contribute to the survey. In households with more than two children, two are randomly selected using the Kish grid method (**4**). The exception to this was in two years with minority ethnic group boosts, where a maximum of three children per household contributed to the survey. Age limits still apply to some questions. Each annual survey runs continuously throughout the year from January onwards, to avoid distortion by seasonal effects.

One of the initial aims of the survey was to monitor progress towards two Health of the Nation targets: to reduce mean systolic blood pressure in the adult population by at least 5mm Hg by 2005 (baseline to be determined by HSE), and to reduce the percentage of men and women aged 16-64 years who are obese by at least 25% for men, and 33% for women by 2005 (**5**). Since 1995, these aims have also included the measurement of height of children at different ages, replacing the National Study of Health and Growth (**6**), and hence the introduction of children into the survey sample in 1995. The prevalence of obesity in children has also been monitored, being a specific objective since the inclusion of children. A core social care module for those aged 65 years and over has been introduced for health surveys from 2011 onwards**.**

The survey focuses on different single or multiple health issues and/or population subgroups in different years. Samples may be boosted to allow the study of specific subgroups of the population. During these years a reduced general population sample may be taken. The first health issue studied was cardiovascular disease, and the first four health surveys (1991-1994) focussed on this issue. The focus of the health surveys from 1991 onwards is given in **Table 1**.

TABLE 1 HERE

Since1994, participants aged 16 years and over, classified as adults, have been asked for consent to follow-up through linkage with the National Health Service Central Register thus converting annual cross-sectional survey data on different representative samples of the population into a longitudinal study with samples from different years with outcomes of mortality and cancer incidence. As the children in the HSE are not part of the prospective follow-up, the rest of this article refers only to adult participants, and to the survey years 1994 and onwards, when consent to follow-up through data linkage was introduced to the survey. Currently, mortality data are available for HSE years 1994-2008 until the first quarter of 2011, and cancer registrations, for these HSE years, can be linked from the date of interview. From 2003, adults have also been asked separately for consent to link their data to the Hospital Episodes Statistics (HES) database. As consent to HES linkage is separate, participants may agree to HES linkage but not to the National Health Service Central Register, and vice versa, although this seldom occurs. Hospital Episode Statistics data will be available for all electronically recorded episodes of hospital inpatient stays, including those preceding the HSE interview.

Who is in the sample?

The HSE covers all of England, UK. It is a nationally-representative sample of those residing at private residential addresses in the general population of England. It has always included people aged 16 years and over. All adults at each household (up to a maximum of ten) are selected for the interviews. Adults who are not able to give consent or to understand questions and give coherent answers, whether from mental illness, disability or through insufficient grasp of English language, are not included in the survey but are considered as non-responders, and are therefore included in the derivation of response rates.

Although an address will normally contain a single household, occasionally there are two or more households. This occurs in approximately 1% of selected addresses. Originally, all households up to a maximum of three were included in the survey. However, since 2009, one is selected at random by the interviewer using a Kish grid. Those living in communal establishments are outside the scope of the survey, which samples only private addresses. However, boost samples may occur in a survey year to increase the number in a population subgroup of interest. In 2000 **(15)** and 2005 **(20)**, adult boosts have included older people aged 65 years and over including older people living in care homes in 2000, and the main minority ethnic groups (Black Caribbean, Bangladeshi, Indian, Pakistani, Irish, and Chinese) in 1999 **(14)** and (including also Black African) in 2004 **(19)**. The care home sample in

2000 used interviews with proxy informants when the informant was unable to respond to the interview due to physical or mental incapacity.

Each survey year consists of a new sample of private residential addresses and people. Whilst it is very unlikely that persons will be selected for inclusion in more than one HSE, they are not precluded from doing so, although addresses are excluded for three years following prior selection. Each year, a new random sample is selected using the small-user Postcode Address File (PAF) as the sampling frame and a two-stage stratified random sampling process. At the first stage, a random sample of primary sampling units (PSUs), based on postcode sectors, is selected, with probability proportional to the total number of addresses within the PSU. On average, a postcode sector contains around 3,000 addresses. Smaller postcode sectors, with less than 500 addresses, are combined with neighbouring sectors to form a primary sampling unit, to prevent the addresses being too clustered. Stratification occurs through ordering the, approximately, 11,600 PSUs, by local authority and, within each local authority, by the percentage of households in the last census with a head of household in a non-manual occupation (National Statistics - Socioeconomic Classification groups 1-3) (**25**). The list is sampled at fixed intervals from a random starting point. Ordering of the PSUs facilitates collection of a representative sample of the population by local authority and socioeconomic group. Once selected, the PSUs are randomly allocated to the 12 months of the year, such that each quarter provides a nationally representative sample. At the second stage, a random sample of a fixed number of addresses from the PAF is then drawn for each PSU. The PAF includes more than 99% of households. However, about 10-12% of the selected addresses are identified on visiting the premises not to contain private households and are excluded from the survey sample.

The response rate to the HSE has fallen in recent years, in common with a wide range of surveys within the UK and across Europe and elsewhere (**26, 27**). However, there is some indication from the HSE to suggest that response rates may have begun to plateau (**Table 2**). In each HSE survey year, between 76% and 96% of those interviewed gave consent to linkage with mortality and cancer registrations (**Table 2**). The percentage consenting was higher in earlier survey years. Up to the end of the first quarter of 2011, 18,040 deaths had occurred in these core general population samples (**Table 2**).

TABLE 2 HERE

What has been measured?

There are two parts to the HSE. First, an interviewer visits the address to conduct an interview and measure height and weight (stage 1), then a nurse visits the address to carry out further measurements and take biological samples (stage 2). Each stage is voluntary, and some may take part in stage 1 but decide not to take part in stage 2, or not to agree to all parts of the nurse visit. However, only those having an interview are eligible for a nurse visit. The repetition of survey focus, such as cardiovascular disease or older people, the use of some ‘core’ questions and measurements each year, and other modules that are repeated at regular intervals, provide consistency that is important for studying temporal trends. Topics which are available from five or more years of the annual HSE surveys are given in **Table 3**, although there is much additional data available for analyses. Survey focus on different single or multiple health issues, or population subgroups in different years sometimes entails enhanced data collection, and therefore extra data are also available. For example, in 2008, a sub-sample were given accelerometers to wear for a week as an alternative more objective measure to compare with self-reported physical activity.

TABLE 3 HERE

In the years with minority ethnic group (**14, 19**) and 65 years and over (**15, 20**) boost samples, in addition to the core topics, physical activity and cardiovascular disease were the main modules asked. For both older people’s boosts, there were also more detailed questions on chronic disease and disability **(15, 20**), and objective measures of physical function in 2005 **(20).** Linkage data are also available for these boost samples excepting HES data for the boost samples predating 2003, before consent to link data to the HES database was introduced.

What has been found?

Obesity in children (**28**) and adults (**29**) increased from 1995 to 2007. Despite stabilization of the overall prevalence between 2004 and 2007, social disparities continued to grow at the expense of children in lower socioeconomic positions (**30**). The prevalence of obesity among adults has shown a marked increase between 1993 and 2004; the increase is more pronounced in men and women aged 35-74 years, and in those from manual social classes (**29**). Systolic blood pressure has declined among adults, meeting the Health of the Nation target (**31**) in 2005 (**32**). Cholesterol levels have fallen, in direct association with a rise in the use of lipid-lowering drugs, among those with established cardiovascular disease or diabetes, and to a lesser and inadequate extent among those with hypertension or otherwise at high cardiovascular risk (**33**). Key results from each year's survey are published in annual reports (**9-24**).

Through the combination of a health interview and health examination, the HSE can investigate both diagnosed and undiagnosed disease at a point in time, such as chronic obstructive pulmonary (lung) disease (**34**) and chronic kidney disease. In 2009, less than 2% of adult participants reported a diagnosis of chronic kidney disease; all those with renal failure stages 4-5 had been diagnosed but 95% of those with stage 2 or 3 disease were undiagnosed (**35**).

The HSE can monitor changes in diagnosis and in treatment over time. Vitamin D levels in older people were found to be too low both in 2000 (**36**) and 2005 (**37**); this has now been measured across the entire adult age range in 2010. The HSE has found that the treatment and control of hypertension have improved, although they remain suboptimal (**38**).

Trend data, which are updated annually, have also been published, and are available from the website of the NHS Information Centre for health and social care (www.ic.nhs.uk/pubs/hse09trends accessed 24 October 2011).

Analyses of the recently linked mortality data indicated that high levels of passive smoking were associated with elevated levels of low-grade inflammation, using C-reactive protein as a proxy marker, and this partly explained the elevated risk of cardiovascular disease death in those who had high secondhand smoke exposure (**39**). Physical activity has been linked with reduced mortality among both medicated and unmedicated adults, although cardiovascular medication was associated with a lower uptake of health-enhancing physical activity (**40**). The physical activity levels among South Asians born in the United Kingdom and living in England are markedly low (**19, 41**), and this made a substantial contribution towards the excess mortality from coronary heart disease observed in this ethnic group (**42**). The scope for future work using these mortality data is significant.

What are the main strengths and weaknesses?

The study provides baseline data and longitudinal health outcomes through linkage. The pooling of data from survey years dating from 1994 provides a significant cohort for whom longitudinal analyses through linkage are possible. For each year the HSE runs, the pooled cohort is augmented. Each sample contributing to the pooled cohort is a random, nationally-representative sample of the adult general population living in private households, and is not selected on healthcare use. There are no plans to request consent for linking children's data, as limitations of data held would preclude ascertaining consent from the individual participants once the children reached adulthood. Varying household response rates of between 64% and 79% have been achieved from the general population samples from 1994 to 2008. The broad thematic range of HSE and the plethora of information on health-related, socio-economic and demographic parameters makes the HSE cohort particularly suitable for multivariable modelling with mortality as the outcome.

Some subgroups of the population, who are not living in private households, are not covered by the survey, such as, the homeless, and those living in communal establishments, for example, residential and nursing homes. Less than 2% of the population of England live in communal establishments (**43**). Data from a survey of care homes across the UK reported that almost four out of five (78%) did not have a ‘normal mental state’ (**44**) and would therefore be unable to give informed consent for participation in the HSE.

Being a household survey, the HSE can examine individual characteristics in relation to those of other members of the household, and boost samples provide valuable research opportunities for analyses of subgroups within the population. Stored whole blood and serum can be used for new analyses, and provides an exciting opportunity for innovative research. Most participants who gave blood also agreed to storage of surplus whole blood (in EDTA, stored at -20^{0}C) and serum (stored at -40^{0}C) (**Table 2**).

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

The survey data for each year’s survey are archived at the UK Data Archive at the University of Essex and can be downloaded from the Economic and Social Data Service (http://www.esds.ac.uk/findingData/hseTitles.asp accessed 24 October 2011). Data can be downloaded free of charge for non-commercial purposes, subject to any access restrictions. To access data that are not currently archived, an application needs to be made to the NatCen Data Release Panel. The data may be provided to the researcher, or possibly made available for analyses through NatCen’s secure data enclave. There will be a charge for all these services to cover NatCen’s costs.

Information about the archived HSE data is available from ESDS Government at www.esds.ac.uk/government/hse/ (accessed 24 October 2011). Reports from HSE 2004 onwards are available on the website of the NHS Information Centre for health and social care (www.ic.nhs.uk/statistics-and-data-collections/health-and-lifestyles-related-surveys/health-survey-for-england accessed 24 October 2011). Earlier reports are available on the English Department of Health website (www.dh.gov.uk/en/Publicationsandstatistics/PublishedSurvey/HealthSurveyForEngland/Healthsurveyresults/index.htm accessed 24 October 2011). The NHS Information Centre for health and social care website also holds information about associated projects, such as the HSE Blood Bank project.

Applications to analyse stored blood or serum samples from HSE participants are considered by the NHS Information Centre for health and social care and the Joint Health Surveys Unit, and require ethical approval. Funding applications would need to cover NatCen's costs, such as linkage, as well as laboratory charges.

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Table 1. Focus of HSE by year of survey, 1991-2011

Year	Focus
1991-1994 (**3,7,8,9**)	Cardiovascular disease
1995 (**10**)	Asthma, accidents and disability
1996 (**11**)	Asthma, accidents and special measures of general health (Euroquol, SF36)
1997 (**12**)	Children and young adults
1998 (**13**)	Cardiovascular disease
1999 (**14**)	Minority ethnic groups
2000 (**15**)	Older people aged 65 years and over, social exclusion
2001 (**16**)	Respiratory disease and atopic conditions, disability and non-fatal accidents
2002 (**17**)	Children and young people (≤24 years), and the health of infants (<1 year) and their mothers.
2003 (**18**)	Cardiovascular disease and the behavioural risk factors
2004 (**19**)	Minority ethnic groups with an emphasis on cardiovascular disease
2005 (**20**)	Older people aged 65 years and over
2006 (**21**)	Cardiovascular disease and risk factors
2007 (**22**)	Knowledge, attitudes and behaviour on key aspects of lifestyle - smoking, drinking, eating and physical activity
2008 (**23**)	Physical activity and fitness
2009 (**24**)	Chronic kidney disease
2010	Respiratory disease and lung function, wellbeing, sexual health, and chronic kidney disease
2011	Cardiovascular disease

Table 2. Sample sizes by year for different levels of linkage in the core general population sample for HSE surveys 1994-2009.

Year	Response rate (%)		No. of adults interviewed	Linkage for cancer and death			Linkage for HES	No. of deaths[c]
	Household response (%)	Estimated adult interview response[a] (%)		No. consenting to linkage (% of interviewed)	No. with whole blood stored in EDTA consenting to linkage[b]	No. with stored serum consenting to linkage[b]	No. consenting to linkage (% of interviewed)	
1994	77	71	15809	15120 (96)	-	-	-	2927
1995	78	73	16055	15036 (94)	-	-	-	2821
1996	79	75	16443	15412 (94)	-	-	-	2642
1997	76	71	8582	8060 (94)	-	-	-	1229
1998	74	69	15908	15046 (95)	-	-	-	2177
1999	76	70	7798	7290 (93)	596	595	-	963
2000	75	68	7,988	6,948 (87)	617	1,555	-	790
2001	74	67	15647	13606 (87)	657	8420	-	1415
2002	74	67	7395	6365 (86)	385	374	-	581
2003	73	66	14836	12754 (86)	7455	7282	12743 (86)	970
2004	72	66	6704	5526 (82)	266	268	5505 (82)	367
2005	74	64	7630	5947 (78)	667	643	5965 (78)	306
2006	68	61	14142	11331 (80)	6347	6398	11135 (79)	477
2007	64	58	6882	5305 (77)	-	-	5208 (76)	173
2008	64	58	15102	11420 (76)	5999	3043	11224 (74)	202
2009	68	61	4645	3646 (78)	1951	1960	3563 (77)	-
TOTAL	**-**	**-**	**181566**	**158812 (87)**	**24940**	**30538**	**55343 (79)**	**18040**

[a] The denominator is estimated as the total number of adults in the sampled households is not known. Imputation is based on the average number of adults for households where data are available;

[b] For HSE survey years 1994 to 1998, it is not possible to confirm the numbers of cases with whole blood stored in EDTA or the number with stored serum, as early years were not catalogued. In HSE 1999 and 2004, nurse visits were not conducted to core sample members except for those in the main minority ethnic groups. In HSE 2001, blood samples were obtained primarily from those aged 11 to 24, and in HSE 2002, only from that age group. In HSE 2000 and 2005, blood samples were requested only from participants aged 65 and over; in 2000 and 2001, only serum samples were obtained from most adult participants. For HSE 2007, blood samples were not collected.

[c] As at first quarter 2011.

Table 3. Data available for adults (aged 16 years and over) in the core general population sample for five years or more, for HSE surveys 1994-2009

Data from the household and individual interview, and nurse visit	Years included[a]
Health measures (self-reported)	
Acute illness in the past two weeks	1994-2002, 2004+
Accidents	1995-1997, 1999-2002
Fractured and broken bones	2002-2007
General health and longstanding illness	1994+
Limiting longstanding illness	1996-2004, 2008+
General Health Questionnaire-12	1994-1995, 1997-2006, 2008+
EuroQoL-5D	1996, 2003-2006, 2008
Perception of current weight	1996-1998, 2002, 2004-2005
Cardiovascular disease	1994, 1998-2000, 2003-2006
Parental history of cardiovascular disease	1994, 1998-1999, 2003-2004, 2006
Diabetes	1994, 1998-2000, 2003-2006
Respiratory problems	1995-1997, 2001-2002
Use of health services	1994-1996, 1998-2002, 2005
Health-related behaviours (self-reported)	
Alcohol consumption	1994+
Smoking	1994+
Fruit and vegetable consumption	2001+
Eating habits	1994, 1997-1998, 2003, 2006+
Physical activity	1991-3, 1994, 1997-1999, 2002-2004, 2006, 2008
Use of cycle helmets	2001-2005, 2008+
Social capital and social exclusion	2000-2002, 2005-2006
Social support	1994-1995, 1998-2006
Contraception	1994-1995, 1997-2006
Hormone replacement therapy	1998-1999, 2001-2006
Nicotine replacement	1996-1998, 2001+
Immunisations	2001+
Prescribed medication	1995-1998, 2000+
Biological measurements	
Height and weight	1994+
Waist and hip circumference	1994, 1997+
Demispan	1994-1996, 1998, 2001, 2007
Blood pressure	1994-1998, 2000+
Lung function	1995-1997, 2001-2002, 2004
Cotinine	1996-1998, 2007+
Urine – sodium, potassium, and creatinine	2003-2007, 2009
Total cholesterol	1994, 1998, 2003-2004, 2008+
High density lipoprotein cholesterol	1998, 2003-2004, 2006, 2008+
Glycated haemoglobin	1994, 2003-2004, 2006, 2008+
C-reactive protein	1998, 2003-2004, 2006, 2009
Immunoglobulin E and house dust mite specific immunoglobulin E	1996-1997, 2001-2002, 2004
Fibrinogen	1994, 1998, 2003-2004, 2006, 2009
Haemoglobin and ferritin	1994-1998, 2001-2002, 2004, 2006, 2009
Individual socio-demographic characteristics	
Economic status	1994+
Occupation	1994+
Marital status	1994+
Benefit receipt	1994+
Educational attainment	1994+
Ethnic group	1997+
Household characteristics	
Household size and composition	1994+
Household relationships	1997+
Housing tenure and no. of bedrooms	1994+
Heating and cooking appliances	1994-1998, 2001-2002
Type of dwelling and area	1994+
Household income	1997+
Economic status of household reference person[b]	1997+
Occupation of household reference person[b]	1997+
Smoking in household	1995+
Telephone ownership	1994-2001
Car ownership	1994+

[a] Year+ indicates data available for the given year and beyond until 2009 inclusive;

[b] The household reference person (HRP), used since 2002, is the householder (the person in whose name the property is owned or rented); if there is more than one, the person with the highest income. If there are two householders with equal income, then the household reference person is the oldest. Prior to that, head of household was defined as the oldest adult male in the household.

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