Trends in Life Expectancy by National Statistics Socio-economic Classification 1982 to 2006 QMI

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To be announced

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1 . Methodology background

National Statistic	No
Frequency	5 year
How compiled	Sample based survey
Geographic coverage	England and Wales
Last revised	November 2011

2 . Executive summary

Trends in life expectancy by National Statistics Socio-Economic Classification updates an earlier series of analyses entitled Trends in ONS longitudinal study estimates of life expectancy 1972 to 2005 with the more up-to-date and conceptually robust National Statistics Socio-economic Classification (NS-SEC) schema for designating socioeconomic position.

This series uses linked data from the ONS Longitudinal Study (LS), tracking individuals from their point of entry into the study until death or the most recent point in time relative to the period of analysis.

Estimates are produced for males and females covering 5-year periods from 1982 to 1986 with the latest period of analysis being 2002 to 2006.

The development of this series is described in an article, Deriving trends in life expectancy by the National Statistics Socio-economic Classification using the ONS Longitudinal Study .

All outputs in this series are announced in advance on the GOV.UK release calendar.

This report contains the following sections:

- Output quality

- About the output

- How the output is created

- Validation and quality assurance

- Concepts and definitions

- Other information, relating to quality trade-offs and user needs

- Sources for further information or advice

3 . Output quality

This report provides a range of information that describes the quality of the data and details any points that should be noted when using the output.

We have developed [Guidelines for Measuring Statistical Quality](#); these are based upon the five European Statistical System (ESS) quality dimensions. This report addresses the quality dimensions and important quality characteristics, which are:

- relevance

- timeliness and punctuality

- comparability and coherence

- accuracy

- output quality trade-offs

- assessment of user needs and perceptions

- accessibility and clarity

More information is provided about these quality dimensions in the following sections.

4 . About the output

Relevance

(The degree to which the statistical outputs meet users' needs.)

The measurement of social inequality in life expectancy is important, evidence-based information that can be used for policy, monitoring and research purposes, in both the public and private sectors. The nature and scale of health inequalities and how they change over time provides extremely valuable contextual information for those engaged in attempts to create a more equitable health landscape.

The subject has a high political profile and has been addressed by various reviews and strategies; such as the influential [Marmot Review 2010](#). In response to this demand, Office for National Statistics (ONS) developed a [methodology](#) that uses the [Longitudinal Study (LS)](#) data originating from 1981 to assign National Statistics Socio-economic Classification (NS-SEC) from historical occupational records of LS members to calculate life expectancy by NS-SEC. The use of linked records enables those of retirement age to be assigned an NS-SEC at an earlier point in their lives to enable risk of death by socioeconomic position to be computed for people aged 65 and over.

The conventional method for estimating mortality rates by class has been to use the decennial census of population to provide age and socio-economically stratified denominators, and death registrations coded by occupation for years close to the census to provide numerators. This method, while producing consistent findings over a long period, had a number of drawbacks such as changes in occupational classification, differences in assignment of occupation at census and at death registration, incomplete coding of occupation at census and death registrations for those of State Pension age; and that an increasing minority of deaths occur at ages below 65 years. To address this and make the assessment of social inequalities in mortality more relevant to policy development and academic study, it became increasingly important to have available a means of classifying older people to NS-SEC using occupation recorded earlier in their lives. In this way, life expectancy can take account of life course exposures of those dying at older ages.

Users of these statistics include:

- the Department of Health – as part of the apparatus for measuring health inequalities on a timely basis using a conceptually credible underlying social classification schema

- the Department of Work and Pensions – expectation of life at various ages for different segments of the population is of importance in policy planning, particularly the fairness of changes to the State Pension age

- academics and non-governmental researchers for hypotheses generation and background context for further research

- commercial users – among these, life tables are of importance to actuaries and pension providers, to enable them to price the products of their industry appropriately. The ability to classify by socio-economic group allows more accurate pricing and planning

Timeliness and punctuality

(Timeliness refers to the lapse of time between publication and the period to which the data refer. Punctuality refers to the gap between planned and actual publication dates.)

There is typically a lag of around 4 years between the end of the study period and publication. This is mainly due to the time it takes for the LS to be updated with events such as births and deaths, linked through the National Health Service Central Register (NHSCR), which occurs at intervals of between 2 and 3 years.

Publication is typically announced approximately 6 to 8 months in advance on the GOV.UK release calendar. Publications have been punctual. In the unlikely event of a change to the pre-announced release schedule, public attention will be drawn to the change and the reasons for the change will be explained fully at the same time, as set out in the Code of Practice for Official Statistics.

5 . How the output is created

Trends in life expectancy by National Statistics Socio-Economic Classification (NS-SEC) are derived from the ONS Longitudinal Study (LS); an approximate 1% sample of the population of England and Wales, based on the method developed by Johnson (2011).

There are three main steps in the production of these statistics, which are detailed in this section.

1. The assignment of NS-SEC to a member on entry to the LS

Sample members are assigned an NS-SEC on the basis of occupation and employment status using the reduced method and derivation tables based on Standard Occupational Classification (SOC) 2000, derivation tables based on SOC 1990, and in future derivation tables based on SOC 2010, which are publically available from the ONS website and details on how to apply them can be accessed from the NS-SEC User Manual.

Because NS-SEC was not developed until the 1990s, Johnson (2011) created a separate derivation matrix to produce NS-SEC for occupational and employment classifications recorded in the LS during the 1980s. This derivation matrix has not been published on the ONS website but instructions for its use in deriving NS-SEC are available on request.

Where possible, an individual's own NS-SEC class is used, either on entry to the study, or at the earliest date to which occupational and employment status records are available. For individuals with no assigned occupation but married, their spouse's classification is used. For individuals who were children at a census or for inter-censal newborns, the father's classification is used or failing that the mother's. Immigrants are assigned NS-SEC at the first census at which they were present but if they are not present at any census, they are excluded from the study since there is no way of assigning a class to them. LS members who remain without an NS-SEC after these steps are coded as "Unclassified".

The main rationale for assigning class at the earliest possible point after entry to the study is that, in a prospective study, it is important that the assignment of class is not influenced by the fact of death or survival. An additional benefit is that the longer the period of follow up, the less prevalent are health selection effects. These occur when some sample members cannot be classified by occupation owing to poor health when assignment of class takes place. These members have a relatively higher probability of dying soon after assignment of class. This health selection out of the labour market often disproportionately affects Routine and Manual occupations, so a bias may be introduced where those in the least advantaged classes appear to have a lower mortality rate relative to others, in the period immediately following classification, than they otherwise would have done. The earlier that assignment takes place, and therefore the longer the period of follow up, the less risk of health selection bias, affecting the estimates.

2. Estimation of age-specific mortality rates for males and females by NS-SEC

Once individuals are assigned an NS-SEC, age-specific mortality rates for males and females in 5-year age groups across 5-year aggregate periods are estimated from the number of deaths and person years survived for each classification strata.

3. The construction of life tables for males and females by NS-SEC

ONS Standard Life Table templates are used to calculate period life expectancy estimates for males and females in 5-year age groups across 5-year aggregate periods. Period life expectancy for a particular NS-SEC class is the average number of years a person would live, if he or she experienced the age-specific mortality rates for that time period, (for example, 2002 to 2006), for that class throughout his or her life: it makes no allowance for any future changes in age-specific mortality rates.

The tables include variances and confidence intervals, derived using ONS standard methodology based on Chiang's method for deriving q, (the probability of death in each interval) and variances (Chiang, 1968 [1]).

The LS is maintained by the ONS LS Development Team. Access to the LS is highly restricted and projects must be approved by the LS Research Board with analysis carried out only within the environment of the Virtual Microdata Laboratory (VML). All outputs must be formally cleared before release, with disclosure issues of paramount importance.

Notes for How the output is created

1. Chiang C L (1968) The life table and its construction' in Introduction to Stochastic Processes in Biostatistics, Chapter 9, pages 189 to 214, John Wiley & Sons: New York.

6 . Validation and quality assurance

Accuracy

(The degree of closeness between an estimate and the true value.)

Trends in life expectancy by National Statistics Socio-Economic Classification (NS-SEC) have a number of potential biases and sources of error due to assumptions made in the assignment of NS-SEC, particularly for occupations recorded during the 1980s. The approach requires the occupational records of ONS Longitudinal Study (LS) members enumerated in 1981 and coded to the classification used at the 1981 Census, Classification of Occupations, 1980 (CO 1980), to be mapped to the appropriate code in the Standard Occupational Classification 1990 (SOC 1990). Empirical testing showed that there were three categories of relationship between CO 1980 and SOC 1990:

- those that mapped directly to a single SOC 1990 code

- those that mapped to more than one SOC 1990 codes, but all relevant SOC 1990 codes produced a unique NS-SEC analytic class when combined with employment status

- those that mapped to more than one SOC 1990 code, at least two of which were associated with different NS-SEC classes (even when employment status was the same)

While the first two categories of mapping produce unique mapping, the third presents problems. The scale of the problem was tested empirically by using the dual coded occupational records in the LS for 1991 enumerations; each enumeration was coded to CO 1980 and SOC 1990.

For each 1981 occupation code, where there was no unique mapping to SOC 1990, the population assigned to each analytic NS-SEC class was measured. This allowed the measurement of the size of the population for which the combination of 1981 occupation and employment status did not uniquely determine NS-SEC class. For example, CO 1980 occupation number 43, (nurse administrators and nurses) maps to SOC 1990 occupation codes 340 (nurses), 640 (assistant nurses, nursing auxiliaries) and 643 (dental nurses). The number in the sample having this occupation and an employment status of employee are as follows:

- NS-SEC Class 2 (lower professional) n equals 4,461

- NS-SEC Class 3 (intermediate) n equals 1,857

- NS-SEC Class 6 (semi-routine) n equals 240

A simple approach to code such individuals with a one-to-many relationship is to apply a simple majority method and use this in a derivation matrix. For those combinations of occupation and employment status that produce ratios of NS-SEC designations in the order of 10:1 or higher and the NS-SEC class in the minority group had 10 or fewer instances, the simple majority rule was applied.

However, in the case of nurses, as previously mentioned, this was not appropriate as the minority classes had more than 10 instances and would have resulted in inaccurate assignment of NS-SEC to a substantial number of LS members. In circumstances such as this, an additional refinement was applied, which made use of data that identified the type of industry and its size the LS member worked in. This additional information enabled better discrimination of NS-SEC than use of occupational and employment status alone; in the example, nearly all the NS-SEC class 6 cases were found to be dental nurses, but CO 1980 did not distinguish them from other nurses; however, industry code showed they were working in dental practices. Consequently, where industry was shown to improve the accuracy of the assignment, it was used to resolve the uncertainty.

Analysis comparing predicted with observed results indicates that this approach introduces a small error in coding of approximately 1.0%.

Adjustments are also made to account for individuals without NS-SEC. Married women without a recorded occupation are assigned NS-SEC on the basis of their spouse's classification and children are assigned according to the most advantaged of either their father's or mother's classification. This "combined" approach is based on the concept of Erikson (1984)[1] and is likely to reflect more accurate assessment of a person's socio-economic position than one based on the primacy of one's own class. While this is not a true "household" measure of socio-economic position, it is useful to determine the sensitivity of the life expectancy estimates to a more family-based assignment of class than one based strictly on the occupation of the individual subject. This is particularly true for women, for some of whom, access to social and economic resources are less defined by the labour market than they are for men.

Further sources of error relate to data linkage between the LS and National Health Service Central Register (NHSCR) and between different census years. Less than 1% of LS members are not traceable on the NHSCR and their records are dropped from these analyses.

There are a number of population sub-groups for whom census to census linkage in the LS is likely to fail. These include:

- being young and male

- being born outside of the UK

- being a member of an ethnic minority

- being enumerated in a communal establishment

- living in privately rented accommodation

- being single or divorced, or living in a lone-parent family

- being unemployed, a student or in the economic position "other inactive"

- being in the armed services

Therefore, steps must be taken to reduce the effect of uneven linkage across the study population.

Individuals enter the LS via a census, birth or immigration. They can leave by death or emigration. Problems occur when LS members are expected at a census but are not found. In these cases there is no evidence of death or emigration but they are not found at the following census. This is often referred to as "loss to follow up". When this occurs, a decision needs to be made as to whether to include or exclude these sample members from the study.

If they are included when, in fact, they are abroad, then they are contributing person-years to the denominator, but if they die abroad, their death will not be counted in the numerator. Alternatively, a person might be excluded when in fact they have re-entered the country during the analysis period. Unrecorded emigration can lead to underestimation of mortality rates, while unrecorded immigration can lead to overestimation.

LS information on migration comes from NHSCR. This relies on people notifying their doctor or health authority that they are emigrating. Exit from the LS is recorded when there is confirmation of emigration. Since there is little incentive for emigrants to inform their doctor, it is generally believed that the NHSCR (and therefore the LS) understates the true level of emigration, though to what extent is unknown.

To minimise this potential bias, Johnson and Blackwell (2007) developed a set of rules for inclusion or exclusion or partial exclusion (after a point in time). There was also an additional mechanism for dealing with those who may have unrecorded emigration. "Cancelled ciphers" arise on the NHSCR when patients de-register from the NHS. This may be for a number of reasons, but the majority re-registers within a year. Owing to the period of non-contact before health authorities deregister a patient, it is appropriate to assume a time lag between the LS member "emigrating" and the date of the deregistration. This is significant in the context of survival analysis because the individual ceases to be at risk from the date of their departure. The 3-year minimum period of non-contact referred to previously suggests a lag of 3 years. However, the appropriate length of lag may also be derived empirically. An investigation, described in Review of methods for estimating life expectancy by social class using the ONS Longitudinal Study supports the assumption that LS members ceased to be at risk for the year prior to their health authority deregistration.

There is a large overlap between candidates for exclusion through sparse census records and those with cancelled ciphers. Thus, to some extent, the system has a degree of self-stabilisation, in that a more liberal approach to inclusion leads to more cancelled ciphers becoming operative and vice-versa. Sensitivity tests have been applied using only cancelled ciphers and minimal exclusions, and vice-versa. There are differences in the overall level of life expectancy, but these are relatively small, and the socio-economic pattern is unchanged.

In order to indicate precision and to facilitate the detection of significant differences, 95% confidence intervals are published alongside estimates of life expectancy.

Comparability and coherence

(Comparability is the degree to which data can be compared over time and domain, for example, geographic level. Coherence is the degree to which data that are derived from different sources or methods, but refer to the same topic, are similar.)

Trends in life expectancy by National Statistics Socio-Economic Classification are designed to represent a comparable time series to detect genuine change in the social gradient over time.

Changes in economic structure, the nature of occupations and in NS-SEC assignment are likely to lead to a degree of discontinuity, however, the impact of such change is likely to be marginal and insufficient to lead to any misrepresentation social inequality.

Mean life expectancies for males and females at birth differ by 0.2 years or less compared to the definitive estimates published in ONS interim life tables. This is because they are calculated from abridged 5-year, rather than single-year, life tables and because a small proportion of LS sample members are "lost to follow up".

Notes for Validation and quality assurance

1. Erikson R (1984) Social class of men, women and families, Sociology, 18, pages 500 to 514.

7 . Concepts and definitions

(Concepts and definitions describe the legislation governing the output and a description of the classifications used in the output.)

The ONS Longitudinal Study (LS) is constrained by Acts governing the Census (especially the 1 920 Census Act, the 1938 Population Statistics Act and the 1984 Data Protection Act).

Confidentiality of the personal data in the LS is of paramount importance. Not only must the requirements of the Census Act, the Population Statistics Act and the Data Protection Act be observed but public confidence must also be maintained. There are a number of safeguards.

Firstly, the index of names of LS members is held under high security and is not linked with the computerised records, which do not include names and addresses. Secondly, the dates of birth used as the basis for selecting the sample have never been publicly announced. Finally, and of most relevance to those using the LS, analyses of the data may only be released as aggregated tabular outputs or statistical summaries; no micro data is ever released or accessed outside a secure setting.

Data may only be accessed via the Virtual Microdata Laboratory (VML), which has no printing or transfer facilities to any other network (except for administrators who may "clear" output for publication, having first checked for any potential disclosure risk). Desk instructions are available outlining the steps for clearing outputs:

- all files must be checked for Statistical Disclosure Control (SDC) before they are released from the VML

- the VML SDC Model is outlined in the VML training course and all files must show unweighted number of observations – the minimum cell threshold rule is 10 observations and the minimum output only can be released such as tables of results; all work should be completed in the VML and so do not request aggregated datasets for release to undergo further analysis outside the secure setting

- SDC for clearance is provided by the Health Inequalities Team; two members of staff must check the results meet the SDC model and record approval in the MAUS database

- If work includes smaller cells, researchers have to discuss with the VML team why they are required and give detailed reasons as to why the results would not be disclosive

- Age Specific Mortality Rates produced from this output that refer to between 10 and 3 deaths can be published

The conceptual basis for the National Statistics Socio-economic Classification (NS-SEC) is the structure of employment relations operating in modern developed economies. Occupations are differentiated in terms of reward mechanisms, promotion prospects, notice periods and job security.

While not designed as a hierarchy, there are differences in social advantage across the classes. The more advantaged NS-SEC classes (higher managerial and professional occupations and lower managerial and professional occupations) typically exhibit personalised reward structures, have good opportunities for advancement, relatively high levels of autonomy within the job, and are relatively secure. These attributes are generally absent from the less advantaged classes (the semi-routine and routine analytic classes).

8 . Other information

Output quality trade-offs

(Trade-offs are the extent to which different dimensions of quality are balanced against each other.)

The complexity of data linkage, security and administration adds substantially to the time between the period under analysis and publication. Due to reliance on data sources external to Office for National Statistics (ONS), for example, the National Health Service Central Register (NHSCR), it is not possible to reduce this time without incurring a significant negative impact on data quality.

User feedback

User needs are central to our analysis and publication programme. There are a number of processes in place to ensure that we capture, understand and act upon user needs.

The Health Inequalities team regularly present analyses at national and international conferences, providing opportunities to engage with and expand the user base. Presentations have been made at the following conferences: Government Social Research 2011, Royal Society for Public Health 2011, and at the British Society for Population Studies 2011. Topic experts are routinely invited to attend divisional meetings and opportunities for collaboration are actively sought.

In addition, the team includes contact details and a request for user feedback in all written communications.

The Health Inequalities team holds user consultations to gather feedback on changes to outputs and when a change in method or data source might affect the statistics within the output. This enables an accurate assessment of the impact of change in terms of user needs. User consultation follows ONS's consultation guidance. In 2012, the Health Inequalities team published the response to a Consultation regarding the replacement of the time series of mortality by social class.

These processes enable the Health Inequalities team to identify the users of the statistics and understand their needs more fully to develop the analysis and publication programme.

Taking account of user needs

User feedback and consultation informs the analysis and publication programme. Collaboration with the Department of Health, in particular, has shaped the work of the Health Inequalities team in order to produce statistics that are both timely and relevant to inform government policy. The statistical output Trends in life expectancy by National Statistics Socio-Economic Classification (NS-SEC) is one example of a work programme that has been produced as a direct result of user consultation.

Discussions with main users have identified the need for sub-national analyses of mortality by NS-SEC and also by occupation and the team are planning to publish inter-censal estimates of all- cause mortality by NS-SEC for English regions and Wales.

The published response to Consultation regarding the replacement of the time series of mortality by social class (2012) provides further illustration of how the Health Inequalities team takes account of user needs.

Users of statistics

Users of Health Inequalities statistical outputs include:

- [Department of Health](#) – measuring and monitoring health inequalities to develop and evaluate policy

- [Department for Work and Pensions](#) – evidence for the debate concerning the change in State Pension age, and to assist with modelling the impact and fairness of future policy changes

- [Health and Safety Executive](#) – evidence of elevated risk of death for certain occupations by cause

- [Public Health Observatories](#) – for measuring and monitoring health

- academia – for example, the influential [Marmot Review 2010](#)

- private sector – life tables are important to actuaries and pension providers, as they enable them to price the products of their industry appropriately; the ability to classify by socio-economic position allows more accurate pricing and planning

- media – for example, the BBC, in articles such as [Do those who retire early live longer?](#)

Future publication plans

The Health Inequalities team are currently working on Age Specific Mortality Rates by NS-SEC. This publication will be an extension of [Trends in life expectancy by National Statistics Socio-Economic Classification 1982 to 2006](#), and using the ONS Longitudinal Study (LS). Separate tables will also be published for males and females by NS-SEC. These tables will be accompanied by a statistical bulletin where the trends will be discussed.

The data source for this series, the LS, is currently being linked by the data team to the 2011 Census and Vital Events data. This will make it possible to extend the Life Expectancy by NS-SEC series beyond 2006.

It is important to note that we expect this series of work to evolve according to user feedback and resource availability. Please contact healthineq@ons.gsi.gov.uk for further information.

Useful resources

Scotland

Equivalent statistics by NS-SEC are not available for Scotland. However, users may find the following helpful in providing an illustration of health inequalities in Scotland: [Long-term monitoring of Health Inequalities in Scotland](#).

Northern Ireland

Equivalent statistics by NS-SEC are not available for Northern Ireland. However, users may find the following helpful in providing an illustration of health inequalities in Northern Ireland: [Health Inequalities in Northern Ireland](#).

Wales

Equivalent statistics by NS-SEC are not published by the Welsh Government. However, we have agreed with the Welsh Government Health Statistics team to calculate and publish inter-censal Mortality Rates by NS-SEC for Wales. Users may find the following helpful: [Health and Care Statistics in Wales](#).

Further information relevant to ONS health inequality statistics is published by the [Institute of Health Equity, at University College London](#).

9 . Sources for further information or advice

Accessibility and clarity

(Accessibility is the ease with which users are able to access the data, also reflecting the format in which the data are available and the availability of supporting information. Clarity refers to the quality and sufficiency of the release details, illustrations and accompanying advice.)

Our recommended format for accessible content is a combination of HTML web pages for narrative, charts and graphs, with data being provided in usable formats such as CSV and Excel. We also offer users the option to download the narrative in PDF format. In some instances other software may be used, or may be available on request. For further information please contact us via email at healthineq@ons.gsi.gov.uk.

More information regarding conditions of access to data is available:

- Terms and conditions (for data on the website)

- Copyright and reuse of published data

- Accessibility

Useful links

Trends in life expectancy by National Statistics Socio-Economic Classification for the period 1982 to 2006 (and by RGSC from 1972 to 2005) may be accessed free of charge on the ONS website.

Sub-national estimates are not currently available, owing to sample size considerations. However, it may be possible to produce estimates by government office region for 5-year periods, using the "condensed NS-SEC" three analytic class schema.

A summary video podcast describing socio-economic inequalities in mortality is also available.