

Information paper

Quality and Methodology Information

General details

Title of output:	National Life Tables
Designation:	National Statistics
Geographic coverage:	United Kingdom, Great Britain and constituent countries
Date of last SQR or QMI ¹ :	January 2012
Contact details:	lifetables@ons.gov.uk

Executive summary

The life table is simply a convenient way of analysing age-specific death rates and is a standard demographic tool used to portray expectation of life at various ages. Life tables are usually constructed separately for men and for women because of their very different mortality patterns. The Office for National Statistics (ONS) routinely publishes two types of national life expectancy, the national interim life table and the period and cohort life expectancy tables.

Life expectancy is the average number of years a person is expected to live before death. This is usually calculated from the time of birth, but can also be calculated from any specified age. This gives the remaining further number of years a person on average can expect to live given the age they have attained.

[Interim life tables](#)¹ have been produced annually for the United Kingdom and its constituent countries since 1980-1982, and are based on population estimates, births and deaths data for a period of three consecutive years. Three-year rolling averages are used to smooth fluctuations due to exceptional events, for example a flu epidemic. They are known as interim life tables because fully graduated life tables have also been prepared every 10 years ([decennial life tables](#)²), based on data around a census year.

Period and cohort [life expectancy tables](#)³ are produced biennially based on the assumptions for future mortality from the [national population projections \(NPP\)](#)⁴. These tables give historic and projected life expectancies by single year of age and sex, from 1981 to the NPP base year and then 50 years into the future from the base year. The historic life expectancies are based on unsmoothed calendar year mortality rates and the projected mortality rates from the National Population Projections.

On 31 January 2006, responsibility for the production of National Life Tables transferred from the Government Actuary's Department to the Office for National Statistics. National Life Tables are produced by the Population Statistics Division (PSD) within ONS.

This document 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; and
- Sources for further information or advice.

Output quality

¹ Quality and Methodology Information' (QMI) replaced 'Summary Quality Reports' (SQR) from 04/11

This document provides a range of information that describes the quality of the data and details any points that should be noted when using the output ONS has developed [Guidelines for Measuring Statistical Quality](#)⁵; these are based upon the five European Statistical System (ESS) Quality Dimensions. This document addresses the Quality Dimensions and important quality characteristics, which are:

- Relevance;
- Timeliness and punctuality;
- Coherence and comparability;
- Output quality trade-offs;
- Assessment of user needs and perceptions; and
- Accessibility and clarity.

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

About the output

Relevance

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

Life expectancy figures provide users with an indicator of the health of the nation which can be used to inform policy, planning and research in both public and private sectors in areas such as health, population, pensions and insurance. Within ONS, interim life tables are used to calculate disability free life expectancy, healthy life expectancy and 'duration of working life'.

Period life tables are calculated using age-specific mortality rates for a given period, with no allowance for any actual or projected future changes in mortality. This means that period life expectancy at birth for a given time period and area is an estimate of the average number of years a new born baby would survive if he/she experienced the particular area's age-specific mortality rates for that time period throughout his/her life. The period life expectancy is therefore a useful measure of mortality rates over a given period and provides an objective means of comparison of the trends in mortality over time and with other countries.

Cohort life tables are calculated using age-specific mortality rates which allow for known or projected changes in mortality in later years.

Period and cohort life expectancies for each year are produced every two years from national population projections.

The expectation of life figures shown in the interim life tables are period life expectancies.

Users and their needs are identified when they contact ONS about life tables. A specific email address is available for life table related enquiries, lifetables@ons.gsi.gov.uk. These are noted and recorded along with any telephone enquiries. The life table is a long established output with a relatively specialised user base.

[Life tables](#)⁶ are published on the ONS web site and are freely available to all.

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.)

The national interim life tables provide the user with life tables in the intercensal period enabling up-to-date analysis of life expectancy. This is important for tracking progress against health targets and pension analysis.

National interim life tables are usually published annually at the end of September. For a particular calendar year they become available around nine months after the end of the reference year. This time lag reflects the availability of the data source, and the time required to process the data and calculate the life tables. The publication date for life tables is determined by the availability of the mid-year population estimates and the registration of births and deaths data.

Period and cohort life expectancy tables are timed to be released one to two months after the publication of the national population projections. National population projections are usually published biennially. The publication of these tables is determined by the availability of the national population projections.

For more details on related releases, the [UK National Statistics Publication Hub](#)⁷ is available online and provides 12 months' advance notice of release dates.

The publication of the life tables would only be later than the planned date if essential data used to calculate the tables were not available or delayed, for example the rebasing of mid-year population estimates to the latest census, or if substantial problems were encountered with the processing systems used to calculate the tables. In previous years the planned publication date, as entered into the [National Statistics Publication Hub Release Calendar](#)⁸ has always been met.

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](#)⁹.

How the output is created

A life table is purely a hypothetical calculation. It is a statistical tool typically used to portray expectation of life at various ages. The basic assumption is that a given cohort of births (100,000 born in a given year) are subject, as the survivors pass through each year of age, to the mortality rates prevailing for each age.

Period life tables deal with current mortality rates only and no assumptions are made about future changes. The mortality rates for each age are used to calculate how many of the cohort will reach each year of age until eventually all members of the cohort have died. This enables the total number of years lived by the cohort to be calculated. When this total is divided by the number of persons in the cohort (100,000), the result is the average number of years lived in the cohort or the mean expectation of life at birth. The total number of years lived by the cohort from any given age can also be calculated and when divided by the number of survivors in the cohort entering upon that year of age, the figure obtained is the expectation of life in years for those persons.

Cohort life tables are calculated using age-specific mortality rates which allow for known or projected changes in mortality in later years. (Cohort and Period life expectancies for each year are produced every two years for national population projections.) A cohort life table provides mortality rates that vary over time for each age. They are calculated using age-specific mortality rates which allow for known or projected changes in mortality in later years. For example, cohort life expectancy at age 65 in 2012 would be worked out using the mortality rate for age 65 in 2012, for age 66 in 2013 for age 67 in 2014 and so on. This uses observed mortality rates in 2012 and projected mortality rates from 2013. Therefore, cohort figures are regarded as a more appropriate measure of how long a person of a given age would be expected to live on average than period life expectancy.

Life tables are usually constructed separately for males and females because of their very different mortality patterns. A life table describes the course of mortality throughout the life cycle. A life table contains:

m_x

The central rate of mortality, defined as the average annual number of deaths at age x last birthday in the year or years to which the life table relates divided by the average population at that age over the same period.

q_x

The mortality rate between age x and $(x + 1)$, that is the probability that a person aged x exactly will die before reaching age $(x + 1)$.

l_x

The number of survivors to exact age x of 100,000 live births of the same sex who are assumed to be subject throughout their lives to the mortality rates experienced in the year or years to which the life table relates.

d_x

The number dying between exact age x and $(x + 1)$ described similarly to l_x , that is $d_x = l_x - l_{x+1}$.

e_x

The average period expectation of life at exactly age x that is the average number of years that those aged x exactly will live thereafter based on the mortality rates experienced in the year or years to which the life table relates.

The method of constructing a life table is widely available in demographic text books, for example, Hinde A, Demographic Methods¹⁰.

The national life tables published by ONS are calculated using a well-established and internationally recognised methodology. The data used at the national level are sufficiently reliable for single year of age to be used throughout. The life tables are thus 'complete'. ONS calculates the life tables for the UK and each of the constituent countries, so each set (national interim life tables, decennial life tables and the period and cohort life expectancy tables) are comparable across and within the UK.

Each life table is based on the mid-year population estimates and deaths by date of registration data. The interim life table use data for a period of three consecutive years. This helps to reduce the effect of annual fluctuations in the number of deaths caused by seasonal events such as a flu epidemic. The interim life tables are based on the mid-year population estimates and corresponding data on births, infant deaths and deaths by individual age from those years (the calculation of infant mortality also requires monthly births data for the year before the three year period). [A guide to calculating interim life tables](#)¹¹ is available on the Office for National Statistics website. The [decennial life tables](#)² are fully graduated (smoothed) and are published with release-specific documentation on methods and results, all this information is available on the ONS website.

Information on the assumption setting process for future mortality patterns are outlined in:

[4. Mortality assumptions: 2012-based national population projections](#)¹².

Quality Reports for the data used in the calculation of life tables are available here: [births](#), [deaths](#), [mid-year population estimates](#), [population estimates of the very old](#) and [population projections](#)¹³.

Validation and quality assurance

Accuracy

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

As already mentioned the ONS use well-established and internationally recognised methods to calculate national life tables. They are 'complete' life tables because single-year age groups are used throughout, as the data used at national level are sufficiently reliable to do so. This is preferable to the 'abridged' life table where some data are lost in the grouping of ages. Abridged life tables are used at the local area level. These are more suitable for calculating sub-national life expectancy than complete life tables due to small numbers of deaths by single year of age, particularly among younger age groups and in smaller areas. [Sub-national life expectancy](#)¹⁴ and associated [quality report](#)¹³ are published on the ONS web site.

There has been no change in methods or classifications within the last 10 years and there are unlikely to be any changes in the near future. Where there has been a revision in the input data, ONS has checked that this would not imply any revision of practical significance to users. There have been [revisions](#)¹⁵ to the life tables for 2000-02 to 2010-12 following the rebasing of the mid-year population estimates to the 2011 Census results. Any revisions observe the [Population Statistics Revisions Policy](#)¹⁶ which is consistent with the ONS Revisions policy.

Broader quality assurance of the period and cohort life expectancy figures is provided by expert discussion of mortality assumptions (which also feed into the NPP). The expert advisory group was set up following a recommendation of the NS Quality Review [Series No. 8 - National Population Projections: Review of Methodology for Projecting Mortality](#)¹⁷ specifically for this purpose. The [minutes](#)¹⁸ of meetings and responses to the expert questionnaire have all been published on the ONS website.

Coherence and comparability

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

Like national interim life tables, [sub-national life expectancy figures](#)¹⁴ are calculated for three-year rolling periods. However, life expectancy statistics for regions, counties and local areas in the UK are calculated annually using abridged (based on five-year age groups) life tables. These are more suitable for calculating sub-national life expectancy than complete life tables (based on single year of age as in the national life tables) because of small numbers of deaths by single year of age, particularly among younger age groups and in smaller areas. Life expectancy figures are also calculated using the abridged method at the national level for comparison purposes with the local area statistics however, these two sets of national life expectancy figures may differ slightly (usually by around + or - 0.1 years).

There have been no changes in methods or classifications within the last 10 years. The ONS uses internationally recognised methodology in the construction of life tables. ONS calculates the life tables for the United Kingdom and each of the constituent countries, so are comparable across and within the UK. The population figures used to produce the tables are fully consistent with the mid-year population estimates.

Concepts and definitions

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

Office for National Statistics uses internationally recognised methodology in the construction of life tables. The method of constructing a life table is widely available in demographic text books, for example, Hinde A, Demographic Methods¹⁰ and Newell C, Methods and Models in Demography¹⁹.

The life table is a method of deriving measures which are representative of average life expectancy prevailing at a given time. It is a purely hypothetical calculation. It is a statistical tool typically used to portray expectation of life at various ages.

A life table describes the course of mortality throughout the life cycle. The components of a life table are described above.

Life expectancy

Life expectancy is the average number of years a person has before death, conventionally calculated from the time of birth, but can also be calculated from any specified age. Life expectancies can be calculated for any age, giving the remaining life expectancy that is, the further number of years a person can on average expect to live given the age they have attained.

Period life expectancy

Period life expectancy at a given age for an area is the average number of years a person would live, if he or she experienced the particular area's age-specific mortality rates for that time period throughout his or her life.

Cohort life expectancy

Cohort life expectancy does make allowances for mortality improvements. They are calculated using age-specific mortality rates which allow for known or projected changes in mortality in later years. For example, cohort life expectancy at age 65 in 2000 would be worked out using the mortality rate for age 65 in 2000, for age 66 in 2001 for age 67 in 2002 and so on. Therefore, cohort figures are regarded as a more appropriate measure of how long a person of a given age would be expected to live on average than period life expectancy.

The cohort life expectancy answers the question 'For a group of people aged x in a given year, how long would we expect them to live, on average, if they experienced the actual or projected future age-specific mortality rates not from the given year but from the series of future years they survive?'

Other information

Output quality trade-offs

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

[Interim life tables](#)¹ are not fully graduated life tables. Three-year rolling averages are used to smooth fluctuations due to exceptional events, for example a flu epidemic. They are known as interim life tables since fully graduated life tables have also been prepared every 10 years ([decennial life tables](#)²), based on data around a census year.

Birth and death registration data necessary for the calculation of mortality rates (the major component of a life table) are from high quality administrative sources based on a statutory obligation to register these events. The ONS official mid-year population estimates are used as the denominator in the calculation of mortality rates and these estimates are the best estimates of the UK population available.

Existing sources of data are used, namely: birth and death registrations, mid-year population estimates and estimates of the very elderly, so there is no additional cost or burden in the collection of statistics. These data are the best possible sources for the calculation of life tables.

Assessment of user needs and perceptions

(The processes for finding out about uses and users, and their views on the statistical products.)

Users and their needs are identified when they contact ONS about life tables. A specific email address is available for life table related enquiries. These are noted and recorded along with any telephone enquiries. The life table is a long established output with a relatively specialised user base.

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.)

The [national life tables](#)⁶ are published on the ONS web site and are freely available to all. User guides, quality reports about input data and methodology papers are all accessible on the ONS web site. The life tables are excel spreadsheets available to download and all other reports are in HTML and PDF formats.

ONS's recommended format for accessible content is a combination of HTML webpages for narrative, charts and graphs, with data being provided in usable formats such as CSV and Excel. The ONS website also offers 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 refer to the contact details at the beginning of this document.

For information regarding conditions of access to data, please refer to the links below:

- [Terms and conditions \(for data on the website\)](#)²⁰;
- [Copyright and reuse of published data](#)²¹;
- [Pre-release access \(including conditions of access\)](#)²²; and
- [Accessibility](#)²³.

In addition to this Quality and Methodology Information, Basic Quality Information relevant to each release is available in the background notes of the relevant Statistical Bulletin.

Useful links

[Population Estimates](#)²⁴.

[Estimates of the very old](#)²⁵.

[Guide to calculating estimates of the very old](#)²⁶.

[Live Births and Stillbirths](#)²⁷.

[Death Registrations](#)²⁸.

[Health expectancies at birth and at age 65 in the UK](#)²⁹.

[Trends in life expectancy by NS-SEC, 1982-2006](#)³⁰.

References

1	National Interim Life Tables	http://www.ons.gov.uk/ons/publications/all-releases.html?definition=tcm%3A77-23535
2	Decennial Life Tables	http://www.ons.gov.uk/ons/taxonomy/index.html?nsc1=Decennial+Life+Tables
3	Period and Cohort Life Expectancy Tables	http://www.ons.gov.uk/ons/publications/all-releases.html?definition=tcm%3A77-23536
4	National Population Projections	http://ons.gov.uk/ons/publications/all-releases.html?definition=tcm%3A77-21600
5	Guidelines for Measuring Statistical Quality	http://www.ons.gov.uk/ons/guide-method/method-quality/quality/guidelines-for-measuring-statistical-quality/index.html
6	Life Tables	http://www.ons.gov.uk/ons/taxonomy/index.html?nsc1=Life+Expectancies
7	UK National Statistics Publication Hub	http://www.statistics.gov.uk/hub/index.html
8	National Statistics Publication Hub Release Calendar	http://www.statistics.gov.uk/hub/release-calendar/index.html
9	Code of Practice for Official Statistics	http://www.statisticsauthority.gov.uk/assessment/code-of-practice/index.html
10	Demographic Methods	Hinde A, 1998. Demographic Methods, London, Hodder Arnold
11	A Guide to Calculating Interim Life Tables	http://www.ons.gov.uk/ons/guide-method/method-quality/specific/population-and-migration/demography/index.html
12	4. Mortality Assumptions: 2010-based National Population Projections	http://www.ons.gov.uk/ons/rel/npp/national-population-projections/2010-based-projections/rep-2010-based-npp-mortality-assumptions.html
13	Quality and Methodology Information Reports for the Population theme	http://www.ons.gov.uk/ons/guide-method/method-quality/quality/quality-information/population/index.html
14	Life Expectancy at Birth and at Age 65 by Local Areas in England and Wales	http://www.ons.gov.uk/ons/rel/subnational-health4/life-expectancy-at-birth-and-at-age-65-by-local-areas-in-england-and-wales/index.html
15	Interim Life Tables, England and Wales, 2009-2011	http://www.ons.gov.uk/ons/rel/lifetables/interim-life-tables/2009-2011/stb-2009-2011.html#tab-Methods
16	Population Statistics Revisions Policy	http://www.ons.gov.uk/ons/guide-method/revisions/revisions-policies-by-theme/population/index.html
17	NSQR, Series No. 8, National Population Projections: Review of Methodology for Projecting Mortality	http://www.ons.gov.uk/ons/guide-method/method-quality/quality/nsqr/full-list-of-completed-quality-reviews/index.html
18	1. Background and Methodology, 2010-Based National Population Projections	http://ons.gov.uk/ons/rel/npp/national-population-projections/2010-based-projections/rep-2010-based-npp.html#tab-Appendix-A--Note-of-the-meeting-of-the-national-population-projections-expert-advisory-group
19	Methods and Models in Demography	Newell C. 1988. Methods and Models in Demography, Chichester, Wiley
20	Terms and conditions (for data on the website)	http://www.ons.gov.uk/ons/site-information/information/terms-and-conditions/index.html
21	Copyright and reuse of published data	http://www.ons.gov.uk/ons/site-information/information/creative-commons-license/index.html

22	Pre-release access (including conditions of access)	http://www.ons.gov.uk/ons/guide-method/the-national-statistics-standard/code-of-practice/pre-release-access/index.html
23	Accessibility	http://www.ons.gov.uk/ons/site-information/information/accessibility/index.html
24	Population Estimates	http://www.ons.gov.uk/ons/taxonomy/index.html?nsc1=Population+Estimates
25	Estimates of the very old	http://www.ons.gov.uk/ons/rel/mortality-ageing/estimates-of-the-very-old--including-centenarians-/index.html
26	Guide to calculating estimates of the very old	http://www.ons.gov.uk/ons/guide-method/method-quality/specific/population-and-migration/pop-ests/calculating-estimates-of-the-very-elderly/index.html
27	Live births and stillbirths	http://www.ons.gov.uk/ons/taxonomy/index.html?nsc1=Live+Births+and+Stillbirths
28	Death Registrations	http://www.ons.gov.uk/ons/rel/vsob1/mortality-statistics--deaths-registered-in-england-and-wales--series-dr-/index.html
29	Health expectancies at birth and at age 65 in the UK	http://www.ons.gov.uk/ons/publications/all-releases.html?definition=tcm%3A77-28154
30	Trends in life expectancy by NS-SEC, 1982-2006	http://www.ons.gov.uk/ons/publications/re-reference-tables.html?edition=tcm%3A77-247704