

National life tables QMI

Quality and methodology information for the national life tables.

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1 . Methodology background

National Statistic	
Survey name	National life tables QMI
Frequency	Annually and biennially
How compiled	Based on third party data
Geographic coverage	UK
Last revised	25 September 2018

2 . About this Quality and Methodology Information report

This quality and methodology report contains information on the quality characteristics of the data (including the five European Statistical System dimensions of quality) as well as the methods used to create it.

The information in this document will help you to:

- understand the strengths and limitations of the data
- learn about existing uses and users of the data
- reduce the risk of misusing data
- decide suitable uses for the data
- understand the methods used to create the data

3 . Quality summary

Important points about the national life tables data

- National life tables (previously called interim life tables) have been produced annually for the UK and its constituent countries since 1980 to 1982.
- The latest release contains life tables for 2015 to 2017.
- In 2011, the national life tables were [assessed by the UK Statistics Authority](#) and given National Statistics status.
- 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.
- Responsibility for the production of national life tables was transferred to Office for National Statistics in 2006 from the Government Actuary's Department (GAD).

Overview of the national life tables data

[National life tables](#) are a convenient way of analysing age-specific death rates and a standard demographic tool used to portray expectation of life at various ages. We construct life tables separately for males and females because of their different mortality patterns. We routinely publish two types of national life expectancy, the national 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 estimates the remaining number of years a person, on average, can expect to live given their age.

National life tables are published annually and are based on population estimates and births and deaths for a period of three consecutive years. The three-year rolling averages are used to smooth fluctuations due to exceptional events, for example, a “flu” epidemic.

Period and cohort life expectancy tables are produced biennially based on the assumptions for future mortality from the [national population projections \(NPP\)](#). 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. The historic life expectancies are based on unsmoothed calendar year mortality rates and the projected mortality rates come from the mortality assumptions underlying the national population projections.

Uses and users of the national life tables data

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. We use national life tables in the methodologies used to calculate disability-free life expectancy and healthy life expectancy. They are also used to inform the assumptions of future mortality for the national population projections.

Organisations that use life tables include the following:

Other government departments or agencies:

- Government Actuary's Department
- Department for Work and Pensions
- Department of Health and Social Care and Health Authorities
- National Records of Scotland, Northern Ireland Statistics and Research Agency and Welsh Government
- Office for Budget Responsibility
- HM Treasury

Non-government organisations:

- financial advisors and consultants
- insurance companies and actuarial professionals
- universities – academics and students
- media
- the general public

Strengths and limitations of the national life tables data

Strengths

- National life tables, period and cohort life tables and decennial life tables use internationally recognised methodology.
- Life tables are produced for the UK and UK countries (decennial life tables are produced for England and Wales) therefore the figures for each country are comparable.
- National life tables are based on data for a period of three consecutive years. The three-year rolling averages are used to smooth fluctuations due to exceptional events, for example, a “flu” epidemic.
- Period life tables assume that the age-specific mortality rates at the reference year(s) will prevail into the future and provide a useful benchmark for life expectancies without the need to make assumptions about future changes in mortality; they therefore provide an objective means of comparison of the trends in mortality over time and with other countries.
- Cohort life expectancies allow for projected future changes in mortality, so although these are based to some extent on assumptions, they are widely regarded as a more realistic projection of future life expectancies.
- National life tables, period and cohort life tables and decennial life tables are “complete” life tables because single-year age groups are used throughout; this is preferable to an “abridged” life table where some data are lost in the grouping of ages.

Limitations

- Different methods are used to produce the various life table products by ONS, therefore life expectancy figures are not comparable between different outputs – for example, national totals pertaining to subnational life expectancies are not comparable with the national totals in the national life tables; the national life tables provide the official set of national life expectancies for the UK and should be used when analysing life tables at the national level (without any subnational analysis).
- While national life tables are updated annually, period and cohort life tables are updated once every two years, and decennial life tables once every 10 years.

4 . Quality characteristics of the national life tables data

Relevance

The national life tables provide the official set of national life expectancies for the UK, Great Britain, England and Wales combined and the UK countries.

The expectation of life figures shown in the national life tables are period life expectancies. 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 newborn baby would survive if they experienced the particular area's age-specific mortality rates for that time period throughout their 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.

Our period and cohort life expectancy tables, produced biennially, also contain cohort life tables. Cohort life tables are calculated using age-specific mortality rates, which allow for known or projected changes in mortality in later years. Cohort figures are therefore regarded as a more realistic measure of how long a person of a given age would be expected to live on average than period life expectancy.

The published estimates meet the known user needs outlined in Section 3. Additional users and their needs are identified when they contact us about life tables. Any population statistics-related enquiries can be sent via email to pop.info@ons.gov.uk. Enquiries related to life tables are noted and recorded along with any telephone enquiries. The life table is a long-established output with a relatively specialised user base.

Accuracy and reliability

We use well-established and internationally recognised methods to calculate national life tables. They are “complete” life tables because single-year age groups from 0 to 100, where the life table is closed, are used throughout. 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 subnational 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. [Subnational life expectancy data](#) and the associated [quality report](#) are available.

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, we have checked that this would not imply any revision of practical significance to users. There have been revisions to the life tables between 2000 to 2002 and 2010 to 2012 following the rebasing of the mid-year population estimates to the 2011 Census results. Any revisions observe the [Population Statistics Revisions Policy](#). Revisions to input data are noted on the Contents page of each life table dataset.

Broader quality assurance of the period and cohort life expectancy figures is provided by expert discussion of mortality assumptions (which also feed into the national population projections). The expert advisory group was set up following a recommendation of the National Statistics Quality Review in [Series No. 8 – National Population Projections: Review of Methodology for Projecting Mortality](#), specifically for this purpose. The [minutes of meetings and responses to the expert questionnaire](#) are also available.

Output quality

Birth and death registration data necessary for the calculation of mortality rates are from high-quality administrative sources based on a statutory obligation to register these events. Our 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. Quality reports for data used in the calculation of life tables are available for [births](#), [deaths](#), [mid-year population estimates](#), [population estimates of the very old](#) and [population projections](#). These data are the best possible sources for the calculation of life tables.

National life tables 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 (and were previously published under this name) since fully graduated life tables have also been prepared every 10 years ([decennial life tables](#)) for England and Wales, based on data around a census year.

Coherence and comparability

Like national life tables, [subnational life expectancy figures](#) 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 subnational 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 plus or minus 0.1 years).

We use internationally recognised methodology in the construction of life tables. We calculate the life tables for the UK and each of the constituent countries, so each set (national life tables, decennial life tables and the period and cohort life expectancy tables) are comparable across and within the UK.

Concepts and definitions

The life table describes the course of mortality throughout the life cycle and is purely a hypothetical calculation. The components of a life table are described in Section 5.

Life expectancy

Life expectancy is the average number of years a person has before death. Life expectancies can be calculated for any age and give 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 their life.

Cohort life expectancy

Cohort life expectancy makes allowances for mortality improvements. Cohort life expectancies 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 realistic measure of how long a person of a given age would be expected to live on average than period life expectancy.

A more detailed explanation of period and cohort life expectancy can be found in [period and cohort life expectancy explained](#).

We also publish data on [healthy life expectancy \(HLE\)](#) and [disability-free life expectancy \(DFLE\)](#) although these are beyond the scope of this document.

Geography

National life tables are produced by Office for National Statistics (ONS) for the UK, Great Britain, England and Wales combined and Scotland, Northern Ireland and England and Wales separately.

[Life expectancy statistics for regions, counties and local areas in the UK](#) are also published annually by ONS.

Accessibility and clarity

The national life tables are published on our website and are freely available to all. The accompanying statistical bulletin, user guides, quality reports about input data and methodology papers are all accessible on our website. The life tables are Excel spreadsheets available to download and all other reports are in HTML and PDF formats.

Our 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. Our website also offers users the option to download the narrative in PDF format.

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

- [terms and conditions \(for data on the website\)](#)
- [copyright and reuse of published data](#)
- [accessibility](#)

In addition to this Quality and Methodology Information, basic methodology information relevant to each release is available in the Quality and methodology section of the relevant statistical bulletin.

Timeliness and punctuality

The national life tables provide users 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 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 sources 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 around the autumn.

For more details on related releases, the [GOV.UK release calendar](#) is available online.

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 GOV.UK release calendar, 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 Statistics](#).

5 . Methods used to produce the national life tables data

Main data sources

The life tables use data for a period of three consecutive years. They are based on 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). Information on the quality of these data sources can be found under Output quality in Section 4.

Period and cohort life tables for future years use projected mortality rates. Information on the assumption-setting process for future mortality is outlined in the [mortality assumptions chapter](#) of the national population projections compendium.

How we analyse the data

The method of constructing a life table is widely available in demographic text books, for example, Hinde A, Demographic Methods. [A guide to calculating national life tables](#) is also available.

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 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. A cohort life table provides mortality rates that vary over time for each age. 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.

Life tables are usually constructed separately for males and females because of their different mortality patterns. A life table contains the following components.

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 [decennial life tables](#) are fully graduated (smoothed) and are published with release-specific documentation on methods and results, all this information is available on our website.

6 . Other information

Useful links

[Death registrations](#)

[Population estimates](#)

[Population estimates of the very old](#)

[Health state life expectancies at birth and at age 65 years in the UK](#)