

National life tables QMI

Quality and methodology information for the national life tables.

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1 . Output information

- National Statistic: Yes
- Survey name: National Life Tables
- Frequency: Annually and biennially
- How compiled: Based on third-party data
- Geographic coverage: UK
- Last revised: 11 January 2024

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 outlined in the [ESS handbook for quality reports \(PDF, 3.0MB\)](#), as well as the methods used to create it.

The information in this report 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 . Important points

- National life tables (previously called interim life tables) have been produced annually for the UK and its constituent countries since 1980 to 1982.
- In 2011, the national life tables were [assessed by the UK Statistics Authority, as shown in their Assessment Report \(PDF, 164KB\)](#) 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.

4 . Quality summary

Overview

Our [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 our [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 related to periodic events, for example, a "flu" epidemic.

In addition to the national life tables we have also published [Single year life tables](#). Single year life tables give a more granular perspective on whether mortality patterns are improving, worsening or staying the same as three-year average life tables. However, unlike three-year life tables, single year life tables are not National Statistics. They are considered less robust as they are more prone to annual fluctuations in deaths caused by seasonal events.

Period and cohort life expectancy tables are produced biennially based on the assumptions for future mortality from our [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.

Every 10 years, the Office for National Statistics (ONS) publishes decennial life tables for England and Wales. They provide period life expectancy for males and females by single year of age for the three-year period centred on a census. The series began in 1841 and the most recent is our [English Life Table \(no. 17\)](#), which is produced using data from the three-year period 2010, 2011 and 2012.

Responsibility for the production of national life tables was transferred to the ONS in 2006 from the Government Actuary's Department (GAD).

Uses and users

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 we use 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

Other government departments or agencies that use life tables include the following:

- 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 using the same methodology, therefore the figures are coherent across the UK countries.
- Estimates for England, Wales and Northern Ireland from 2010 to 2012 onwards have been revised to reflect rebased population estimates using 2021 Census data and are comparable with each other; estimates for Scotland are provisional and not currently comparable with the rest of the UK and will be revised in 2024 when rebased population estimates from Scotland's 2022 census are available.
- National life tables are based on data for a period of three consecutive years; the three-year rolling averages are used to smooth fluctuations related to periodic 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

- National life tables are period life tables and, as such, assume that current age-specific mortality rates will prevail into the future.
- Cohort life tables are better adapted for determining future life expectancy, especially for younger people, as they allow for mortality to improve into the future.
- During a period of unusual mortality patterns, such as the Coronavirus (COVID-19) pandemic, the assumption that current age-specific mortality rates will prevail into the future may not hold and therefore users should bear this in mind when interpreting the national life tables.
- Different methods are used to produce the various life table products by the 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 after the publication of the National population projections (usually once every two years,) and decennial life tables are updated after the Census, that is once every 10 years.

5 . 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 new-born 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.

The 2018 to 2020 national life tables were the first life tables to include the higher mortality observed in 2020 due to the coronavirus (COVID-19) pandemic. We have also published life tables for 2019 to 2021 and 2020 to 2022. For all of these life tables, the assumption that current age-specific mortality rates will prevail into the future may not hold and therefore users should bear this in mind when interpreting the national life tables.

Our period and cohort life expectancy tables, usually 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 4: Quality summary](#). The life table is a long-established output with a relatively specialised user base. 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.

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 years, 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 owing to small numbers of deaths by single year of age, particularly among younger age groups and in smaller areas. The subnational life expectancy data, as presented in our [Life expectancy for local areas of the UK: between 2001 to 2003 and 2018 to 2020 bulletin](#), and our accompanying [Health state life expectancies, UK QMI 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.

The 2020 to 2022 publication includes rebased population estimates for mid-2012 to mid-2020 for England, Wales and Northern Ireland following the 2021 Census. These rebased population estimates have been used to revise all relevant life tables up to the 2020 to 2022 life table. The 2020 to 2022 life table for Scotland is provisional and is based on projected population for Scotland from the 2020-based interim national population projections; all life tables for Scotland between 2010 to 2012 and 2020 to 2022 will be revised once rebased population estimates following the 2022 Census are available.

Where there has been a revision in the input data, it is highlighted on the Contents page of each life table dataset, and we would highlight any revisions of practical importance to users. Revisions observe our [Revisions policy for population and international migration statistics](#).

The [methods we use to produce our estimates of the very old \(EVOs\), including centenarians](#) are revised with each new year of estimates to improve their accuracy. We have been updating the life tables with the revised back series of EVOs since the release of the 2015 to 2017 life tables in September 2018, and will do so for all future publications. For the 2020 to 2022 life tables, the revisions to the EVOs also include the impact of rebased mid-year population estimates for the age group 90 years and over, for mid-2012 to mid-2020. More quality and methodology information on strengths, limitations, appropriate uses, and how the data were created is available in our [Population estimates of the very old, including centenarians, QMI](#).

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 Number 8 – National Population Projections: Review of Methodology for Projecting Mortality](#), specifically for this purpose. The minutes of the National Population Projections (NPP) expert advisory panel meetings are available on request by contacting pop.info@ons.gov.uk.

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. Owing to delays in birth registrations during the coronavirus (COVID-19) pandemic, birth notifications, rather than birth occurrences, data were used for England and Wales for 2020 to produce the 2018 to 2020 national life tables when they were first published in September 2021. Birth occurrences data were used for Scotland and Northern Ireland for 2020 and earlier years, and for England and Wales for the years prior to 2020. Births data are used to create the denominators for mortality at age 0 in the life tables and the use of notifications rather than occurrences does not affect the quality of the life table as a whole.

For the 2020 to 2022 release, published in January 2024, birth occurrences data have been used for all four nations of the UK for all years, and the previously published 2018 to 2020 life tables have been revised to include birth occurrences for 2020 (rather than birth notifications).

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. The numerator is annual death registrations. The use of mid-year estimates does not pose a problem if we assume that deaths vary across the year in a recognisable pattern, for example with a peak (of varying degrees) in the winter months and a trough over the summer months.

However, the peaks and troughs in mortality were different in 2020 and 2021 during the Coronavirus (COVID-19) pandemic. When we produced the 2018 to 2020 national life tables in September 2021, we did consider whether the mid-year population estimates were still the most appropriate denominator to use given the scale and timing of mortality observed during 2020. However, we decided to continue to use the mid-year population estimates for this life table, and for subsequent life tables, because:

- excess mortality in 2020 and 2021 occurred either side of the midpoint (30 June)
- it is important to maintain methodological consistency within the life table, with previous life tables and with other producers of life tables
- mid-year population estimates have been chosen as the most appropriate denominator for other related statistics, for example annual births and deaths publications, which also use calendar year births and deaths, to calculate fertility and mortality rates, respectively

Quality and methodology information for data used in the calculation of life tables are available in:

- our [Births QMI](#)
- our [Mortality statistics in England and Wales QMI](#)
- our [Mid-year population estimates QMI](#)
- our [Estimates of the very old, including centenarians, QMI](#)
- our [National population projections QMI](#)

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 related to periodic 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 (our [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).

More information on the different Office for National Statistics (ONS) life expectancy statistics and their different uses can be found in our article, [Life expectancy releases and their different uses](#).

We use an 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 generally comparable across and within the UK. However, users should bear in mind that while the 2020 to 2022 life tables for England, Wales and Northern Ireland use rebased population estimates for mid-2012 to mid-2020, following Census 2021, the 2020 to 2022 life table for Scotland is provisional and makes use of projected population estimates for mid-2022. The Scottish life tables from 2010 to 2012 onwards will be revised once rebased population estimates following the 2022 Census are available.

The UK life table for 2020 to 2022, and previous UK life tables back to 2010 to 2012, will also need to be revised once rebased population estimates for Scotland for mid-2012 onwards become available. The impact of these revisions on the UK life table are likely to be small.

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 6: Methods used to produce the national life tables data](#).

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 years in 2022 would be calculated using the mortality rate for age 65 years in 2022, for age 66 years in 2023, for age 67 years in 2024 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 our [Period and cohort life expectancy explained methodology](#).

We also publish data on healthy life expectancy (HLE) and disability-free life expectancy (DFLE), as explained in our [Health state life expectancies, UK QMI](#), although these are beyond the scope of this document.

Geography

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

We also publish life expectancy statistics for regions, counties and local areas in the UK annually, as in our [Life expectancy for local areas of the UK: between 2001 to 2003 and 2018 to 2020 bulletin](#).

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 see:

- our [terms and conditions webpage](#)
- our [copyright and reuse of published data information](#)
- our [accessibility statement](#)

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.

Our [guide to calculating national life tables](#) contains further explanation of the methodology used to create the national life tables.

Timeliness and punctuality

The national life tables provide users with life tables in the period between censuses, 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.

The 2019 to 2021 life table and the 2020 to 2022 life table are being published approximately two years and one year after the end of their respective reference periods. This is because of delays to the publication of rebased population estimates for mid-2012 to mid-2020 after the 2021 Census of England and Wales.

We expect the life tables to return to the normal timeliness of approximately nine months after the end of the reference period for future life tables.

The publication of the life tables would only be later than the planned date if essential data used to calculate the tables were delayed or not available, or if substantial problems were encountered with the processing systems used to calculate the tables.

In the 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 [UK Statistics Authority's Code of Practice for Statistics](#).

Period and cohort life expectancy tables are timed to be released a few weeks after the publication of the National Population Projections, which are usually published biennially in the autumn.

For more details on related releases, please see the [GOV.UK release calendar](#).

6 . 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 birth occurrences by month, infant death registrations by age in months and death registrations by individual age from those years (the calculation of infant mortality also requires monthly birth occurrences 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 5: Quality characteristics of the national life tables data](#).

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 our National population projections methodology](#).

The Office for National Statistics (ONS) has recently consulted users on a [prospective new method for producing mortality assumptions, as described in our article](#). Further details can be found in the [New mortality assumptions method for national population projections consultation response](#).

How we analyse the data

The method of constructing a life table is widely available in demographic text books, for example "Demographic Methods" by A Hind. Our [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), as the survivors pass through each year of age, are subject 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 people 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. 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 people.

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 years in 2022 would be calculated using the mortality rate for age 65 years in 2022, for age 66 years in 2023, for age 67 years in 2024 and so on. This uses observed mortality rates in 2022 and projected mortality rates from 2023.

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.

Our [decennial life tables](#) are fully graduated (smoothed) and are published with release-specific documentation on methods and results.

7 . Related links

[Deaths registered in England and Wales: 2022](#)

Bulletin | Released 15 December 2023

Registered deaths by age, sex, selected underlying causes of death and the leading causes of death. Contains death rates and death registrations by area of residence and single year of age.

[Life expectancy for local areas of the UK: between 2001 to 2003 and 2018 to 2020](#)

Bulletin | Released 23 September 2023

Subnational trends in the average number of years people will live beyond their current age measured by “period life expectancy”.

[Population estimates releases](#)

Webpage | Updated regularly

Annual population estimates. Figures are available for various administrative and electoral geographies and for different population sub-groups, for example, estimates of the very old and estimates by marital status.

[Estimates of the very old, including centenarians, UK](#)

Bulletin | 23 September 2021

Annual mid-year population estimates for people aged 90 years and over by sex and single year of age (90 to 104 years, and 105 years and over) and comparisons between UK countries.

[Past and projected period and cohort life tables: 2020-based, UK, 1981 to 2070](#)

Bulletin | 19 January 2023

Life expectancy (ex), probability of dying (qx) and number of persons surviving (lx) from the period and cohort life tables, using past and projected mortality data from the 2020-based interim national population projections (NPPs), for the UK and constituent countries.

[Period and cohort life expectancy explained: January 2023](#)

Methodology | 12 January 2022

A guide to the two types of life table – cohort and period – used to calculate past and projected life expectancy.

[Life Expectancy releases and their different uses](#)

Article | 29 November 2022

The different life expectancy releases and their potential uses.

8 . Cite this QMI

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