Office for National Statistics

Period and cohort life expectancy explained

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

Contact:
Julian Buxton
pop.info@ons.gov.uk
+44 1329 444661

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1 . Life expectancy

Life expectancy is a statistical measure of the average time someone is expected to live, based on the year of their birth, current age and other demographic factors including their sex. It is used to assess and set a number of important policies that impact on everyday life, for example, setting the State Pension age and targeting health policy initiatives.

To calculate life expectancy, we use a tool called a life table, which shows, for each age, what the probability is that a person will die before his or her next birthday.

There are two different types of life table: cohort and period. This article explains the concept behind these and how they should each be used and interpreted.

2 . Cohort life expectancies

A cohort life table shows the probability of a person from a given cohort dying at each age over the course of their lifetime. In this context, a cohort refers to a group of people with the same year of birth.

The cohort life table is based on age-specific probabilities of death, which are calculated using observed deaths (mortality) data from the cohort. A cohort life table uses a combination of observed mortality rates for the cohort for past years and projections about mortality rates for the cohort for future years. For example, cohort life expectancy at age 65 years in 2020 would be worked out using the mortality rate for age 65 years in 2020, for age 66 years in 2021, for age 67 years in 2022, and so on.

Importantly, the cohort life table takes into account observed and projected improvements in mortality for the cohort throughout its lifetime. Cohort figures are therefore regarded as a more appropriate measure of how long a person of a given age would be expected to live on average than the alternative measure, known as period life expectancy. This is calculated using mortality rates for a fixed period in time.

For example, period life expectancy at age 65 years in 2020 would use the mortality rates for 2020 for ages 65, 66 and 67 years, and so on. Period life expectancy would match cohort life expectancy only if there were no change in age-specific mortality rates over time. This is an extremely unlikely scenario as, in reality, these change from year to year.

3 . Uncertainty in the cohort life expectancy projections

The estimate of cohort life expectancy at birth shows us the number of years, on average, for which we would expect someone born in a given year to live. Estimates are produced separately for males and females. Some people will die before those ages and others will live to be older. These numbers are an average for the cohort and do not consider any person-specific factors such as lifestyle choices.

It is important to understand that these are projections and not forecasts. As we do not know what the future will hold, we make assumptions about how mortality rates will change in the future. Information on how mortality rates have changed in the past is used to estimate the current rate of mortality improvement by age and sex. It is then used to make assumptions about improvements (increases or decreases) in mortality in the future.

Expert judgement is applied to decide how long historical trends will continue into the future. Considering all of the available evidence, target annual mortality improvement rates by age, for males and females, are set for future years in the population projections. Improvement rates are used to produce future mortality rates by age and sex, for each year of the projection. These, in turn, are used to produce projected life expectancies. The detailed methodology for setting the assumptions is explained in the National population projections, mortality assumptions article.

These projected life expectancies are what would happen if the assumptions were to hold true. Although the assumptions best reflect demographic patterns at the time they are adopted, the inherent uncertainty in demographic behaviour means that they will inevitably be proved wrong to a greater or lesser extent.

We reflect this inherent uncertainty by publishing variant projections in the national population projections dataset tables, using alternative plausible assumptions. These assumptions allow for higher and lower mortality improvements in the future. They are intended to provide an indication of the uncertainty and the sensitivity of the projections.

4 . Period life expectancies

A different way of looking at life expectancies is the use of period life expectancies, rather than the cohort life expectancies that we have looked at so far. Period life expectancies use mortality rates from a single year (or group of years) and assume that those rates apply throughout the remainder of a person's life. This means that any future changes to mortality rates would not be taken into account.

Period life expectancies are a useful measure of mortality rates experienced over a given period. They can provide a baseline against which to benchmark cohort life expectancies. For past years, they provide an objective way of comparing trends in mortality over time, between areas of a country and with other countries. Official life tables in the UK and in other countries that relate to past years are generally period life tables for these reasons.

Cohort life expectancies, even for past years, usually require projected mortality rates for their calculation and so, in such cases, involve an element of subjectivity. Many other types of life expectancy that allow comparisons to be made for different population sub-groups, or to look at how long people might expect to live in good health (healthy life expectancy), are calculated on a period basis.

5 . Difference between period and cohort life expectancies

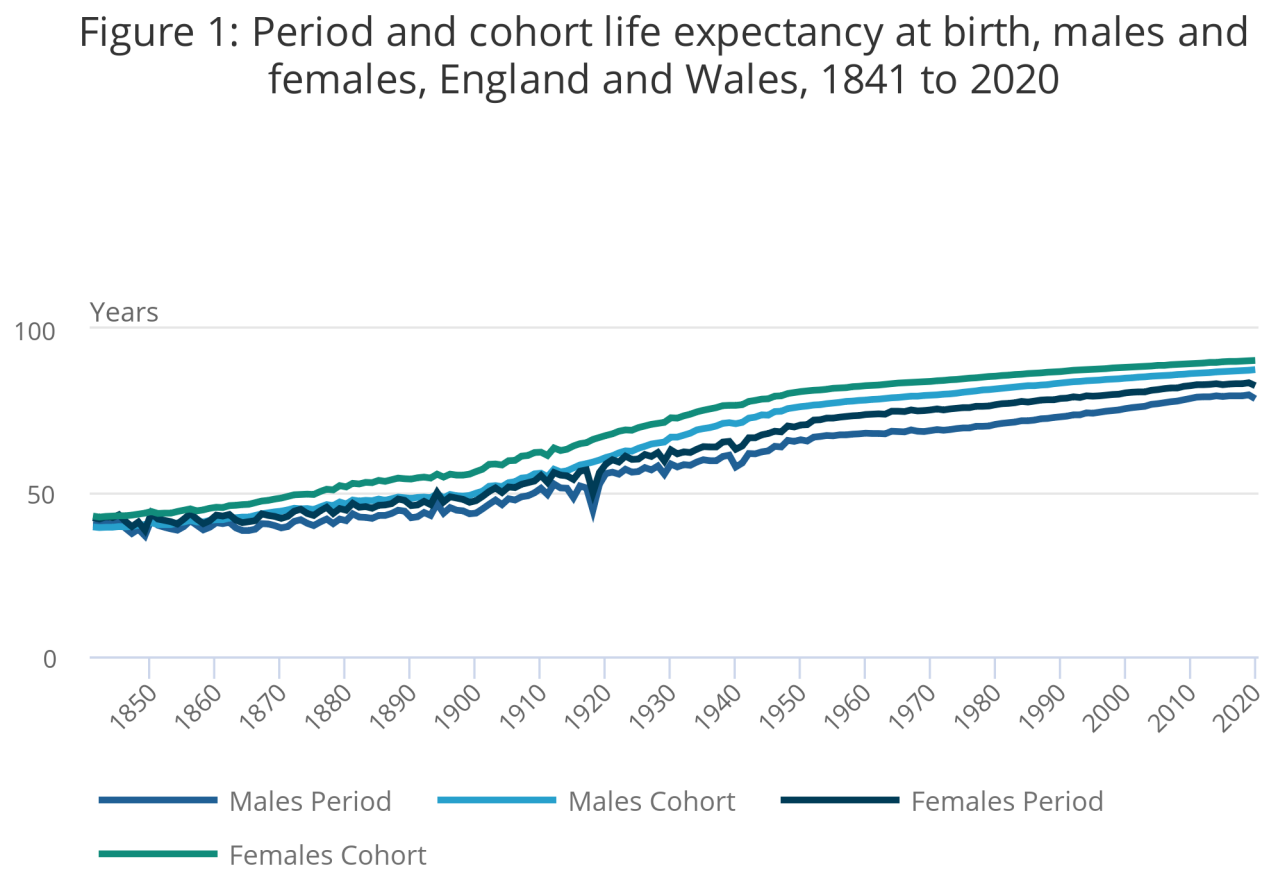
Period life expectancies tend to be lower than cohort life expectancies because they do not include any assumptions about future improvements in mortality rates.

Figure 1 shows period and cohort life expectancy at birth for males and females from 1841 to 2020 for England and Wales. The period life expectancy figures use observed historical mortality rates, while the cohort life expectancy figures use a combination of observed and projected mortality data. The earlier the year of birth, the more observed data there are for any given cohort. The only way to get a true cohort life expectancy at birth is to use fully observed mortality data across their life course, at the point when the whole cohort has died.

This analysis shows that for cohorts born between 1950 and 2000, the gap for both males and females between cohort and period life expectancy at birth has been around 8 to 10 years for England and Wales. This means that if period life expectancies had been used for cohorts born in 1950, we would have underestimated their life expectancy by this many years. This is because observed improvements in mortality rates and projected future improvements have not been taken into account.

In the 2020-based interim national population projections, future cohort life expectancy at birth is typically around seven to eight years higher than the respective period life expectancy at birth for England and Wales. Therefore, although cohort life expectancies continue to be projected to be noticeably higher than the corresponding period life expectancy, the differences between period and cohort expectancies are comparable with historical ones.

Figure 1: Period and cohort life expectancy at birth, males and females, England and Wales, 1841 to 2020



Source: Office for National Statistics – Expectation of life, 2020-based interim national population projections - principal projection, England and Wales

6 . The estimates of life expectancy we produce

We produce national life tables annually for the UK and its constituent countries, using past mortality rates; these are calculated on a period basis and are based on past mortality experience. The life tables are based on three consecutive years' worth of data to reduce the effect of annual fluctuations in the number of deaths caused by seasonal events, such as flu.

We also produce past and projected period and cohort life tables, which provide historical and projected statistics for 50 years into the future. They are produced biennially, based on assumptions for future mortality from the national population projections (NPPs).

We also publish the decennial (English) 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 and are published every 10 years.

To find out more about life expectancy, please see the related publications or email pop.info@ons.gov.uk.

7 . Related links

Expectation of life, principal projection, England and Wales
Dataset | Released biennially
Period and cohort expectation of life in England and Wales using the principal projection by single year of age 0 to 100.

Past and projected period and cohort life tables
Bulletin | Released biennially
Life expectancy (e), probability of dying (q) and number of persons surviving (l) from the period and cohort life tables, using past and projected mortality data from the national population projections (NPPs), for the UK and constituent countries.

Life expectancy releases and their different uses
Article | Released 29 November 2022
The different life expectancy releases and their potential uses.

National life tables – life expectancy in the UK
Bulletin | Released annually
Trends in period life expectancy, a measure of the average number of years people will live beyond their current age, analysed by age and sex for the UK and its constituent countries.

Guide to interpreting past and projected period and cohort life tables
Methodology | Last revised 2 December 2019
Explanation and guidance on how to use the data published in the past and projected period and cohort life tables.

8 . Cite this methodology

Office for National Statistics (ONS), released 19 January 2023, ONS website, methodology, Period and cohort life expectancy explained