Guide to interpreting past and projected period and cohort life tables

Explanation and guidance on how to use the data published in the past and projected period and cohort life tables.

Contact:
Edward Morgan
pop.info@ons.gov.uk
+44 (0)1329 444661

Release date:
2 December 2019

Next release:
To be announced

Table of contents

1 . What are past and projected period and cohort life tables?

A life table is a demographic tool used to analyse death rates and calculate life expectancies at various ages. We calculate life tables separately for males and females because of their different mortality patterns.

We publish past and projected data from period and cohort life tables biennially in December for the UK, Great Britain, England and Wales combined and the UK countries separately. They are based on the assumptions for future mortality from the national population projections (NPP). These tables give historic and projected life expectancies to the NPP base year and then 50 years into the future.

Period and cohort life tables give two different measures of life expectancy. Period life expectancy assumes mortality rates remain constant into the future, while cohort life expectancy uses projected changes in future mortality rates. A cohort refers to a group of people all born within the same specified time period; in these tables a cohort refers to a group of people with the same year of birth.

The period and cohort life tables are calculated by single year of age (known as complete life tables) from age 0 years up to age 100 years. Although people do live beyond age 100 years, life expectancies at these oldest ages are highly uncertain and so we do not routinely publish them.

We publish period and cohort measures of life expectancy (e_x), probability of dying (q_x) and numbers surviving (l_x) from the period and cohort life tables. These are produced for the principal projection as well as variant projections, which are based on alternative assumptions about future mortality.

As well as past and projected period and cohort life tables, the Office for National Statistics (ONS) also publishes different types of life table. You can read about the different types of life table and life expectancy we produce in our life expectancy explainer article.

The method for deriving e_x, q_x and l_x in the past and projected period and cohort life tables is the same as deriving these components for the national life tables, and is explained in our guide to calculating national life tables.

2 . Interpreting life expectancy (e)

Period life expectancy (e_x) is the average number of additional years a person would live if he or she experienced the age-specific mortality rates of the given area and time period for the rest of their life.

Cohort life expectancy (e_x) is the average number of additional years a person would live considering assumed future changes in mortality for their cohort over the remainder of their life.

Our period and cohort life expectancy explained article explains in more detail the difference between period and cohort life expectancy.

Finding life expectancy figures works the same in a period e_x table as it does in a cohort e_x table, but the resulting life expectancies will be different as they are calculated using different age-specific mortality data.

In both the period and cohort tables for males and females, "year" corresponds to the year of interest. For example, if you were interested in the year 2018, you would navigate to 2018 across the top of the table. "Attained age (years)" is the age of interest, for example, the 50th birthday. If you navigate down the table to age 50 years and across to the corresponding year, 2018, an e_x value is displayed. This is the average number of years someone aged exactly 50 years in the year 2018 has in remaining period or cohort life expectancy.

Period life table example

(Figures from males period e_x – Expectation of life, principal projection, UK)

A male reaching age 50 years in 2018 has a remaining period life expectancy of 31.4 years. This means that a male aged 50 years in 2018 could expect to live on average a further 31.4 years, that is, to age 81.4 years, if mortality rates remain at 2018 levels for the rest of his lifetime. This period life expectancy figure only considers future projected mortality rates for the year 2018. This means that it is based on the age-specific mortality rates for each age above age 50 years for the year 2018 only. For example, age 51 years in 2018, age 52 years in 2018 and so on.

Cohort life table example

(Figures from males cohort e_x – Expectation of life, principal projection, UK)

A male reaching age 50 years in 2018 has a remaining cohort life expectancy of 34.1 years. This means that a male aged 50 years in 2018 could expect to live on average a further 34.1 years, that is, to age 84.1 years. This cohort life expectancy figure considers future projected mortality rates by age and for each year. This means that it is based on age-specific mortality rates for every age above age 50 years for each year after 2018. For example, age 51 years in 2019, age 52 years in 2020 and so on.

Warning:

When using cohort life expectancy and projected period life expectancy, users should be aware that any calculation will include assumed future changes in mortality and that these become less reliable the further into the future from the projection's base year.

3 . Interpreting the probability of dying (q)

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

Finding a mortality rate in a period q_x table works differently to finding a mortality rate in a cohort q_x table.

In the period q_x tables for both males and females, "year" corresponds to the year of interest. For example, if you were interested in the year 2018 you would navigate to 2018 across the top of the table. "Exact age (years)" is the age of interest, for example, the 99th birthday. If you navigate down the table to age 99 years and across to the corresponding year, 2018, a q_x rate is displayed. This is the projected probability (per 100,000) of someone aged exactly 99 years in the year 2018 dying before reaching age 100 years.

In the cohort q_x tables for both males and females, "year of birth" corresponds to the year that the cohort was born, for example, the group of people that were born in 1981. "Exact age (years)" is the age of interest, for example, 99th birthday. You would navigate down the table to age 99 years and across to the year 1981. This means that you are looking at someone aged 99 years in 2080, because they were born in 1981. The q_x rate that is displayed is the projected probability (per 100,000) of someone aged 99 years who was born in 1981 dying before reaching age 100 years.

The probability of survival from exact age x years to exact age x+1 (p_x) years can be found by calculating 1 -q_x.

Period life table example

(Figures from males period q_x – mortality rates (q_x) principal projection, UK)

A male reaching age 99 years in 2018 has a projected probability of dying of 0.33 before they reach age 100 years (33,204.13 divided by 100,000 equals 0.33). This gives a male the probability of surviving (p_x) from age 99 years to age 100 years in 2018 of 0.67 (1 subtract 0.33) or 67%.

Cohort table example

(Figures from males cohort q_x – mortality rates (q_x) principal projection, UK)

A male that is born in 1981 will reach age 99 years in 2080. They have a projected probability of 0.27 of dying aged 99 years before they reach age 100 years (27,175.52 divided by 100,000 equals 0.27). This gives a male the probability of surviving (p_x) from age 99 years to age 100 years of 0.73 (1 subtract 0.27) or 73%.

Warning:

When using the cohort probabilities of dying and projected period probabilities of dying, the user should be aware that any calculation will include assumed future changes in mortality and that these become less reliable the further into the future from the projection's base year.

4 . Interpreting numbers surviving (l)

l_x is the number of people alive at exact age x years. The starting population l_0 is an arbitrary number for which we have used 100,000. The l_x figures represent a hypothetical population and not a population estimate.

The l_x is often used to calculate the chance of surviving from one age to an older age, which is usually expressed as a percentage.

The formula for calculating the probability of surviving from age x years to age x+n years is as follows:

$$(l_x + {}_n / l_x) * 100$$

Finding numbers of survivors in a period l_x table works differently to finding numbers of survivors in a cohort l_x table.

In the period l_x tables for both males and females, "year" corresponds to the year of interest. For example, if you were interested in the year 2018, you would navigate to 2018 across the top of the table. "Exact age (years)" is the age of interest, for example, the 31st birthday. If you navigate down the table to age 31 years and across to the corresponding year, 2018, an l_x value is displayed. This is the number surviving at exact age 31 years in the year 2018, under the projected assumptions for mortality rates in 2018 for ages up to age 31 years.

In the cohort l_x tables for both males and females, "year" corresponds to the year of birth of a given cohort. For example, if you were interested in the year 2018 for males and navigated to age 50 years, this figure is a projection, out of a population of 100,000, of the number of male babies born in 2018 that will survive to their 50th birthday in 2068.

Period life table example

What is the probability of a female aged 30 years in 2018 surviving to age 100 years?

(Figures from females period l_x – numbers surviving (l_x) principal projection, UK)

The following equation is used to calculate the probability of a female aged 30 years in 2018 surviving to age 100 years:

$(l_{100} / l_{30}) * 100$

Numbers taken from "Females period l_x" table; year 2018, exact ages 100 years and 30 years are:

(2,661/99,181) * 100 = 2.7%

A female aged 30 years in 2018 therefore has a 2.7% chance of surviving to age 100 years.

Cohort life table example

What is the probability of a female aged 30 years in 2018 surviving to age 100 years?

(Figures from females cohort l_x – numbers surviving (l_x) principal projection, UK)

The following equation is used to calculate the probability of a female aged 30 years in 2018 surviving to age 100 years:

$(l_{100} / l_{30}) * 100$

A female aged 30 years in 2018 would have been born in 1988 and would reach age 100 years in 2088. Numbers taken from Females cohort l_x table; year of birth 1988, exact ages 100 years and 30 years are:

(10,325 / 98,622) * 100 = 10.5%

A female born in 1986 and having survived to age 30 years therefore has a 10.5% chance of surviving to age 100 years.

Warning:

When using the cohort numbers surviving and projected period numbers surviving, the user should be aware that any calculation will include assumed future changes in mortality and that these become less reliable the further into the future from the projection's base year.