Mortality Insights

Modelling future life expectancy

Welcome to Mortality Insights. In this edition we explore why it is important to consider how life expectancy might change in the future and examine 2 models which project these future changes.

When estimating how long someone might expect to live, there are 2 aspects to consider:

1. What is the current expected probability of death at each age (also known as the mortality rate)? How these rates might be set was covered in the July edition of Mortality Insights.

2. How these rates might change in the future (commonly referred to as the future mortality improvement assumption). This assumption is the focus of this edition.

As discussed in the first edition of Mortality Insights life expectancy increased significantly in England and Wales over the 20th century and in the first part of this century. However, it's been stalling since 2012. The choice of future mortality improvement assumption is therefore an important component when estimating future life expectancy.

In this edition we look at 2 sources of mortality improvement assumptions: The Office for National Statistics (ONS) population projections, and the Actuarial Profession's Continuous Mortality Investigation (CMI) model.

ONS 2018-based future mortality improvements

Typically, every 2 years the ONS publishes population projections which provide an indication of how the population size and age structure of the UK and its constituent countries may develop in the future.

These projections are based on assumptions of future fertility, mortality and migration. These are projections, not forecasts – ONS does not attempt to predict the impact that factors, such as political and economic changes, might have on demographic behaviour.

The ONS published its 2018-based population projections on 21 October 2019. Under these projections, life expectancy is still assumed to increase in the future, but less quickly than the 2016-based projections. This is mainly due to the continuation, over the last 2 years, of the slower growth in life expectancy experienced since 2012.

Figure 1 on the next page shows how projected future life expectancies from the ONS population projections have been reducing since 2012 reflecting the continuation of the stalling increases in observed life expectancy. The solid line reflects actual historical data in the UK, while the dotted lines are the various ONS projections into the future.

Mortality Insights

Figure 1: Male period life expectancy at birth, 2010 to 2018 ONS UK projections
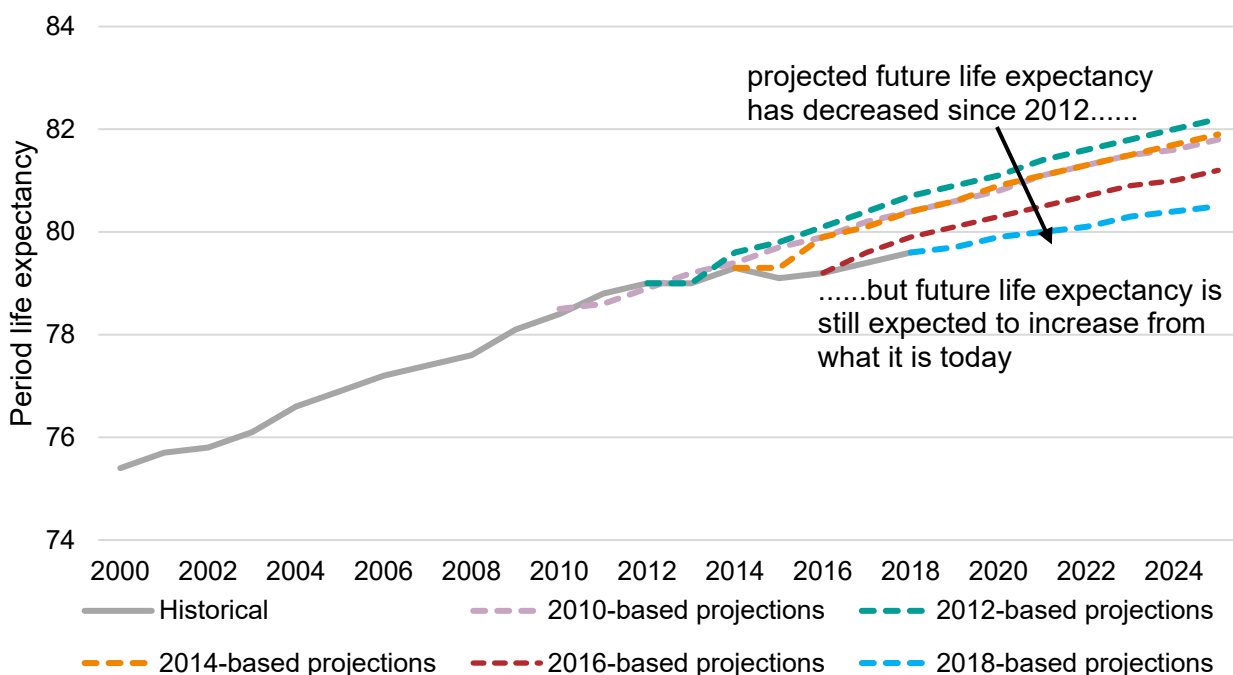
Source: GAD chart of ONS data

Three implications that could be drawn from this chart are:

1. It is important to include an assumption on future improvements to life expectancy. For example, if you had performed a calculation in 2000 without such an assumption, then a boy in the UK would be assumed to live on average from birth until 75½ years old in all future years. This is significantly lower than the corresponding figure in later years.

2. This assumption should be revisited frequently in the light of recent UK population data. Although it's always worth bearing in mind that the group of lives under consideration will not necessarily reflect the same improvement over time as the general population.

3. Any assumption adopted is highly uncertain. For instance, each of the dotted lines above (the projections) appear sensible, based on the historical data up to that point in time. Ultimately however, they now appear to be too high based on data up to 2018.

> **Period life expectancy** is a theoretical measure of expected lifespan calculated using the observed death rates at all ages for a particular year or years.

ONS methodology: The ONS 2018-based future mortality improvements are broadly constructed by considering the changes in death rates observed in the UK population up to 2017, and then projecting them into the future so they converge to a long-term rate of improvement of 1.2% a year after 25 years, for most ages.

The long-term improvement rate is based on an analysis of past trends and input from a panel of experts who consider likely future trends. The current assumption of 1.2% a year is broadly in line with the average improvement rate experienced in the past 100 years or so. This long-term rate remains unchanged from previous projections.

> An **improvement rate** of 1.2% means that the assessed probability of dying at a certain age in a given calendar year is 1.2% lower than it was at the same age in the preceding calendar year.
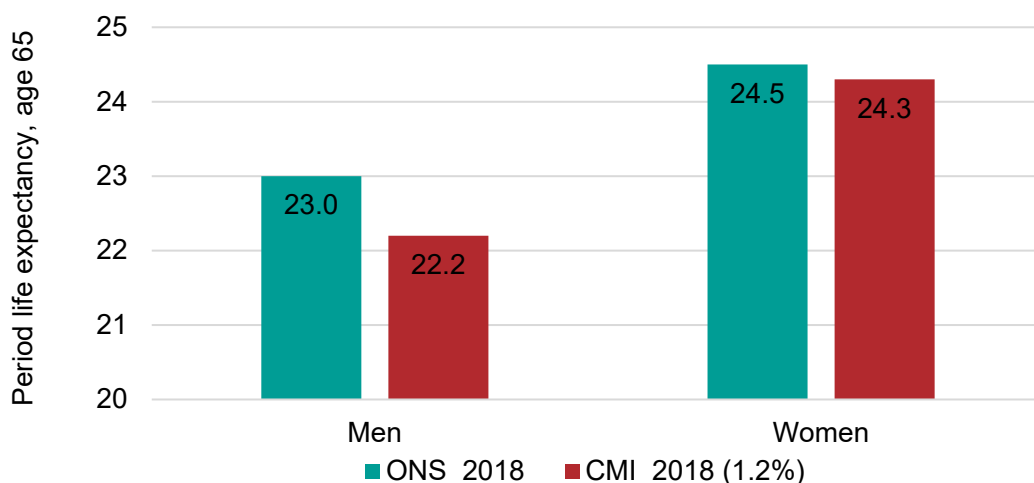
Mortality Insights

CMI model

In the private sector the CMI model published by the Actuarial Profession is widely used to produce future mortality improvements. An updated CMI model is released every year.

CMI methodology: Similar to the ONS population projections, the CMI model uses historic population data to estimate historical mortality improvements by age and sex, and then projects these forward to converge to a long-term rate. However, the long-term rate (as well as other features) is set by the user in the CMI model.

As shown in figure 2 below, if you use the same long-term improvement rate of 1.2% in the core 2018 CMI model, then the resulting life expectancies are lower compared to those using ONS future improvement rates. This is especially so for men. This is due to a difference in the pattern of projected improvement rates and other construction differences between the two models.

Figure 2: Period life expectancies in 2045 – comparison between ONS and CMI*

*based on industry standard initial mortality rates (which start at later ages, hence the comparison at age 65 instead of from birth)

Final thoughts

It's very difficult to predict with any certainty what will happen to mortality in the future, however the ONS and CMI provide projections that can be used to inform actuarial assumptions. Both the ONS 2018-based population projections and 2018 CMI model project lower future life expectancies compared to previous iterations.

Conversely, initial data from the first 9 months of 2019 suggests that there have been fewer deaths than expected in the population. It will be interesting to see if this positive experience continues and if so, how that impacts on the next set of projections.

There is also growing evidence that the extent to which mortality changes over time varies according to socio-economic group. The ONS and CMI projections are constructed using data on the whole population, but there may be a future demand for projections which explicitly cover different socio-economic or other groups.