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Continuous Mortality Investigation

Institute and Faculty of Actuaries

Mortality Projections Committee

WORKING PAPER 111

Regular monitoring of England & Wales population mortality

April 2019

Version 1 of this working paper was originally issued in October 2018. Section 3.5 of this version describes a simpler approach to updating the calculations for new calendar years, adopted in 2019.

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Summary

Over the past few years the CMI Mortality Projections Committee has published various analyses of mortality in the general population in England & Wales, using provisional weekly deaths data published by the Office for National Statistics (ONS). We now intend to publish an "England & Wales population mortality update" along similar lines every quarter.

This paper describes the data and our proposed method and includes the provisional first analysis, dated October 2018 and based on data for the first three quarters of 2018 (specifically to 28 September 2018).

The update itself is in Section 6.

Method and consultation

The broad approach is to:

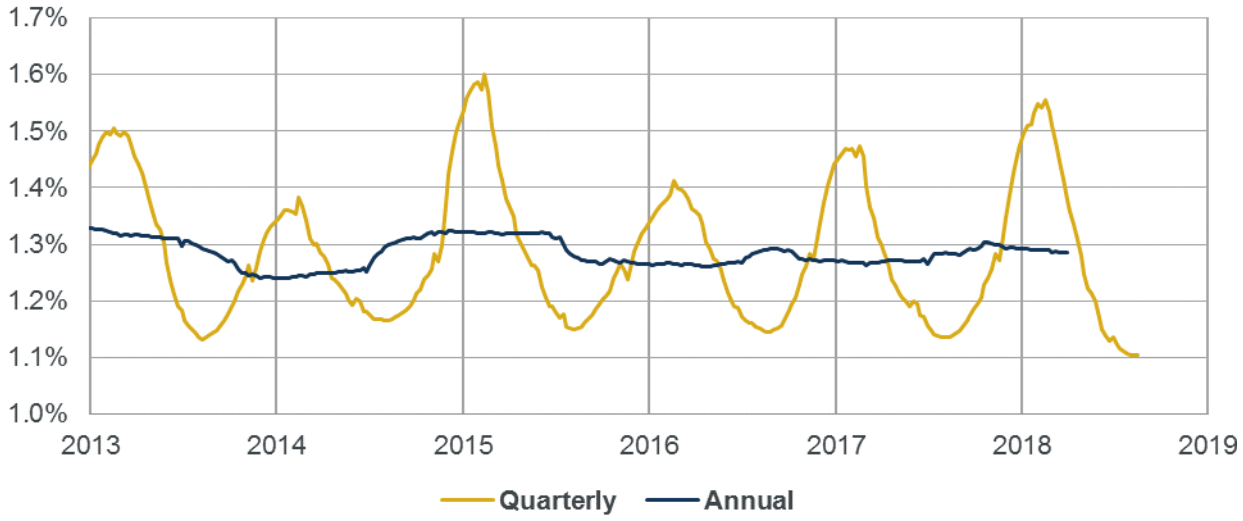
- Use provisional weekly deaths data from the ONS.
- Standardise the mortality data to allow for changes in the size and age profile of the population.
- Produce various analyses, based on standardised mortality rates (SMRs), to highlight different features of recent mortality.

We invite feedback on our proposals, and may make changes to the method and/or outputs as a result. If we do so, we intend to publish an updated version of the analysis dated October 2018, so that it uses a method consistent with future updates. For that reason, we describe this analysis as provisional.

We ask that any feedback on our proposals is sent to projections@cmilimited.co.uk by 30 November 2018, so that it can be considered in time for the next release, intended for January 2019.

Provisional October 2018 update

The chart below is from the provisional October 2018 update and shows quarterly and annual centred average SMRs for the current year and the past five years. It shows that mortality in the early part of 2018 was heavier than in most recent years, but below the peak of early 2015. Mortality in the summer of 2018 has been lighter than at any time in the dataset.



Contents

1. Introduction

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This paper describes the data and our proposed method and contains the provisional first analysis.

We invite feedback on our proposals, and may make changes to the method and/or outputs as a result. If we do so, we intend to publish an updated version of this analysis, so that it uses a method consistent with future updates. For that reason, we describe this first analysis as provisional.

1.1 Overview

The broad approach is to:

- Use provisional weekly deaths data from the ONS – described in Section 2.
- Standardise the deaths data to allow for changes in the size and age profile of the population – Section 3.
- Produce various analyses, based on standardised mortality rates (SMRs), to highlight different features of recent mortality – Section 4.

1.2 Examples

To illustrate the methods we show charts for data to 28 September 2018, the period used for the provisional first analysis. Section 5 describes how the time periods for charts in future updates will vary.

1.3 Publication schedule

We intend to publish future analyses quarterly in April (based on ONS data to week 13 of the year), July (to week 26), October (to week 39) and January (to the end of the previous year). This relies on the expected timing of the publication of ONS data.

1.4 TAS compliance

This paper is intended to describe the methods that we propose to use to analyse recent mortality, and to solicit feedback from interested parties. This paper complies with the principles in the Financial Reporting Council's Technical Actuarial Standard "TAS 100: Principles for Technical Actuarial Work". Any person using this paper should exercise judgement over its suitability and relevance for their purpose.

1.5 Feedback

We ask that any feedback on our proposals is sent to projections@cmilimited.co.uk by 30 November 2018, so that it can be considered in time for the next release, intended for January 2019.

1.6 Acknowledgements

The members of the Mortality Projections Committee involved in the production of this paper and the accompanying outputs are Tim Gordon (Chair), Steve Bale, Piero Cocevar, Cobus Daneel, Steven Rimmer, Neil Robjohns and Brian Sewell.

We are grateful to Matthew Fletcher for reviewing an earlier draft of this paper.

2. Dataset

This section describes the ONS data that we use, and some key features of it.

2.1 Data sources

The analysis uses provisional weekly deaths data for England & Wales, published by the ONS. We are reliant on the ONS for their timely publication of this data.

- The ONS has published data for weeks ending on a Friday, numbered using the ISO 8601 definition. This means that week 1 of a year ends on the Friday that falls between January 2 and January 8 inclusive.
- Data for a week ending on a Friday is typically published on the Tuesday that falls eleven days later, although this can be delayed by public holidays.

In order to have as long a time series as possible we combine data from three ONS sources:

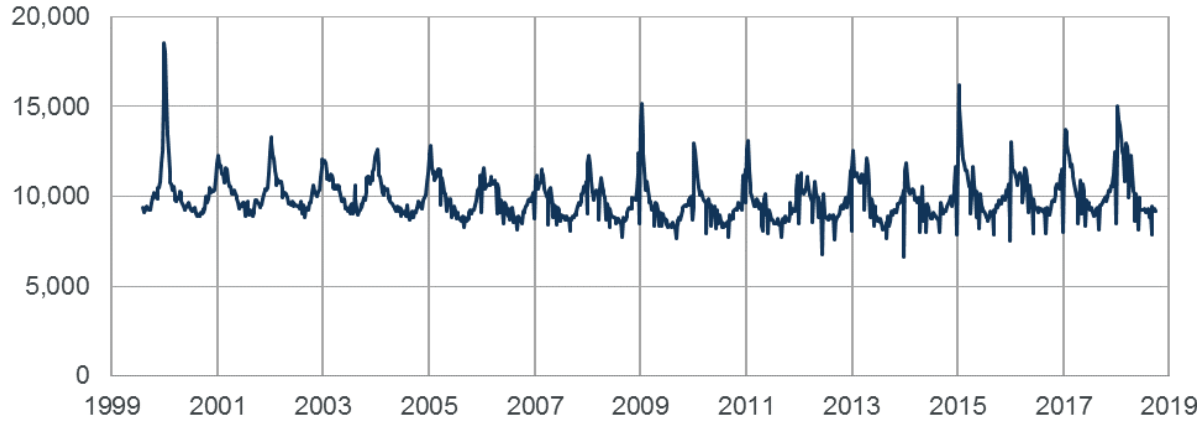
- For week 31 of 1999 to week 53 of 2004, we use a single file of total deaths on an occurrences basis[1], as registered deaths are not available for this period.
- For week 1 of 2005 to week 53 of 2009, we use a single file of total deaths on a registrations basis[2].
- From week 1 of 2010 onwards, we use annual files of deaths on a registrations basis[3]. These contain splits of deaths by gender and age band.

There is an inconsistency in the analysis due to the data being on an occurrences basis before 2005 and on a registrations basis afterwards. We could have adjusted the data to minimise the impact of this difference, but considered this to be unnecessary: the older data is only used after averaging over a period of at least thirteen weeks.

2.2 Features of ONS deaths data

Chart 2A shows the numbers of deaths in each week, without any adjustments, combining the data sources described in Section 2.1.

Chart 2A: Weekly deaths, combined data as described in Section 2.1



[1] Source: Figure 4 of http://www.ons.gov.uk/ons/rel/subnational-health2/excess-winter-mortality-in-england-and-wales/2013-14--provisional--and-2012-13--final-/stb.html
[2] Source: http://www.ons.gov.uk/ons/about-ons/business-transparency/freedom-of-information/what-can-i-request/published-ad-hoc-data/pop/may-2014/weekly-provisional-figures-on-deaths-registered-in-england-and-wales-2005-2013.xls
[3] Source: https://www.ons.gov.uk/peoplepopulationandcommunity/birthsdeathsandmarriages/deaths/datasets/weeklyprovisionalfiguresondeathsregisteredinenglandandwales

Change in population

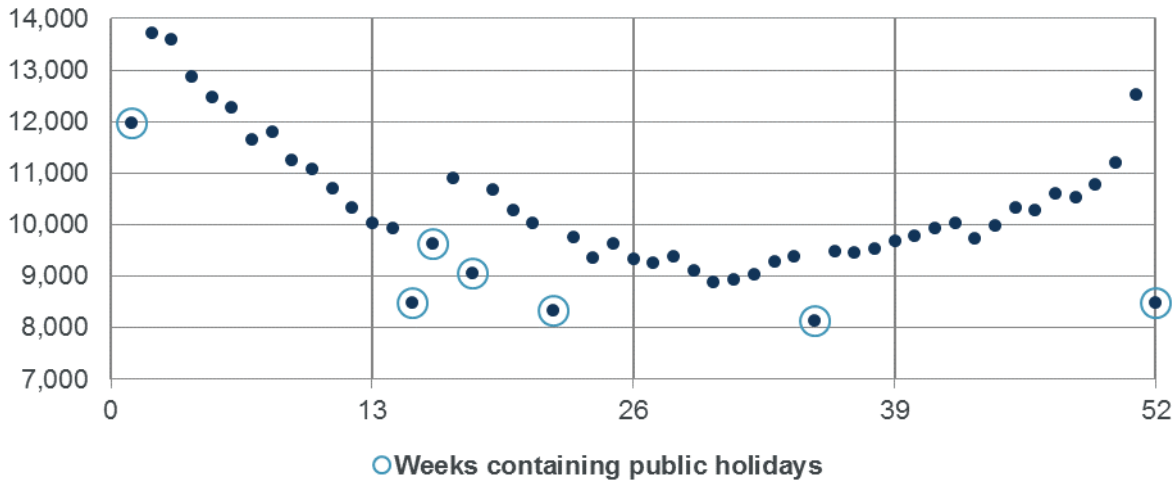
The numbers of deaths shown in Chart 2A are affected by changes in the size and average age of the population over time, as well as mortality rates. In order to focus on mortality rates we standardise our results to remove the impact of the growing and ageing population. This is described in Section 3.

Volatility

There are several sources of variation in the numbers of deaths from week to week:

- The numbers of deaths in Chart 2A show a strong seasonal pattern, with larger numbers of deaths seen around the start and end of each year.
- The registrations data shows a number of spikes. The downward spikes typically correspond to weeks containing public holidays, when Register Offices are closed so fewer deaths are registered. This is clearly seen in Chart 2B, which shows registered deaths in 2017 and highlights weeks that contain one or more public holidays. Depending on the timing of the holidays within those weeks, there can be a corresponding upward spike when Register Offices reopen.
- There will also be some idiosyncratic variation from week to week. For example, if we expect 10,000 deaths in a particular week, with deaths following a Poisson distribution, then the actual number of deaths would have a standard deviation of 100.

Chart 2B: Weekly death registrations in 2017, with public holidays highlighted



Section 4 describes how we smooth the standardised mortality rates for some charts in order to make the underlying patterns clearer. This smoothing is intended to reduce the impact of idiosyncratic variations and of public holidays.

We considered whether to adjust the data to attempt to reduce the impact of distortions caused by public holidays, but decided not to do so:

- For Charts A to C of the provisional analysis, the impact of public holidays is greatly reduced by smoothing, so that adjustments seem unnecessary.
- For Charts D to G (described in more detail in Section 4.2) we want our estimate of registered deaths in a calendar year to closely match the ONS's annual figure. For this reason we do not want to make an adjustment for public holidays.

Charts A to G can be found in Section 6 along with the rest of our provisional October 2018 analysis.

3. Standardisation

Over the period that we consider, the population of England & Wales has grown and its average age has increased. This would lead to an increased number of deaths even if mortality rates remained constant. In order to fairly assess changes in mortality rates we need to remove the impact of changes in the population. We do this by calculating Standardised Mortality Rates (SMRs).

There is an established method for calculating an SMR using annual data, but the nature of the available weekly deaths data means that weekly SMRs cannot be calculated in exactly the same way. Consequently we have devised a method for weekly SMRs which uses the same underlying principles as the annual SMR calculation as far as possible. Although it cannot mathematically be entirely consistent, we expect close agreement in practice.

Section 3.1 gives an overview of the method, and we give further details of its implementation in later sections.

3.1 Overview

We want a method which can calculate a Standardised Mortality Rate (SMR) consistently for various time intervals. We are particularly interested in:

- Calendar years (as in working papers that accompanied releases of the CMI Mortality Projections Model);
- The first part of calendar years (i.e. from 1 January to a later date within the same calendar year) in order to show cumulative mortality through a year; and
- Weeks (ending on a Friday, to coincide with the ONS data).

We propose to use the formula:

$$SMR(G,i) = \sum_{(x,g)\in G}(P(x,g) \times D(x,g,i) \div E(x,g,i)) \div \sum_{(x,g)\in G} P(x,g)$$

for all SMRs, where:

- G is the group (defined by some combination of age and gender) for which we calculate the SMR.
- i is the time interval for which we calculate the SMR.
- x is age.
- g is gender.
- $P(x,g)$ is the standard population for age x and gender g.
- $D(x,g,i)$ is the number of deaths for age x and gender g in time interval i.
- $E(x,g,i)$ is a measure of the exposure for age x and gender g in time interval i. As a proxy we use the population at the midpoint of interval i.

For calendar years this method is identical to our current practice, e.g. in the analysis in Working Paper 105 that accompanied the publication of CMI_2017, the latest version of the CMI Model.

We use the 2013 European Standard Population[4] as our standard population P_0. This is provided in age bands, which we have split into single years of age. We assume that the population within each five-year age band is split equally between its five ages; and that the open age band 95+ is split equally between the six ages from 95 to 100 inclusive. This is the same approach as in Working Paper 105.

We discuss $D(x,g,i)$ and $E(x,g,i)$ further below.

[4] This is available from http://ec.europa.eu/eurostat/cache/metadata/Annexes/hlth_cdeath_esms_an1.pdf.

3.2 Determining deaths, $D(x, g, i)$

We first consider periods, such as the current year, for which we need to make an estimate based on age-grouped provisional weekly deaths data.

A. Start with provisional weekly deaths data by band

Write $D^{(0)}(b, w, y)$ for the number of deaths for band b in ISO week w of ISO year y, from the ONS provisional weekly deaths data.

Note that for 2010 onwards the bands incorporate gender and age (i.e. we have deaths data for males and females separately, and split by age bands <1, 1-14, 15-44, 45-64, 65-74, 75-84 and 85+). For 2009 and earlier we have a single band containing all ages and both genders.

B. Assign the deaths to individual days

We assign deaths to individual days so that we can eventually calculate the numbers of deaths in any part of any year. We do this step first, before assigning deaths to single ages, in order to be consistent with the method for constructing the CMI Model calibration data, which first splits weeks that span multiple years.

If a week lies entirely within one calendar year, then we assign one-seventh of the deaths for that week to each of the days within it.

If a week spans two calendar years then we first apportion the deaths between the years according to the number of working days in each year. This is consistent with the approach used for the CMI Model calibration dataset. Then within each part-week within each calendar year, we divide the deaths equally according to the number of days (all days, not working days) within each part-week.

If week w spans years y_1 and y_2 then write n_1 and n_2 for the numbers of days of that week in each year, and w_1 and w_2 for the numbers of working days of that week in each year. Then if there are d deaths in the week we assign $\frac{dw_1}{n_1(w_1+w_2)}$ deaths to the days in year y_1 and $\frac{dw_2}{n_2(w_1+w_2)}$ deaths to the days in year y_2.

For example:

- The week ended on 4 January 2013 has 3,164 deaths for females aged 85+.
- That week has three days in 2012, one of which is a working day; and four days in 2013, three of which are working days.
- We split the 3,164 deaths between 2012 and 2013 in the ratio of the numbers of working days; i.e. 791 in 2012 and 2,373 in 2013.
- We further the split the deaths by days, so for females aged 85+ in that week we have 263.7 deaths on each of 29-31 December 2012, and 593.3 deaths on each of 1-4 January 2013.

In the final step we could have instead assigned deaths to individual days based on working days, so that no deaths are assigned to weekends or public holidays. However this would give a “bumpier” picture. The proposed approach uses working days where necessary, to apportion deaths between years in order to be consistent with the CMI Model method, but we need not use working days to apportion deaths within a year.

Note that the proposed method can mean that some days have no deaths assigned (e.g. if 31 December is a Saturday then it will have no deaths assigned as deaths for the week ending on Friday 6 January will all be assigned to the following year).

At this stage we have $D^{(1)}(b, d, y)$ for the deaths for band b in day d of calendar year y.

C. Split into single years of age

For each day, we now split the numbers of deaths in each age band into deaths by gender and single year of age. This is done using the same method as for the CMI Model, based on the proportions of deaths under an assumed mortality table.

We want to calculate:

$D^{(2)}(x,g,d,y)$ Deaths for age x and gender g in day d of calendar year y

based on:

$E(x,g,y)$ mid-year population for year y by age and gender; and
$m^{(Std)}(x,g,y)$ assumed standard mortality rate for year y by age and gender

We first calculate $D^{(Std)}(x,g,y)$, the expected number of deaths for year y by age and gender based on the assumed mortality table:

$$D^{(Std)}(x,g,y) = E(x,g,y) \times m^{(Std)}(x,g,y)$$

Then we use this to split $D^{(1)}(b,d,y)$ into $D^{(2)}(x,g,d,y)$

$$D^{(2)}(x,g,d,y) = D^{(1)}(b,d,y) \times D^{(Std)}(x,g,y) \div \sum_{(x,g)\in b} D^{(Std)}(x,g,y)$$

We will use a National Life Table (NLT) for $D^{(Std)}$, and discuss the choice of table for each year in Section 3.5.

D. Combine deaths within the interval

The final step is to combine daily deaths $D^{(2)}(x,g,d,y)$ into deaths for the time interval, $D(x,g,i)$

To do this, we simply add up the deaths for the days that fall within the interval:

$$D(x,g,i) = \sum_{(d,y)\in i} D^{(2)}(x,g,d,y)$$

3.3 Determining $E(x,g,i)$

We use the population at the midpoint of interval i as a proxy for the exposure. The population at the midpoint is calculated by linear interpolation between mid-year populations $E^{(A)}(x,g,y)$.

For example, for the week ended on 1 June 2018:

- the mid-point of the week is 29 May 2018;
- we interpolate between mid-year populations in 2017 and 2018, deemed to be at 1 July in each year;
- the interpolated population is $9.04\% \times E^{(A)}(x,g,2017) + 90.96\% \times E^{(A)}(x,g,2018)$

In order to calculate $E(x,g,i)$ for the current year we need to estimate the population for the two most recent years. We use the same method as used for the CMI Model.

3.4 Leap years

For Charts D to G of the provisional analysis, which compare cumulative mortality within several calendar years, we want to treat leap years and non-leap years consistently. For non-leap years we simply plot the cumulative value against the day of the year. For leap years we plot values for day d of the leap year against day $\frac{365}{366}d$ of non-leap years. This means that the end-year values are compared consistently.

3.5 Updating calculations

The Committee intends that once rates have been published, they will not be restated (e.g. when estimated deaths or populations are replaced by official figures, or when the ONS restates its own data, or when the CMI changes its methods).

When the CMI Model is published towards the start of each year we will determine which population estimates and standard mortality table to use for all SMRs for that year, and these will not be changed until the next release of the Model. For example:

- SMR calculations in 2018 will use population estimates for mid-2017, mid-2018 and mid-2019, consistent with the CMI_2017 calibration dataset:
  - Population estimates for 2017 are calculated as part of the calibration dataset for CMI_2017, although the calculations will be extended to cover younger ages.
  - Population estimates for 2018 can be estimated from 2017 populations and deaths, both of which are estimated as part of the calibration dataset, using a consistent method.
  - Population estimates for 2019 are estimated using a consistent method, which requires an estimate of deaths in 2018 first. We use $D^{(Std)}(x, g, 2018)$ based on the latest NLT.
- SMR calculations in 2019 will use population estimates for mid-2020 calculated in early 2019.
  - The original October 2018 version of this paper indicated that population estimates for mid-2018 and mid-2019 would be revised in early 2019. However, on reflection, the Committee has decided not to revise previous population estimates.
- SMR calculations in 2019 will use the NLT 2015-2017 as the standard mortality table (extended to older ages as for the CMI Model calibration dataset) as that will be used in the production of CMI_2018.
  - Because calculations for 2018 have been done for the first time in October 2018, rather than earlier in the year, we have been able to use the recently released NLT 2015-2017 for these.

Historical values of SMRs for regular mortality monitoring will use the data that is available at the time of the first update:

- Exposure data will be consistent with the CMI_2017 Model – i.e. 2017 will be estimated and earlier years will be based on ONS figures.
- Where possible we use the NLT centred on the year in question (e.g. use NLT 2009-2011 for calendar year 2010). Where this is not possible for later years, we use the NLT used in conjunction with the latest CMI Model. This means that SMRs for 2016, 2017 and 2018 will all use NLT 2015-2017.

Note that annual SMRs shown in the working paper that accompanies the CMI Model will continue to be based on the dataset used to calibrate that year's CMI Model. For example, the SMR for calendar year 2017 in Working Paper 105 is based on the CMI's estimates of deaths and populations in 2017, but the SMR for calendar year 2017 in the working paper that accompanies CMI_2018 will be based on figures published by the ONS for deaths and populations in 2017.

4. Analysis

The analyses in the quarterly mortality update are of two types:

- Centred averages of smoothed SMRs over time; described in Section 4.1.
- Analysis of cumulative (unsmoothed) SMRs for specific years, described in Section 4.2.

4.1 Centred average SMR

We calculate centred averages of SMRs in two ways:

- The "quarterly" average for a particular week is the average of the weekly SMRs for the 13 weeks centred on that week; i.e. that week, 6 weeks before and 6 weeks after.
- The "annual" average for a particular week is the average of the weekly SMRs for the 53 weeks centred on that week; i.e. that week, 26 weeks before and 26 weeks after.

The annual average removes seasonal effects and effectively shows an annual SMR, but at weekly intervals. The quarterly average removes short-term variations but still shows seasonal patterns, e.g. allowing the identification of winters with particularly heavy or light mortality.

The quarterly mortality update shows this information in three ways:

- Chart A (like Chart 4A below) shows quarterly and annual centred average SMRs for the whole of the period for which we have data, to provide historical context.
- Chart B (like Chart 4B) "zooms in" to the lower-right corner of Chart A to more clearly show the past five years and the current year.
- Chart C (like Chart 4C) shows the same information as Chart C, but plots it by ISO week number so that the years are superimposed. This enables a more direct comparison between the current year and the recent past.

In previous analyses we have included the 2000-2011 trend line to draw attention to more recent deviations from it. At the time this was helpful in considering the "blip versus trend" debate; i.e. to what extent recent experience represented a shorter- or longer-term deviation from the preceding trend. Now that we have seen six or so years of low improvements, this feels less relevant so we do not show a trend line.

Chart 4A: Quarterly and annual centred average SMRs – whole period

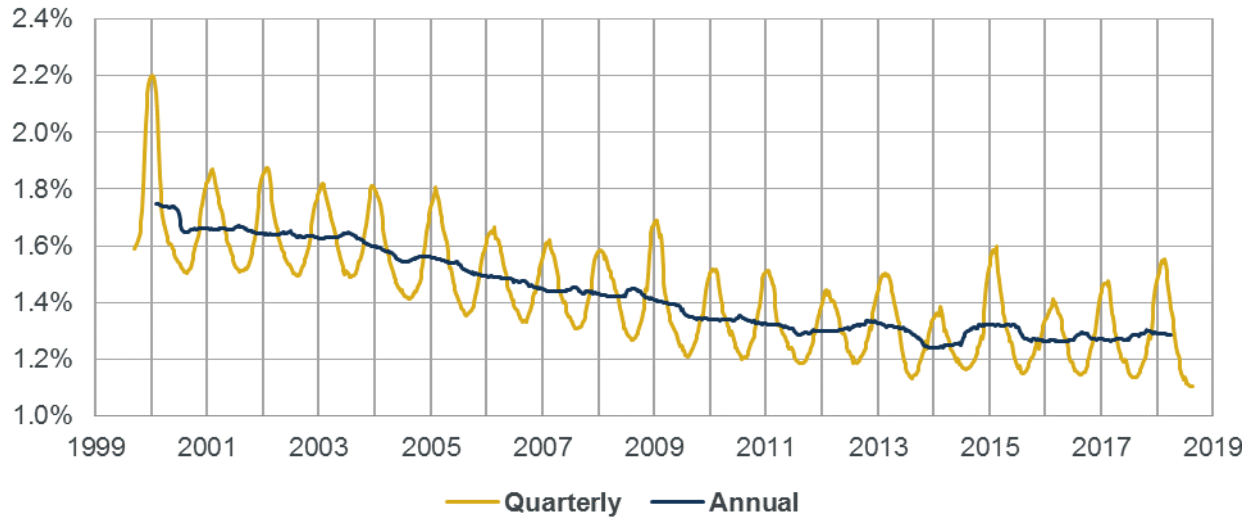


Chart 4B: Quarterly and annual centred average SMRs – current year and previous five years

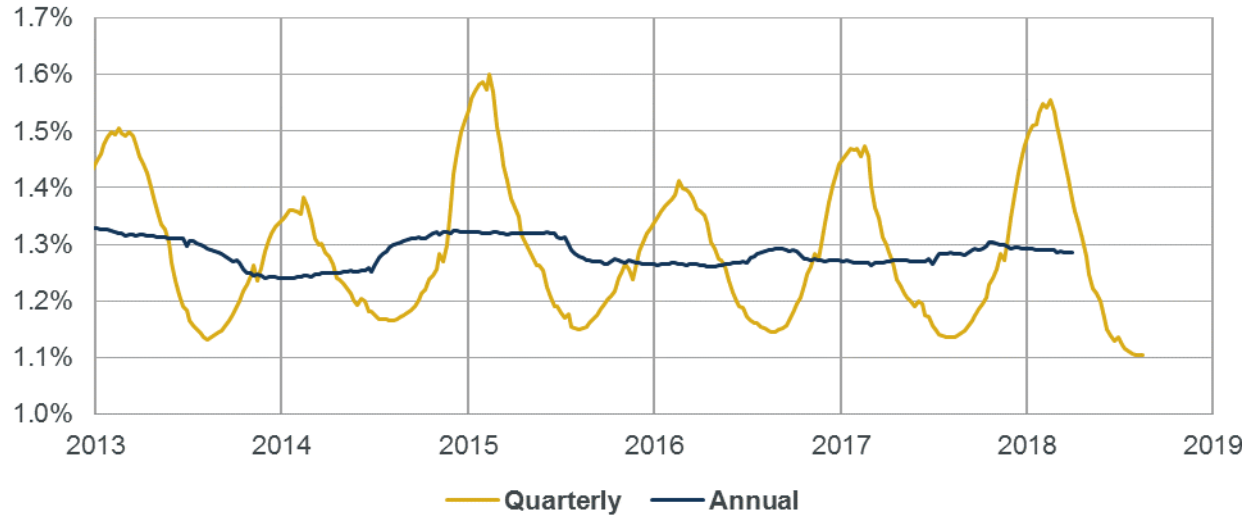
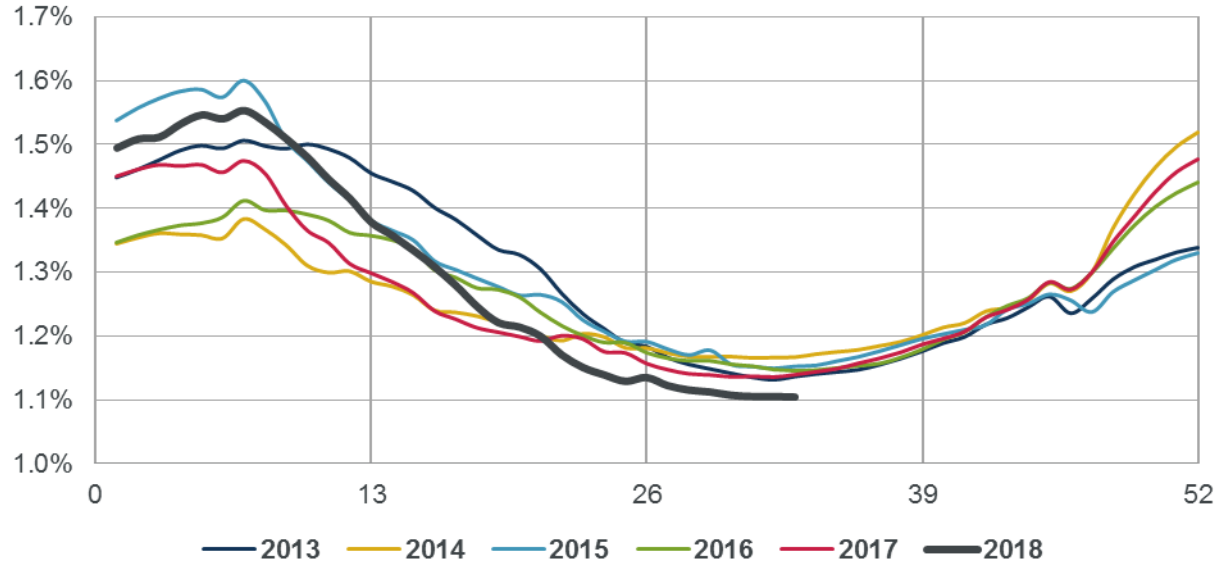


Chart 4C: Quarterly centred average SMRs, by week number



The annual average SMR in Chart 4A shows a fairly steady fall from 1.75% in early 2000 to 1.30% by mid-2011. Since 2011 the annual average SMR has been relatively flat, remaining within the range from 1.24% to 1.34%. Its latest value is at a similar level to six years earlier.

The quarterly average shows that mortality peaks each winter. Winter mortality in 2017/18 was higher than in seven of the previous eight winters, the exception being 2014/15, but quarterly average mortality in the summer of 2018 has been lower than at any other point in the dataset.

4.2 Cumulative mortality by year

Charts in the previous section show smoothed mortality at a point in time. However, because the CMI Model is calibrated to annual mortality data, it is instructive to consider cumulative weekly deaths during each year.

Section 7 of Working Paper 105 shows how results from CMI_2018 might vary, assuming no change in method, for various levels of mortality improvements in 2018. Our key aim in this section is to produce a measure that we can track over the course of the year that will agree closely at the end of the year with the mortality improvement for 2018. This can inform a view, during the year, of the possible level of mortality improvement for 2018, and hence how results from CMI_2018 might compare to CMI_2017.

The method for deaths in Section 3.2 means that the emerging cumulative standardised mortality for the current year should closely match the estimate eventually used in calibrating the CMI Model.

Annual mortality improvement

Section 7 of Working Paper 105 uses an "m-style" annual mortality improvement; i.e. the improvement for 2018 is:

$$MI_{2018} = \log(m_{2017}) - \log(m_{2018})$$

This is equivalent to:

$$MI_{2018} = \log\left(\frac{m_{2017}}{m_{2018}}\right) = -\log\left(\frac{m_{2018}}{m_{2017}}\right) = -\log\left(1 + \left(\frac{m_{2018}}{m_{2017}} - 1\right)\right)$$

Since the difference between m_{2018} and m_{2017} should be small, a Taylor expansion lets us approximate this closely by $MI_{2018} \approx 1 - \frac{m_{2018}}{m_{2017}}$.

Relative cumulative mortality

In this section we consider cumulative mortality relative to the average of the previous ten years; i.e.

$$R^*(d, y) = \frac{m^*(d,y) - \overline{m^*}(d)}{\overline{m^*}(365)}$$

where

- $m^*(d, y)$ represents cumulative mortality over the first d days of year y (after scaling leap years as described in Section 3.4); and
- $\overline{m^*}(d)$ is the average of $m^*(d, y)$ for the ten most recent complete calendar years (e.g. 2008-2017 currently).

This is shown in Chart D of the quarterly mortality update (Chart 4D below).

Chart 4D: Cumulative standardised mortality rate (cSMR) compared to the 2008-2017 average

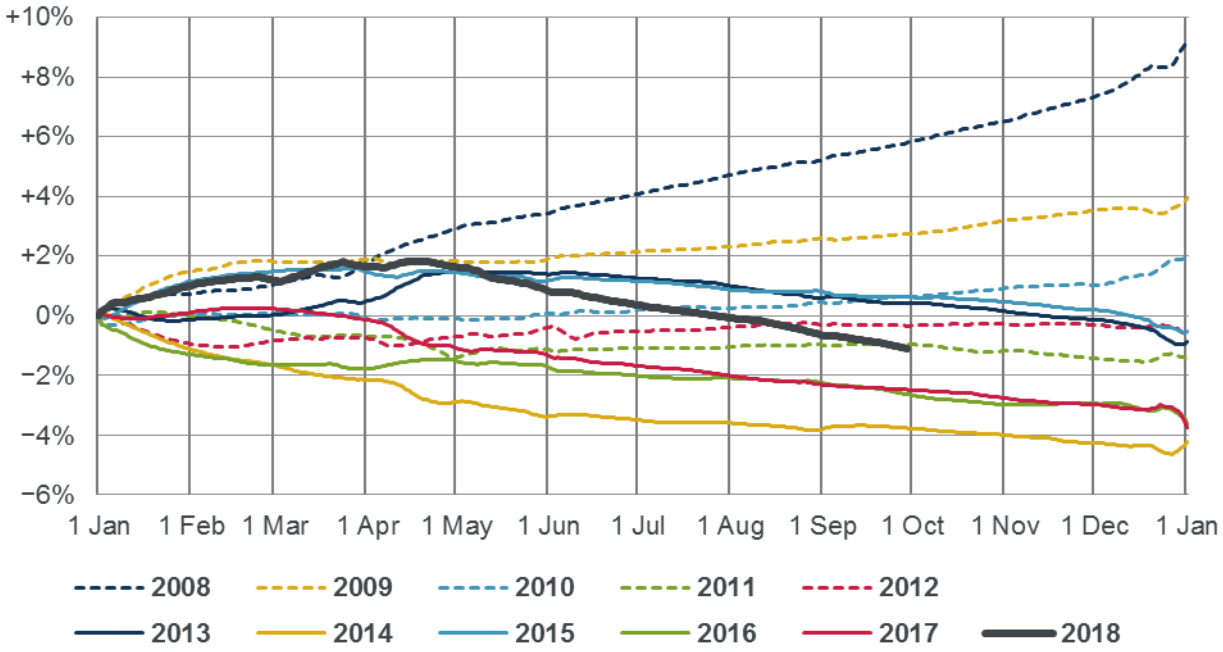


Chart 4D shows that cumulative standardised mortality to date in 2018 is a little below the ten-year average, despite heavy mortality in the first quarter, but is higher than at the corresponding points in 2016 and 2017.

Cumulative standardised annual mortality improvement

We also define a cumulative standardised annual mortality improvement measure:

$$CI^*(d,y) = \frac{m^*(d,y-1) - m^*(d,y)}{m^*(365,y-1)}$$

Note that $CI^*(0,y) = 0$ and

$$CI^*(365,y) = \frac{m^*(365,y-1) - m^*(365,y)}{m^*(365,y-1)} = 1 - \frac{m^*(365,y)}{m^*(365,y-1)}$$

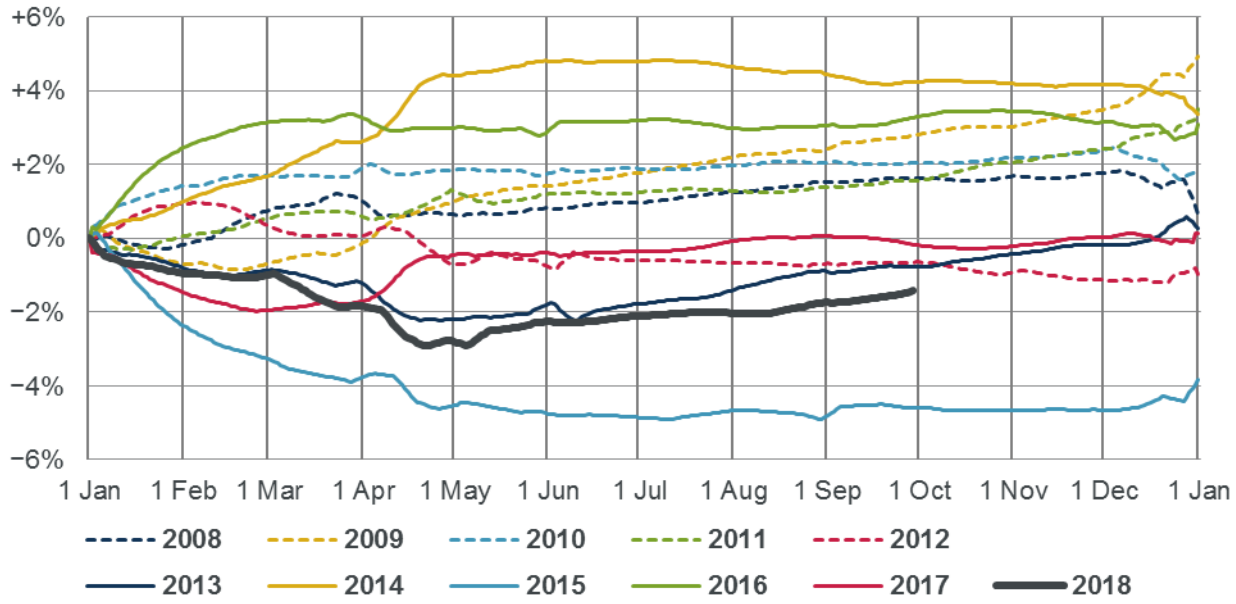
which corresponds to the annual mortality improvement over the whole of year y. So $CI^*(d,y)$ starts at zero and by the end of the year it corresponds to the annual mortality improvement.

Results

Chart E of the update (like Chart 4E below) shows the cumulative annual standardised mortality improvement for the current year and the previous ten years.

Note that Chart 4E shows cumulative improvements, so a higher value represents a higher improvement and lower mortality; whereas in Chart 4D a higher value represents higher mortality.

Chart 4E: Cumulative annual standardised mortality improvement (cSMRI)



Lines on Chart 4E show a number of short-term "bumps" corresponding to public holidays, so readers are advised not to read too much into week-to-week changes, but to concentrate on longer-term patterns.

To date, 2018 shows a negative mortality improvement; i.e. mortality in 2018 to date has been higher than in the corresponding period of 2017. The cumulative mortality improvement to date is lower than in nine of the previous ten years; the exception being 2015.

We note that it is too early to say with any confidence what the mortality improvement for the whole of 2018 will be. For example, the line for 2013 shows that a negative cumulative improvement in the early part of the year need not imply a negative improvement for the year as a whole.

Charts F and G of the update are similar to Charts D and E respectively, but show variations by gender and age band.

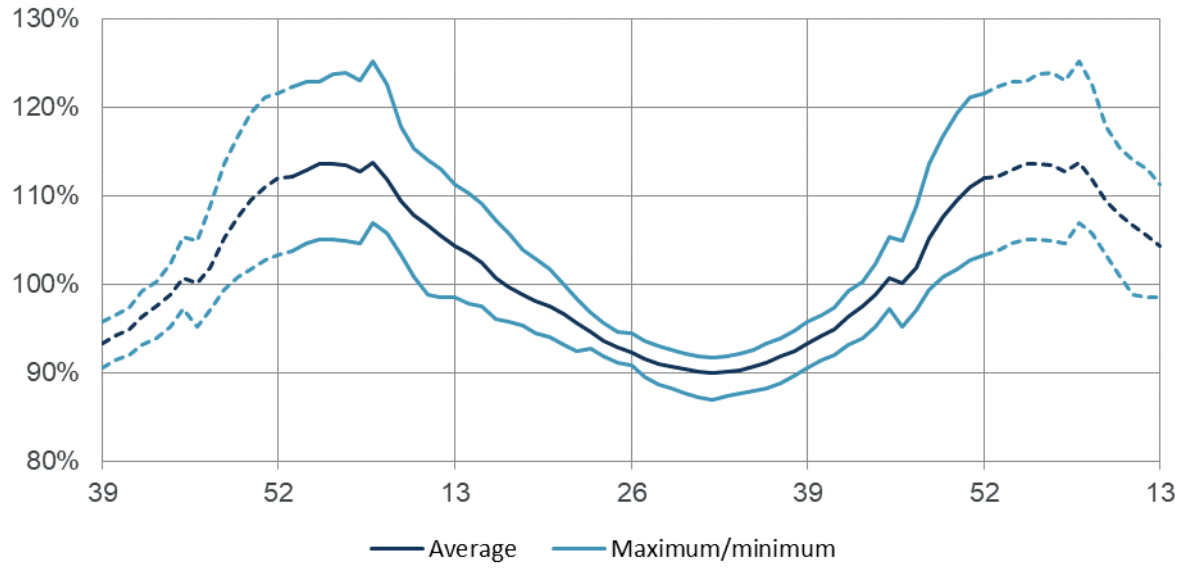
4.3 Seasonal variations in mortality

Chart 4F is not part of the provisional quarterly mortality analysis, but is included here to provide some context and aid interpretation of other charts. It shows the seasonal variation in quarterly average SMR. We:

- Calculate a ten-year exponential trend of quarterly centred average SMR.
- Divide the quarterly centred average SMR for each week by its trend to obtain the weekly variation.
- Plot the average weekly variation, over the previous ten years, for each week number; i.e. the average for week N is the average of the variation for week N in each of the previous ten years.
- Also show the maximum and minimum for each week number within the previous ten years to give an indication of the variability of the seasonal pattern.

The dashed lines repeat the values for weeks 39-52 and 1-13 to make the patterns at either end of the year clearer to see.

Chart 4F: Seasonal variation in quarterly centred average SMR from 2008-2017

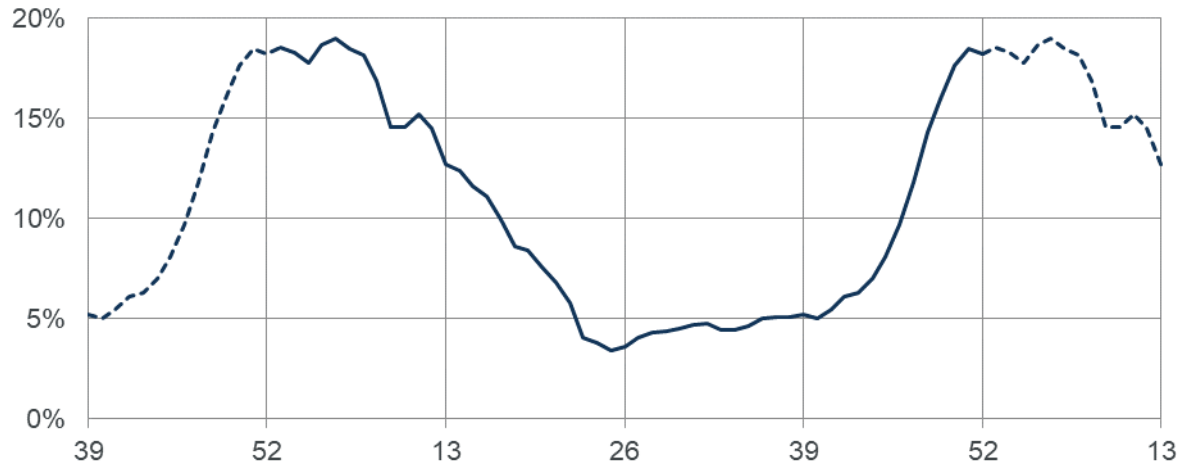


The chart shows that there is considerable seasonal variation in mortality. Using quarterly averages of SMR over the last ten years:

- The average seasonal variation ranges from 90% (for weeks 30-34) to 113-114% (for weeks 2-7).
- The lowest and highest variations shown are 87% and 125%.

Chart 4G plots the range of seasonal variation; i.e. the difference between the maximum and minimum lines in Chart 4F. It shows that the variation is greatest early in the year, and is lowest in the third quarter.

Chart 4G: Range of seasonal variation in quarterly centred average SMR from 2008-2017



5. Future updates

This section describes our intentions for future quarterly updates.

Once we have made any changes in method as a result of the feedback solicited in Section 1, we intend that the method will be consistent for the foreseeable future, so that we have consistency from quarter to quarter.

Writing Y for the current year (e.g. $Y = 2018$ now):

- Chart A will show results for the whole of the period for which we have data.
- Charts B and C will show results for years $Y - 5$ to Y.
- Charts D to G will show results for years $Y - 10$ to Y.

6. Provisional October 2018 update

The following pages contain the provisional update at October 2018, in the form that we propose to publish quarterly.

As noted earlier, we invite feedback on our proposals, and may make changes to the method as a result. If we do so, we will publish an updated version of the October 2018 analysis, so that it uses a method consistent with future updates.

PROVISIONAL England & Wales mortality monitor

October 2018

Background

This is the first in a series of quarterly updates analysing mortality in England & Wales.

Note: This is a provisional update. The format and method may change following consultation. If the changes are significant, we intend to issue a revised version alongside the next release.

It is based on provisional weekly deaths data to 28 September 2018 (i.e. week 39 of 2018), published by the Office for National Statistics (ONS) on 9 October 2018. We intend to publish the next update, for data to the end of 2018, in January 2019.

All updates are publicly available from the CMI pages of the Institute and Faculty of Actuaries website: https://www.actuaries.org.uk/learn-and-develop/continuous-mortality-investigation/other-cmi-outputs/mortality-monitor.

Notes

All of our analysis is based on Standardised Mortality Rates (SMRs). These adjust the provisional weekly deaths data published by the Office for National Statistics (ONS) to allow for changes in the population over time.

Charts A, B and C show centred averages of weekly SMRs. The annual averages smooth out seasonal variation. The quarterly averages smooth the short-term variations but still show seasonal patterns, allowing the identification of e.g. winters with particularly heavy or light mortality.

Chart D shows cumulative standardised mortality (cSMR) for each year, relative to the average for 2008-2017, and Chart E shows cumulative standardised mortality improvements (cSMRI) for each year (i.e. the progression of annual mortality improvements over the course of each year).

Charts A to E show results for males and females combined, for ages 20-100. Charts F and G show variations in the cSMR and cSMRI by gender and age band.

The numerical results underlying the charts are provided in an accompanying spreadsheet, together with further results, including SMRs by gender and age band.

Full details of the methods used are included in Working Paper 111.

Use of this document

Please note that:

- The CMI disclaims any liability from use of or reliance on these calculations, including in relation to financial transactions such as longevity swaps; and
- The CMI does not guarantee that it will continue to publish quarterly updates.

Please also see the disclaimer and copyright notice on the final page of this document.

TAS compliance

This paper is intended to analyse recent mortality in England & Wales. It complies with the principles in the Financial Reporting Council's Technical Actuarial Standard "TAS 100: Principles for Technical Actuarial Work". Any person using this paper should exercise judgement over its suitability and relevance for their purpose.

Smoothed mortality at a point in time

Chart A shows quarterly (13-week) and annual (53-week) centred averages of SMR, since weekly deaths data became available. Note that although we have used data from 31 July 1999 to 28 September 2018, the quarterly and annual averages start 6 and 26 weeks later and stop 6 and 26 weeks earlier.

The annual average SMR shows a fairly steady fall from 1.75% in early 2000 to 1.30% by mid-2011. Since 2011, the annual average SMR has been fairly flat, remaining within the range from 1.24% to 1.34%. Its latest value is at a similar level to six years earlier.

The quarterly average shows that mortality peaks each winter. Winter mortality in 2017/18 was higher than in seven of the previous eight winters, the exception being 2014/15, but quarterly average mortality in the summer of 2018 has been lower than at any other point in the dataset.

Chart A: Quarterly and annual centred average SMRs – whole period

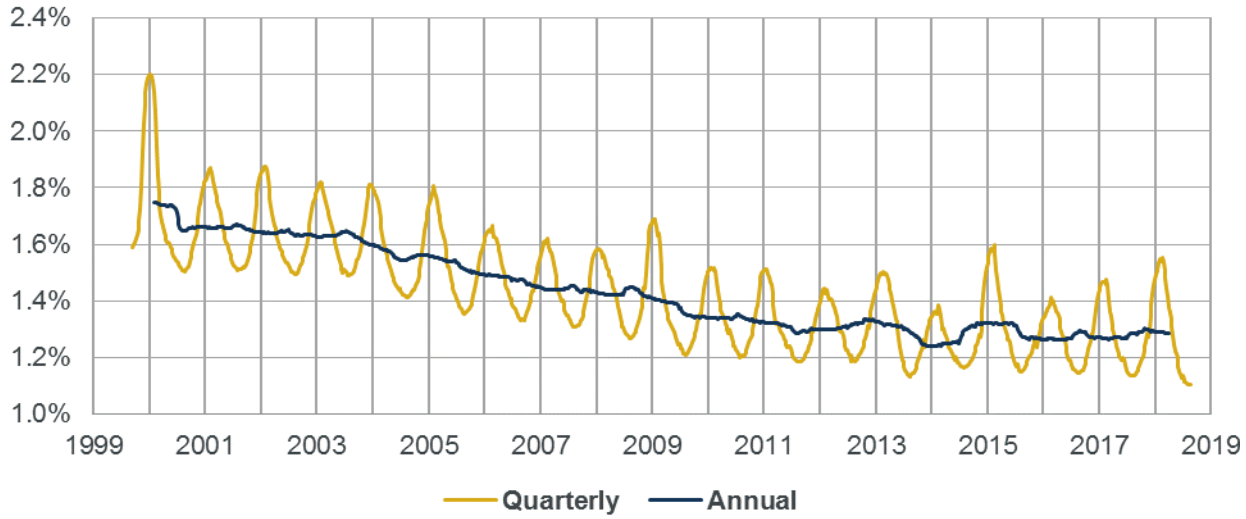


Chart B shows the same information as Chart A, but "zooms in" to show the current year and the previous five years more clearly.

Chart B: Quarterly and annual centred average SMRs – current and previous five years

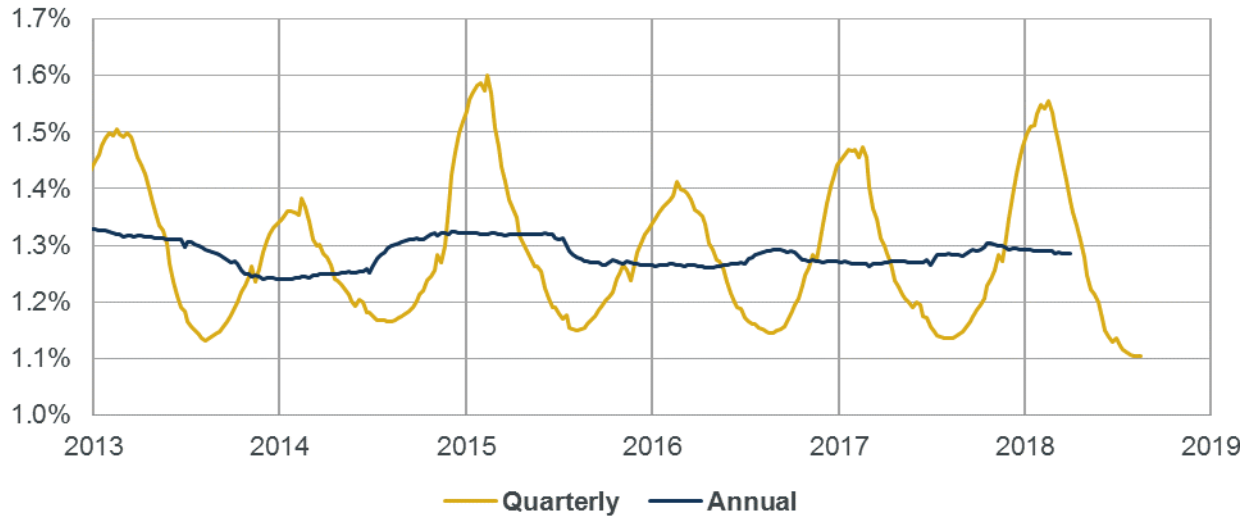
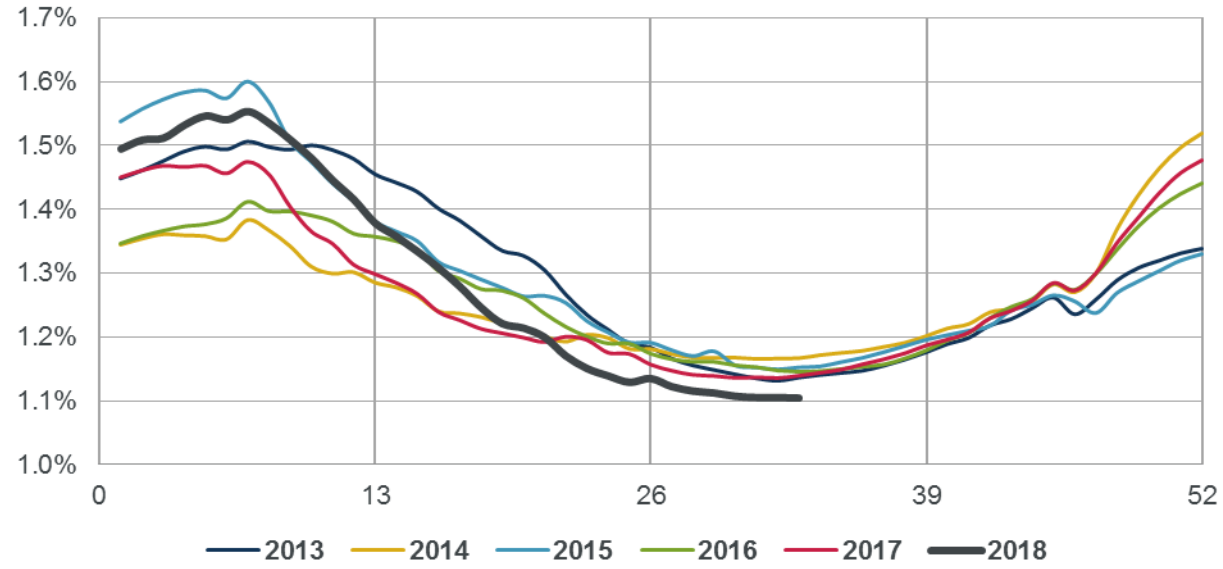


Chart C shows the quarterly average SMRs from Chart B for each year, with values plotted by week number to aid comparison. This again illustrates the relatively high level of mortality in the early part of 2018, but comparatively light mortality in the third quarter of the year.

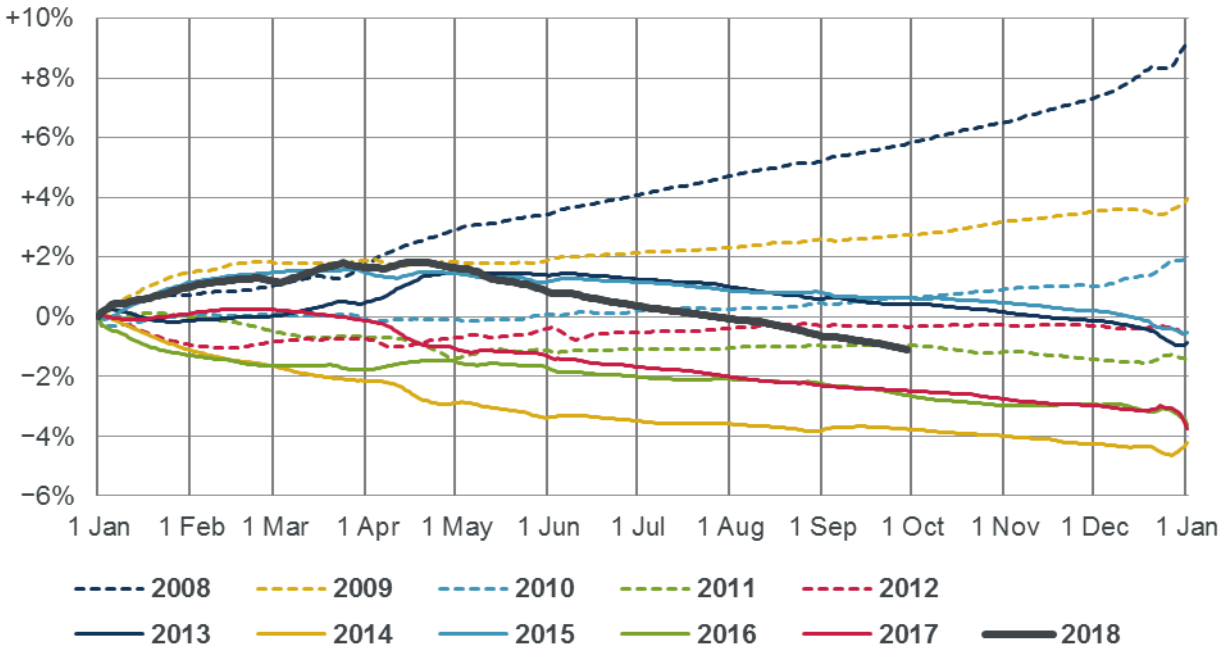
Chart C: Quarterly centred average SMRs, by week number



Cumulative mortality

Chart D shows cumulative standardised mortality rates compared to the 2008-2017 average. (The calculation method is described in Section 4.2 of Working Paper 111.)

Chart D: Cumulative standardised mortality rate (cSMR) compared to the 2008-2017 average



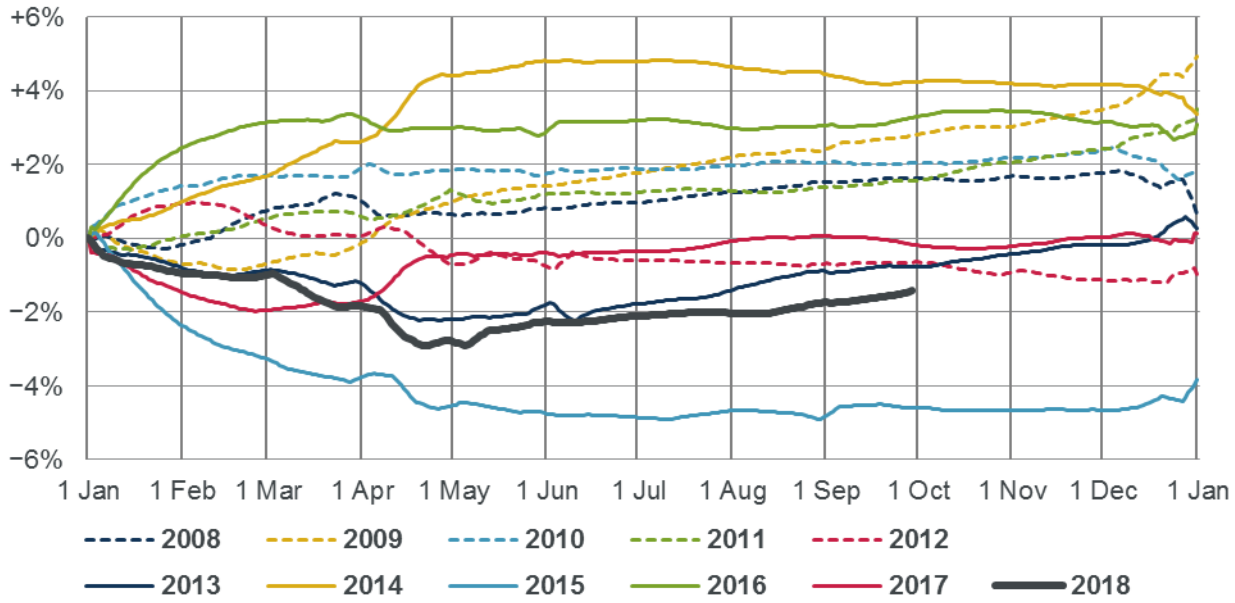
All years have a value of 0% at the start of the year, by definition, as there has been no mortality at that point of the year. If mortality improvements had been constant throughout the period considered then the lines for each

year would form a “fan”, with the end-year values decreasing steadily from year to year. While we see a decrease of this sort from 2008 to 2011, there is no clear pattern to the end-year values for later years, as mortality has been volatile with low improvements. Mortality was lowest in 2014.

Chart D shows that cumulative standardised mortality to date in 2018 is a little below the ten-year average, despite heavy mortality in the first quarter, but is heavier than in the corresponding part of 2017; i.e. there has been a negative mortality improvement.

Chart E shows the cumulative annual standardised mortality improvement (also described in Section 4.2 of Working Paper 111) for 2018 and for the previous ten years. Note that Chart E shows cumulative improvements, so a higher value represents a higher improvement and lower mortality; whereas in Chart D a higher value represents higher mortality.

Chart E: Cumulative annual standardised mortality improvement (cSMRI)



The cumulative improvement for 2018 after three quarters of the year is −1.4%; i.e. mortality has been higher in the first three quarters of 2018 than in the corresponding part of 2017. The cumulative mortality improvement to date is lower than in nine of the previous ten years; the exception being 2015.

Chart E suggests that 2018 could show a negative mortality improvement; however, lighter mortality in the rest of the year could still lead to a positive mortality improvement for the year as a whole.

Charts F and G shows how cSMR and cSMRI have varied by gender and age band.

Chart F shows considerable variation by age band:

- The spread of mortality rates over the period is widest for ages 65-84 and narrowest for ages 85+.
- Mortality in the early part of 2018 was particularly high, compared to the 2008-2017 period, for females in the 85+ age band.

Chart G shows that:

- Mortality improvements in the 2008-2018 period have been most volatile for the 85+ age band, particularly for females.
- Mortality improvements in the first three quarters of 2018 have been negative for all age bands shown for both genders.
- For the 0-64 age band, improvements in the first three quarters of 2018 have been lower than any of 2008-2017. For the older age bands shown, 2015 had lower improvements.

Chart F: Cumulative standardised mortality rate (cSMR) compared to the 2008-2017 average, by gender and age-band

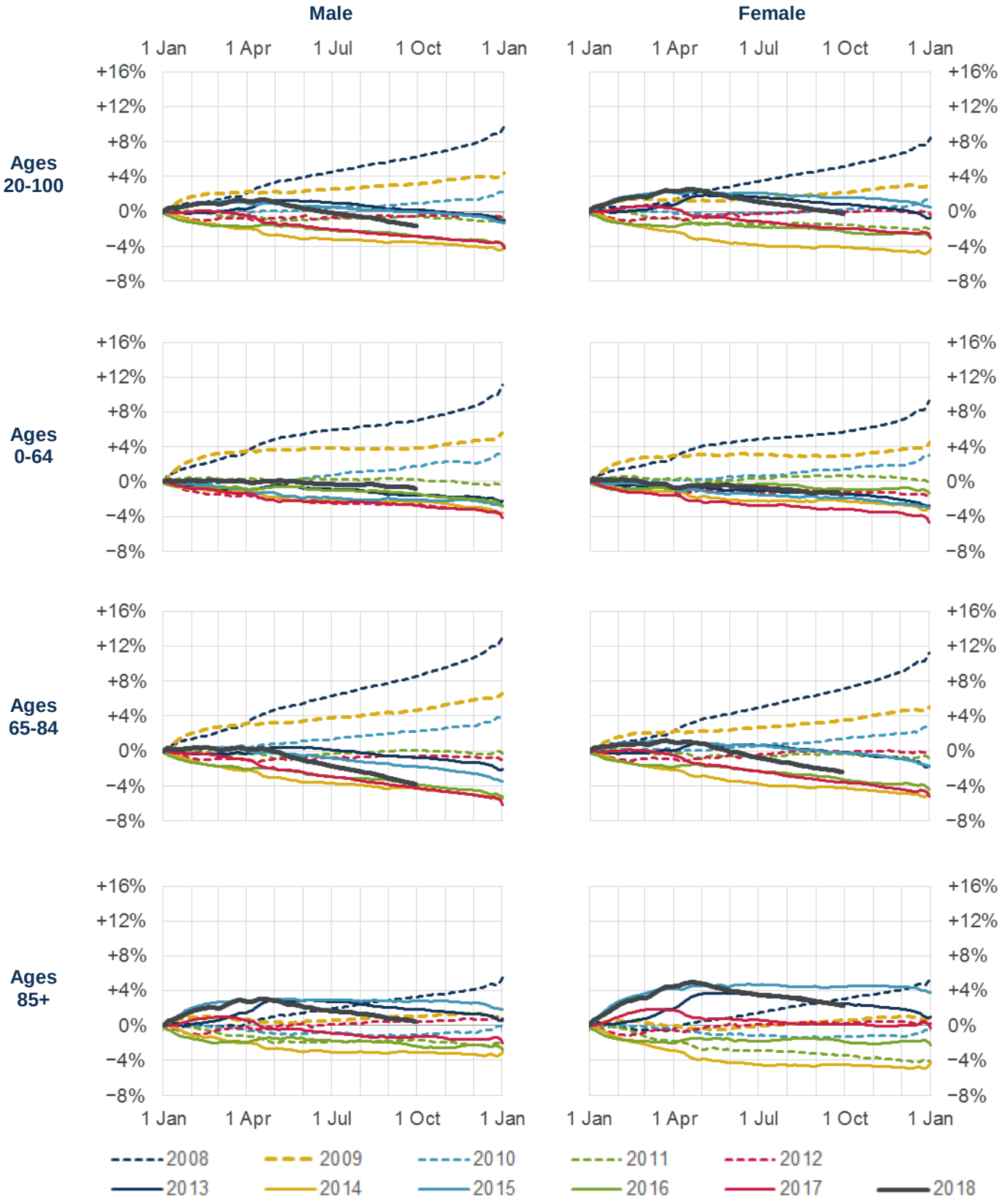
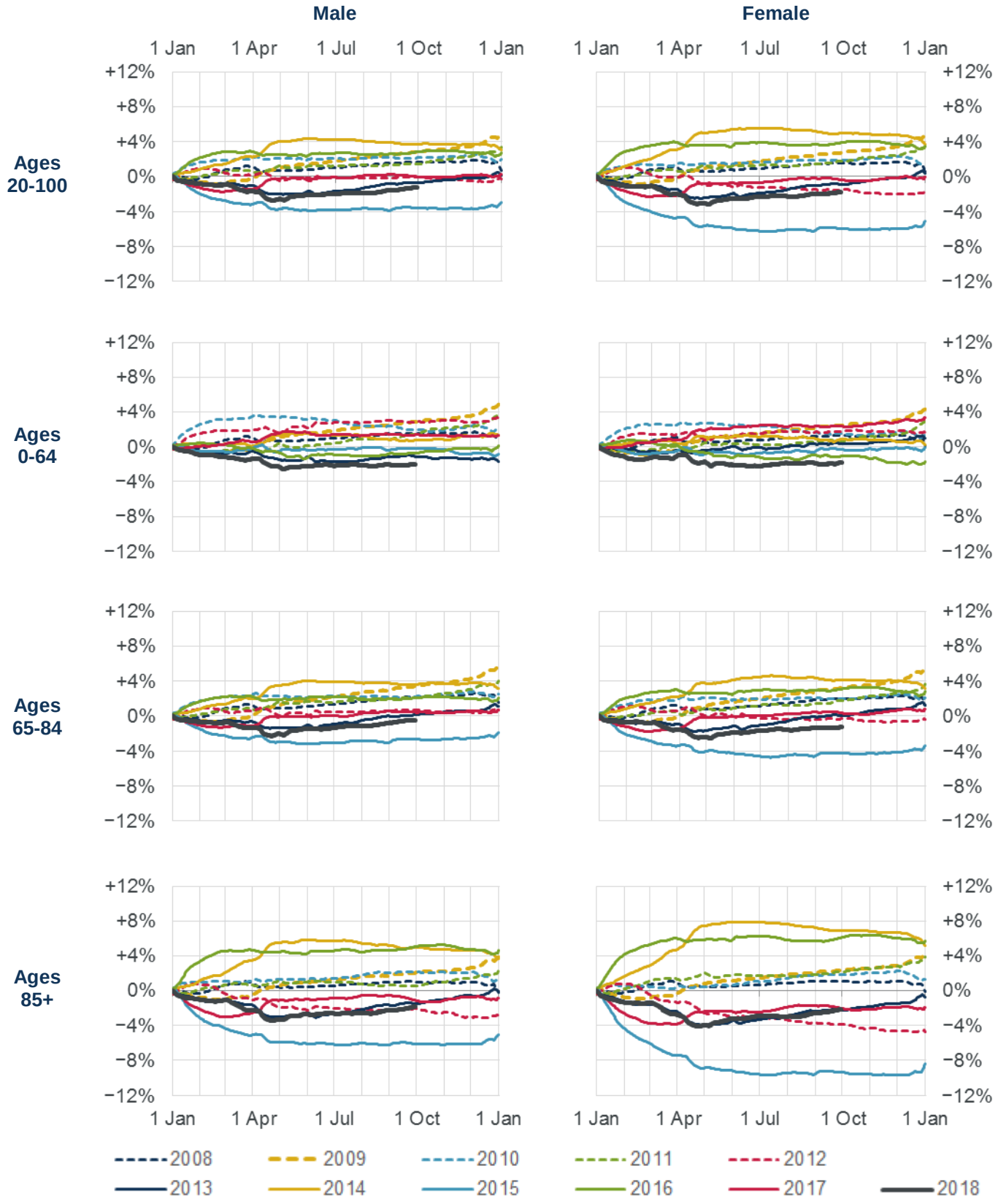


Chart G: Cumulative annual standardised mortality improvement (cSMRI), by gender and age band



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