



England & Wales mortality monitor – Q3 2023

Summary

Mortality in the third quarter of 2023 compared to the third quarter in recent years was higher than in 2018, 2019 and 2020, and lower than in 2021 and 2022.

At the end of Q3 2023, the cumulative standardised mortality rate for 2023 was 0.5% above the 2013-2022 average and 5.4% above 2019, the last full year before the pandemic.

Results are based on the date of registration of deaths. Using date of occurrence would give different results, particularly since late 2022. Appendix 2 discusses this and estimates the impact.

Background

This is the latest in a series of quarterly updates monitoring mortality in England & Wales. It is based on provisional weekly deaths data published by the Office for National Statistics (ONS) up to 29 September 2023 (i.e. week 39 of 2023) on 10 October 2023. We intend to publish the next quarterly update, for data to the end of 2024, in January 2024.

We are also publishing weekly updates which focus on “excess mortality”. Summary versions are published weekly, with a more detailed version every quarter. The monitor for week 39 of 2023 uses the same data as this quarterly monitor and shows more detail of excess mortality during the past quarter.

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>. The same page has “beta” mortality monitor software, which is available to Authorised Users. This enables users to produce their own ad hoc updates to the results of this report.

Notes

We have used our standard approach in producing this report, basing it on data published by the Office for National Statistics.

Our calculations rely on data for registered deaths, and we are conscious that during the coronavirus pandemic the timing of registration of deaths may have differed from previous years. Consequently, comparisons of mortality between years may not be entirely on a like-for-like basis. Also, results for individual weeks may not be consistent between years due to the timing of public holidays.

We have included analysis of the difference between when deaths were registered and when they occurred in Appendix 1 of the mortality monitor for week 39 of 2023.

We note that the ONS expects to publish its revised mid-year population estimates for mid-2012 to mid-2020, reflecting the results of the 2021 census, in November 2023. This will use a more detailed method and more detailed data to assess the 2012 to 2020 population than the CMI_2022 dataset that we use for this monitor. We intend to analyse the impact of the ONS dataset on the mortality monitor once it is available.

All of our analysis in this update is based on Standardised Mortality Rates (SMRs). These adjust the provisional weekly deaths data published by the Office for National Statistics to control for changes in the size and age and gender distribution of the population over time.

Contents

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

Chart D shows cumulative standardised mortality (cSMR) for each year, relative to the average for 2013-2022, 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 D2 and E2 show the same information



as charts D and E respectively in a different format and may be easier to interpret for those with colour vision deficiency.

Chart F shows the mortality improvement between 2019 and 2023.

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

Full details of the methods used are included in [Working Paper 111](#).

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

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.

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This document is categorised as a “Research Report” as defined in the Terms and Conditions.

TAS compliance

This paper is intended to translate publicly available demographic information published by the Office for National Statistics and similar bodies into indicative mortality measures to illustrate recent mortality experience primarily in England & Wales. The paper is intended for use by actuaries and other parties interested in detailed mortality statistics and is for information only.

The paper complies with the principles in the Financial Reporting Council’s Technical Actuarial Standard “TAS 100: General Actuarial Standards”. 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 29 September 2023, 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. From mid-2011 to mid-2018 the annual average SMR was fairly flat, remaining within the range from 1.24% to 1.34%, but it reached a new low of 1.21% in early 2019. It rose rapidly because of the coronavirus pandemic, reaching 1.48% in September 2020, but has since fallen. The latest value is 1.33%.

The quarterly average SMR shows that mortality typically peaks near the start of each year. However during the pandemic the quarterly average SMR peaked at 1.78% in week 15 of 2020 and 1.77% in weeks 1 and 2 of 2021. In contrast, the low of 1.08% in week 31 of 2020 was the lowest ever seen. It reached 1.55% in the first quarter of 2023 and the latest value is 1.15%.

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

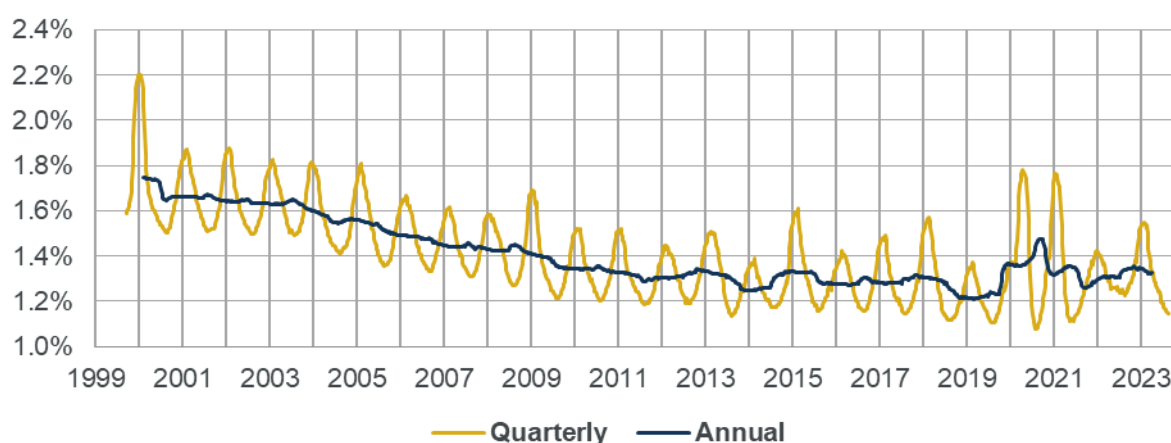


Chart B shows the same information as Chart A, magnified to show the current year and the previous five years more clearly.

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

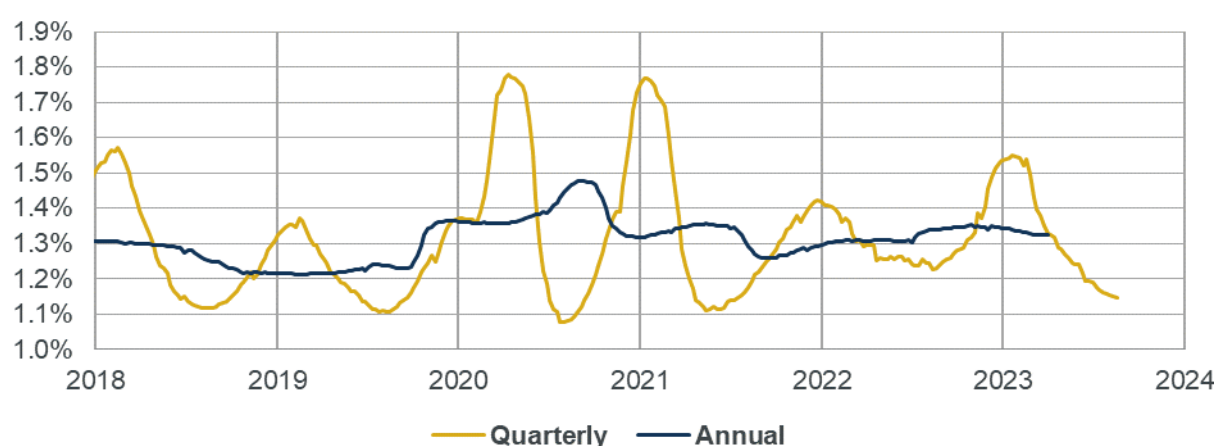
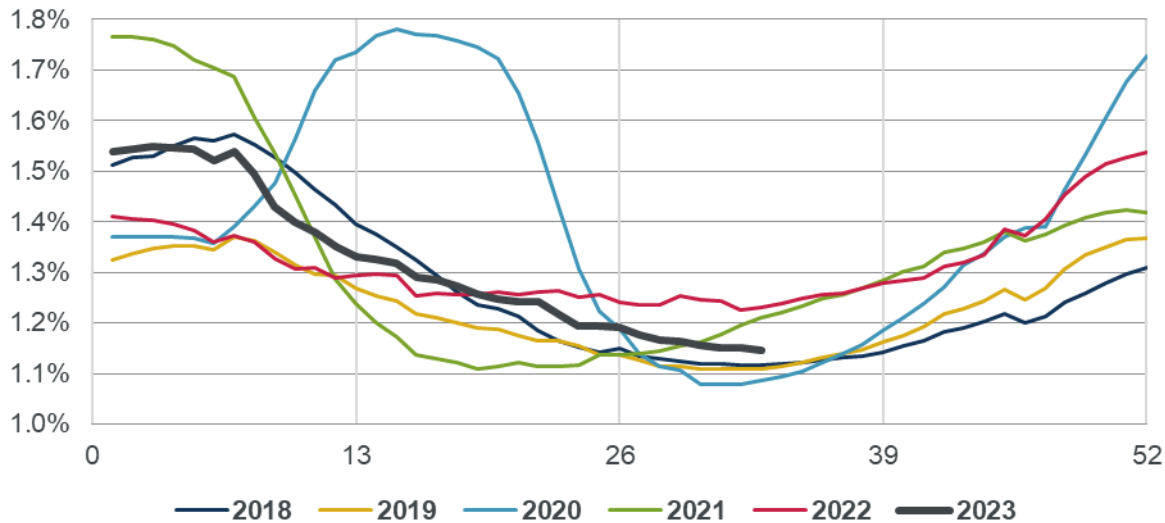


Chart C shows the quarterly average SMRs from Chart B for each year, with values plotted by week number to aid comparison. Although lines are labelled by calendar year, the quarterly averages for weeks towards the start and end of each year will be affected by mortality in earlier and later years respectively. The chart again illustrates the exceptional nature of mortality during the pandemic, with highs in Q2 of 2020 and Q1 of 2021, and lows in Q3 of 2020 and Q2 of 2021. The latest figure is higher than the corresponding point in 2018, 2019 or 2020, but lower than in 2021 or 2022.

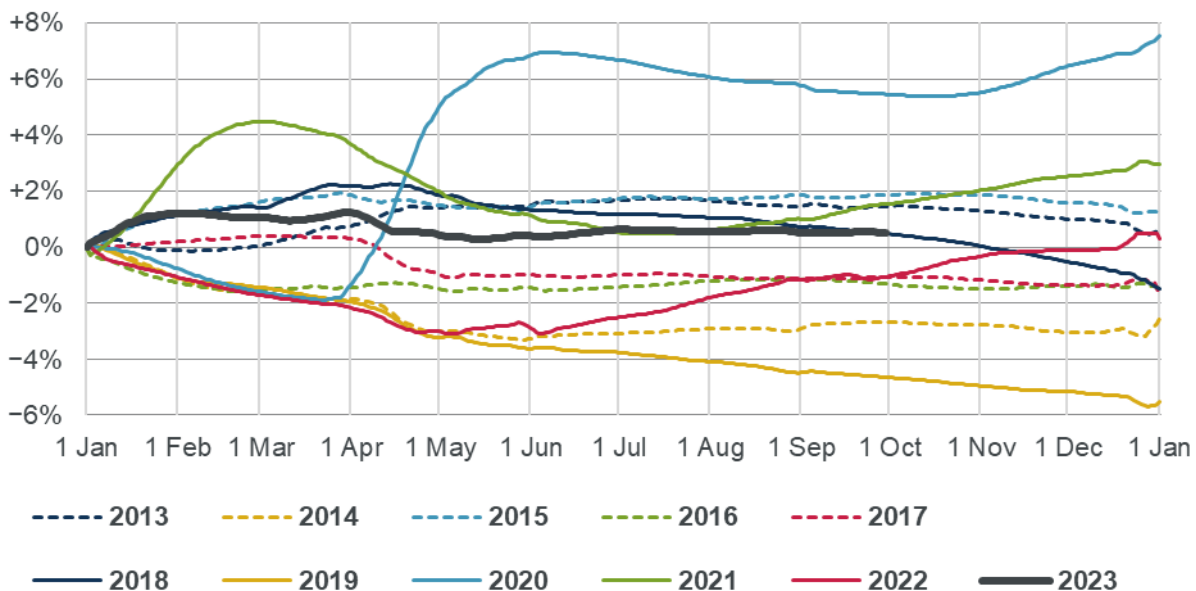
Chart C: Quarterly centred average SMRs, by week number



Cumulative mortality

Chart D shows cumulative standardised mortality rates for 2022 and the previous ten years compared to the 2013-2022 average. The calculation method is described in Section 4.2 of Working Paper 111. Chart D2 (in Appendix 1) shows the same information in a different format and may be easier for those with colour vision deficiency.

Chart D: Cumulative standardised mortality rate (cSMR) compared to the 2013-2022 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; the year-end values show how mortality for each year as a whole compares to the 2013-2022 average; and intermediate points show how mortality has developed during the year, relative to the average. 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 saw a decrease of this sort in the years up to 2011 (not shown), there is no clear pattern to the end-year values for later years, as mortality has been volatile with low improvements. Mortality for complete calendar years was lowest in 2019 and highest in 2020 (of the years shown).

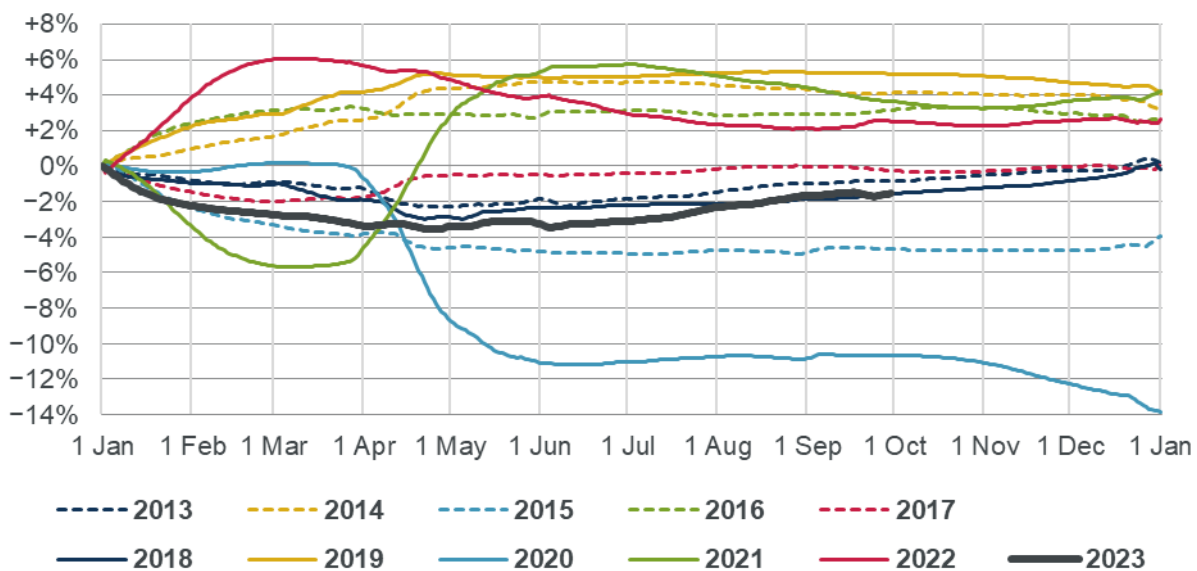
Chart D shows that cumulative standardised mortality in the first three quarters of 2023 was a little higher than the ten-year average. It ended the third quarter at 0.5% above the ten-year average, equivalent to 5.4% above 2019.

Chart E shows the cumulative annual standardised mortality improvement (also described in Section 4.2 of Working Paper 111) for 2023 and for the previous ten years. Chart E2 (in Appendix 1) shows the same information in a different format and may be easier for those with colour vision deficiency.

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; the year-end values show how mortality for each year as a whole compares to the previous year; and intermediate points show how mortality improvements have developed during the year.

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 mortality improvement at the end of Q3 of 2023, relative to 2022, is -1.5% .

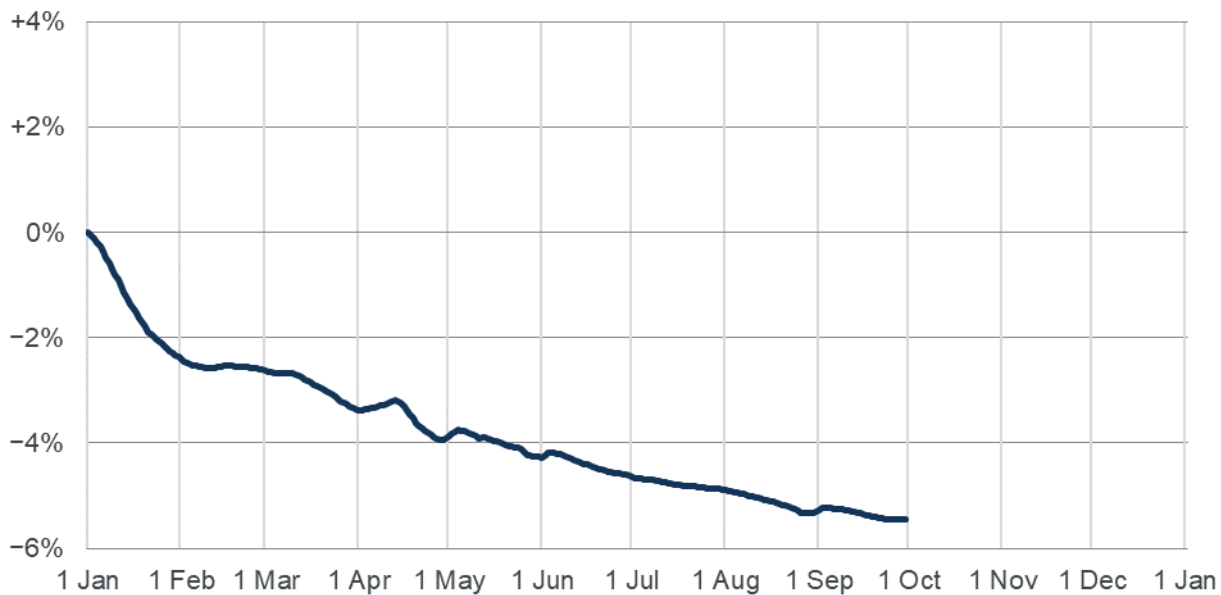
Note that:

- The cumulative values at the end of the year in Charts D and E may not necessarily agree precisely with the corresponding values based on annual data. This is because some weeks span two years, requiring us to estimate in which year those deaths were registered.
- Mortality improvements vary by age (as shown later in this report) and the mortality improvements shown in Chart E are sensitive to the age distribution of the chosen standard population.

Chart F shows the cumulative standardised mortality improvement between 2019 and 2023. The calculation in this chart is consistent with the method for 2023 used for Chart E, other than the starting mortality year being 2019 rather than 2022.

Up to the end of Q3 of 2023, mortality is worse than in 2019, ending the quarter at -5.4% .

Chart F: Cumulative standardised mortality improvement between 2019 and 2023



Implication for CMI_2023

The analysis in this section shows possible outcomes from CMI_2023 for a range of mortality scenarios and weight parameters. We currently expect that CMI_2023 will use the same method as CMI_2022, with suitable choices for the weights and other parameters. We aim to confirm our intentions for CMI_2023 towards the end of 2023.

We note that the results of CMI_2022 and our illustrations for CMI_2023 are based on CMI estimates of the population, including our estimated revisions to the 2012-2020 populations in light of the results of the 2021 census in England & Wales. The ONS aims to publish its own revised population estimates in November 2023, based on a more detailed method, and this will affect the results of CMI_2023.

Tables 1 to 3 are similar to the analysis in Section 7 of [Working Paper 177](#) (which includes further detail on the methods used) and show how life expectancy might change between CMI_2022 and hypothetical versions of CMI_2023.

All life expectancies in this section are as at 1 January 2024 and use an illustrative long-term rate of 1.5% p.a. and Core assumptions unless specified otherwise. They use S3PMA and S3PFA mortality tables, so differences in life expectancies reflect differences in mortality improvements since 1 January 2013, the effective date of the “S3” tables. Results would differ for mortality tables with a different effective date.

The tables are based on a range of possible mortality improvements between 2019 and 2023 and assume no change in method other than potential changes to weights.

The tables show illustrative results for overall mortality improvements between 2019 and 2023 of -5%, -6.5%, and -8%:

- If mortality in the fourth quarter of 2023 is like 2019, then the cumulative improvement would remain at around -5.5% relative to 2019.
- If mortality in the fourth quarter of 2023 is like 2022, then the cumulative improvement would remain at around -1.5% relative to 2022, and around -7.7% relative to 2019.

The mortality scenarios used span this range, but it is possible that actual mortality for 2023 is outside this range. As seen in Chart D, the progression of mortality within a year can vary significantly in different years.

We have illustrated the impact on CMI_2023 for each mortality scenario for three assumptions for weight parameters. Each assumes 0% weight for 2020 and 2021:



- Weights of 25% for 2022 and 50% for 2023 – the illustration used in Section 7 of Working Paper 177.
- Weights of 25% for 2022 and 25% for 2023.
- Weights of 10% for 2022 and 10% for 2023.

We stress that we have not confirmed the weights or other parameters that we will use when calibrating CMI_2023, and we may take a different approach to those considered here.

Percentage difference in life expectancy at 1 January 2024 between CMI_2022 Core and illustrative CMI_2023 for different mortality scenarios for 2023.

Table 1: Weights of 25% for 2022 data and 50% for 2023 data.

Improvements v 2019	Improvements v 2022	Male 25	Male 45	Male 65	Male 85	Female 25	Female 45	Female 65	Female 85
-5%	+1%	-0.8%	-1.3%	-1.9%	-2.4%	-0.6%	-1.0%	-1.6%	-2.0%
-6.5%	-0.5%	-1.1%	-1.7%	-2.6%	-3.2%	-0.9%	-1.3%	-2.1%	-2.8%
-8%	-2%	-1.4%	-2.2%	-3.2%	-4.0%	-1.1%	-1.7%	-2.6%	-3.5%

Table 2: Weights of 25% for 2022 data and 25% for 2023 data.

Improvements v 2019	Improvements v 2022	Male 25	Male 45	Male 65	Male 85	Female 25	Female 45	Female 65	Female 85
-5%	+1%	-0.6%	-1.0%	-1.5%	-1.8%	-0.5%	-0.8%	-1.2%	-1.5%
-6.5%	-0.5%	-0.8%	-1.3%	-1.9%	-2.4%	-0.6%	-1.0%	-1.6%	-2.0%
-8%	-2%	-1.0%	-1.6%	-2.3%	-2.9%	-0.8%	-1.2%	-1.9%	-2.5%

Table 3: Weights of 10% for 2022 data and 10% for 2023 data.

Improvements v 2019	Improvements v 2022	Male 25	Male 45	Male 65	Male 85	Female 25	Female 45	Female 65	Female 85
-5%	+1%	-0.1%	-0.2%	-0.3%	-0.3%	-0.1%	-0.2%	-0.3%	-0.2%
-6.5%	-0.5%	-0.2%	-0.4%	-0.6%	-0.6%	-0.2%	-0.3%	-0.5%	-0.5%
-8%	-2%	-0.3%	-0.6%	-0.9%	-0.9%	-0.3%	-0.5%	-0.8%	-0.8%

Variation by gender and age

Charts G and H shows how cSMR and cSMRI have varied by gender and age band. Tables 4 and 5 show the values at 29 September 2023.

We note that results by age should currently be treated with particular caution:

- Delays in registrations versus occurrences, described in Appendix 2, could have impacted different age ranges to different degrees.
- The rebasing of population estimates following the 2021 census is likely to impact younger ages more than older ages.

Table 4: Cumulative standardised mortality rate (cSMR) compared to the 2013-2022 average, by gender and age-band, at 29 September 2023

	0-64	65-84	85+	20-100	20-44	45-64	65-74	75-84
Male	+3.6%	-1.1%	+1.6%	+0.6%	+8.6%	+2.4%	+0.7%	-2.2%
Female	+1.6%	-0.9%	+1.2%	+0.3%	+5.5%	+0.8%	+0.5%	-1.7%
Combined	+2.8%	-1.0%	+1.4%	+0.5%	+7.5%	+1.8%	+0.7%	-2.0%

Table 5: Cumulative annual standardised mortality improvement (cSMRI), by gender and age-band, at 29 September 2023

	0-64	65-84	85+	20-100	20-44	45-64	65-74	75-84
Male	-2.7%	-1.2%	-1.1%	-1.4%	-5.5%	-2.0%	-1.7%	-0.9%
Female	-1.9%	-1.5%	-2.1%	-1.8%	-3.2%	-1.4%	-2.2%	-1.1%
Combined	-2.4%	-1.3%	-1.5%	-1.5%	-4.6%	-1.8%	-1.9%	-1.0%

For the period from 2011 to 2019:

- The spread of mortality rates is widest for ages 65-84 and narrowest for ages 85+, for both genders.
- Mortality improvements have been most volatile for the 85+ age band, particularly for females.

Mortality rose during 2020 and 2021 due to the coronavirus pandemic:

- For ages 65 and above, mortality was higher in 2020 than in 2021.
- For ages 0-64, mortality was higher in 2021 than in 2020.

In 2022:

- Cumulative mortality rates for the older age groups were below the 2013-2022 average, but those for 20-44 were well above the 2013-2022 average.
- Cumulative mortality improvements were positive for almost all groups (the exception being the 85+ age group for both males and females) and were particularly high for the 45-64 age group.

In the first three quarters of 2023:

- Cumulative mortality rates for the combined 20-100 age group are higher than the 2013-2022 average, but there is considerable variation by age. Mortality for males aged 20-44 is higher than in any of the previous ten years, but mortality for the 75-84 age group is below the ten-year average.
- Cumulative mortality improvements are lower than for most years shown and are negative for all age groups.

Chart G: Cumulative standardised mortality rate (cSMR) compared to the 2013-2022 average, by gender and age-band

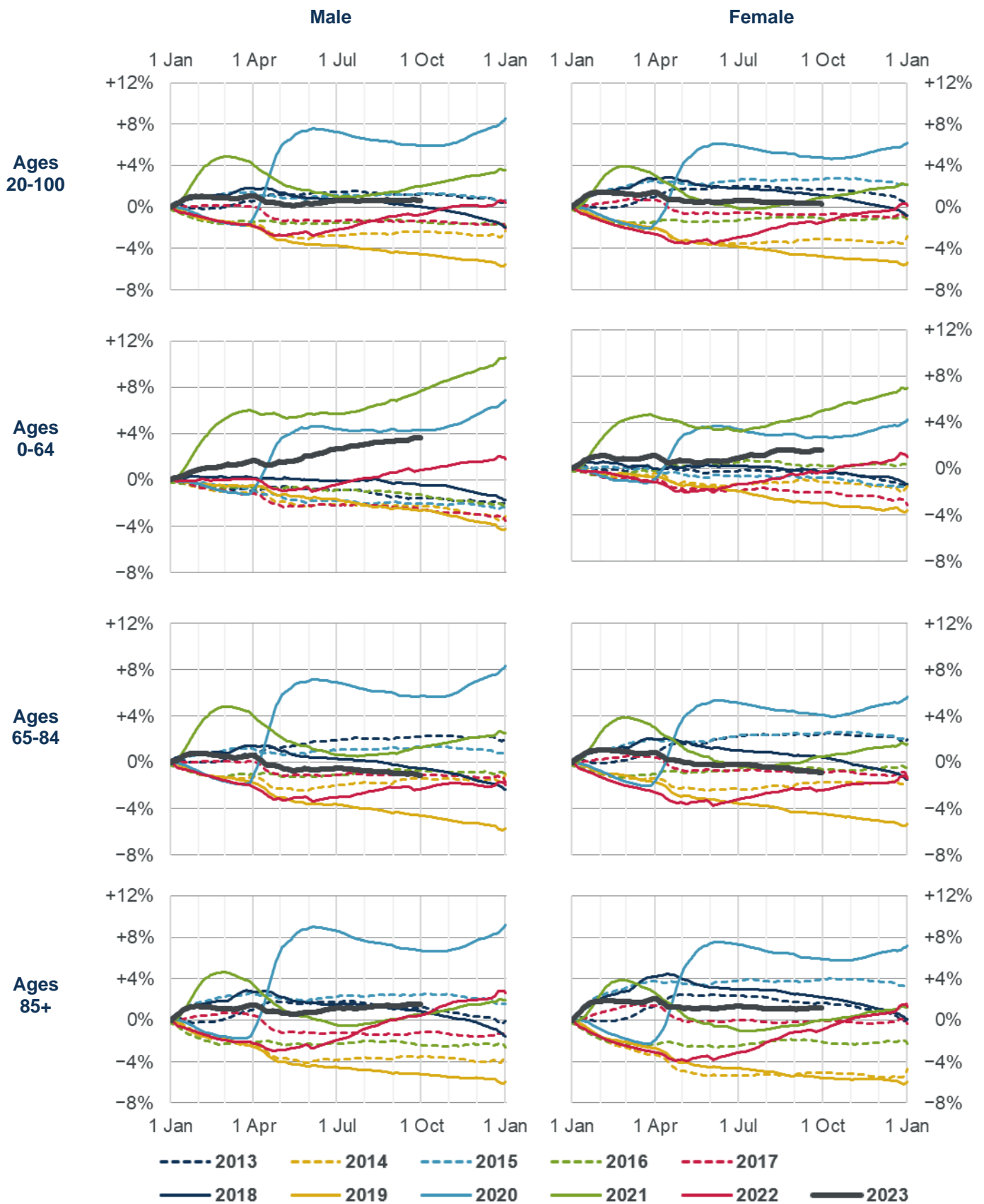




Chart G (cont): Cumulative standardised mortality rate (cSMR) compared to the 2013-2022 average, by gender and age-band

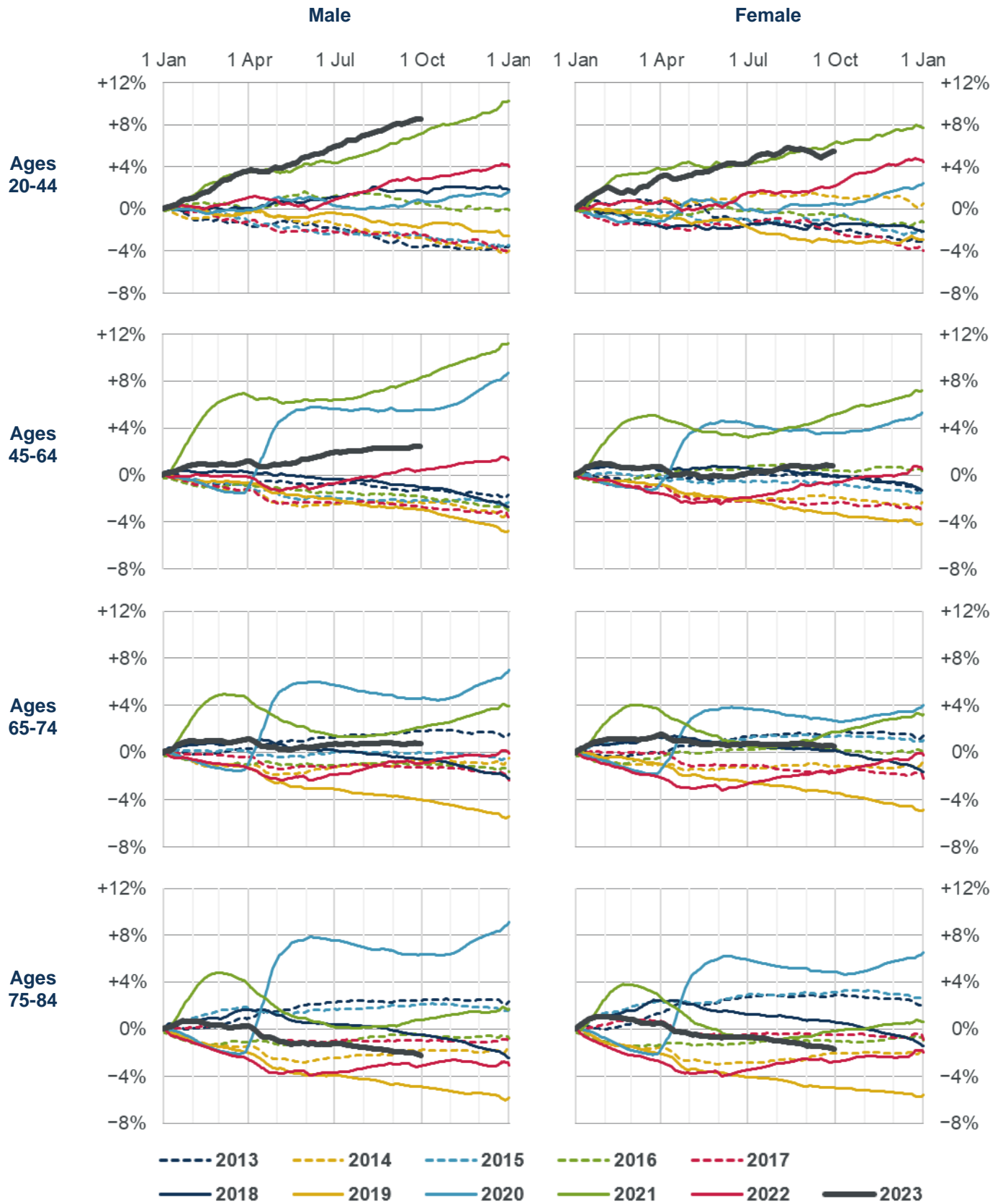




Chart H: Cumulative annual standardised mortality improvement (cSMRI), by gender and age band

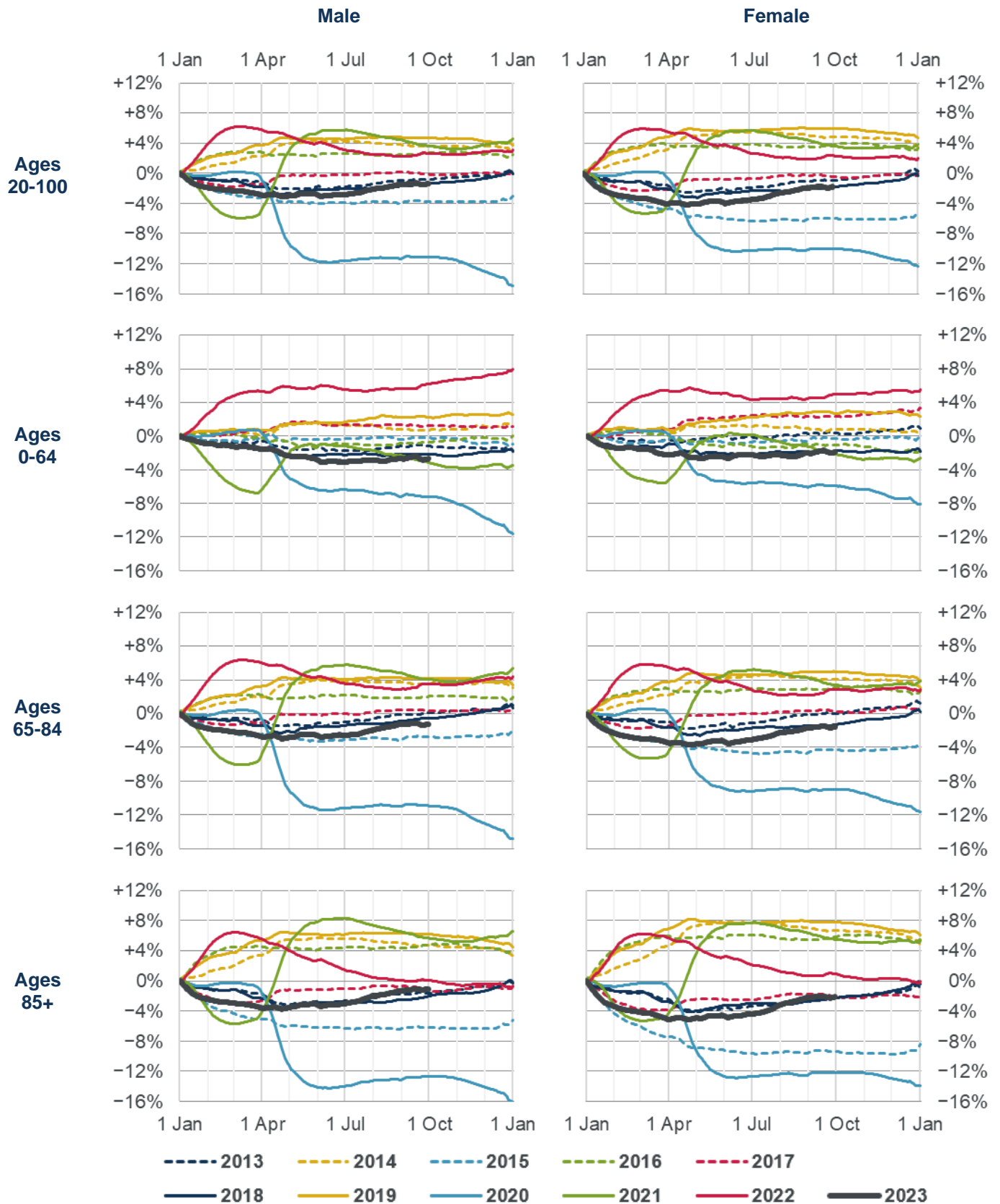
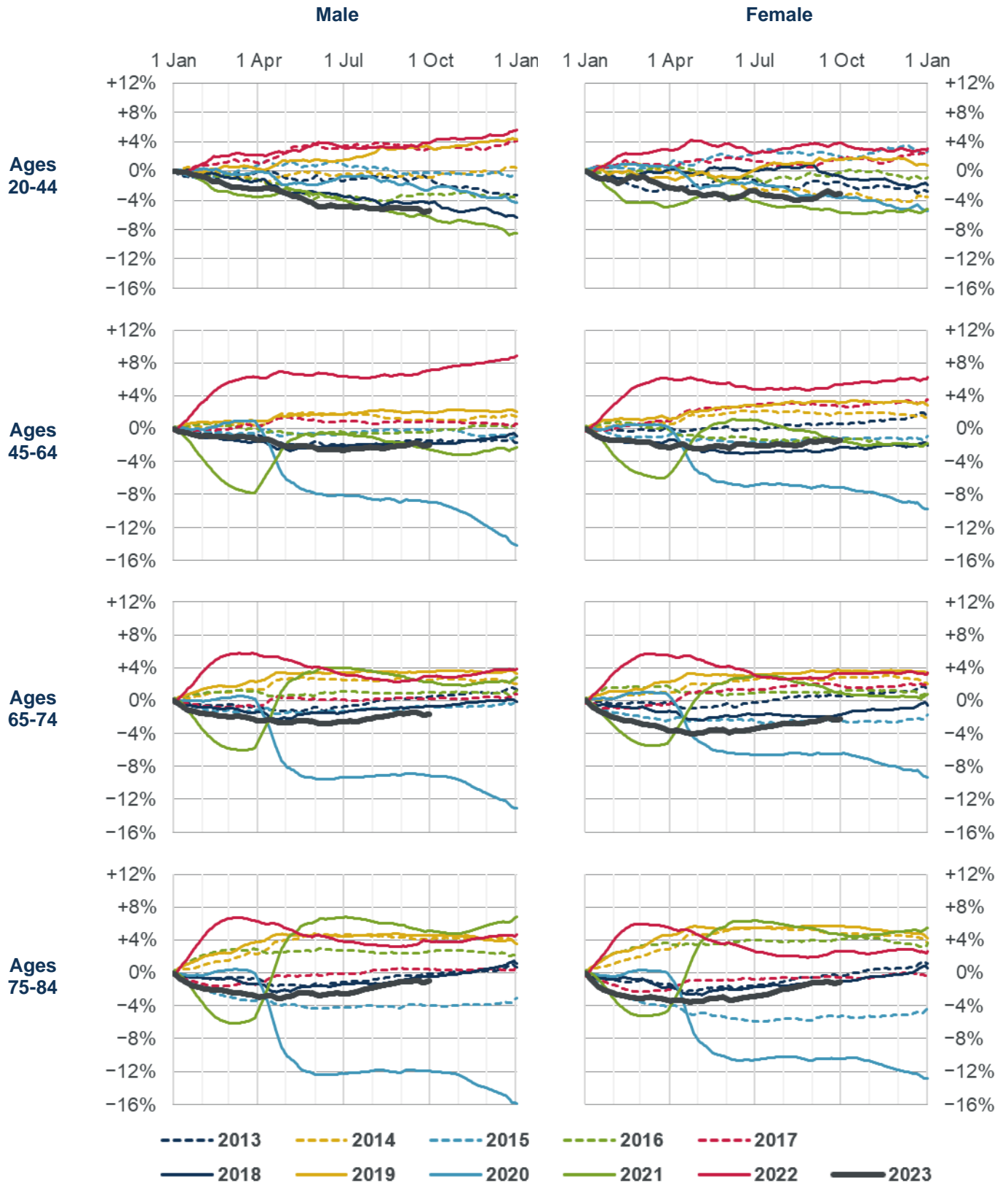




Chart H (cont): Cumulative annual standardised mortality improvement (cSMRI), by gender and age band





Appendix 1 – Accessible versions of charts D and E

Chart D2: Cumulative standardised mortality rate (cSMR) compared to the 2013-2022 average, showing 2013-2023 and highlighting individual years

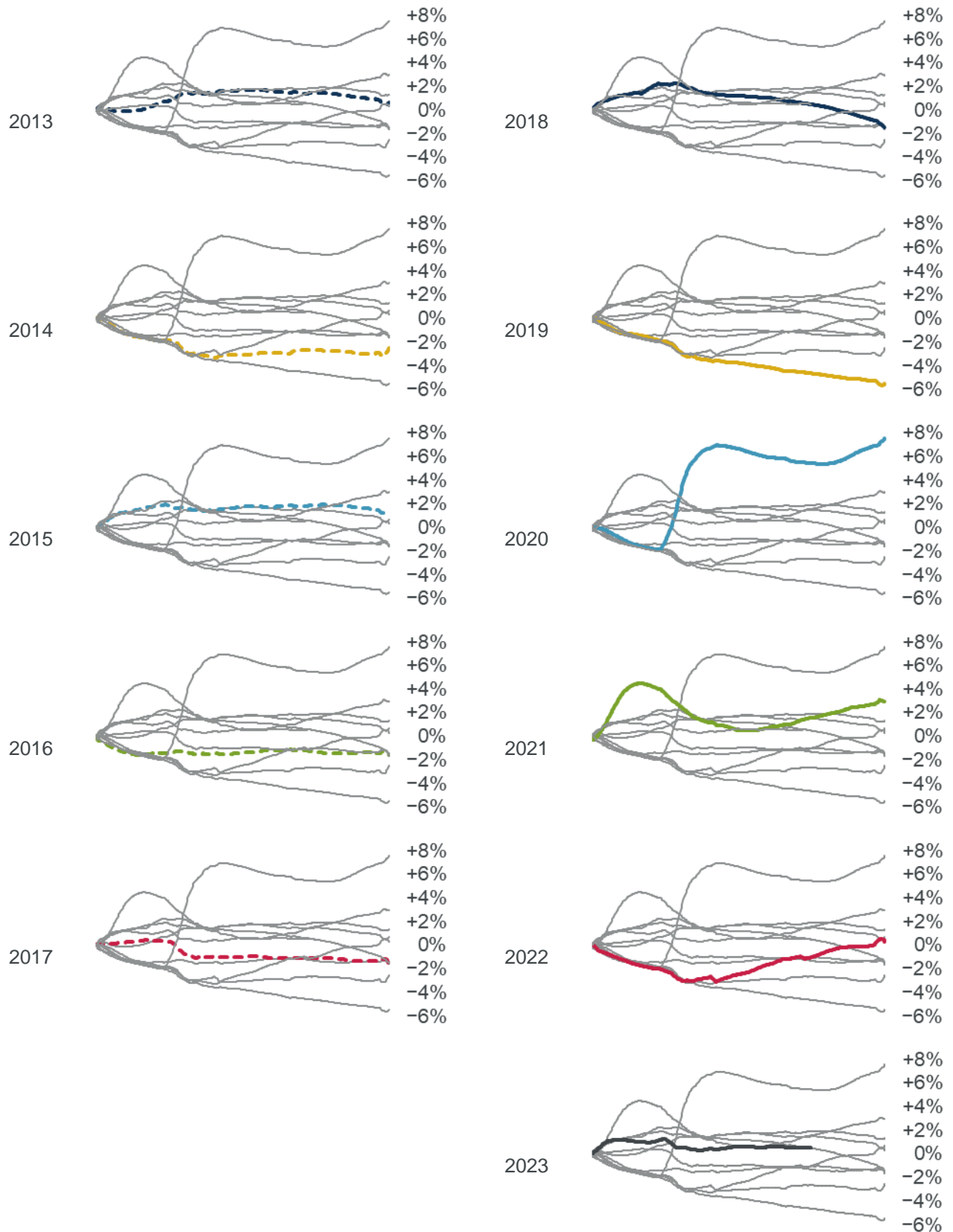
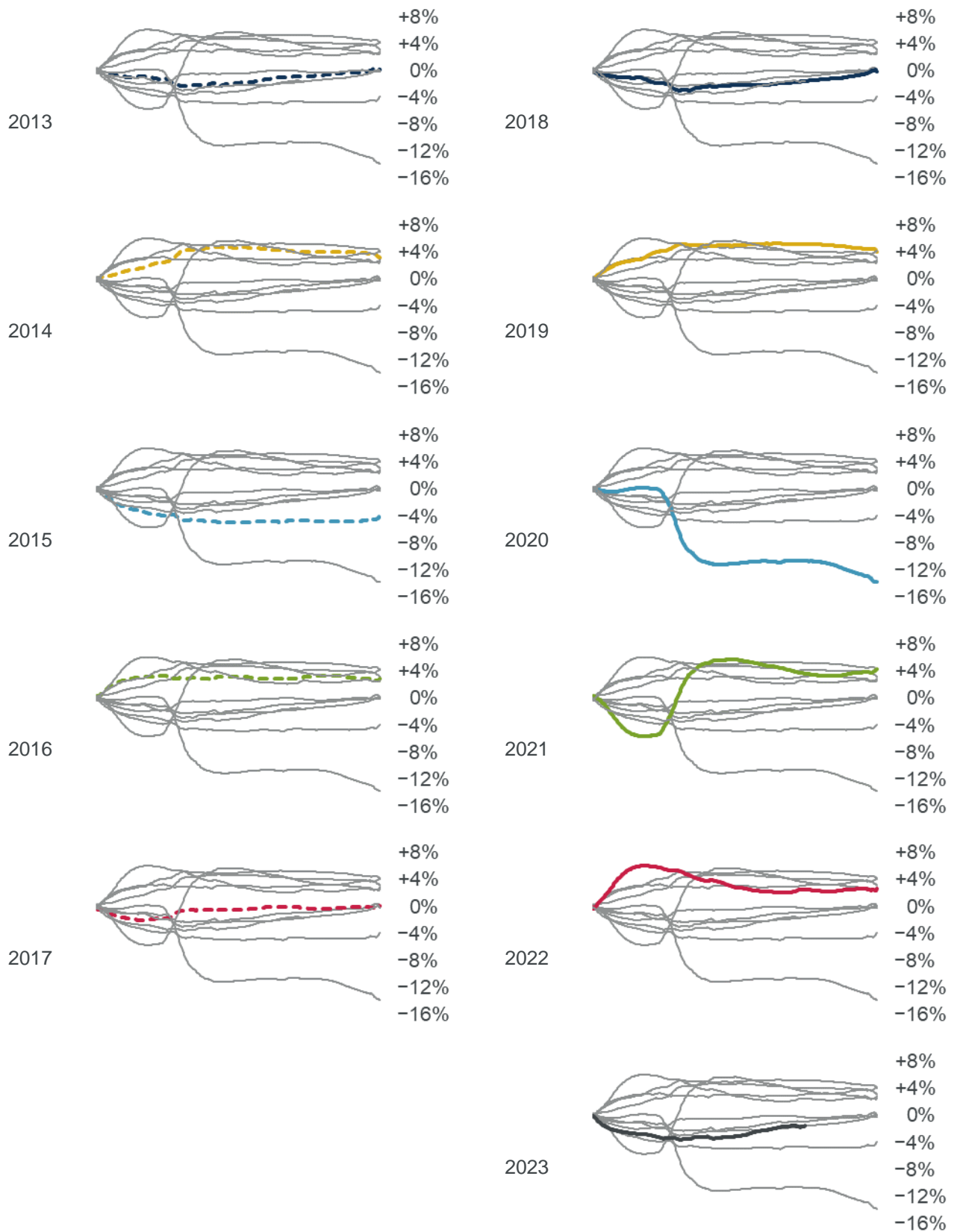


Chart E2: Cumulative annual standardised mortality improvement (cSMRI) for 2013-2023, highlighting individual years



Appendix 2 – Estimated results on an occurrences basis

This appendix considers how the results of the monitor for England & Wales would differ if they were based on death occurrences rather than death registrations. It largely reproduces the appendix from the monitor for week 33 of 2023. We have not updated the analysis of occurrences since then as the ONS has not published updated monthly data on occurrences.

Occurrences, registrations, and delays

Deaths data for a particular time period can be based on “occurrences” (when the deaths occurred) or based on “registrations” (when the death was registered).

There is typically a “registration delay” between the date of occurrence and date of registration. The registration delay is often short, as UK deaths should be registered within five days unless referred to a coroner, but delays of several years are possible in some cases.

Why we use registrations

The number of deaths in a period on an occurrences basis is uncertain for some time after that period due to registration delays. While it is possible to estimate the number of occurrences sooner, based on typical registration delays, these estimates are themselves uncertain.

Registrations are a timely and reasonable proxy for occurrences, as long as registration delays are stable, or reasonably stable, over time.

The mortality data published weekly by the ONS provides much more detail on a registrations basis than on an occurrences basis. The registrations data provides splits by gender and five-year age band, while the occurrences data only provides a total figure.

Registration delays

Chart A1 shows registration delays in the month following occurrence, based on monthly data published by the ONS¹. For deaths occurring in each month, we show the number of deaths registered in the following month as a percentage of the number registered within the month of occurrence. For example, data to the end of December 2022 shows 48,164 deaths occurring in December 2022, while data to the end of January 2023 shows 61,286 deaths occurring in December 2022, which is 27% higher. A higher percentage indicates a longer delay in registering deaths.

Chart A1: Registration delays in the month following occurrence – see text for details



The chart shows a fairly steady pattern for the first half of the period, but with the registration delay drifting upwards. The pattern changes dramatically in recent months, with large registration delays in December 2022, March 2023, and April 2023.

Chart A1 shows the registration delay between the month of occurrence and the following month. We have also looked at registration delays for later periods (e.g. between the following month and three months later, or

1

<https://www.ons.gov.uk/peoplepopulationandcommunity/birthsdeathsandmarriages/deaths/datasets/monthlymortalityanalysisenglandandwales>

between three months later and a year later). These delays are smaller and show a more stable pattern, without the sharp peaks of recent months.

Estimated recent occurrences and registrations

We have estimated the number of occurrences in each month based on the number of occurrences registered by 31 July 2023 with an allowance for a typical historical pattern of monthly registration delays after that point. These estimates are necessarily uncertain, particularly for more recent periods where registration delays form a larger proportion of the estimate.

Chart A2 compares monthly death registrations with our estimate of monthly occurrences. Registrations and estimated occurrences tend to show peaks and troughs at similar times, but there are some notable differences, particularly for December 2022.

Chart A2: Estimated occurrences and registrations

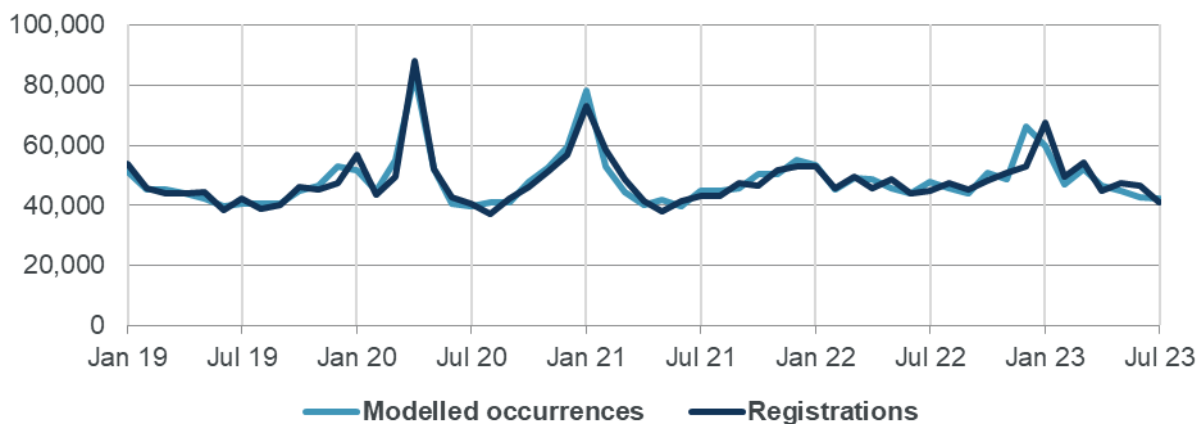


Table A1 considers the difference between modelled occurrences and registrations for calendar years 2019 to 2022 and for 1 January 2023 to 31 July 2023.

Table A1: Comparison of modelled occurrences and registration by year

Period	Modelled occurrences minus registrations		
	Number	Relative to 2019	Relative to 2019 (%)
2019	+4,800	-	-
2020	+1,600	-3,200	-0.6%
2021	+3,000	-1,800	-0.3%
2022	+13,400	+8,700	+1.6%
2023 – to 31 July	-16,200	-12,700	-2.4%

In 2019, 2020 and 2021 the difference between modelled occurrences and registrations was less than 1% of the number of deaths on either basis. The differences are more material for 2022 and for 2023 to date, due to the unusual registration delays shown in Chart A1.

We have not at this stage calculated ASMRs on an occurrences basis, due to a lack of detailed occurrences data by age and gender. If registration delays had the same impact on ASMRs as on deaths, and if there was no difference between registrations and occurrences after 31 July 2023, the cumulative ASMR for 2022 relative to 2019, shown in Chart 2 on a registrations basis, would be 1.6% higher, so around +7.8% rather than +6.2%; and



the cumulative ASMR for 2023 to 29 September 2023 date relative to 2019 would be 2.4% lower, so around +3.0% rather than +5.4%. However, these figures are uncertain as we do not know how registration delays may have varied by age and gender, and what registration delays have been after 31 July 2023.



Reliances and limitations

The purpose of the mortality monitor is to provide regular updates on standardised mortality in England & Wales, adjusting ONS data to allowing for changes in the size and age of the population. This can be used to inform a view on the outcome of the next version of the CMI Model, in the absence of any change in method.

The CMI aims to produce high-quality outputs and takes considerable care to ensure that the mortality monitor and the accompanying spreadsheet of results are accurate. However:

- We cannot guarantee their accuracy (see the Disclaimer).
- There is a reliance on the underlying data, published by the ONS and described as provisional.
- We have also applied judgement and assumptions in deciding on the calculation methods and the presentation of results.
- Anyone using the results of the mortality monitor should ensure that it is appropriate for their particular use, and note that care is needed when estimating full year experience from partial year experience. This is particularly true during the coronavirus pandemic.
- While the results allow for the 2021 census data published to date by the ONS, populations for years after 2011 are our own estimates. The final revised estimates published by the ONS are due in November 2023.

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