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COVID-19 Actuaries Response Group – Learn. Share. Educate. Influence.

Summary

The focus on understanding the extent to which the pandemic has affected different countries has thrown a spotlight on the concept of excess mortality. However, care is needed when interpreting the data and results to ensure that an objective view is obtained as to what is being seen in the data.

A recent ONS paper[1] provided an excellent overview of the situation across Europe. The report concludes that in the first phase of the pandemic the UK fared worst in terms of overall mortality, although Spain had the highest weekly peak. Although the report doesn't conjecture as to why it might be, the fact that the UK's decline from the peak appears to have been considerably slower than other badly hit countries must surely be a point for discussion in understanding how our response differed, and the lessons we can learn as we manage ongoing phases of the pandemic.

Introduction

The ONS recently published its first comparison of excess mortality across Europe, covering the impact of the first wave of the pandemic. This group has consistently stated that excess mortality is the most appropriate way to assess the impact of the pandemic, and so welcomes the analysis and insight provided by the ONS. We note also the engagement that the ONS had with the actuarial profession through its UK mortality monitoring body, the CMI, in the development of the report. But how is excess mortality calculated, and what needs to be considered when analysing and interpreting the results? This note sets out some of the key considerations in attempting to come up with the best view on excess mortality.

It's Not Just Excess Deaths

Those cautioning against simply using COVID deaths to assess the impact of COVID have often referred to the need to use "excess deaths" instead. For one country in isolation, that's a reasonable measure to take, and is undoubtedly an easy message to give, in that "we expected X deaths, we saw Y, so the total excess is Z". It's certainly better than simply trying to count COVID related deaths, with all the issues that Public Health England has been having in trying to assess whether somebody died of COVID, died with COVID, or "died but had a COVID positive test three months ago".

But in any comparison with other countries, "excess deaths" has two fundamental flaws. The first, and most obvious one, is that states have different populations. A comparison of Belgium, with 11m and the UK with 65m is clearly going to be meaningless without adjusting for the relative sizes.

More subtly, countries have different age profiles. An example is Italy, which has a greater proportion of elderly people. With a virus that has significantly worse outcomes at older ages, a country with Italy's age profile would, all else being equal, expect to get a higher number of deaths. But that wouldn't mean that it had performed any worse than a country with a younger demographic profile. A more sophisticated measure is needed if we are to compare countries.

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[1] https://www.ons.gov.uk/peoplepopulationandcommunity/birthsdeathsandmarriages/deaths/articles/comparisonsofallcausemortalitybetweeneuropeancountriesandregions/januarytojune2020

Age Standardised Mortality Rates are the Answer

Rather than look simply at excess deaths, we prefer, as the ONS has now done, to measure the effect of the pandemic by using age standardised mortality rates. This allows distortions caused by different age distributions to be eliminated. It also allows for any difference in proportions of males and females – useful given the virus results in much worse outcomes for males.

The ONS has standardised mortality rates against a known standard population, the "2013 European Standard population" which is already used in regular mortality monitoring across the continent.

The extent of the increase in mortality is then measured by considering the ratio of 2020 mortality against standard "expected" mortality, together with the absolute level of any increase (the equivalent of an "excess deaths" as represented by a mortality rate).

For those interested in the maths, the formulae are given in the ONS report, but to avoid too many readers switching off, they are not repeated here.

What Did You Expect?

The principle of excess mortality relies on comparison to "expected" mortality. If the overall level of mortality stayed constant over time, and there was little volatility year-on-year, then expected mortality would be relatively straightforward. But things aren't quite so simple.

Mortality rates tend to improve over time, so the further an average goes back the less appropriate it is as an estimate of expected mortality today. However, year-on-year volatility in mortality rates suggests that an average of a few years may be a better measure than simply comparing to last year. There is a balance to be struck, and there is no single correct baseline to compare against.
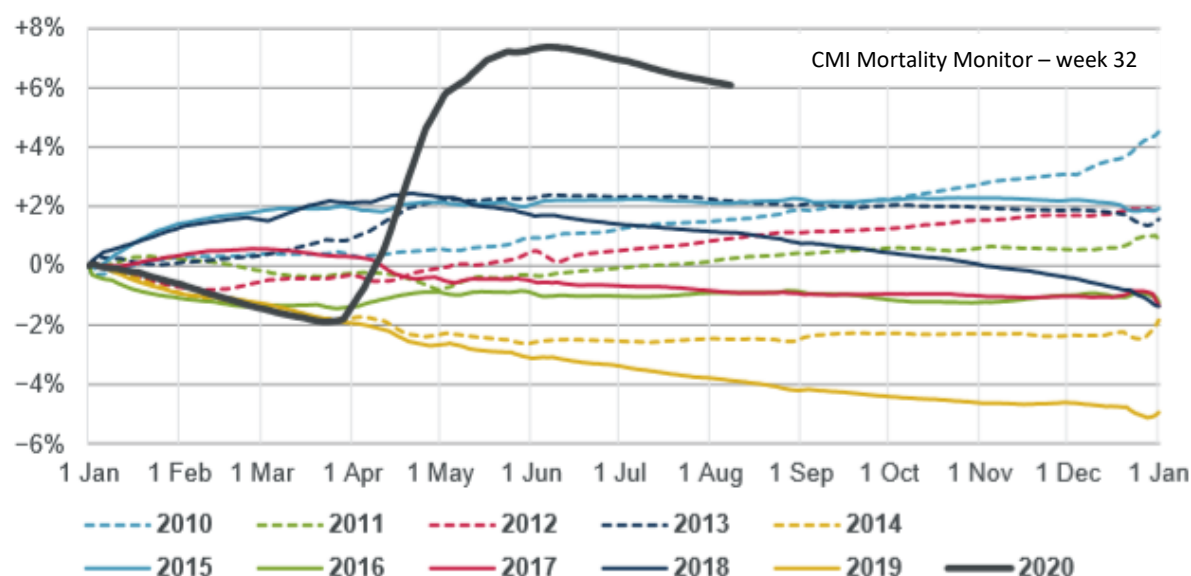
The ONS has chosen to use an average of the last five years, and in terms of a comparison with other countries that seems reasonable, and probably doesn't result in too much distortion to comparisons between countries, which is the aim of its bulletin.

Those following the CMI Mortality Monitor bulletins[2] produced during the pandemic will note that its view is that a direct comparison with 2019 is a better measure. Their rationale is that mortality in England and Wales during the first three months of the year was tracking almost exactly in line with 2019, and so that is judged to be the best baseline. Had the pandemic started in January (without any "normal" 2020 experience to see) a different view might have been taken.

This emphasises that judgement is needed in determining a suitable baseline, and that differing conclusions can both be valid depending on the purpose of the calculations.

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[2] https://www.actuaries.org.uk/learn-and-develop/continuous-mortality-investigation/other-cmi-outputs/mortality-monitor

CMI Mortality Monitor – week 32

2020 Vision

So how bad has it been in 2020 across Europe? We can start by looking at relative weekly mortality ratios. A sample of three countries gives a good comparison. Portugal has fared relatively well; Netherlands has not done so well, and Spain had the highest weekly mortality across Europe. The lighter line is for over 65s, and the darker line represents under 65s.


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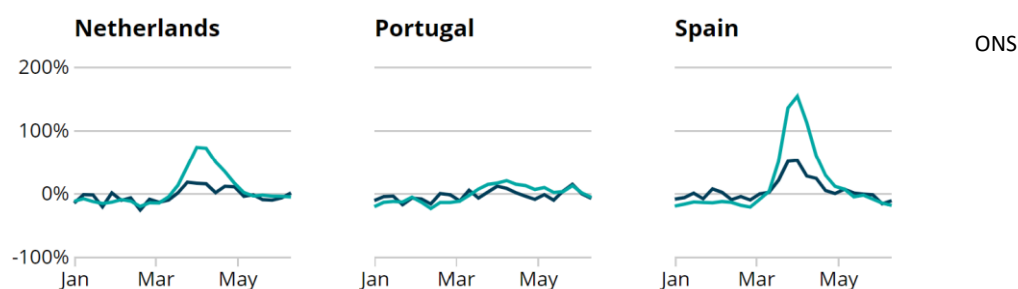
We can see that the older age group has been much more badly affected in terms of relative increase in mortality. It's striking how little Portugal has been affected, with the graph appearing to show little more than normal volatility that might be seen during a bad flu season.

These graphs give a sense as to the comparison in the worst weeks, but what is more difficult to ascertain is how badly a country has been hit overall. To assess that we need to look at the accumulation of excess mortality over the period of the pandemic and beyond.

Cumulative Comparisons are Better

The cumulative mortality charts used by the CMI, and now the ONS, plot year-to-date difference between expected and actual mortality using relative cumulative age-standardised mortality ratios, which express the 2020 mortality as a percentage of the full year expected mortality. This measure avoids distortions due to where in the calendar year the pandemic has taken hold, and enables comparisons between countries where the timing of the pandemic differs. However, care is still needed as to how this data is interpreted.

As noted above, UK mortality in the first three months of 2020 was low in comparison to recent years, so before the pandemic started to affect the figures, excess mortality was actually negative. This effect was seen in other countries too, as can be seen with three further examples.
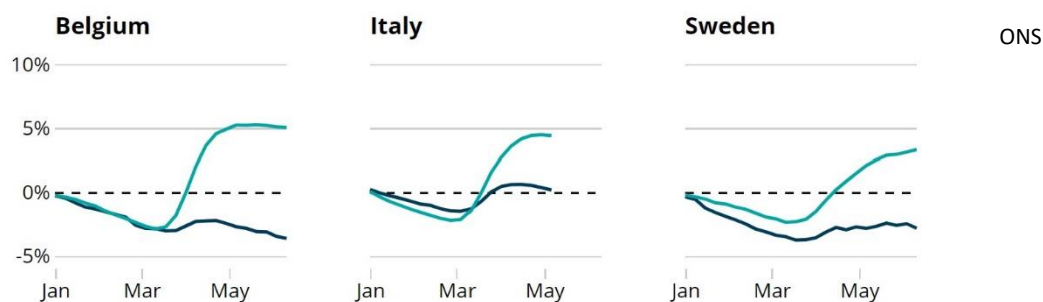
So although overall excess mortality for the year is calculated by reference to the dotted line, a better starting point from which to measure the impact of the pandemic might be the low point before the increase starts.

Even that view can be challenged though, as the track before the pandemic was downward, so might the effect be better estimated by plotting a continuation of the pre-pandemic trend instead?

Understanding the reasons for low mortality in the early part of the year helps in forming a view as to how likely it would be to continue. For example, light mortality due to a benign flu season would be unlikely to continue into the summer.

The under 65 line for Belgium reinforces the need to exercise a degree of judgement. Excess deaths have been negative throughout, although clearly there were some COVID-19 deaths, evidenced by the small uptick in the curve in April. Since then the downward trend has continued, which looks as though it is simply a reversion to the previous low mortality. So how does one judge the impact? In this instance it would seem a line continuing the pre-pandemic trend would be preferable to quantify the additional mortality experienced.

In summary, cumulative analyses need to be interpreted carefully, to understand what the shape of the curve is telling us. The ONS helpfully provides a tabular summary which confirms that whilst Spain had the highest peak mortality, the UK has the overall worst experience, by virtue of a slower fall from the peak.

Monitoring beyond the first wave

It has been suggested that a majority of COVID-19 deaths were very old and frail people who would have died soon anyway. The author disagrees with this view, but there will undoubtedly have been a proportion of deaths where that is the case, so an important part of mortality monitoring should be to try and ascertain the degree to which "forward displacement" mortality has occurred.

Intuitively, if people died weeks or months early due to COVID-19 then this should be seen in lighter than expected mortality as the pandemic subsides. Thus monitoring needs to continue beyond the initial phase of excess deaths. Again, this can throw up conundrums, as a return to Belgium's experience can demonstrate.

As noted, mortality, particularly for the over 65s, was running well below track in the first quarter. So if we see negative excess mortality in the coming months, is it due to forward displacement reducing deaths, or simply the previous trend picking up from where it left off? In the UK, which has seen a similar pattern to Belgium, weekly deaths reporting has indeed shown lighter than average mortality over the summer months, although this has not been out of line with the pre-pandemic experience. Future analysis may be able to pinpoint how much of this is due to forward displacement, particularly looking at the experience of very elderly lives, where it is more likely to have occurred, to aid interpretation of the data.

The timing of the pandemic in relation to calendar years can also influence results. There is a temptation to close off any analysis at the end of 2020. Not unreasonable maybe, but if a second wave occurs in the autumn, the effects will likely run into 2021, meaning an analysis extending beyond one year may be appropriate.

2021 will also bring new challenges in terms of the methodology used to assess excess deaths. Any comparison with prior years (which would then include 2020) will be distorted by the impact of the pandemic in 2020, and so some adjustment will be needed to avoid results that are misleading.

Conclusion

Whilst excess deaths can be a simple and relatively easy to understand measure, excess mortality, as measured by relative age standardised mortality rates is undoubtedly the best way to compare different countries' experiences. But even here, any figures and graphs need to be interpreted with caution, to avoid jumping to inappropriate conclusions.

Over the course of the pandemic, differing, sometimes extreme, views have been aired in mainstream media and social media as to how bad the UK's mortality has been, whether lockdown has (or will) contribute to excess deaths, or indeed whether those who died would have done so anyway this year. Excess mortality analyses are a way to present data in a balanced and considered way to give an objective contribution to any discussion.

The ONS report concludes that in the first phase of the pandemic the UK fared worst in terms of overall mortality, although Spain had the highest weekly peak. Although the report doesn't conjecture as to why it might be, the fact that the UK's decline from the peak appears to have been considerably slower than other badly hit countries must surely be a point for discussion in understanding how our response differed, and the lessons we can learn as we manage ongoing phases of the pandemic.

1 September 2020