

Estimating additional deaths to expand the RWCS

Office for National Statistics (ONS) and Department of Health and Social Care (DHSC), June 2020

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1. Summary

The Reasonable Worst Case Scenario (RWCS) provides an estimate of deaths directly due to COVID-19, based on Public Health England (PHE) data on deaths of people who have had a laboratory-confirmed COVID-19 test. This information is timely but not comprehensive, as ONS's weekly death registration data show a number of deaths where COVID-19 is mentioned on the death certificate but a test was not necessarily completed. ONS weekly death registrations also show a recent increase in deaths not involving COVID-19, assumed to be related to the COVID-19 outbreak and/or government's interventions to tackle COVID-19. To assist in planning, ONS and DHSC have produced the following adjustments to the RWCS, to capture the deaths which the RWCS does not include.

These adjustments change the RWCS to account for:

- The number of COVID-19 direct deaths which would have been expected within the 16-week RWCS reference period (18 May to 6 September). This adjusts the RWCS down, as not all deaths due to COVID-19 will represent additional demand for services.
- The number of COVID-19 deaths not counted within PHE data. This adjusts the RWCS up, as death certificates can mention COVID-19 without a positive test being completed.
- The number of non-COVID-19 excess deaths expected. In most cases this adjusts the RWCS up; for some age groups there is very little effect.

The accompanying workbook demonstrates the calculations to produce these adjustments.

Please note for all three of these calculations, the adjustments provided are based on the information we have so far about COVID-19 deaths and non-COVID-19 excess deaths, which is a limited time-series. Further, we still have a lot to understand about COVID-19 fatalities and how close they were to end of life. The relationships between PHE estimates and ONS estimates, and between deaths involving COVID-19 and not involving COVID-19, are all unstable over time, even for the few weeks for which data are available. In the absence of better understanding, we have compiled a set of instructions to create an adjustment to the RWCS for *all* deaths, based on cautious assumptions that err on being a potential over-estimate, rather than under-estimate, of total deaths. As for the RWCS itself, the adjusted RWCS represents a **scenario** and not a forecast of all deaths.

It should be noted that the estimates at a regional level will be much less robust than estimates at a national level (England and Wales), as there is significantly more uncertainty in incidence and R values; and there may be variation in other circumstances affecting the outcome of total deaths. Therefore, caution should be applied when utilising the regional estimates.

2. Adding additional COVID-19 deaths

Analysis of the relationship between ONS and PHE data shows it does not appear to be constant over time. The weeks used for adding non-COVID-19 deaths in section 4 of this paper are Weeks 14 to 20 of 2020; over this period, ONS data began at 1.1x PHE's deaths, rose steadily to over 1.4x in mid-April (Week 16), and fell steadily to 1.1x by mid-May (Week 20). These values have been produced by ONS using multivariate modelling.

As a very cautious estimate, **multiplying the number of COVID-19 deaths in the RWCS by 1.3** can provide a figure for the total deaths involving COVID-19 for that week.

As mentioned above, the ratio between ONS deaths data and PHE deaths data is not constant, so any adjustment made here should be treated with caution.

3. Removing deaths which would have occurred anyway within the reference period

ONS's internal modelling has estimated how many of the RWCS's deaths were expected to occur within the 16-week period, so would not represent an additional burden on services. This estimate is broken down by age. Overall, the expected change in total deaths is -6.4%. So 93.6% of COVID-19 deaths (both in the RWCS, and additional added in Section 2) are not expected to occur otherwise within the 16-week period.

Table 1 below provides the adjustment factor to apply to the number of COVID-19 deaths. For example, 95.9% of deaths involving COVID-19 for 60-69 year olds are additional burden – so 4.1% of COVID-19 deaths within that age group would have occurred anyway within the RWCS reference period.

When producing values for regions, use the all ages factor.

Analysis does suggest some deaths in younger age groups would have occurred anyway within the reference period in the absence of COVID-19; but the analysis is not sufficiently robust at these ages to include an adjustment.

Table 1: adjustment factor for COVID-19 excess deaths

| Age group | Adjustment factor |
|-----------------|-------------------|
| <60 | 1.000 |
| 60 to 69 | 0.959 |
| 70 to 79 | 0.958 |
| 80+ | 0.920 |
| All ages | 0.936 |

4. Adding non-COVID-19 deaths

The following uplifts in Table 2 can be applied to the England and Wales RWCS estimate; the regions of England, and Wales independently estimates; and estimates broken down by age. The same flat increase should be applied to all weeks.

Table 2: weekly non-COVID-19 excess deaths to add to the RWCS

| Breakdown | Weekly non-COVID-19 excess deaths expected |
|--------------------------|---|
| England and Wales | 1,784 |
| <hr/> | |
| By region: | |
| North East and Yorkshire | 257 |
| North West | 245 |
| Midlands | 405 |
| East of England | 235 |
| London | 256 |
| South East | 247 |
| South West | 150 |
| Wales | 10 |
| <hr/> | |
| By ageband: | |
| 0-19 | 6 |
| 20-39 | 0 |
| 40-59 | 68 |
| 60-69 | 53 |
| 70-79 | 344 |
| 80-89 | 671 |
| 90+ | 677 |

These numbers are calculated using ONS's weekly registration data¹.

- The non-COVID-19 deaths are calculated by subtracting death registrations involving COVID-19 from "all causes" total deaths;
- The non-COVID-19 excess deaths are calculated by subtracting the five-year average from the non-COVID-19 deaths;
- The average (mean) of this non-COVID-19 excess deaths result for weeks 14 to 20 is used to give a suitable estimate for the number of additional non-COVID-19 deaths to expect for this

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<https://www.ons.gov.uk/peoplepopulationandcommunity/birthsdeathsandmarriages/deaths/dataset/weeklyprovisionalfiguresondeathsregisteredinenglandandwales>

group, per week. This can be added to the RWC for that breakdown for every week of the reference period.

We recommend applying the same change to every week of the RWCS reference period, as the evidence available so far does not support using more precise adjustments.

For some regions and age breakdowns, notably Wales and younger age groups, the result for this calculation is negative. This is because the non-COVID-19 deaths observed in latest data are below the five-year average. In these cases for the RWCS, the additional number of deaths to expect have been treated as 0, rather than a reduction in deaths.

Due to the small number of deaths per week in ages 1 to 59, we have summed these into three age bands: 0-19, 20-39, 40-59. The older age groups have sufficient numbers of deaths to not require this change.

Weeks 14 to 20 are used for the average, as these are the weeks in which non-COVID-19 excess deaths were most significant so far, matching the future RWC estimates. Death registrations are used rather than occurrences because there is usually a delay of around five days between a death occurrence and its registration, with that delay varying depending on cause of death. As such registrations are a more meaningful measurement when looking at deaths data in very recent periods.

There are alternative methods for calculating the expected number of deaths in the absence of COVID-19, other than the five-year average. However, the five-year average is the simplest and relies less on additional assumptions, such as adjusting for how the population size and age distribution has changed over time.

The published data used to produce these estimates cover England and Wales. There is no consistent trend over time for non-COVID-19 excess deaths or the relationship between them and COVID-19 deaths – and time series are even more unpredictable for individual regions. For this reason, we are not in a position to recommend what uplift to apply to Scotland or Northern Ireland COVID-19 deaths.

5. Combining these adjustments

The order in which these adjustments are applied will impact the results produced. We recommend the same order as this paper:

- Adjust the RWCS to account for additional COVID-19 deaths (Section 2)
- Adjust this new number to account for excess COVID-19 deaths (Section 3)
- Add the relevant non-COVID-19 excess deaths (Section 4)

This means the RWCS's weekly values should be adjusted as in Table 3 to produce an expanded weekly estimate. The full time-series for each of these breakdowns is presented in the accompanying workbook.

Table 3: weekly non-COVID-19 excess deaths to add to the RWCS

| Breakdown | Adjustment to RWCS |
|------------------|---------------------------|
|------------------|---------------------------|

England and Wales $(RWCS * 1.3 * 0.936) + 1784$

By region:

North East and Yorkshire $(RWCS * 1.3 * 0.936) + 257$
North West $(RWCS * 1.3 * 0.936) + 245$
Midlands $(RWCS * 1.3 * 0.936) + 405$
East of England $(RWCS * 1.3 * 0.936) + 235$
London $(RWCS * 1.3 * 0.936) + 256$
South East $(RWCS * 1.3 * 0.936) + 247$
South West $(RWCS * 1.3 * 0.936) + 150$
Wales $(RWCS * 1.3 * 0.936) + 10$
England $(RWCS * 1.3 * 0.936) + 1770$

By age band:

0-19 $(RWCS * 1.3) + 6$
20-39 $(RWCS * 1.3)$
40-59 $(RWCS * 1.3) + 68$
60-69 $(RWCS * 1.3 * 0.959) + 53$
70-79 $(RWCS * 1.3 * 0.958) + 344$
80-89 $(RWCS * 1.3 * 0.920) + 671$
90+ $(RWCS * 1.3 * 0.920) + 677$
