

# Analysis of unreported Covid 19 mortality statistics for the United Kingdom of Great Britain and Northern Ireland

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This document contains material supplementing the prediction analysis in daily reports published on <https://er.ethz.ch/Covid-19>.

**Summary:** On 1 May 2020, the UK government reported 27,510 deaths from Covid 19 for the whole of the UK as recorded on the Johns Hopkins portal. We combine data sets published separately for England and Wales (E&W), Scotland and Northern Ireland. We find that the daily published data for England and Wales are seriously under-reported for two reasons. First, when official statistics are published about 12 days in arrears, these revise upwards the daily published figures. Second, there is excess mortality in care homes and in people's houses that is not being recorded as Covid 19 related. While the possibility exists for collateral excess deaths at this time, the scale of the excess mortality is such that it seems most likely to result from Covid 19, but lacks confirmation by a test. Combining data from the three jurisdictions with the under-reporting from care homes and the community, we compute that, on 1 May 2020, actual UK deaths from Covid 19 were ~ 52,736. Our conclusion is that the UK government is under reporting Covid 19 deaths on a daily basis by approximately 92%. The daily basis number is the headline reported by the media.

## Introduction

The reliability of reported Covid 19 confirmed cases and deaths has been and remains a hot topic. This often applies to less developed countries where, for example, Belarus with no lockdown also reports low fatality rates. These are often dismissed by the media as artificially suppressed statistics.

Among the OECD countries we would normally expect a high level of reliability in reported statistics give or take certain delays in compiling and reporting some data at these high stress times. Somewhat surprisingly, however, the UK has found itself at the centre of a reporting controversy. At some point in the course of March, it was made clear by the British Government that deaths being reported daily were only those for UK hospital deaths leaving a question mark over what the actual total deaths figure was.

Before continuing, it is useful to review the jurisdictions of the United Kingdom of Great Britain (England, Scotland and Wales) and Northern Ireland. Scotland, Wales and Northern Ireland all have devolved governments that have varying degrees of devolved powers. Scotland has the greatest degree of "independence" including tax-varying powers. Scotland and Northern Ireland are compiling their own Covid 19 statistics. The UK Office for National Statistics (ONS) has responsibility for reporting England and Wales (E&W). This is a fragmented dog's dinner of statistics. But it is the ONS that has responsibility for reporting on behalf of the whole of the UK and they have presumably taken reports from Scotland and N Ireland and deconstructed them into hospital deaths for the whole of the UK.

The population structure of the UK is as follows:

England and Wales 59.116 million

Scotland 5.454 million

N Ireland 1.882 million

UK total 66.452 million

Presumably under pressure from certain quarters, in their week 14 report (week ending 3<sup>rd</sup> April that will have been made in mid-April), the ONS included a tab showing the location of deaths in England and Wales backdated to week 11 ending 13 March. The Financial Times picked up on this additional information and published an analysis that revealed potential under-reporting in care home deaths that we have taken a great interest in. The present Covid 19 supplemental report focuses on the non-hospital death-reporting standard of ONS for E&W. We focus on potential serious under-reporting of mortality in care homes and in the community (normal homes) and attempt to compile an accurate picture of Covid 19 deaths in the UK. We then normalise this to our logistic projections to make an estimate of final UK mortality.

### Summary of Covid 19 mortality in England and Wales

Contrary to numerous media reports, and well understood by the medical community, Covid 19 does not kill indiscriminately. It targets mainly the old and very old. 88% of all E&W deaths are in the >65 age group. The mean age of the dead in week 18 was 80.5 years. Furthermore, the majority of those dying have one or more co-morbidities frequently dementia, obesity, high blood pressure, coronary artery disease, diabetes or cancer. In France, 99% of the deceased > 75 years have 4 or more chronic diseases. The disease is killing mainly the very old and already sick. That is not to say that it does not kill younger people at all, but they are relatively few. Numerous studies indicate that young fit people either do not have significant SARS-Cov-2 virus load or, if they do exhibit symptoms, they manage, in their large majority, to shake off the infection without the need for hospitalisation.

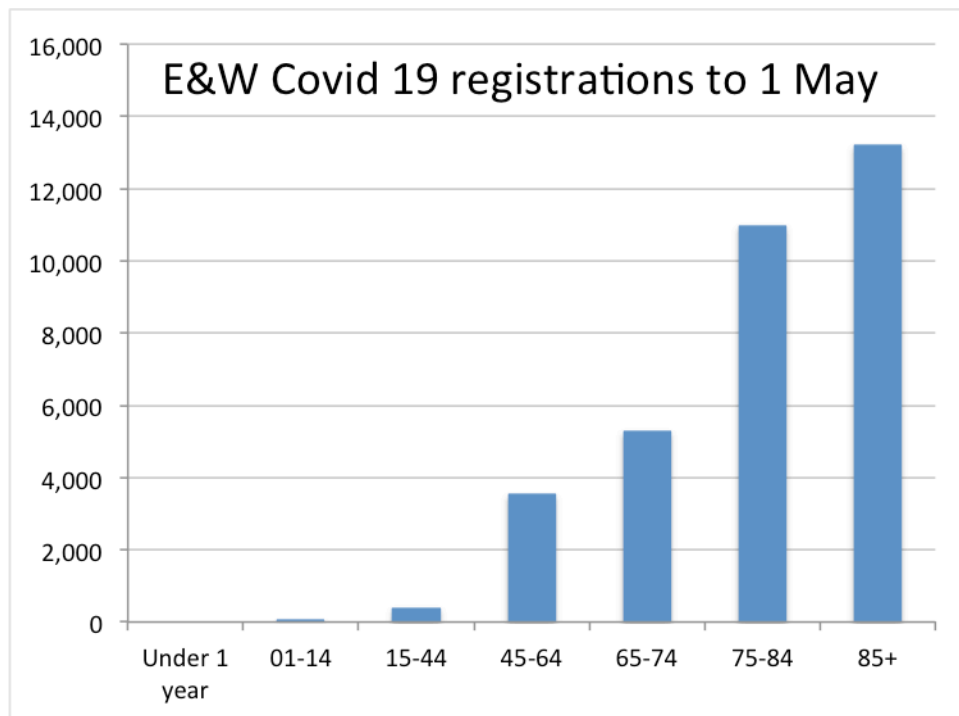


Figure 1 Covid 19 deaths by age group for E & W.

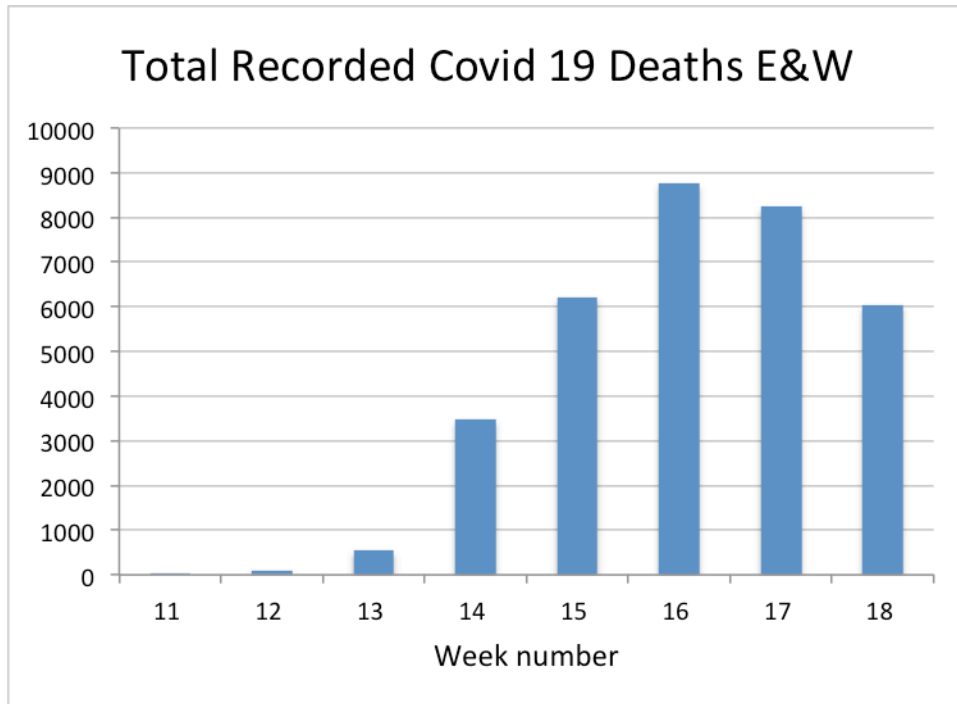


Figure 2 Covid 19 deaths by week for E & W as recorded in [1].

Perhaps the most tragic examples of younger people dying is among the hospital and care home sectors where young individuals have been exposed to higher viral load, some of them having been very sick (and some have died), suggesting a dose effect still under scientific scrutiny.

Figure 2 shows the numbers of Covid 19 deaths by week. Starting from a very low base in week 11 (ending 13 March), the epidemic peaked at 8758 deaths in week 16 (ending 17 April). Three weeks on and the worst should by now be past.

### Care Home Deaths in England and Wales

This report is constructed with the most recent statistics from ONS released on 12 May that updates to week 18 ending 1<sup>st</sup> May 2020. Time of writing began on 12 May.

The data are accessed from the ONS web site [1]. We are working off the XL spread sheet called publishedweek182020.xlsx, tab Place of occurrence, accessed on 12 May 2020. The data are plotted in Figure 3.

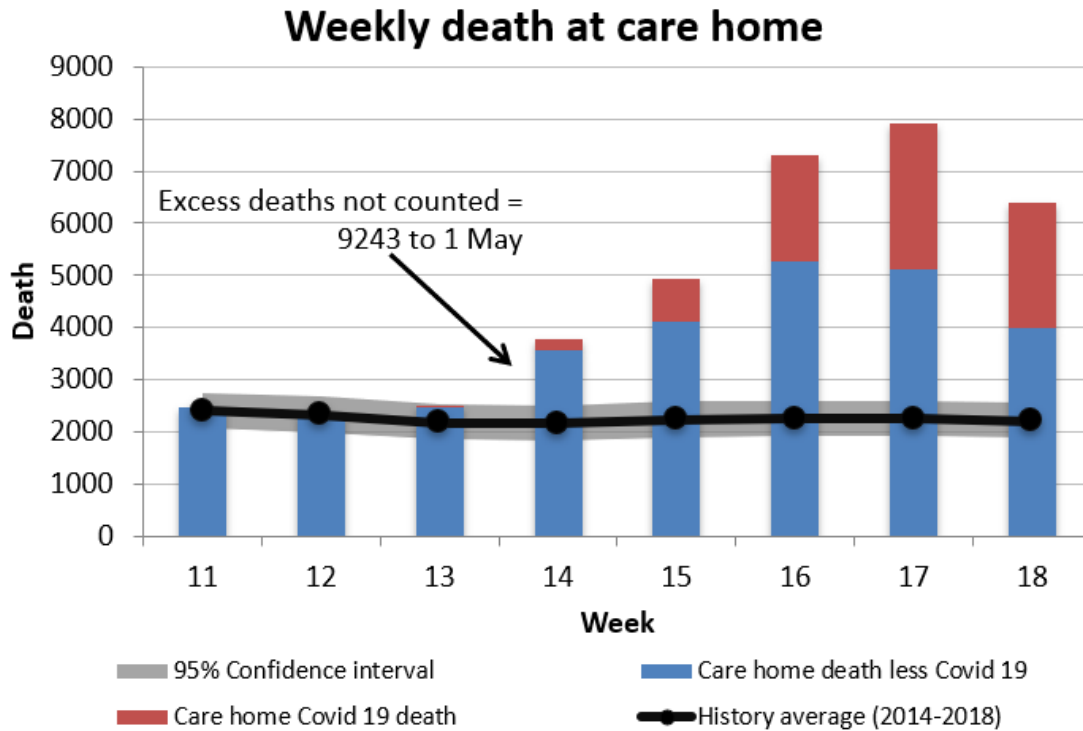


Figure 3 The graph shows total deaths in UK care homes as reported by ONS divided into confirmed COVID-19 deaths and unconfirmed COVID-19 deaths. The history average is based on the data in 2014-2018 after adjusting for seasonality [2]. The 95% confidence interval is based on the average standard error of the seasonal variations. The excess deaths not counted as COVID-19 is derived as the number of deaths above the upper boundary of the confidence interval after deducting the confirmed COVID-19 deaths.

Figure 3 shows the distribution of care home deaths for weeks 11 to 18, in red are the recorded Covid 19 care home deaths (ONS): in blue the residual of total care home deaths. The history average (2014-2018) is plotted by the black line with the 95% confidence interval in the shaded area. The care home deaths in Week 11-13 are in line with past years' data. The beginning of week 11 is Monday 9<sup>th</sup> March and the end of week 13 is Friday 27<sup>th</sup> March. In this three-week period, the UK Covid 19 epidemic had not yet taken grip. We assume that deaths above the upper boundary of the confidence interval are excess deaths due to Covid 19. We then deduct the upper boundary from total deaths and then we deduct the recorded Covid 19 deaths from that residual to compute the number of excess deaths not accounted for, which we reasonably allocate to unrecorded Covid 19 deaths.

In weeks 14 to 18, these amount to 9243 excess deaths that may be attributed directly or indirectly to Covid 19 (most likely) or to collateral deaths where conventional hospital treatment was denied to those in need of it.

For weeks 14 to 18, we therefore compute the following:

- Recorded Covid 19 deaths in care homes, E&W reported by ONS = 8288
- Excess care home deaths in E&W likely due directly or indirectly to Covid 19 that are not yet recorded = 9243
- Likely total care home deaths from Covid 19 in E&W to 1<sup>st</sup> May 2020 ~ 17,531

Community deaths in England and Wales

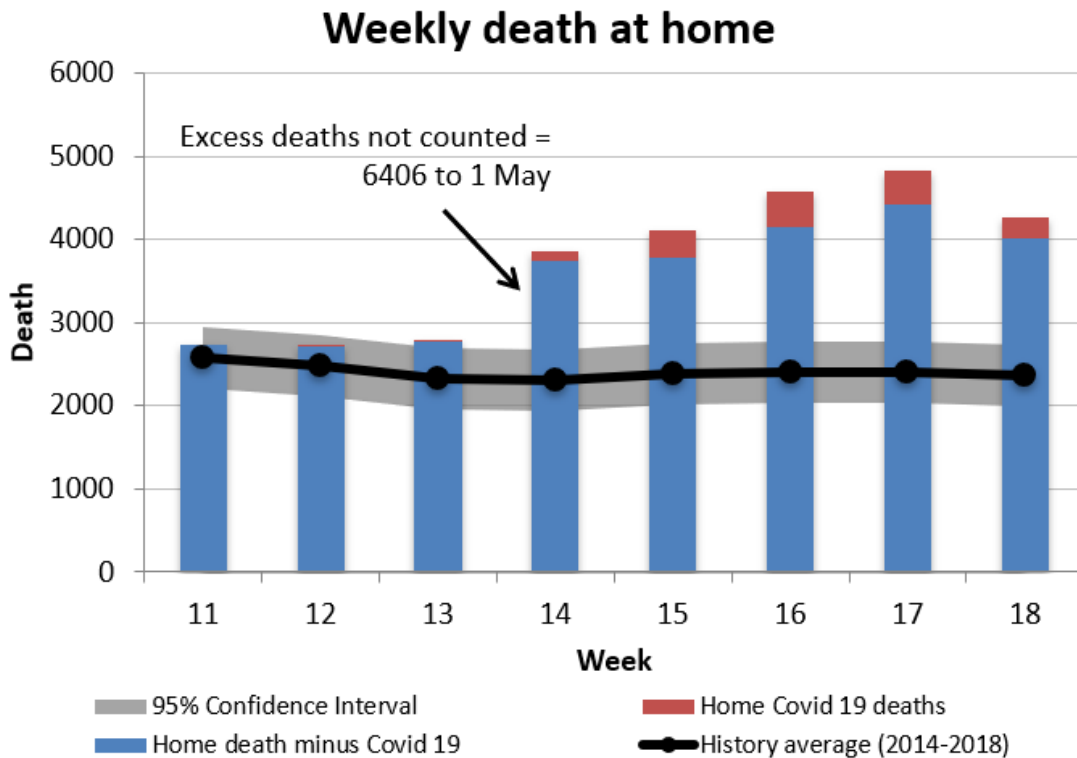


Figure 4 The other major contribution to Covid 19 deaths in the UK comes from deaths in the community. The methodology is the same as described in the caption to Figure 3.

The other significant category reported by ONS is deaths at home. This of course happens all the time (normally unreported by the media) and in Figure 4 we show the incidence of deaths at home for E&W as reported by ONS up to week 18. We perhaps need to assume that these are very elderly people, living alone, who have elected to die at home. Or perhaps they had no phone and no one to help. Following the same methodology as we use for care homes, we observe that Week 11-13 are in line with the past years' data, while there is a significant rise in weeks 14 to 18, a likely consequence of excess deaths resulting from the Covid 19 epidemic, where only a small fraction of the excess Covid 19 deaths are officially recorded by ONS (in red).

From Figure 4, we compute:

- Deaths from Covid 19 at family home as recorded by ONS, weeks 14 to 18 = 1543.
- Excess deaths in family home not recorded by ONS for weeks 14 to 18 ~ 6406.
- Total community deaths possibly from COVID-19 ~ 7949 for weeks 14 to 18.

## Deaths in other locations

On the spread sheet published week182020.xlsx, tab Place of occurrence, there are six locations of death reported. The three main ones are family home, hospital and care home. Three other locations are also recorded namely hospice, other communal establishment and elsewhere. The totals from these three other locations for weeks 11 to 18 are as follows:

Hospice	385
Other communal establishment	143
Elsewhere	133
Total	661

## Discussion

As a leading member of the OECD, we may have expected the UK to have set an exemplary standard in reporting the Covid 19 epidemic. But quite the opposite seems to have happened. A trend has developed where first it was conceded that UK deaths from Covid 19 were actually deaths confirmed by a test in UK hospitals, leaving the scale of broader community deaths unanswered. And then on 29<sup>th</sup> April, the UK changed its reporting standard from confirmed hospital deaths to confirmed hospital deaths + confirmed community deaths from Covid 19, leaving the issue of unconfirmed community deaths from Covid 19 an open question. We have applied a simple methodology of estimating excess deaths in weeks 14 to 18 compared to the data in the period 2014 to 2018, combined with gathering all the data from the ONS [1] that are published as official statistics about 12 days behind the deaths actually occurring.

The three UK jurisdictions that are accounting Covid 19 deaths are using different standards. Up to 28 April, E&W were reporting hospital deaths only while Scotland and North Ireland report hospital, care home, and community deaths. Figure 5 is extracted from National Records Scotland (covid-deaths-extra-tables-week-19) [3]. This clearly shows how care home deaths have come to dominate the Scottish statistics. There is no reason to believe that the E&W statistics would be significantly different.

Figure S6: Daily deaths by location, COVID-19 deaths

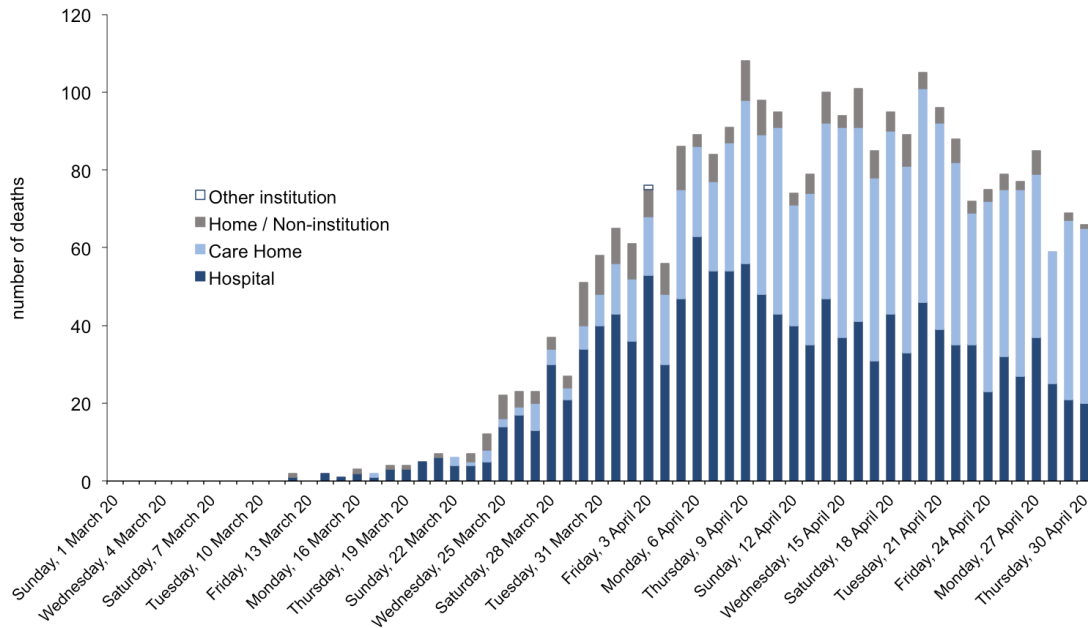


Figure 5 The chart shows locations of deaths in Scotland, compiled by National Records Scotland [3]. The epidemic is concentrated on care homes for the elderly. What we do not yet know is the number of hospital deaths that originate in care homes. We have requested this data via an FOI (freedom of information) request.

On 29<sup>th</sup> April, the UK Office for National Statistics revised their reporting standard from hospital deaths only to allegedly hospital + care home and they added ~ 4000 deaths to the running tally for the whole of the UK. We cannot make any sense out of this number since ONS’s own figures show 8310 care home deaths on May 1.

Our findings are summarised below, Covid 19 deaths to 1 May.:

E&W hospital deaths	22,844
E&W recorded care home deaths	8,310
E&W excess care home deaths not recorded	9,243
E&W recorded at home deaths	1,559
E&W excess at home deaths not recorded	6,406
E&W Covid 19 deaths in other locations	661
Scotland total Covid 19 deaths [3]	3213
Northern Ireland total Covid 19 deaths [4]	500
 Total UK Covid 19 deaths as of 1 May 2020	 52,736

The Northern Ireland data are published by the Northern Ireland Statistics and Research Agency [4].

The total figure of 52.736 contrasts with the official figure reported on 1 May that was 27,510 as recorded on the Johns Hopkins portal. Our conclusion is that the daily UK reports on Johns Hopkins underestimate actual UK mortality by 92%.

On 1 May, our middle logistic estimate for final UK deaths was 33,600 [6], based on the under-reported European Centre for Disease Prevention and Control (ECDC) [5]. Adjusting for our new

estimate of total UK deaths we now compute  $52,736/26,771*33,600 = 66,188$  final deaths in the UK.

The UK appears not to be alone in under-reporting of Covid 19 deaths. The Financial Times [7] has been regularly updating a summary graphic based on comparing recorded deaths in a number of countries compared with a baseline for the same period in recent years. We have summarised their results in Table 1 (see column Excess deaths) and compared them with Johns Hopkins reported numbers, after accounting for a possible average reporting delay of 4 days (details see appendix). This shows potential underreporting in a range of countries. The Financial Times computes a total of 50,000 excess deaths in the UK to 12 May, a figure comparable to the one we compute for the 1 May.

Country	Excess Deaths	Date	JH 4-day delay	Fraction JH/Excess
UK	53000*	May 1	29427	56%
Austria	1100	Apr 26	584	53%
Belgium	8000	Apr 26	7594	95%
Denmark	200	Apr 24	434	217%
France	22100	Apr 26	24345	110%
Germany	3706**	Apr 12	4052	109%
Israel	0	Apr 18	189	NA
Italy	24500	Mar 31	15362	63%
Netherlands	8900	Apr 26	4795	54%
Norway	0	Apr 22	201	NA
Portugal	1100	Apr 21	880	80%
South Africa	0	Apr 21	86	NA
Spain	32000	Apr 28	25100	78%
Sweden	3000	Apr 28	2669	89%
Switzerland	1650***	Apr 26	1737	105%
US	30800	Apr 11	32734	106%

Table 1. Comparing excess deaths and Johns Hopkins reported deaths for a range of countries. Countries with Johns Hopkins reported numbers divided by excess deaths less than 80% reported deaths are marked as red. The reporting delay of 4 days is based on the analysis for Sweden [8] and may differ significantly across countries. Excess Deaths are taken from [7], except for

\*See our detailed breakdown above.

\*\*<https://www.destatis.de/DE/Themen/Querschnitt/Corona/Gesellschaft/bevoelkerung-sterbefaelle.html>

\*\*\*<https://www.bfs.admin.ch/bfs/de/home/statistiken/gesundheit/gesundheitszustand/sterblichkeit-todesursachen.html>

#### Appendix: Reporting delay of mortality data

When comparing mortality statistics from different sources, one has to be careful with reporting delays and time stamps of reported numbers. Mortality data from Johns Hopkins, which is compiled from daily updates of various sources, is very timely data that will usually miss deaths recorded with a delay of more than two days. A preliminary analysis [8] on Sweden, for example, shows reporting delays ranging from zero to more than fourteen days, with an average reporting delay of roughly 4.5 days. This is the kind of delay that explains the difference between UK data reported on the day and the official data archived about 12 days in arrears.



Excess mortality statistics or ex-post mortality analysis, such as the data from ONS we use above, is compiled at a later stage and is less affected by such a delay. Especially during the peak of the epidemic, this reporting delay may account for a significant number of “missing deaths” and should be taken into account, before confidently labelling the difference of excess mortality and Johns Hopkins daily updates as “missing”. In Figure 6 below, we have shifted the reported numbers from Johns Hopkins for the US and the UK, comparing with US excess mortality until April 25 [8] and UK excess mortality until May 1. The reporting delay of four days is chosen ad hoc; ideally a country-specific detailed breakdown as in [9] should be done before comparing Johns Hopkins time series with excess mortality statistics.

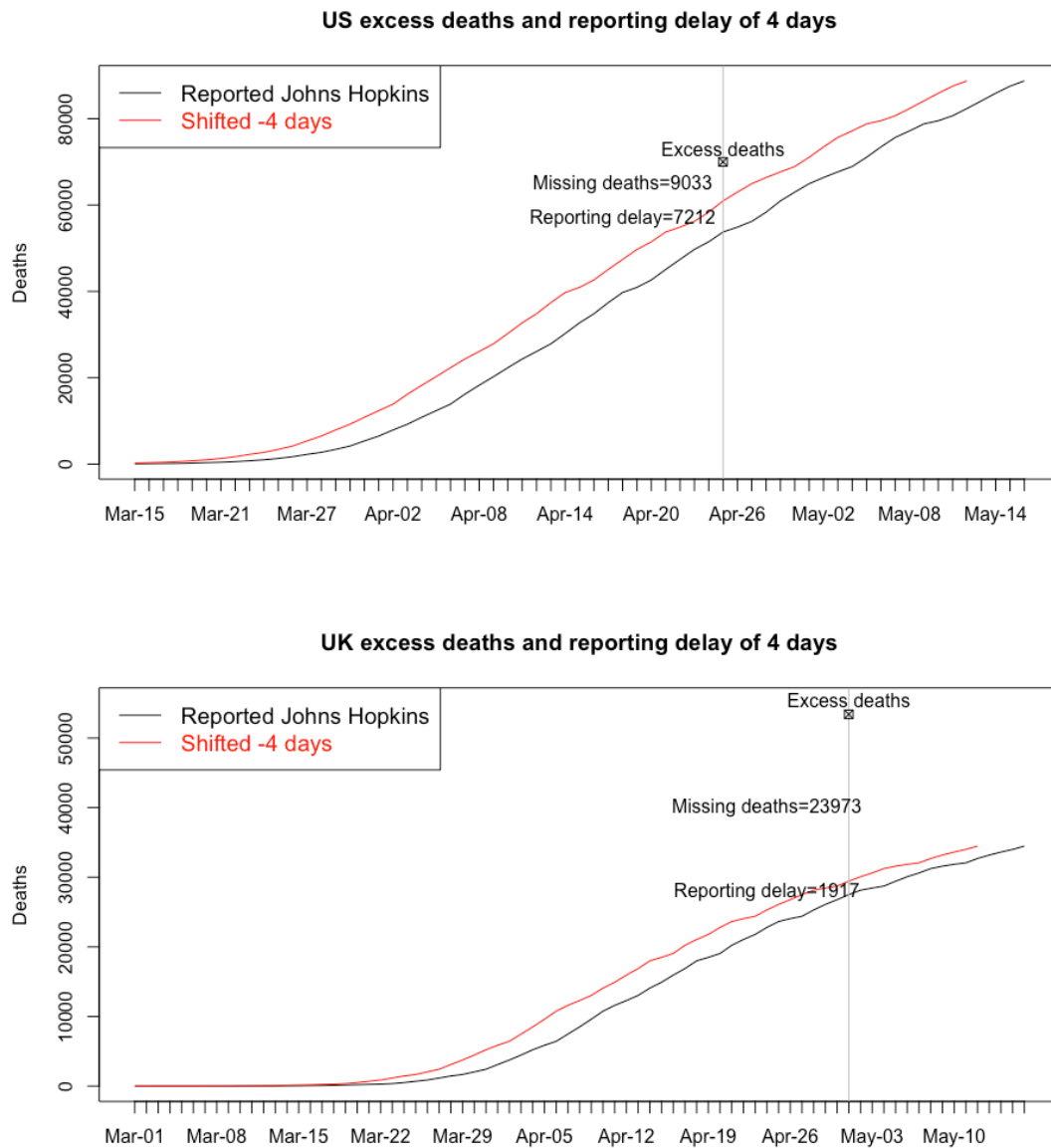


Figure 6. Comparing excess deaths and Johns Hopkins reported deaths for US and UK, respectively. The difference of excess mortality and reported numbers are split into deaths due to reporting delay and actual “missing deaths”. The reporting delay of 4 days is based on the analysis [2] for Sweden and may differ significantly across countries.

## References:

[1] <https://www.ons.gov.uk/peoplepopulationandcommunity/birthsdeathsandmarriages/deaths/datasets/weeklyprovisionalfiguresondeathsregisteredinenglandandwales>

[2] <https://www.ons.gov.uk/peoplepopulationandcommunity/birthsdeathsandmarriages/deaths/datasets/deathsregisteredinenglandandwalesseriesdrreferencetables>

[3] <https://www.nrscotland.gov.uk/statistics-and-data/statistics/statistics-by-theme/vital-events/general-publications/weekly-and-monthly-data-on-births-and-deaths/deaths-involving-coronavirus-covid-19-in-scotland>

[4] <https://www.nisra.gov.uk/publications/weekly-deaths>

[5] <https://www.ecdc.europa.eu/en/geographical-distribution-2019-ncov-cases>

[6] [https://ethz.ch/content/dam/ethz/special-interest/mtec/chair-of-entrepreneurial-risks-dam/documents/Covid-19/Covid\\_daily-forecasts\\_ETH\\_1May2020.pdf](https://ethz.ch/content/dam/ethz/special-interest/mtec/chair-of-entrepreneurial-risks-dam/documents/Covid-19/Covid_daily-forecasts_ETH_1May2020.pdf)

[7] <https://www.ft.com/content/a26fbf7e-48f8-11ea-aeb3-955839e06441>

[8] <https://adamaltmejd.se/covid/>

[9] <https://www.nytimes.com/2020/05/13/opinion/coronavirus-us-deaths.html>