

How many extra deaths have really occurred in the UK due to the Covid-19 outbreak?

II. Local hot spots

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See http://www.hcaf.biz/2010/Publications_Full.pdf for all research

An initial estimate (at end of March) is given for the worst affected local authorities in England, Wales and Scotland. Covid-19 hot spots are evident.

A revised estimate is provided at the week ending 17th April at regional level, with London experiencing a 13.1% increase in annual deaths.

Total 'excess' deaths is slightly higher at a level of 2.2-times the in-hospital deaths

It is suspected that asymptomatic infection with Covid-19 may be triggering seemingly unrelated deaths

We need to ask the question if similar events occurred in China?

Current methods for choosing the baseline against which to determine 'excess' deaths have limitations (see Technical Appendix)

In the Tuesday evening Covid-19 briefing on 21st March one of the governments scientific advisors claimed that estimates of excess deaths during the Covid-19 outbreak across Europe were not yet available. This data is freely available via the EuroMOMO website (<http://www.euromomo.eu/>), and has

been so for many years. Was this designed to throw the National Press off the trail of disturbingly high excess mortality?

Excess Deaths up to 17th April (most recent data)

For the method see Part I at the end of this document. Table 1 shows the estimated extra deaths up to the 10th and 17th of April and the percentage increase in deaths that this would have across a whole 52-weeks. Recall that the first official death due to Covid-19 in the UK occurred on the 7th March 2020.

On 17th April reported in-hospital Covid-19 deaths in the UK were 14,576. Total 'extra' or 'excess' deaths are therefore **2.2-times** the number of in-hospital deaths. East of England almost doubled total deaths in the week ending 17th April.

Table 1: Extra deaths up to 10th and 17th April 2020

Location	Extra		Extra		Commences
	deaths at	Per	deaths	Per	
	10th April	year	at 17 th April	year	
London	3,991	8.1%	6,432	13.1%	21-Feb-20
West Midlands	2,113	3.8%	3,721	6.8%	06-Mar-20
North West	2,539	3.5%	4,509	6.3%	21-Feb-20
Scotland	1,845	3.2%	2,863	5.0%	21-Feb-20
England	15,789	3.2%	28,548	5.7%	06-Mar-20
UK	17,756	3.1%	31,641	5.5%	06-Mar-20
South East	2,160	2.6%	3,894	4.8%	28-Feb-20
East	1,358	2.4%	2,810	4.9%	28-Feb-20
East Midlands	1,104	2.4%	1,977	4.3%	06-Mar-20
Wales	764	2.3%	1,353	4.1%	28-Feb-20
North East	657	2.3%	1,353	4.8%	06-Mar-20
South West	1,141	2.0%	2,076	3.7%	06-Mar-20
Yorkshire & Humber	985	1.9%	2,035	3.9%	20-Mar-20
Northern Ireland	281	1.8%	389	2.5%	27-Mar-20

Public Health England also produce a weekly report on excess mortality (see <https://www.gov.uk/government/publications/national-covid-19-surveillance-reports>), however, they only report on England as a whole and do not give any comparison with in-hospital deaths.

Sub-acute effects of Covid-19

This analysis points to the potential for a sub-acute infection with Covid-19 to trigger deaths from seemingly unrelated conditions. The earliest official death in the UK occurred on the 7th March, yet the rolling 52-week total methodology suggests that 3 regions showed signs of higher deaths at some point after the 21st February (Table 1). We also need to ask the question if very high levels of seemingly unrelated deaths also occurred in China?

Excess Deaths by Local Authority (to end of March)

Monthly data on deaths is available from the Office for National Statistics and the National Records of Scotland covering local authorities in England, Wales and Scotland.

An initial estimate of the excess deaths which occurred in March as a percentage of annual deaths is shown in Figure 1 which only gives local authorities and regions which exceed the +1 Standard Deviation (STDEV) level.

In Poisson statistics 85.3% of all outcomes fall below +1 STDEV. 108 local government areas passed this simple statistical test while 372 did not achieve this level.

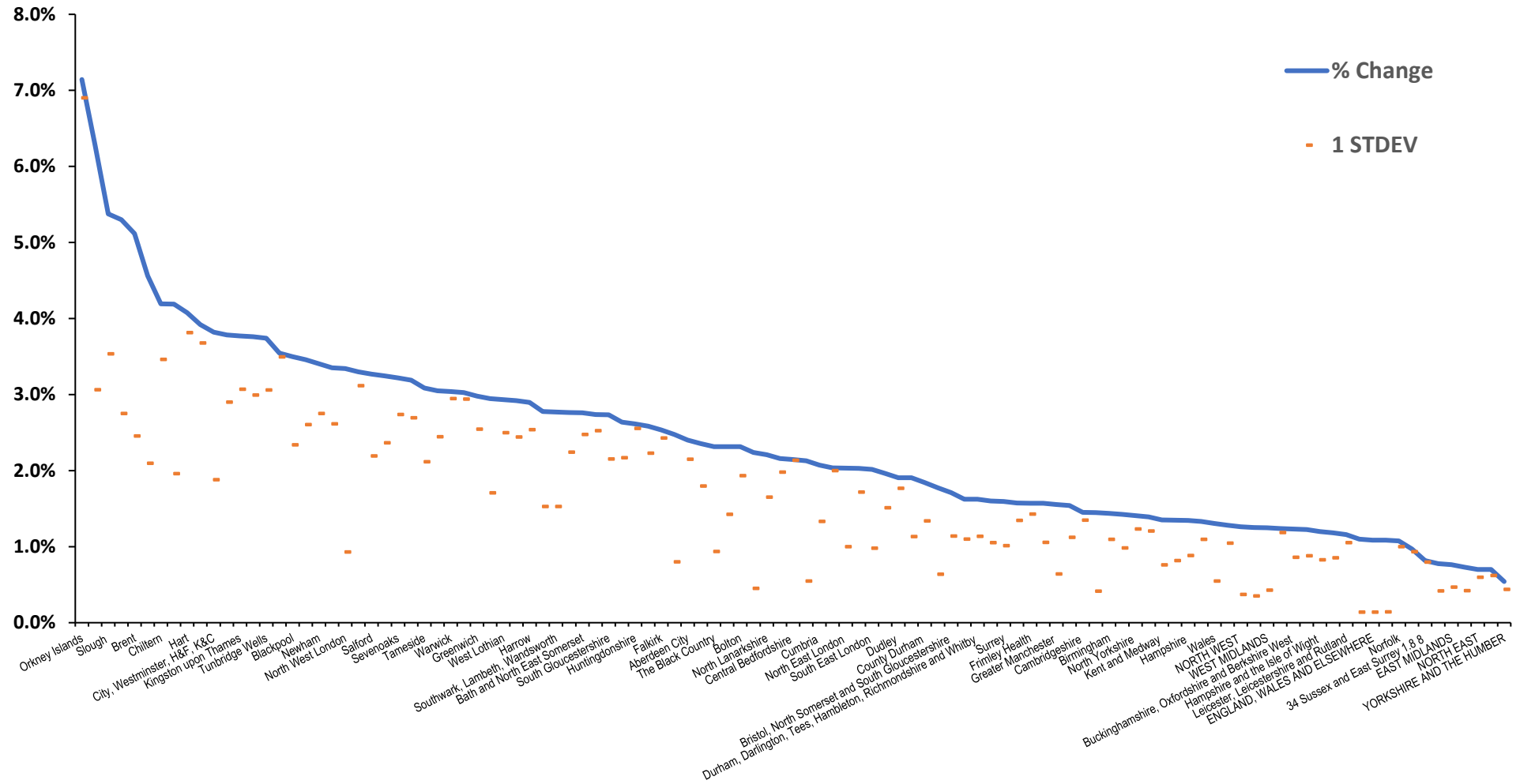
Areas with an increase (excess deaths) greater than 4% (i.e. >10-times UK average excess deaths) were: Orkney islands +7.1%, Westminster +6.3%, Slough +5.4%, Southwark +5.3%, Brent +5.1%, Barnet +4.6%, Chiltern +4.2%, Wolverhampton +4.2% and Hart +4.1%. These figures will be confirmed when April deaths are available in late May.

At the 31st March 2020, some 2,352 in-hospital deaths were reported for the UK which is equivalent to 0.4% annual excess deaths. Hence, total excess deaths in March are at least 1.2 extra or excess death for every 1 reported in-hospital Covid-19 death.

However, it is clear from Figure 1 that there are Covid-19 hot spots scattered throughout the UK, and that some locations initiated far earlier than others (Table 1).

Interestingly, many politicians had to self-quarantine due to Covid-19 infection and the London Borough of Westminster was one such hot spot. Politicians and civil servants are likely to have been high contact individuals.

Figure 1: Local government areas in England, Scotland and Wales showing a significant increase in total deaths during March 2020. The increase is expressed as a percentage increase in the annual total deaths. Only every second name is displayed.



Technical Appendix: What is the baseline for deaths?

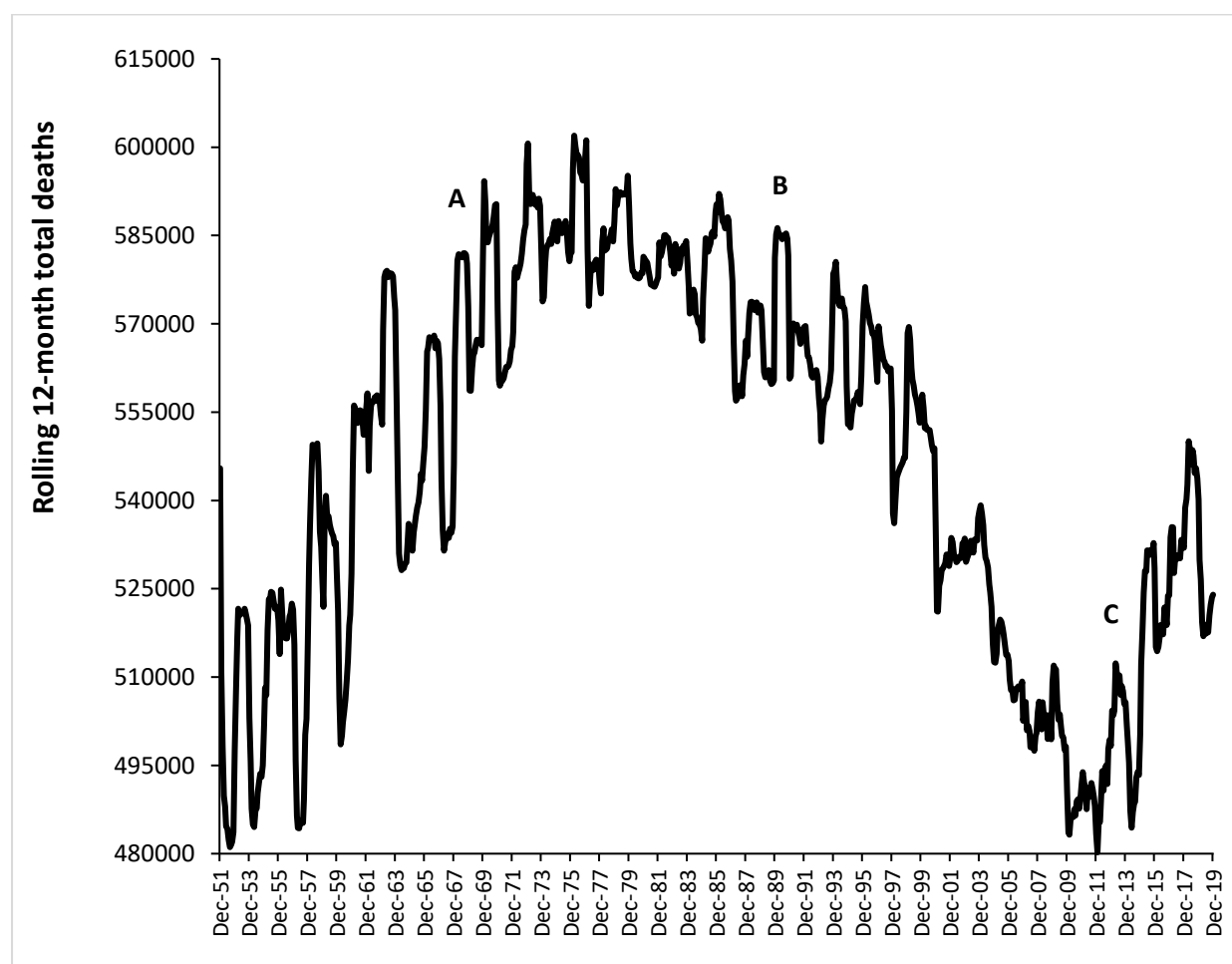
In Part I of this series I made an estimate of the excess deaths during Covid-19 in the UK (see rear of this document) using a method involving rolling 12-month totals.

This brings us to a consideration of how to choose the baseline against which to assess the 'excess' deaths.

What are the trends in the baseline?

To demonstrate the difficulty of choosing a baseline Figure 1 shows a rolling 12-month total trend in deaths in England and Wales over the period 1951 to 2019. Data was kindly provided on request by the Office for National Statistics.

Figure 1: Rolling 12-month total deaths in England and Wales, 1951 to 2019

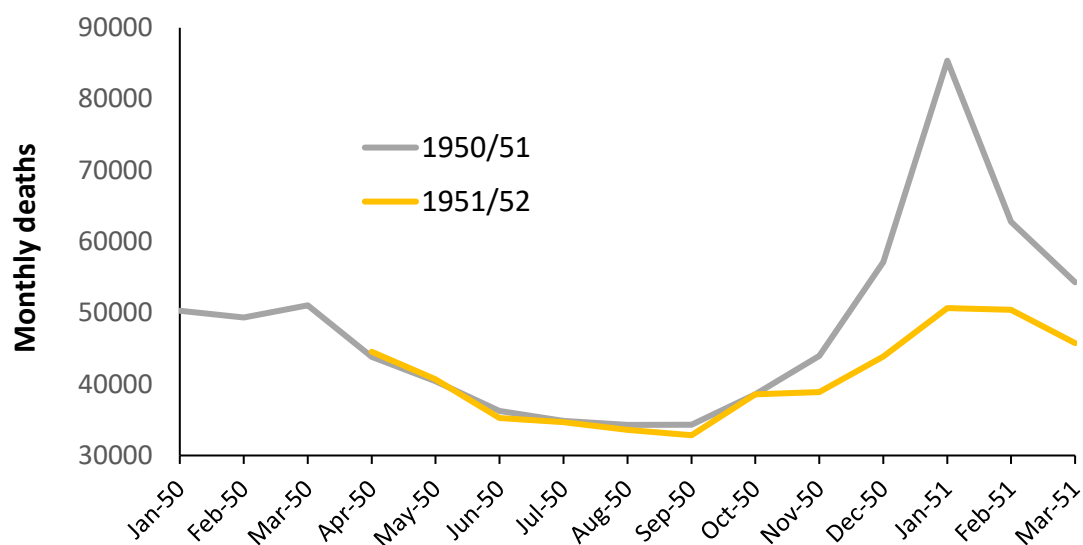


Deaths (all-cause mortality) first rise to a maximum around 1975, then fall to a minimum for the 12 months ending January 2012 and then start to rise again. The pattern is a complex function of previous patterns of births and

immigration, improvements in life expectancy, influenza and other infectious outbreaks and temperature.

While influenza is an important contributor to winter deaths, the incidence of a pure influenza-only event is relatively rare. In a rolling 12-month total an influenza outbreak typically shows up as a table-top shaped feature as in A and B. Curious sudden shift up/down events also occur as in C, but also occur prior to some influenza events. By shift up/down it is meant that deaths suddenly increase by say 10% and stay 10% high for at least 12 months (sometimes up to 3 years) and then suddenly shift back down. In a rolling total this shows up as a ramp up/down.

Figure 2: Monthly deaths in two adjacent years covering the winters of 1950/51 and 1951/52



Methods to estimate the baseline

While it is true that deaths are generally the most stable in the summer months even then there are differences due to temperature. Figure 2 gives an example of monthly deaths for two adjacent years. The winter of 1950/51 is a mix of unusually low temperatures and a major influenza epidemic.

Three approaches can be taken in an attempt to resolve this issue.

1. The approach used by the Office for National Statistics where deaths are average over the previous 5 years for that month or week. This approach has the limitation that deaths may be rising/falling depending on where you are in time, and it also ignores the existence of the curious up/down shifts. Hence during the Covid-19 outbreak in the UK during 2010 the

five previous years cover 2015 to 2019. 2015 commenced with a shift up which started in 2014 while 2019 contains a large shift down. 2020 is marked by a shift up which commenced around May 2019 but shows different timing across the UK. This method probably **underestimates** the 'excess' deaths during the Covid-19 outbreak.

2. The EuroMOMO methodology takes a maximum of 5 years previous data from the most stable parts of spring and autumn (weeks 15-26 and 36-45) to which are applied linear, linear splines or a sine curve models depending on the age bands to be compared. This is more accurate than the ONS method, however, it assumes that shift up/down events do not exist. Given the key role of shift down/up in 2018 and 2019 extending into 2020 this model may both over- and under-estimate.
3. The most sophisticated methodology is to use mean daily temperature to correct for the effect of temperature on deaths for different age-bands, leaving residual deaths due to the pathogen (influenza or Covid-19)- see Lytras et al Euro Surveill 2019; 24(14): 1800118. doi: [10.2807/1560-7917.ES.2019.24.14.1800118](https://doi.org/10.2807/1560-7917.ES.2019.24.14.1800118). This method is currently not widely used but will need to be employed if a more reliable estimate is needed. This method suffers from the fact that it ignores the existence of up/down shifts in deaths but could readily be corrected for these factors.

Hence, the reason that a rolling 52-week total was used in Part I to estimate 'excess' deaths during the Covid-19 epidemic in the UK was that it acknowledged the contribution from up/down shifts and gave the best available approach to a reasonable estimate of the baseline applicable at the time of the Covid-19 epidemic. It has the limitation that effect of the previous step-up which occurred in 2019 may still be accumulating in the running total.

No method is perfect but hopefully the one used here gets us closest to the true figure.

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I. Initial estimate

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Deaths in hospital with Covid-19 are only half of the total extra deaths occurring during the epidemic.

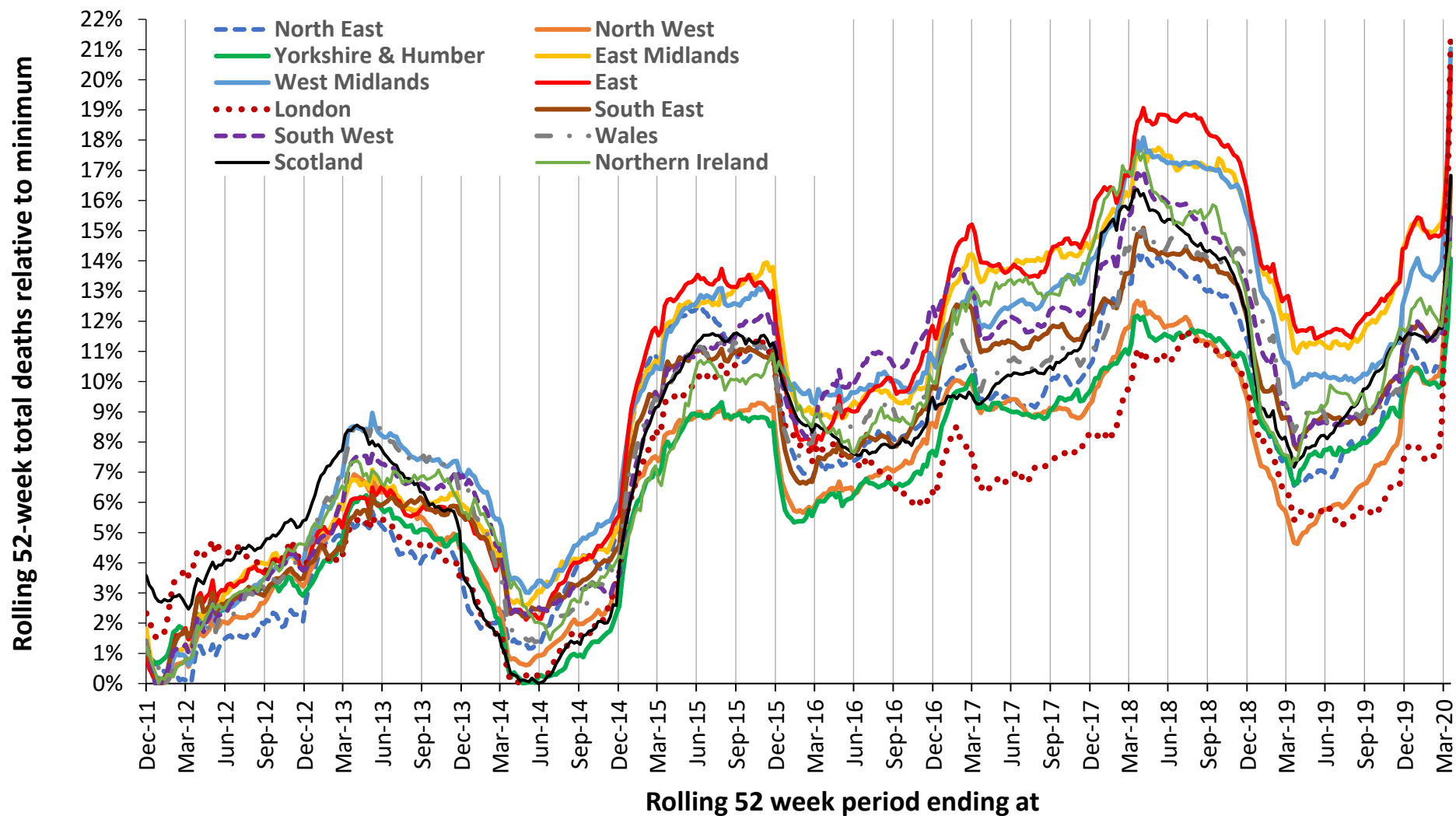
Like many I have been left somewhat disappointed by the daily Covid-19 updates in England and by the answers given to questions raised by the press. They have been a missed opportunity in eloquent analysis of the data which should have been a showcase of the scientific expertise available to Her Majesties Government.

Indeed, there has been much debate around the real number of deaths directly attributable to Covid-19. By the real number I mean deaths in all places (Hospitals + Nursing Homes + Elsewhere + the unintended consequences of the disruption of primary and secondary care) and after adjusting for the number of persons who were diagnosed with Covid-19 but would have died anyway from their medical condition(s).

A method exists to extract this number from published weekly deaths (all-cause mortality) using a method called a rolling, running or moving 52-week total. In a rolling 52-week total the effects of summer/winter are minimised since the 52-week total always covers all the seasons.

For example, Figure 1 shows a rolling 52-week total of all deaths across the four countries of the UK and regions within England. Total deaths in Figure 1 are relative to the point of minimum deaths in either 2012 or 2014 as a

Figure 1: Rolling 52-week total of deaths (relative to the point of minimum deaths) across the UK. Rolling 52-week total commencing 30th December 2011 through to 10th April 2020. (Subsequently updated to 17th April 2020)



percent difference. Due to the WW II baby boom deaths will trend upward over the next 30 to 40 years.

The first point from Figure 1 is that deaths are following complex patterns which arise from a mix of winter infectious outbreaks (mainly due to influenza) which vary from year to year, plus unexplained sudden shifts up/down which are not supposed to exist.

In a rolling total such sudden shifts show up as a ramp simply because the sudden shift accumulates in a rolling total. Such sudden shifts up occur in early 2012, around June 2014 and around April 2019. A very large and sudden shift down commences around August 2018.

An influenza outbreak causes a table-top shaped feature which may be imposed on a ramp up/down from the sudden shifts.

Thankfully, the winter of 2018/19 and 19/20 are characterised by low influenza activity.

The total number of extra deaths due to Covid-19 are revealed at the far right of the chart. This is a repeat of the large increase in early 2015, which has never had an adequate explanation (see link above).

Table 1: Extra deaths attributable to Covid-19 and date at which the outbreak takes hold in each location

Location	Extra deaths	Per year	Commences
North West	2,539	3.5%	21-Feb-20
Scotland	1,845	3.2%	21-Feb-20
London	3,991	8.1%	21-Feb-20
East	1,358	2.4%	28-Feb-20
South East	2,160	2.6%	28-Feb-20
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Yorkshire and The Humber	985	1.9%	20-Mar-20
Northern Ireland	281	1.8%	27-Mar-20

To calculate the extra deaths due to Covid-19 involves locating the minimum just before the large jump at the far right of Figure 1 and calculating the difference. The results of this analysis are shown in Table 1 which gives the data at which the Covid-19 outbreak takes hold in each location, the extra deaths from that point to the 10th of April, and the effect this increase would have on the annual total deaths. The date at which the outbreak takes hold is later than the date of first arrival. The percentage extra deaths per year will increase over time as the outbreak adds further deaths to the total.

As can be seen the Covid-19 outbreak commences first in the North West, Scotland, and London. London is affected far worse than the other two, probably due to extremely high population density.

The outbreak commences last in Yorkshire and the Humber and Northern Ireland and this later onset explains the smaller increase to the 10th of April.

On the 10th of April 2020, the official UK Covid-19 death toll stood at 8,958 which is a mere 50% of the total calculated in Table 1.

Since the 10th of April to 21st April a further 7,551 with Covid-10 deaths have occurred in hospital implying 15,102 extra total deaths in that period.

This figure of double the deaths is larger than the 41% higher reported in the National Press. The value of double may be closer to the truth than 41%.

The unintended consequences of Covid-19 may be worse than first appreciated.

Data Sources

The data comes from three sources and finishes on the 10th April 2020 which is the most recent available data released on 21/04/2020.

England & Wales:

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

Scotland: <https://www.nrscotland.gov.uk/statistics-and-data/statistics/statistics-by-theme/vital-events/general-publications/weekly-and-monthly-data-on-births-and-deaths/weekly-data-on-births-and-deaths>

Northern Ireland: <https://www.nisra.gov.uk/publications/weekly-deaths>

The figure of 8,958 is available from the Trending Stats tab at

<https://www.bing.com/search?q=covid-19+deaths+uk&form=EDGEAR&q=PF&cvid=6c1f4044ab5643ab88300f67cd7792d6&cc=GB&setlang=en-GB&plvar=0&PC=ASTS>