Latest statistics on England mortality data suggest systematic mis-categorisation of vaccine status and uncertain effectiveness of Covid-19 vaccination

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Latest statistics on England mortality data suggest systematic mis-categorisation of vaccine status and uncertain effectiveness of Covid-19 vaccination

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3 December 2021

Abstract

The risk/benefit of Covid vaccines is arguably most accurately measured by an all-cause mortality rate comparison of vaccinated against unvaccinated, since it not only avoids most confounders relating to case definition but also fulfils the WHO/CDC definition of "vaccine effectiveness" for mortality. We examine the latest UK ONS vaccine mortality surveillance report which provides the necessary information to monitor this crucial comparison over time. At first glance the ONS data suggest that, in each of the older age groups, all-cause mortality is lower in the vaccinated than the unvaccinated. Despite this apparent evidence to support vaccine effectiveness - at least for the older age groups - on closer inspection of this data, this conclusion is cast into doubt because of a range of fundamental inconsistencies and anomalies in the data. Whatever the explanations for the observed data, it is clear that it is both unreliable and misleading. While socio-demographical and behavioural differences between vaccinated and unvaccinated have been proposed as possible explanations, there is no evidence to support any of these. By Occam's razor we believe the most likely explanations are systemic miscategorisation of deaths between the different categories of unvaccinated and vaccinated; delayed or non-reporting of vaccinations; systemic underestimation of the proportion of unvaccinated; and/or incorrect population selection for Covid deaths.

1. Introduction

Our recent articles [1, 2] have argued that the simplest and most objective way to assess the overall risk/benefit of Covid-19 vaccines is to compare all-cause mortality rates of the unvaccinated against the vaccinated in each separate age-group. For such an assessment we need accurate periodic data on both age-categorized deaths and the number of vaccinated/unvaccinated people in each age group for that period.

Any systemic errors or biases can lead to conclusions that are inversions of the real situation. For example, simply reporting deaths one week late when a vaccine programme is rolled out will (with statistical certainty) lead to any vaccine, even a placebo, seemingly reducing mortality. The same statistical illusion

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will happen if any death of a person occurring in the same week as the person is vaccinated is treated as an unvaccinated, rather than vaccinated, death [16].

The UK Government (through its various relevant agencies) has been better than most countries in providing detailed data on Covid cases and deaths indexed by vaccine status. However, in [1] we highlighted the absence of relevant age-categorized mortality data for England, and major inconsistencies in the data provided by different agencies. Of most concern are the very different estimates provided by UKHSA (United Kingdom Health Security Agency) and the ONS (Office for National Statistics) of the number of vaccinated and unvaccinated people. The reports from UKHSA use estimates from the NIMS (National Immunisation Management Service) database [10], while the estimates from the ONS are based on 2011 census respondents and patients registered with a GP in 2019. Hence the ONS England 'population' (which therefore includes only people aged at least 10) is only approximately 39 million, compared to the approximately 49 million listed in NIMS. While our focus is on mortality by vaccination status, accurate periodic estimates for the proportion of people vaccinated are also crucial for determining vaccine effectiveness, since this is simply a comparison between the 'cases', hospitalisations and deaths per 100K vaccinated and unvaccinated.

An indication of just how critical this is illustrated by the latest UKHSA report [3] which showed that, in each age group above 29, the Covid case rate was higher among the vaccinated than the unvaccinated.

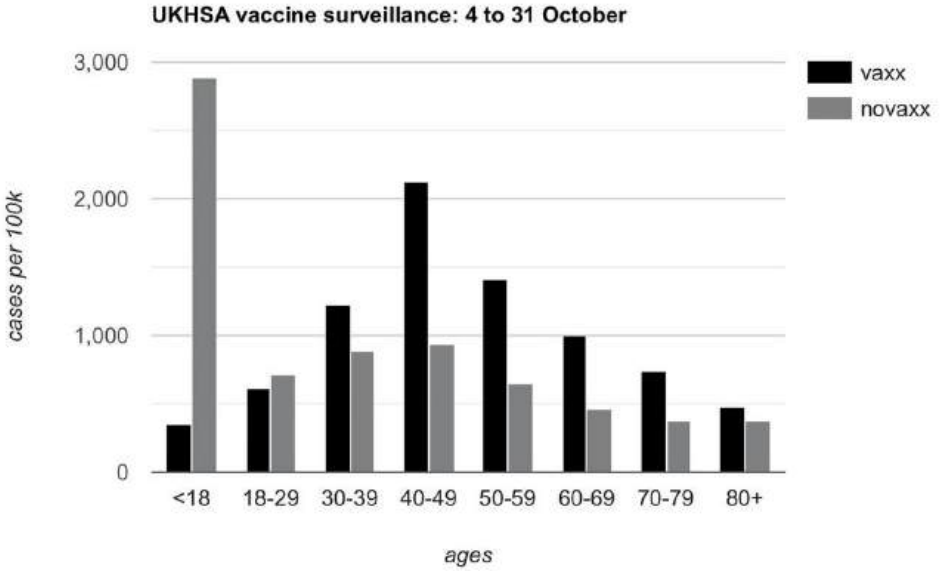

Figure 1: Covid-19 case rates based on UKHSA data in [3] and reproduced from [5]

The UKHSA report caused a flurry of indignation, and prominent scientists, such as Professor Sir David Spiegelhalter, claimed that the data was 'feeding conspiracy theorists worldwide' [4] and subsequently led to the UK statistics regulator stepping in and chastising the UKHSA for using inappropriate population denominators [5]. An article describing the fallout from this can be found in [6].

The justification for these criticisms (which were aimed at both UKHSA and any others simply reporting the UKHSA data) was that NIMS were double counting some vaccinated people, and hence the NIMS population estimates for the number of people vaccinated were therefore too high. They claimed that the ONS data 'fixed' this bias and hence properly adjusted the results. However, as we pointed out in [1], while the NIMS data may indeed overestimate the number of vaccinated, it is likely that it also

underestimates the number of unvaccinated (a much more difficult number to estimate than those vaccinated).

One key question at that time was: how accurate is the estimate of the proportion of the population that is unvaccinated? In [1] we argued that the ONS data was underestimating the proportion unvaccinated; hence, ONS reported mortality rates (and by implication also effectiveness rates) were too high for the unvaccinated and too low for the vaccinated. Since then, the latest ONS Vaccine Effectiveness Surveillance Report for England has been released, on the 1st of November, and provides us with further evidence [7].

In what follows we attempt to analyse this latest 'age stratified' ONS report and other relevant sources of data on mortality to examine patterns of mortality and any connection this might have with vaccination.

In section 2 we examine the all-cause mortality rates in this ONS data. Section 3 then compares vaccinated and unvaccinated non-covid mortality. Section 4 looks at the correlation between the vaccine roll out and non-covid mortality, discussing curious oddities in the data that may be explainable by mis-categorisation of vaccine status at death. In section 5 we look to explain this and correct for this mis-categorisation. Section 6 focuses on covid mortality and looks at the relationship between vaccination and infection and hypothesises that the data is better explained by a temporal offset correction model that takes this into account. Further oddities in the population and death data are revealed in Section 6 and finally Section 7 discusses caveats in the analysis and draws conclusions.

2. All-cause mortality rates

In response to our request, the ONS now includes age categorised all-cause death numbers by vaccination status in [7]. Unfortunately, while separate data for age groups 60-69, 70-79 and 80+ are provided, there is only a single group of data for the age group 10-59.

The mortality rate (deaths per 100K people) for all age groups derived from the unadjusted data is shown in Figure 2. Clearly the early weeks show a higher mortality rate for the older age groups, which is larger for the older age groups.

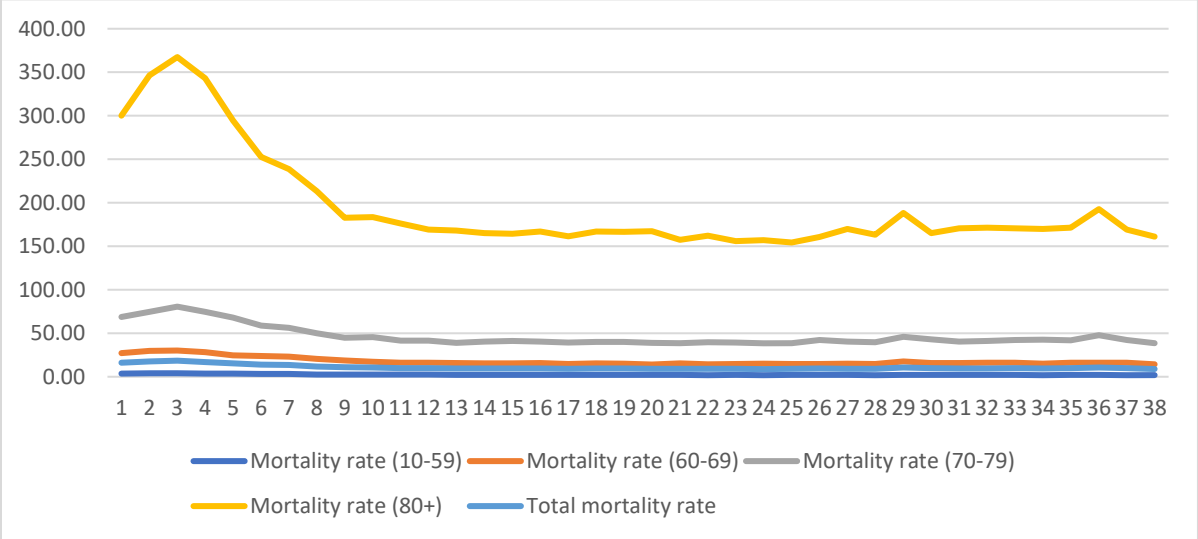

Figure 2: Total mortality rate and age group specific mortality rates (weeks 1-38, 2021)

The mortality rate for non-Covid deaths is shown in Figure 3, which shows a more or less stable pattern through the year to September, and certainly by the last 12 weeks, the summer months, they look to have

stabilised to averages of 14.83, 39.58 and 164.81 (deaths per 100k population) for each age group per week. Also note that the mortality rates are in approximate agreement with those published in actuarial life tables, which are 18, 46 and 214. This suggests there are no significant excess non-Covid deaths included in the ONS data.

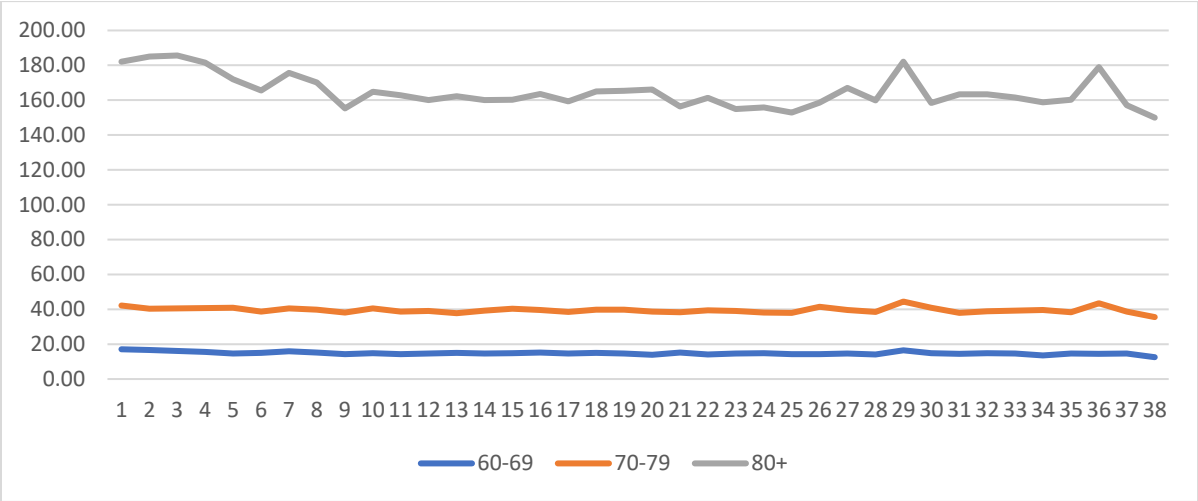

Figure 3: Non-Covid mortality rates per age groups, 10-59 excluded (weeks 1-38, 2021)

In comparing mortality rates between vaccinated, curiously, in the 'youngest' age group the mortality rate is currently around twice as high for those who have received at least one dose of the vaccination compared to those who are unvaccinated, as shown in Figure 3.

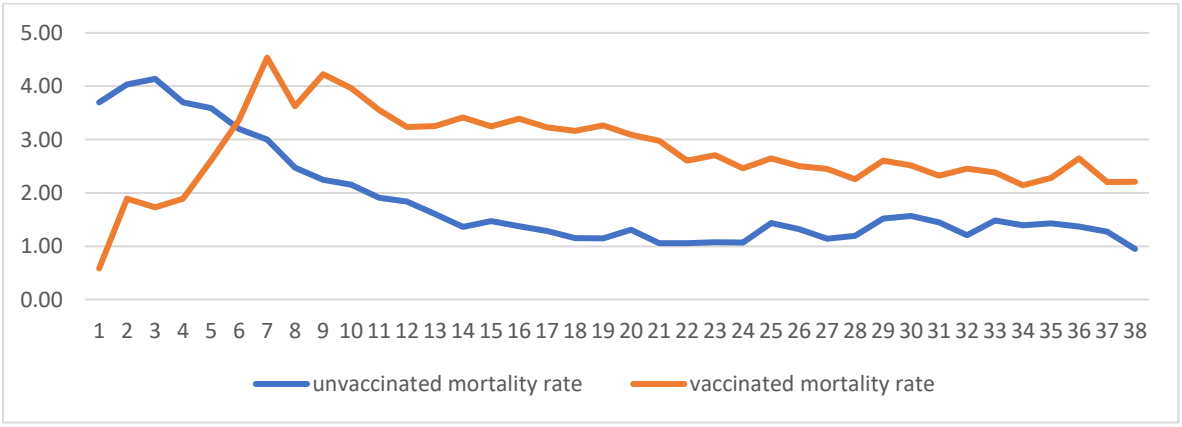

Figure 4: All-cause mortality rate: vaccinated versus unvaccinated in age group 10-59 (weeks 1-38, 2021)

However, because this group includes such a wide age range it is possible that this extremely disturbing statistic remains strongly confounded by age. Therefore, without a finer age categorisation it is impossible to tell what the actual difference in all-cause deaths might be. Why the age confounding was not apparent in weeks 1 to 5 when only the most vulnerable were being vaccinated remains unexplained.

Where age groups are narrower, 60-69, 70-79 and 80+, the age confounding effects are somewhat mitigated, and the data appear to show (in each of these age groups) a lower all-cause mortality for the vaccinated, compared to the unvaccinated. See Figures 5, 6 and 7.

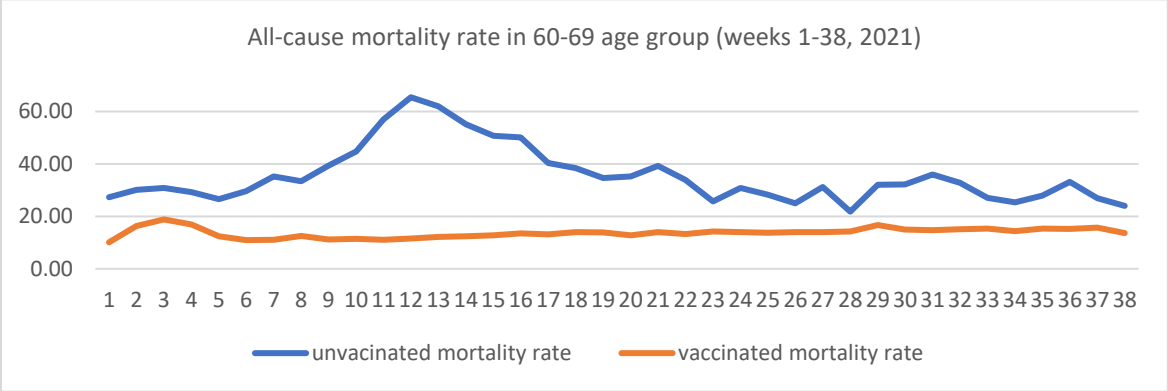

Figure 5: All-cause mortality rate: vaccinated versus unvaccinated in age group 60-69 (weeks 1-38, 2021)

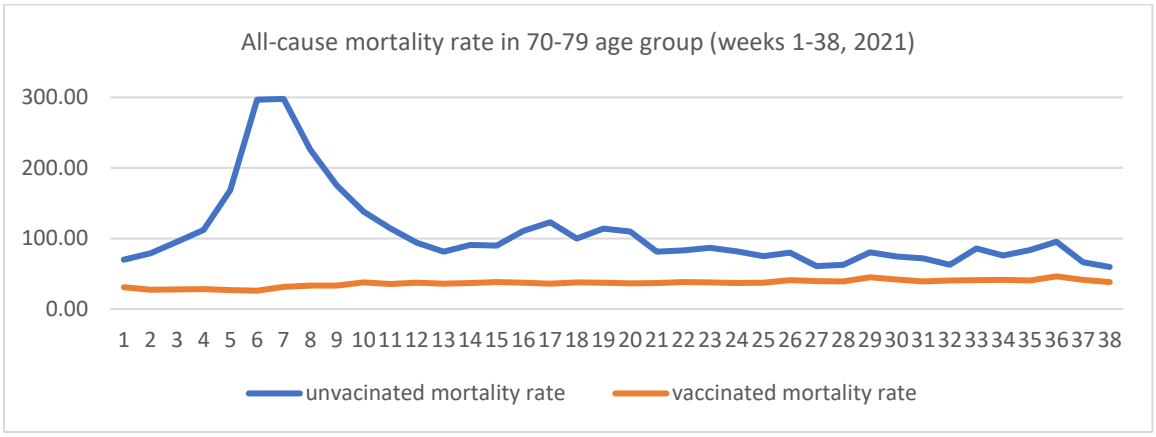

Figure 6: All-cause mortality rate: vaccinated versus unvaccinated in age group 70-79 (weeks 1-38, 2021)

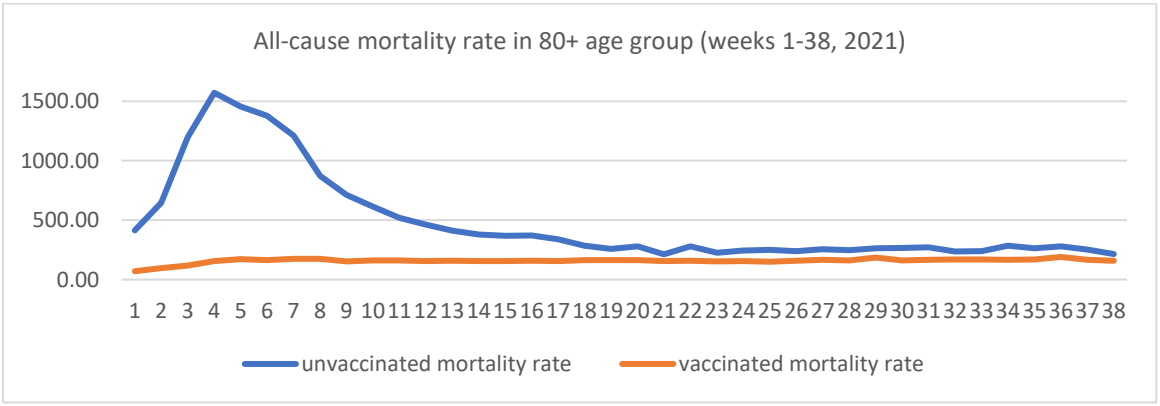

Figure 7: All-cause mortality rate: vaccinated versus unvaccinated in age group 80+ (weeks 1-38, 2021)

Note that from Figures 5-7 we might conclude that the unvaccinated face an all-cause mortality rate higher than that faced by the vaccinated because they bear the burden of higher mortality caused by covid-19. This is something we will return to in Section 3.

In previous years, each of the 60-69, 70-79 and 80+ groups have mortality peaks at the same time during the year (including 2020 when all suffered the April Covid peak at the same time). Yet in 2021 each age group has non-Covid mortality peaks for the unvaccinated, at a different time, namely the time that vaccination rollout programmes for those cohorts reach a peak.

3. Comparing vaccinated and unvaccinated mortality

An examination of these older age groups reveals a different fundamental problem with the data, which becomes evident when we look at causes of death other than Covid. By looking at non-covid mortality we are removing the Covid death signal from the data and looking at changing patterns of mortality caused by other causes of death such as cancer, heart diseases, accidents and so forth. When we do this, we notice incomprehensible differences in non-Covid mortality rates (i.e., all-cause minus Covid-19 mortality)

Setting aside age group 10-59 because of probable age confounding, the data appear to show (in each of the older age groups) a significantly lower non-Covid mortality rate for the vaccinated, compared to the unvaccinated. See Figures 8, 9 and 10.

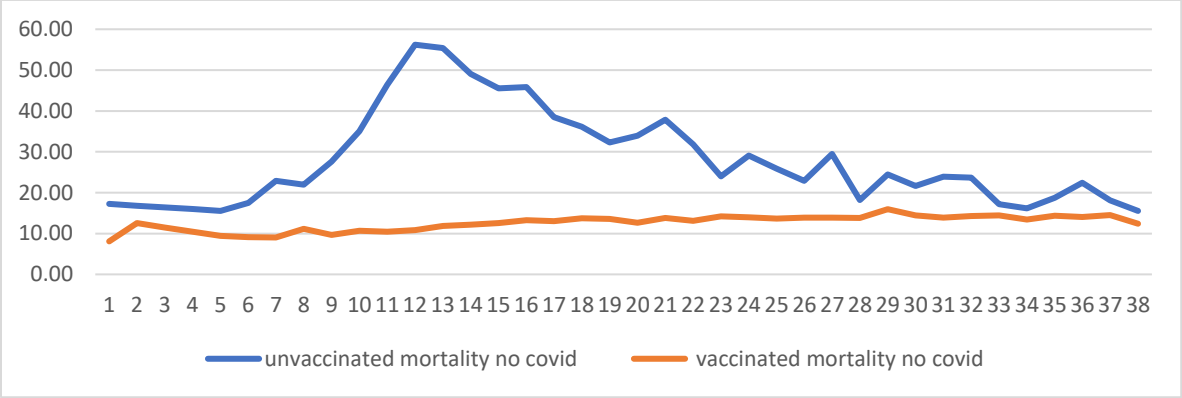

Figure 8: Non-Covid mortality rate: vaccinated versus unvaccinated in age group 60-69 (weeks 1-38, 2021)

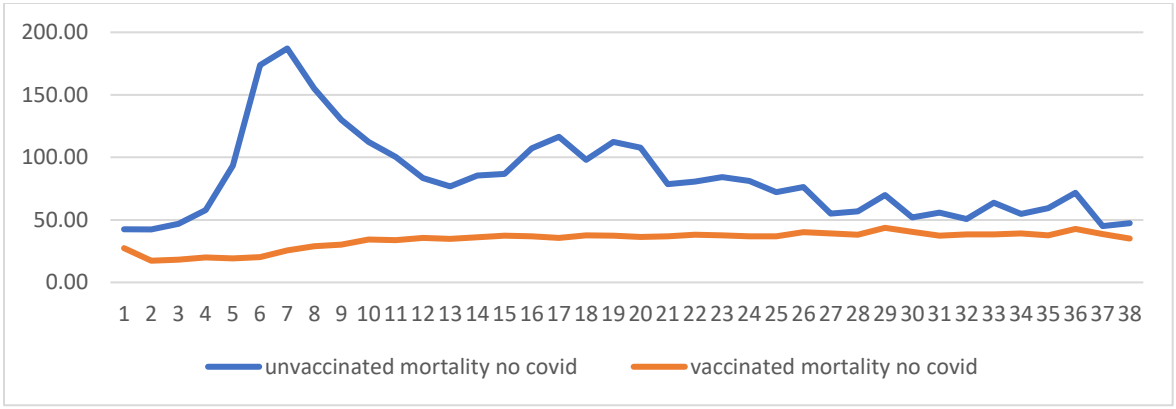

Figure 9: Non-Covid mortality rate: vaccinated versus unvaccinated in age group 70-79 (weeks 1-38, 2021)

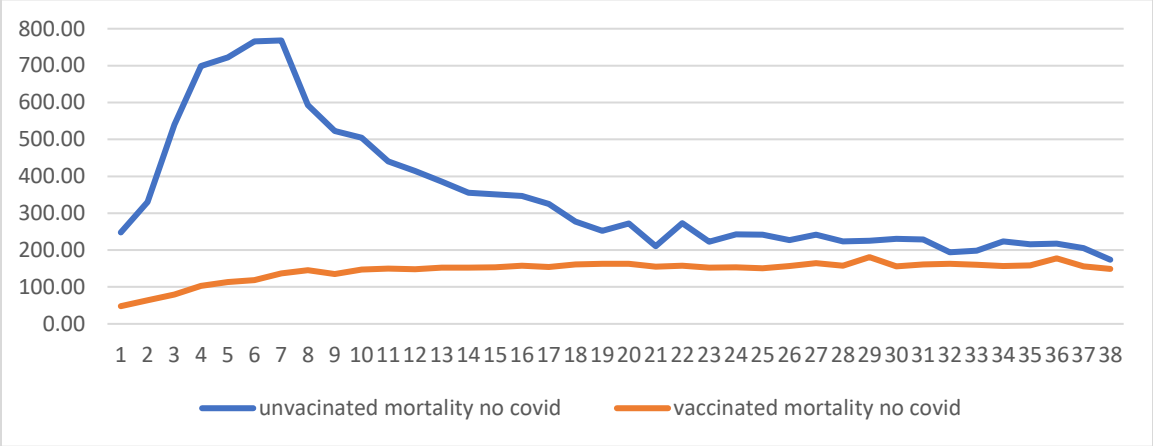

Figure 10: Non-Covid mortality rate: vaccinated versus unvaccinated in age group 80+ (weeks 1-38, 2021)

Moreover, as with the all-cause mortality, the unvaccinated mortality rates peak in each age group at the same time as the vaccine rollout peaks for that age group, before falling and approaching that of the vaccinated.

If we compare these results to weekly average 'actuarial' mortality from the ONS national lifetables for England [8] we can again see some surprising results. Here the lifetable values are adjusted according to the population pyramid proportion given in [9] to arrive at a lifetable average weighted by population size.

In Table 1 the average all-cause mortality for weeks 1-38 for the vaccinated group is lower than the lifetable values for age groups 70-79 and 80+. The unvaccinated mortality is more than double lifetable mortality for all causes.

Age group	Unvaccinated	Vaccinated	Lifetable
60-69	63 (39, 121)	26 (18, 32)	18
70-79	106 (59, 297)	36 (26, 46)	46
80+	480 (212, 1571)	158 (70, 190)	214

Table 1: Comparison of mean all-cause mortality (per 100k) for each age group for weeks 1-38 (min, max) with mean of historical lifetable values

In Table 2 we examine non-Covid causes of death. Here the unvaccinated mortality rate is again higher than the lifetable value suggesting that even with Covid mortality risk removed, the unvaccinated still have a much higher mortality rate than expected and that this cannot be due to Covid.

Age group	Unvaccinated	Vaccinated	Lifetable
60-69	28 (15, 56)	12 (8, 15)	18
70-79	83 (42, 187)	34 (17, 43)	46
80+	344 (173, 768)	145 (47, 180)	214

Table 2: Comparison of mean non-Covid mortality (per 100k) for each age group for weeks 1-38 (min, max) with mean historical lifetable values. Values are mean (min, max)

Table 3 compares the average non-Covid mortality of the unvaccinated and vaccinated with historical lifetables and shows the respective equivalent lifetable age group for the data, i.e., the age group that historically corresponded to that mortality rate.

Unvaccinated Age group	Equivalent Lifetable Age group for unvaccinated	Vaccinated Age group	Equivalent Lifetable Age group for vaccinated
60-69	70 (63 - 76)	60-69	61 (56 - 63)
70-79	79 (73 - 86)	70-79	71 (64 – 73)
80+	91 (86 - 99)	80+	84 (75 – 86)

Table 3: Estimated lifetable ranges for unvaccinated and vaccinated for other-than covid mortality based on historical lifetables. Values are mean (min, max)

Clearly the corresponding lifetable age group for the unvaccinated has an average significantly older than the lifetable for that age group, with min/max values that are much higher than we might expect from lifetables. Conversely, for the vaccinated the corresponding lifetable age group is significantly younger than we would expect from lifetables.

Intuitively – as would be the case for any other vaccine - we would expect to see slightly higher non-Covid mortality rates in the vaccinated than the unvaccinated because those most at risk of death were most likely to be vaccinated, and there may have been adverse effects from the vaccine. Moreover, we might also expect to see, early in the vaccine roll out, a much higher mortality for the vaccinated since people with comorbidities were prioritised for Covid vaccination. Instead, those vaccinated appear to have the health of people much younger.

Consider what we are witnessing here. We have a vaccine whose recipients are suffering fewer deaths by causes other than covid and hence are benefitting from improved mortality. It appears very unlikely that this can be from the vaccine since the very best we can hope for is that the vaccine is causing no adverse reactions leading to additional non-Covid deaths. Instead, we have the unvaccinated who are suffering increased non-Covid mortality, especially in the near term close to the vaccine rollout for each age group. This is enigmatic. Does the vaccine have short-term benefits beyond reducing Covid deaths? Is undetected Covid increasing mortality in the unvaccinated in a way that presents itself as other causes of death? If so, why would it be staggered by vaccine rollout periods across age groups? None of these possible reasons make any sense so we need to look elsewhere for a more plausible explanation.

The one thing that stands out is that, compared to historical mortality lifetable values, not only is there a difference in all-cause mortality between vaccinated and unvaccinated, but the mortality rates look to differ significantly from historical norms, as evidenced in statistical mortality lifetables. By simple comparison with lifetable values, the vaccinated appear to suffer less mortality than we would expect them to (and this is during a period of expected higher seasonal mortality) and vice versa for the unvaccinated. This is very odd.

Further evidence of problems with the data can be seen when we consider non-Covid mortality rates of the different categories of vaccinated people. The vaccinated are categorised into three different categories, namely: ‘within 21 days of first dose’, ‘at least 21 days after first dose’, and ‘second dose’. However, in each age category the mortality fluctuates in a wild, but consistent way. For example, the two-dosed vaccinated non-Covid mortality rate is consistently far lower than the baseline, while the > 21 days 1-dose vaccinated non-Covid mortality rate is consistently far higher than the baseline. This is illustrated in the 70-79 age group in Figure 11 but the other age groups show very similar patterns.

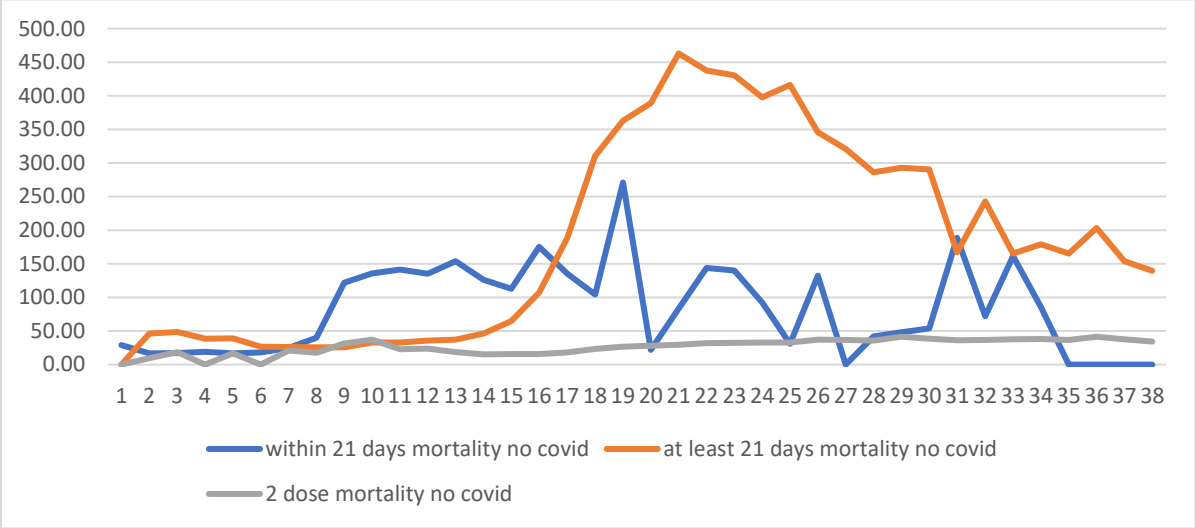

Figure 11: Non-Covid mortality rate for 'within 21 days' and 'at least 21 days' of first dose and 'two dose' in age group 70-79

4. Correlating unvaccinated mortality with the vaccine roll out

In Figures 12, 13 and 14 we compare the non-Covid mortality rate of those who are unvaccinated with those who are vaccinated (all vaccination categories combined) along with the timing of the first and second dose rollout.

Each figure shows the percentage uptake of the first and second dose of the vaccine (these are the dotted lines and the right-hand side vertical axis show the percentage of the age group vaccinated during that week). These lines show increasing uptake of the first and second doses of the vaccine. Each clearly envelops the period within which the majority of the first and second vaccinations were administered to each age group. Again, we have removed Covid mortality to isolate the signal of interest.

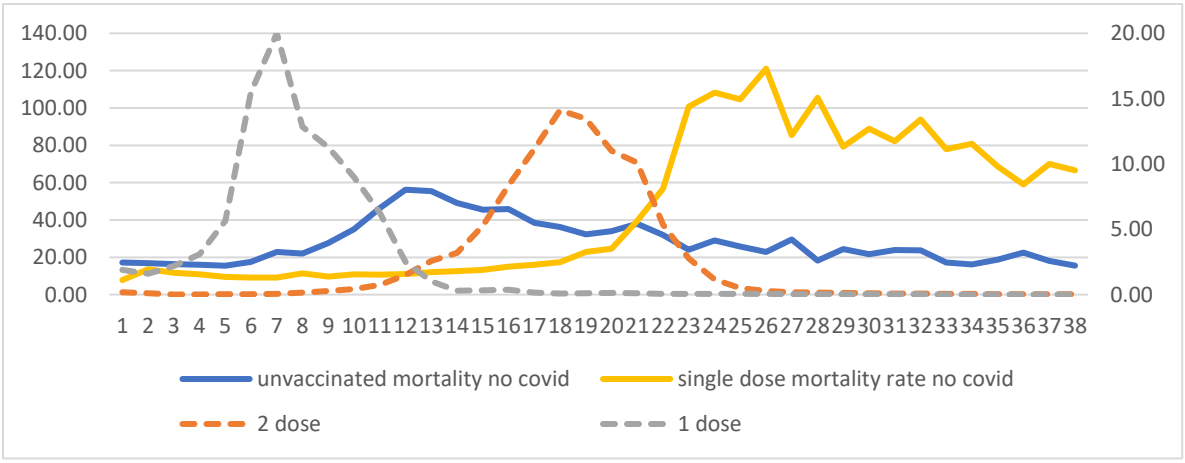

Figure 12: Non-Covid mortality rate in unvaccinated and vaccinated versus % vaccinated for age group 60-69 (weeks 1-38, 2021)

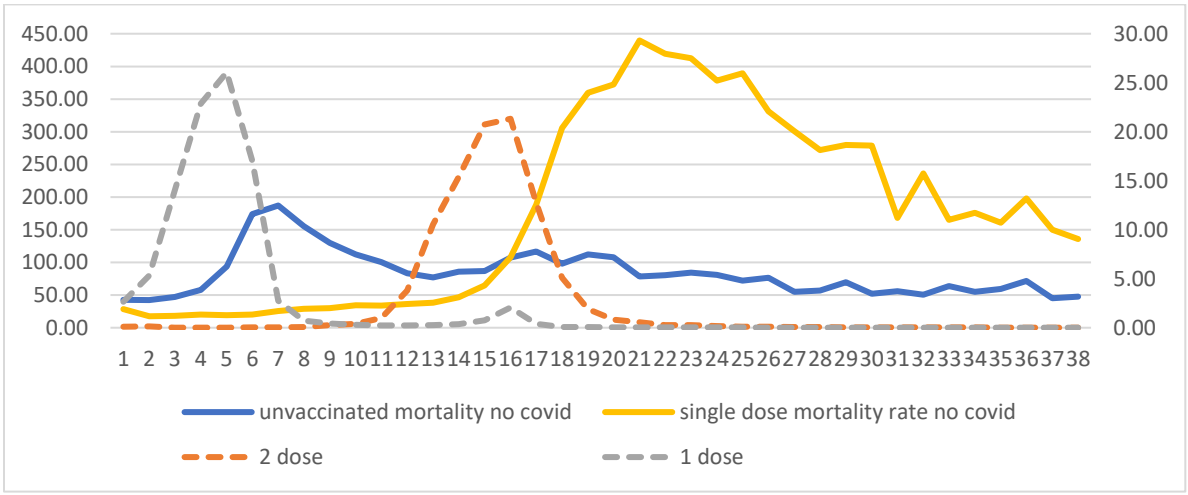

Figure 13: Non-Covid mortality rate in unvaccinated and unvaccinated versus % vaccinated in age group 70-79 (weeks 1-38, 2021)

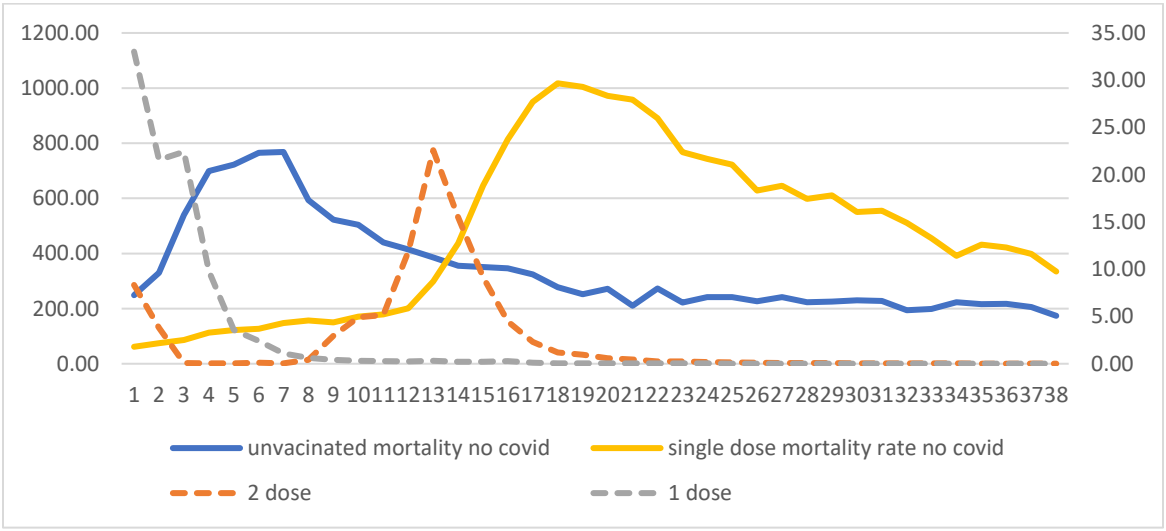

Figure 14: Non-Covid mortality rate in unvaccinated and unvaccinated versus % of age group vaccinated in age group 80+ (weeks 1-38, 2021)

In all Figures 12 to 14 we see peaks in mortality risk for the unvaccinated across the three age groups that occur almost immediately as if they had received the first vaccine and peak at consecutively later times in line with when vaccine was administered for that age group. The fact that the peaks in mortality are not temporally aligned strongly suggests that this is not caused by natural events. As reported previously [16], such a phenomenon would be inevitable if the deaths of people who die shortly after vaccination are miscategorised as unvaccinated.

5. Correcting the miscategorization

A major problem in evaluating the overall risk-benefits of a vaccine is that different classifications of what constitutes a 'vaccinated' person are required depending on whether we are primarily interested in its efficacy in reducing infections or in whether we are primarily interested in its impact on all-cause mortality. In this section we are interested in the latter, which is why we believe it is important to consider a person as 'vaccinated' if they have received at least one dose since adverse reactions are most likely

shortly after the vaccination. However, for efficacy in reducing infections, it seems reasonable to allow for suitable elapsed time (and even number of doses) before considering that a person is 'vaccinated'. Indeed, the vaccine manufacturers claim that they are only effective when the recipient is fully vaccinated, which they define as being >14 days after the second dose [18], with a recommended gap between the first and second dose of 3 weeks [20]. This is why the ONS and other data sets focus on categorisation before and after the 21-day period elapsed between doses.

However, there are also claims that the vaccines are effective after the first dose, but only after 14 days have elapsed. In fact, the USA CDC (Center for Disease Control) classifies any case, hospitalization or death occurring during this 14-day period after first dose as 'unvaccinated', despite injection [18]. Evidence from Israel suggests that this definition applies there [23], but in the UK it was never clear that this was the case until the release of documentation suggesting that the vaccinated who die within 14 days of vaccination might be categorized as unvaccinated [17].

Similarly, if it is possible that someone who dies within 14 days of vaccination (first dose) is miscategorised as unvaccinated then, hypothetically at least, a similar thing could occur post second dose, whereby the people who die within a period of taking the second vaccine are mis-categorised as 'single dose vaccinated'. A fuller investigation of the mis-categorisation problem as seen in the Dagan study [23] is expanded in the analysis by Reeder [22] and demonstrates that confounding by mis-categorisation can account for most, if not all, of any effectiveness claimed in an observational study.

The possible mis-categorisation processes are summarised in Figure 15.

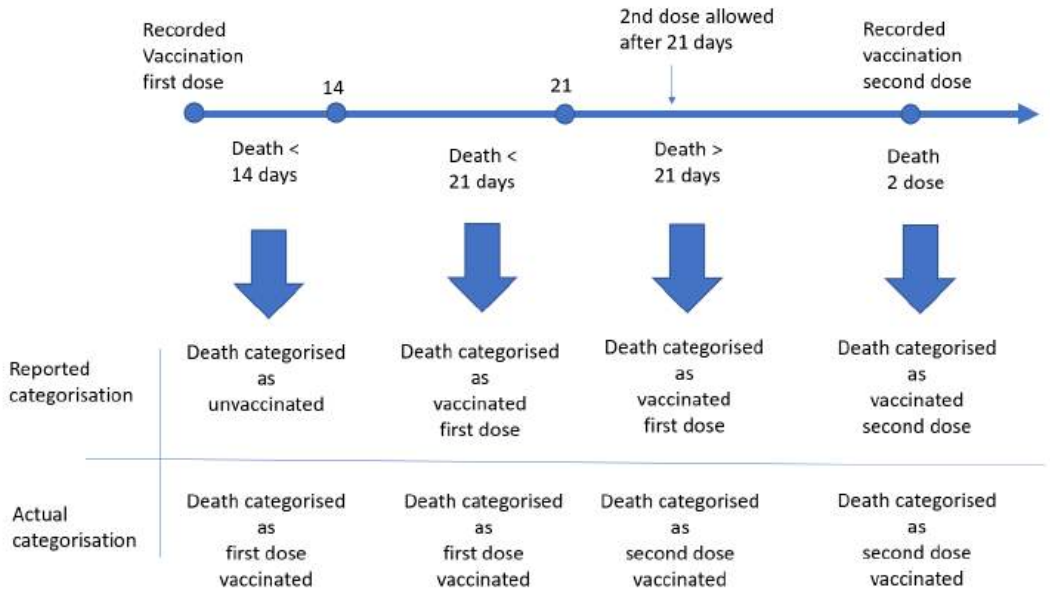

Figure 15: Possible reported versus actual vaccination status mis-categorisations

If we accept the possibility of mis-categorisation then how might the ONS data be adjusted to take account of it? Our hypothesis is that miscategorisation might explain the various odd phenomena in mortality rates described in Sections 3 and 4.

To test this hypothesis, we proceed as follows:

- We compare each group to the expected mortality from actuarial life tables to determine how far they were from historical expectations.
- We assume the true mortality rate for the unvaccinated equals a value close to the lifetable values (using [8] and [9]). Recognising that no data will exactly match history, we selected a baseline for comparison equal to the average of the final 12 week mortality rates in the ONS data. This includes the summer period, when covid mortality rates were almost zero. For the age groups these mortality rates were (lifetable values in brackets):
    - 60-69: 14.48 (18)
    - 70-79: 39.62 (46)
    - 80+: 163.40 (214)
- The difference between this mortality baseline and the unvaccinated and single dose mortalities was calculated to determine possible miscategorised mortality and this was re-assigned to the first dose and second dose mortality rates per week. Hence, excess mortality in the unvaccinated was assigned to the single dose vaccinated and that in the single dose vaccinated was assigned to the double dosed.
- We plot the new adjusted mortalities for the vaccinated and unvaccinated and compare to the vaccine roll out periods for each of the age groups.

Figures 16 to 18 show the adjusted mortalities for each of the three age groups for vaccinated and unvaccinated, along with the percentage of that age group being vaccinated for first and second doses. The similarity between them all is notable. In each there is an early spike in non-Covid mortality in the vaccinated groups, which then settles down and converges with that for the unvaccinated group, which is equal to the baseline mortality. In all cases the spike begins with the roll out of the first dose for each age group.

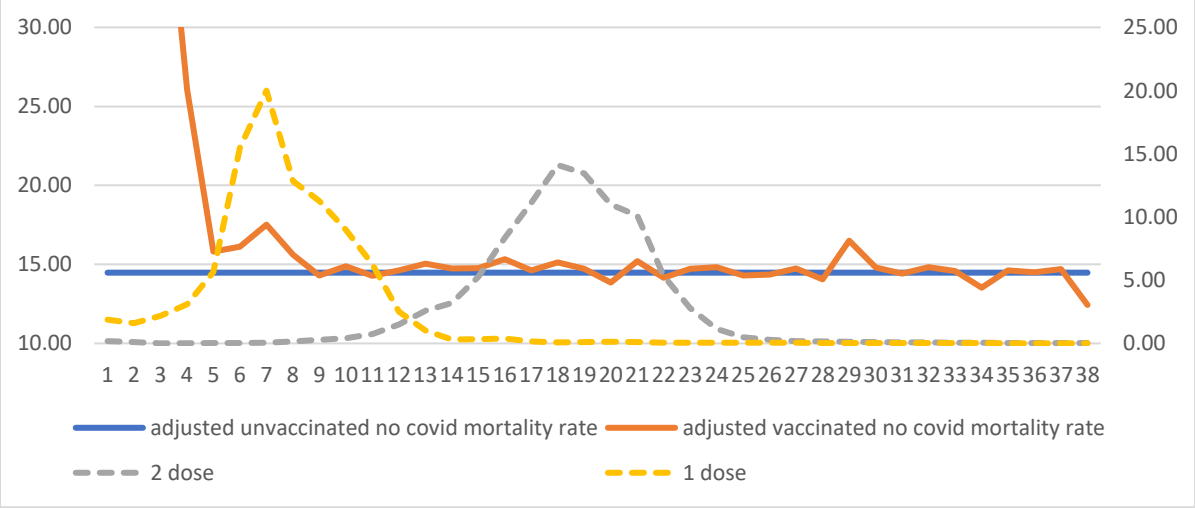

Figure 16: Adjusted non-Covid mortality rate in unvaccinated and unvaccinated versus % vaccinated for age group 60-69 (weeks 1-38, 2021)

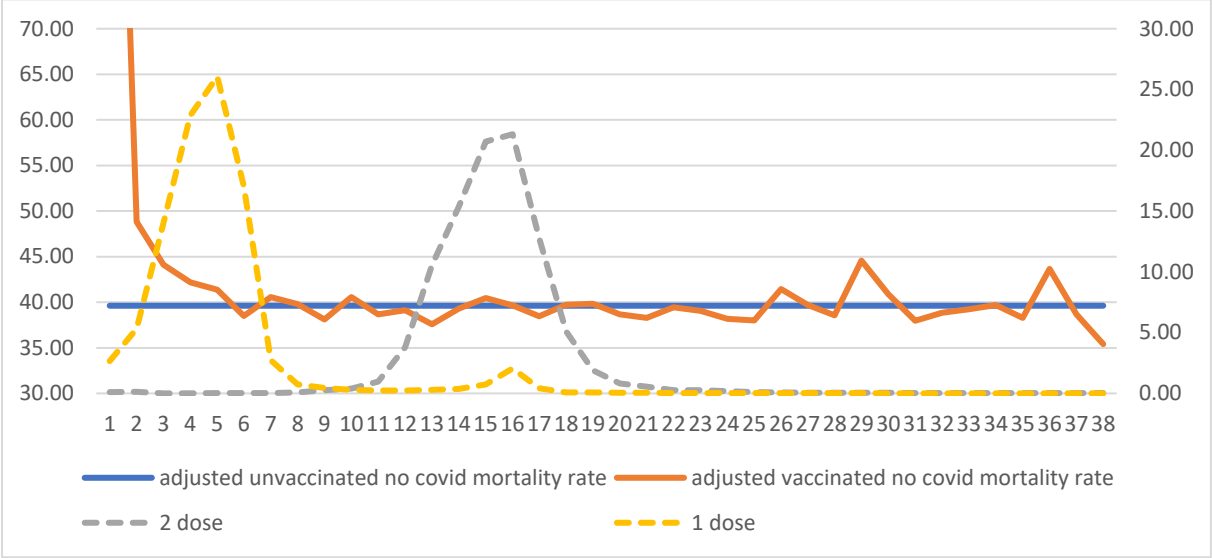

Figure 17: Adjusted on-Covid mortality rate in unvaccinated and vaccinated versus % vaccinated for age group 70-79 (weeks 1-38, 2021)

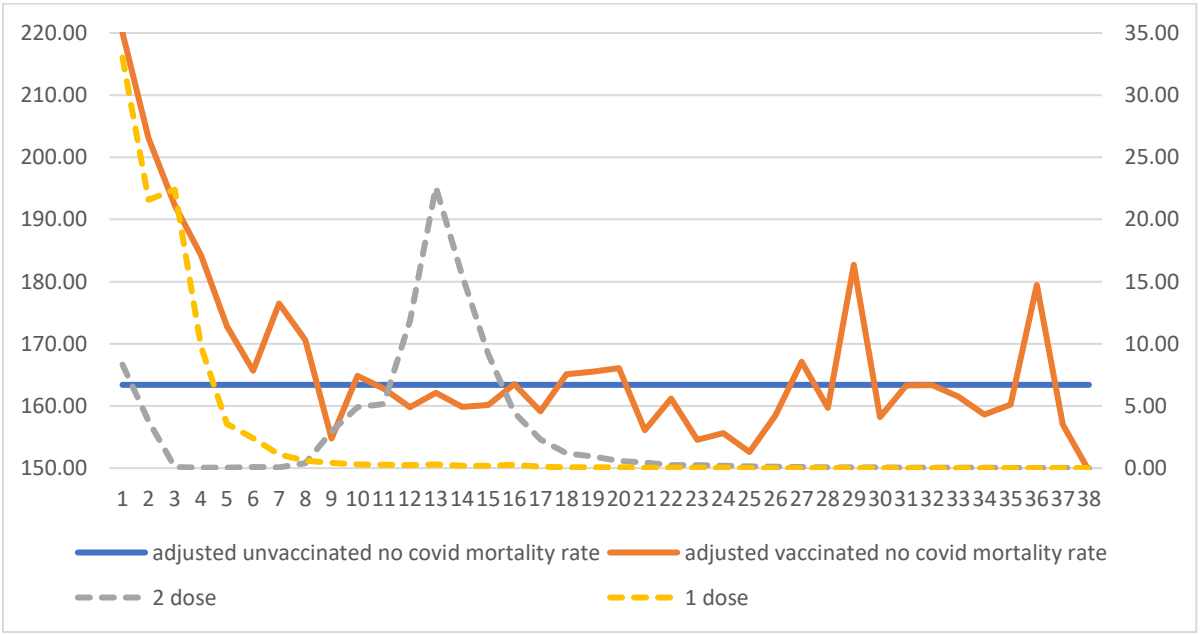

Figure 18: Adjusted on-Covid mortality rate in unvaccinated and unvaccinated versus % vaccinated for age group 80+ (weeks 1-38, 2021)

The scale of the mortality adjustment suggests that approximately 14% of all deaths are being mis-categorised across all three age groups.

In line with the fact that the data does not reveal excess mortality compared to previous years, we see no direct evidence of *overall* excess mortality caused by vaccine side effects in the data. The spikes in mortality that appear to occur soon after vaccination may be caused by the infirm, moribund, and severely ill receiving vaccination in priority order and thus simply appearing to hasten deaths that might otherwise have occurred later in the year.

This exploratory analysis suggests there is sufficient evidence to indicate that single and double dosed vaccinated may be being systemically mis-categorised (either accidentally or as a matter of policy). Given the simplicity of this analysis in explaining what must be flaws in the ONS data, it is surprising that the ONS has not considered this hypothetical possibility or sought to correct for it, should it be true.

6. Temporal offset adjustment of Covid-19 mortality

When we examine the Covid mortality curves for the three age groups, we find what at face value appears to be clear evidence of vaccine effectiveness, with the vaccinated benefitting from a lower Covid mortality rate than the unvaccinated. Figures 19 to 21 show this for each age group.

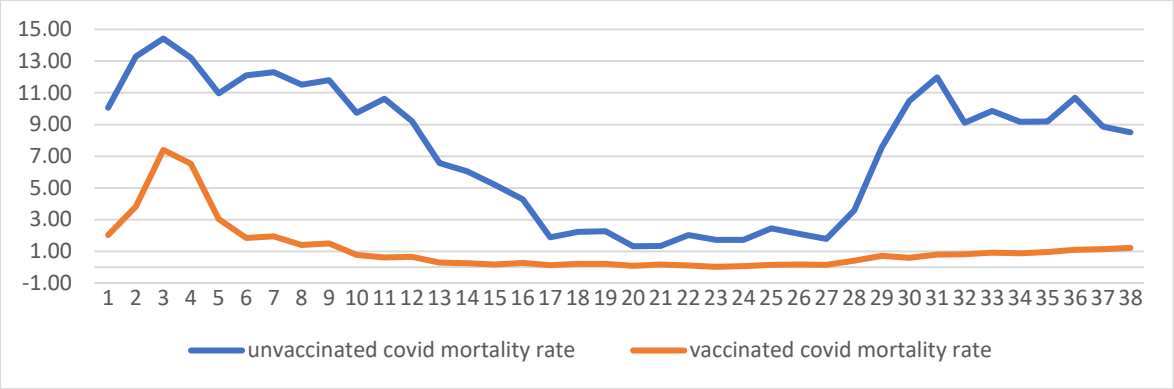

Figure 19: Covid mortality rate among unvaccinated and vaccinated for age group 60-69

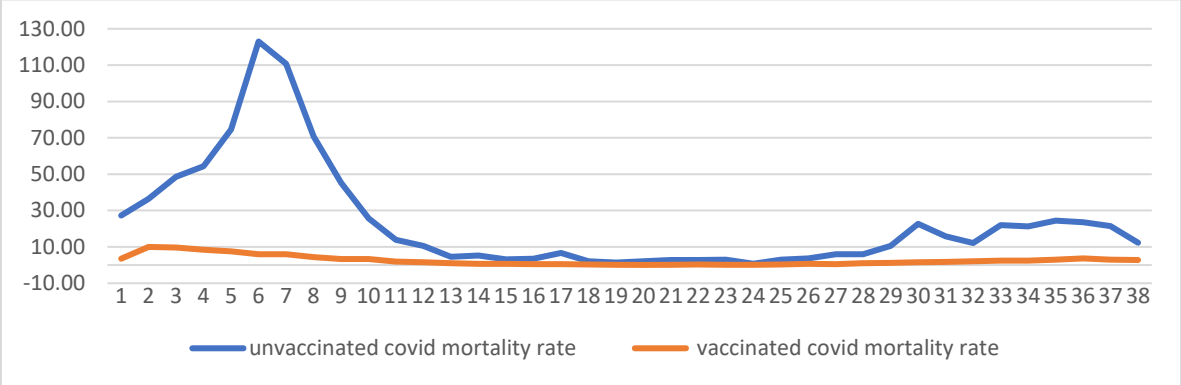

Figure 20: Covid mortality rate among unvaccinated and vaccinated for age group 70-79

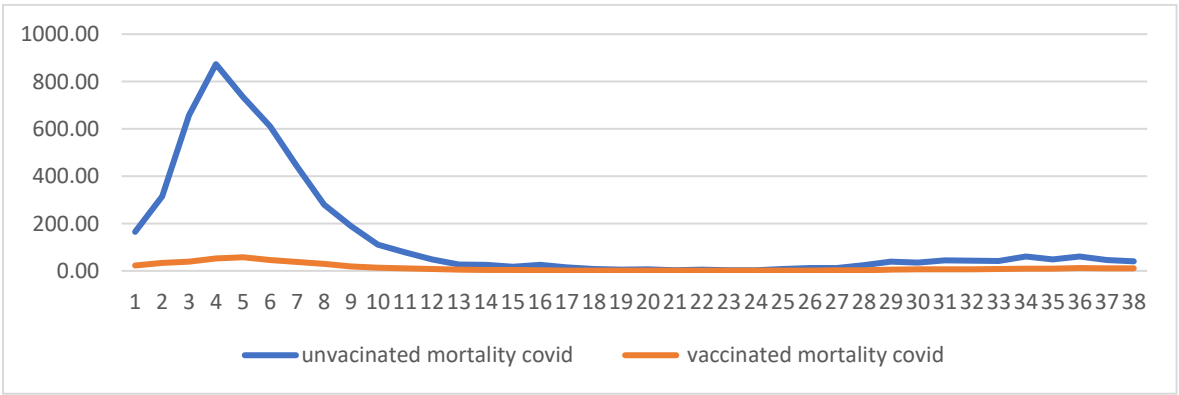

Figure 21: Covid mortality rate among unvaccinated and vaccinated for age group 80+

However, in interpreting these results it is important to avoid an overly simplistic understanding of the processes at play before and after vaccination. On the one hand, after vaccination the vaccinee is reported to endure a weakened immune response, [19], [21], for a period of up to 28 days [20] and may be in danger of infection from Covid or some other infectious agent at any time during that period. On the other hand, infection prior to vaccination, where Covid remaining symptomless for a period of up to three days, might endanger the vaccinee after vaccination because vaccination is supposed to be prohibited for 3-4 weeks after contracting Covid. Both processes are shown in Figure 22.

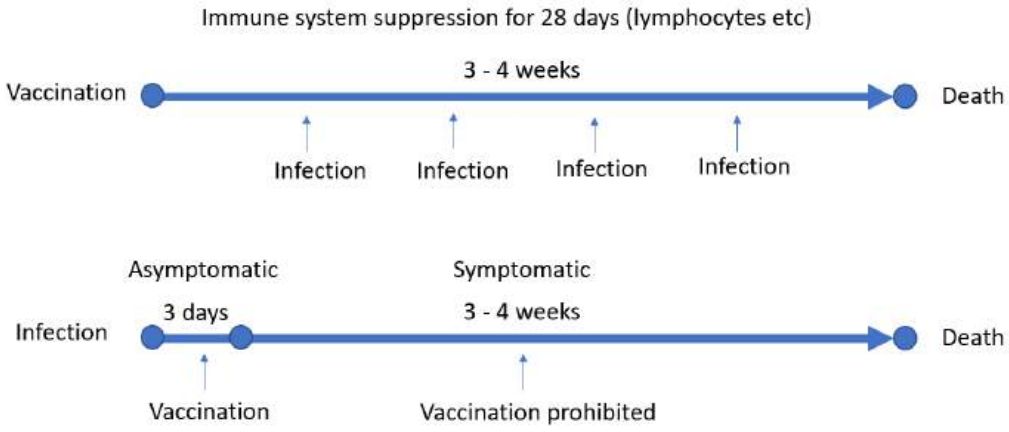

Figure 22: Infection and Vaccination processes

Given the fact that infection may cause death around three weeks after infection it makes sense to examine *infection date* rather than *death registration date*. Our exploratory hypothesis is therefore that a three-week offset in the death data, where we offset deaths in week, *t*, when they were registered, to week, *t-3*, when they were hypothetically infected would restore the correct temporal relationship between infection and death that underpins the observed data.

Figures 23 to 25 show this offset adjustment for the covid mortality rate for both the vaccinated and unvaccinated, along with the percentage of that age group receiving the first and second doses of the vaccine (right hand side axis).

After the temporal offset adjustment, we can see a large spike in mortality for all age groups during the early weeks, when covid prevalence was high, and when the first dose vaccination rollout peaked. After that early spike the covid mortality rates for both the vaccinated and unvaccinated look indistinguishable one from each other: as the summer months progressed there was little covid around and hence little opportunity for vaccine protection. However, by late summer we can see a rise in covid mortality for both groups.

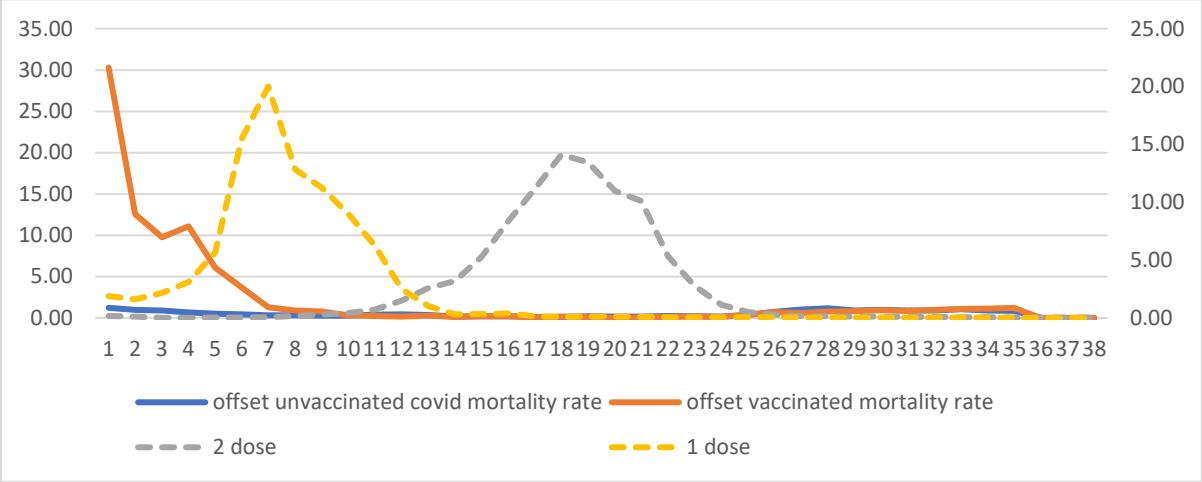

Figure 23: Offset Covid mortality rate in unvaccinated and vaccinated versus % of vaccinated for age group 60-69 (weeks 1-38, 2021)

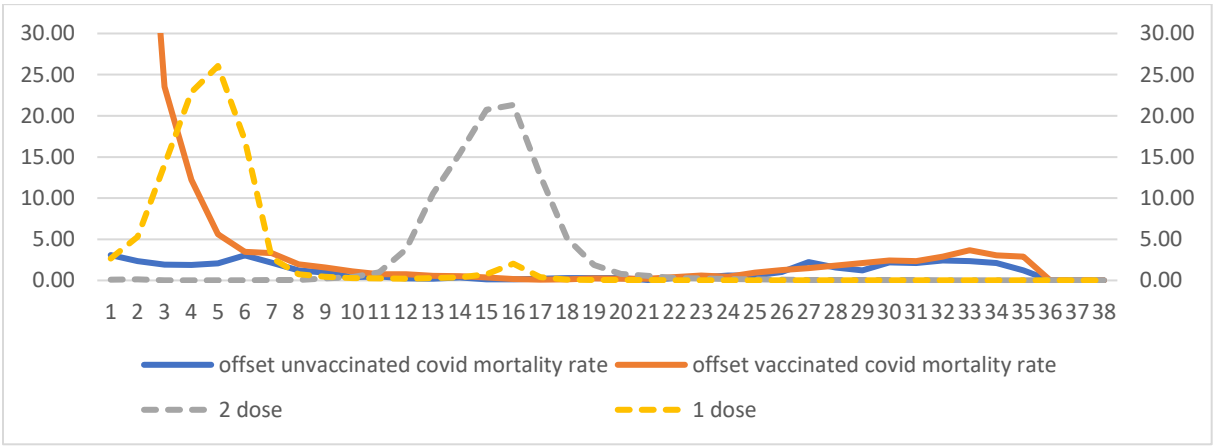

Figure 24: Offset covid mortality rate in unvaccinated and unvaccinated versus % of age group vaccinated for age group 70-79 (weeks 1-38, 2021)

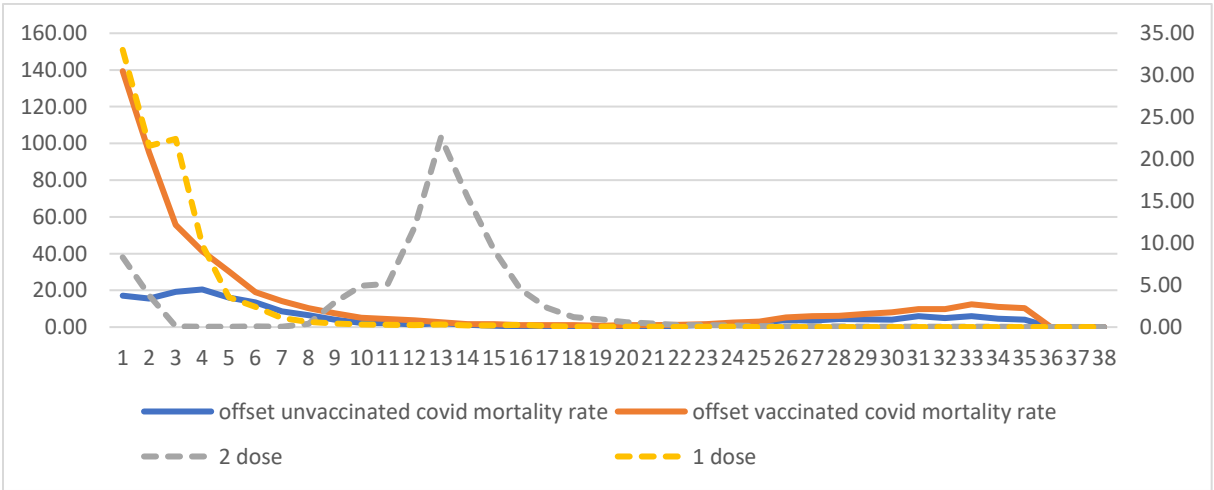

Figure 25: Offset covid mortality rate in unvaccinated and unvaccinated versus % vaccinated for age group 60-69 (weeks 1-38, 2021)

Hence, after our offset adjustment we observe no significant benefit of the vaccines in the short term. They appear to expose the vaccinee to an increased mortality, in line with what we know about immune exposure or pre-infection risks, but with perhaps a small protective benefit accruing post second vaccination (although we do not see this in the offset adjusted results).

An excellent analogy for what we are observing is made in [15] where the challenge is to get from a foxhole to a bunker, which is protective against artillery but to get to the bunker you must cross a minefield where you are exposed to accurate and deadly sniper fire. The second vaccine is like the bunker, while those in the foxhole are like the unvaccinated; those who die when crossing the minefield are classified as fox-hole deaths.

7. Changes in total population across age groups

Finally, there is one further oddity in the ONS data[5]. The ONS population data is defined in such a way that the total deaths per week and total loss of population should be the same each week. That is because the total maximum population is exactly the set of people registered in the 2011 census and who were also registered with a GP in 2019. This explicitly excludes the possibility for numbers changing due to emigration or immigration or indeed birth. Obviously, the populations move between age groups as people have birthdays, but overall, the total population in each week should be exactly equal to the total population in the preceding week minus the total number of deaths.

Figure 26 shows how total deaths and population change from weeks 1 to 37. The total number of deaths unaccounted for by the change in total population is around 10,000 per week until week 10 and positive until week 12. This should not be possible. Likewise, logically we might expect the total population change to be negative across the whole period but remarkably it is positive between weeks 8 to 10, suggesting population has somehow been added to the data set. From week 12 the decline is predictable and steady as expected but in the first three weeks the decline is much steeper before the period in which population is added back in. After week 12 the total change in population exactly matches the total deaths, as expected.

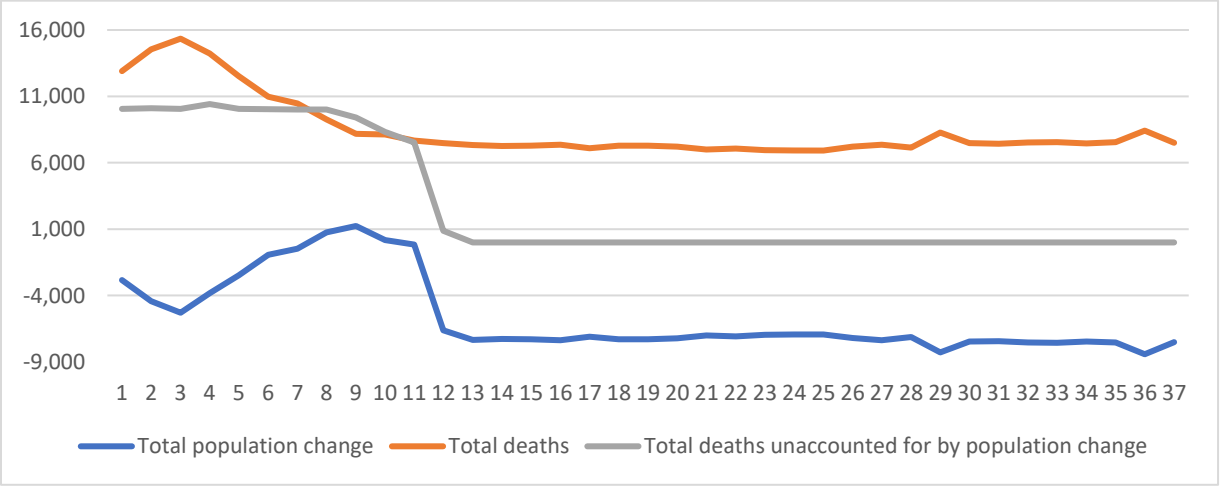

Figure 26: Total deaths, total population change and total deaths unaccounted for by total population change for all age groups (weeks 1-37, 2021)

[5] We acknowledge Dr. Hans-Joachim Kremer for pointing out this anomaly

This suggests something odd is going on up to week 11, when a possible systematic bias is introduced, which is then 'recovered' by week 12 and the bias disappears thereafter. We cannot explain why this pattern exists, but it is clearly a concern.

8. Can demographics, behavioural or health factors explain the differences?

While we have shown that miscategorisation can explain the strange phenomena in the ONS data, other possible explanations have been suggested, including socio-demographic and behavioural differences between the two groups. Indeed, the ONS has claimed their data as trustworthy given there are, as yet hypothetical, but presumed plausible explanations for these differences [14], including:

- "If a more virulent strain is active for a particular period of the year, this can increase the mortality rates in this period."
- "… that after most people had been able to receive two doses, this group becomes atypical, with people being too ill to receive their second dose becoming over-represented".
- "…more vulnerable people and health and social care workers were vaccinated first, and as the vaccine rollout progressed, the group of people who had received one dose became more representative of the general population."

It has also been argued that there may be systematic self-selection for vaccination, whereby on one hand terminally ill people close to death go unvaccinated while on the other hand the healthiest people choose vaccination. However, there is no evidence of this self-selection bias happening in the UK; on the contrary, there is evidence that it is the healthier people or those who have natural immunity to the virus who are more likely to remain unvaccinated which would make the ONS data even more suspect. Whilst we acknowledge that these may indeed be credible and plausible explanations, they are multivariate and involve very complex interactions and patterns. Thus far we have seen no evidence to support these explanations, nor do we see how they can explain the unique pattern of findings we report, especially the temporally staggered pattern of deaths in each age group coincident with vaccine rollout. Another possible explanation is that the differences are driven by ethnicity and deprivation, with the population separating into sub-groups where the unvaccinated contain a higher proportion of the deprived and ethnic minorities who might choose to refuse the offer of vaccination. Fortunately, we can look to the ONS and their academic partners for data here [11] and ask whether deprivation and ethnicity are credible.

From [11] we know vaccination take up is high in white British, Indian, and Chinese populations and lower in those of Bangladeshi & Pakistani heritage and in the Black population. Jointly, this lower take up group are only 5.4% of England's population and vaccination rates by August 2021 were lower across all age groups drawn from the Bangladeshi & Pakistani heritage and Black ethnicities, but not significantly lower.

There are approximately 39 million people in the ONS data set. Adopting the 5.4% figure above for minority ethnic, with lower take-up, this results in a total sub-population of approximately 1.9 million in this group. It is stated in [11] that between 65-85% of these ethnicities are vaccinated, so this is approximately 1.4m. Yet, the ONS data claims 7,637,511 people are unvaccinated. If only 1.4m of these might be minority ethnic who have declined the vaccine, it is too low a proportion to support any claim that ethnicity explains the differences.

We can also ask if the historical mortality of these ethnic minorities might explain the differences. Well, again, this is not supported by published data on life expectancies by ethnicity, [12], where we find that the life expectancies of these groups are at least as high, if not higher than those of white ethnicity.

Finally, we examine deprivation. From [11] we find that the two most deprived groups are on average around 80% likely to be vaccinated. Approximately 40% of the population belong in these two deprivation groups, so in the ONS data we might expect approximately 15.6m deprived people and of these approximately 3m would be unvaccinated. Using the same logic as before, we know that in the ONS data 7,637,511 people are unvaccinated, hence there are, at most, approximately 3m of these are deprived. Yet the ONS life expectancy statistics by deprivation show only an 8-year life expectancy difference [13]. Given that most of the deprived are actually vaccinated, this would surely negatively affect the life expectancy of the vaccinated group should it contain a disproportionate number of the deprived population (which it doesn't).

Of course, the above are rough calculations, but if the ONS and other commentators or policy makers wish to claim that social and demographic factors explain the striking mortality differences between these groups they should release the data and present their case.

In summary, as there is no empirical evidence to support these various alternative explanations for the strange phenomena in the ONS data, we believe that the simpler hypotheses of miscategorisation are more plausible.

9. Summary and Conclusions

The accuracy of any data purporting to show vaccine effectiveness or safety against a disease is critically dependent on the accurate measurement of: people classified as having the disease; vaccination status; death reporting; and the population of vaccinated and unvaccinated (the so called 'denominators'). If there are errors in any of these, claims of effectiveness or safety cannot be considered reliable.

The risk/benefit of Covid vaccines is best – and most simply - measured by all-cause mortality of vaccinated against unvaccinated, since it avoids the thorny issue of what constitutes a Covid 'case/infection'. In principle, the data in the ONS vaccine mortality surveillance reports should provide us with the necessary information to monitor this crucial comparison over time. However, until the most recent report [7], no age categorized data were provided, meaning that any comparisons were confounded by age (older people are both disproportionately more vaccinated than younger people and disproportionately more likely to die).

The latest ONS report does provide some relevant age categorised data. Specifically, it includes separate data for age groups 60-69, 70-79 and 80+, but there is only a single group of data for the age group 10-59.

At first glance the data suggest that, in each of the older age groups, all-cause mortality is lower in the vaccinated than the unvaccinated. In the 10-59 age group all-cause mortality is higher among the vaccinated, but this group is likely confounded by age since it is far too wide for the data provided to be sufficient to draw any firm conclusions.

However, despite this apparent evidence to support vaccine effectiveness - at least for the older age groups - on closer inspection of this data, this conclusion is cast into doubt. That is because we have shown a range of fundamental inconsistencies and flaws in the data. Specifically:

- In each group the non-Covid mortality rates in the three different categories of vaccinated people fluctuate in a wild, but consistent way, far removed from the expected historical mortality rates.
- Whereas the non-Covid mortality rate for unvaccinated should be consistent with historical mortality rates (and if, anything slightly lower than the vaccinated non-Covid mortality rate) it is not only higher than the vaccinated mortality rate, but it is far higher than the historical mortality rate.
- In previous years each of the 60-69, 70-79 and 80+ groups have mortality peaks at the same time during the year (including 2020 when all suffered the April Covid peak at the same time). Yet in 2021 each age group has non-Covid mortality peaks for the unvaccinated at a different time, namely the time that vaccination rollout programmes for those cohorts reach a peak.
- The peaks in the Covid mortality data for the unvaccinated are inconsistent with the actual Covid wave.

Whatever the explanations for the observed data, it is clear that it is both unreliable and misleading. We considered the socio-demographic and behavioural differences between vaccinated and unvaccinated that have been proposed as possible explanations for the data anomalies, but found no evidence supports any of these explanations. By Occam's razor we believe the most likely explanations are:

- Systematic miscategorisation of deaths between the different groups of unvaccinated and vaccinated.
- Delayed or non-reporting of vaccinations.
- Systematic underestimation of the proportion of unvaccinated.
- Incorrect population selection for Covid deaths.

With these considerations in mind we applied adjustments to the ONS data and showed that they lead to the conclusion that the vaccines do not reduce all-cause mortality, but rather produce genuine spikes in all-cause mortality shortly after vaccination.

There are, of course, some caveats to our analysis. While we have completely ignored the 10-59 age group because it is far too coarse for age confounding not to potentially overwhelm any conclusions, the age groups 60-69, 70-79, 80+ are still quite coarse, and there may be some age confounding within these age groups. For example, the average age of the vaccinated 60-69 age group may be higher than that of the unvaccinated 60-69 group and hence the number of deaths would naturally be slightly higher.

We have deliberately chosen not to subject the data to a degree of sophisticated statistical or probabilistic modelling but can readily imagine what might be done. We have carried out some basic computations of confidence intervals to address the fact that at various points the population sizes differ dramatically and from this the patterns reported remain visible, significant and our analysis credible.

Ultimately, our analysis is hypothetical insofar as it presents two processes, one based on time vaccine-infection interaction and one based on categorisation, that might better explain the patterns in the data. However, we believe it is up to those who offer competing explanations for the data to explain how and why the data is the way it is. We have explained that various social and ethnic factors are very unlikely to explain these odd differences in the ONS data set. Absent any other better explanation Occam's razor would support our conclusions. In, any event the ONS data provide no reliable evidence that the vaccine reduces all-cause mortality.

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