**Supplementary Material 4: Sensitivity Analysis for Projected Nationwide COVID-19 Vaccine Fatalities**

***Subtracting Fatalities That May Have Occurred Regardless of Vaccination Status***

It is possible that reported deaths following vaccination were not caused by vaccination but rather were coincident with vaccination. To address this issue, one could subtract deaths that might have occurred regardless of vaccination status. The phrasing of the survey question with regard to potential vaccine related health problems made it clear that health issues that emerged following vaccination should be reported. This suggests that it may be inappropriate to subtract deaths resulting from ongoing chronic conditions or other ongoing illnesses that would likely be known by respondent prior to vaccination. In other words, deaths that arise relatively quickly that might have occurred in tandem with vaccination but would have occurred regardless of vaccination status should be subtracted. According to Slovis, et al. (1), the five most common causes of sudden death are fatal arrhythmias, acute myocardial infarction, intracranial hemorrhage/massive stroke (cerebrovascular accident), massive pulmonary embolism and acute aortic catastrophe.

Available from the author upon request are the calculations for the reported Covid vaccine deaths from the survey along with the 2019 standardized mortality rates per 100,000 people for the top ten causes of death for each age group, which are obtained from the National Center for Health Statistics (2).

There is a high proportion of reported COVID-19 vaccine fatalities occurred among the younger age groups. Also, expected fatalities among the younger age categories are low but increase with age. This is true for quick onset death (diseases of the heart and cerebrovascular disease) as well as for all fatality categories minus external causes. Fatalities that are expected to occur regardless of vaccination are then subtracted from reported COVID-19 vaccine fatalities from the survey.

As shown in Figure 1 in the body of the article, expected fatalities exceed reported fatalities for the 65-74 and 74-85 age groups, but the other categories generate positive vaccine deaths after subtracting expected fatalities. Setting COVID-19 vaccine fatalities to zero for the 65-74 and over 74 age groups, and tallying net fatalities for the other age groups generates 39 vaccine-related fatalities. Applying the same method described in the article to calculate estimated nationwide vaccine-induced fatalities generates 205,737 fatalities. Subtracting expected fatalities from all causes generates negative net fatalities for the 55-64 age group as well. In this case, the sum of fatalities net of all expected fatalities is 25, which generates projected fatalities nationwide of about 126,407 fatalities.

This additional analysis provides evidence that survey respondents are observing more fatalities than expected among young people and fewer fatalities than expected among the older age groups. While it may be inappropriate to subtract all expected fatalities given the nature of the survey question, this additional analysis shows that more fatalities than expected are occurring among the younger age groups. As a result, projected net nationwide vaccine fatalities from the survey are substantial regardless of whether “quick onset” fatalities or all fatalities except those from external causes are subtracted.

***Comparison with Different Social Circle Size***

The social circle framework used in the survey and analysis is well-defined in the literature, and of particular relevance is the research of Bruin et al. (2), who use the social circle framework in the context of evaluating vaccination decisions. Also, the study by Shupp et al. (3) uses the same social network style of question to increase understanding of stigma around prescription drug use disorders. As with Shupp et al. (3), the survey provides a brief description of social circle as “family, friends, church, work colleagues, social networks”.

Regarding social circle size, according to Stiller and Dunbar (4), personal social networks form a set of “concentric circles of acquaintanceship containing, roughly, 5, 15, 50, 150, 500, 1,500 individuals with their circles reflecting successively declining emotional closeness and frequency of contact.” On the scale of regular contact (in contact at least once a month), the authors indicate a network size is in the range of 12-15 people.

For health issues such as vaccination, social network size is important to the study. Consider the following:

1. Each person is likely to know health information such as vaccination status of a relatively small number of people. While some people appear willing to announce their vaccination status in the public sphere, most people remain private about health issues. In the context of an adverse event, one might observe that a person had a stroke or heart attack, yet without knowing vaccination status or the temporal relationship between the health event and date of vaccination, a person would not associate the health event with vaccination.
2. During a portion of 2021, many US citizens were on lockdown in parts of the US.  Accordingly, in-person interactions were likely limited.  Many did not attend community gatherings, and many worked from home, etc. Thus, people were less likely to have direct personal conversations about health and other personal topics. Also, a potential vaccine adverse event is arguably a taboo topic in some portions of society.

Regarding measuring the size of social circles, the survey includes a question about the size of respondent social circles:

Q32 Think about your social circles (family, friends, church, work colleagues, social networks, etc.). About how many people in your circles do you know well enough that you would typically learn about a significant emerging health condition? (numerical answer only please)

On average, respondents indicated that they know about 10 people well enough to learn about a significant emerging health condition. The mean size of social circles is then utilized to calculate the number of fatalities within respondents’ social circles that would be expected to have occurred regardless of vaccination status.

The size of social circle used in the baseline evaluation is based on reported social circle size from the survey, where respondents indicated that, on average, they knew about 10 people well enough to know something about health status. As described by Stiller and Dunbar (13), the average size of the social network a person sees at least once a month is 15. If a social network size of 15 is used in the calculation of expected fatalities, estimated nationwide COVID-19 vaccine fatalities is about 189,000 after subtracting “sudden onset” fatalities and 103,000 after subtracting “all cause fatalities.

To show that results are robust with respect to the computational approach used, consider an alternate method for calculating social circle size and vaccine fatalities from the survey. With this approach, estimated vaccine fatalities are calculated using the following equation:

1. Estimated Vaccine Deaths =

(Survey Vaccine Deaths/# People in Social Network) \* Total US Population

Estimated Covid Illness fatalities can be calculated in a similar way:

1. Estimated Covid Illness Deaths =

(Survey Covid Illness Deaths/# People in Social Network) \* Total US Population

Total official COVID-19 illness fatalities of 839,993 through the end of 2021 in combination with equation 2) can be used to examine the both social network size and fatalities under the assumption that a respondent knows just one person who they report died from COVID-19 illness. Note that it is likely that some people know more than one person who died from COVID-19.

Assuming a respondent knows just one person who died from COVID-19, social network sizes of 10 or 15 generate too high a number for projected COVID-19 illness fatalities to match actual data on COVID-19 fatalities. The projected COVID-19 vaccine fatalities are therefore also too high. A social network size of 23 creates projected COVID-19 fatalities that match official statistics. In this scenario, COVID-19 vaccine fatalities are projected to be about 291,000, which is similar to the estimate reported in the body of the article. A limitation of this approach is the additional needed assumption that respondents only know one person who died from COVID illness and only one person who may have died from the COVID-19 vaccine. The calculation based on this alternative method is provided to demonstrate that a different methodological approach yields projected nationwide vaccine fatalities that are in range similar to that reported in the body of the article.

Returning to the method used in the article, if a social network size of 23 is used to generate expected fatalities, estimated nationwide COVID-19 vaccine fatalities is about 162,000 after subtracting “sudden onset” fatalities and 66,000 after subtracting “all cause” fatalities.

***Examining Bias Based on Respondent Characteristics***

To examine potential bias in respondent perceptions, consider ratio of reported COVID-19 inoculation fatalities to COVID-19 illness fatalities for Democrats, Republicans and Independents which are 6/46, 32/58, and 18/61, respectively. Democrats report fewer COVID-19 inoculation fatalities than Republicans or Independents, suggesting politicization of the issue. Estimated nationwide fatalities are calculated with scenarios where Democrats, Republicans and Independents are presumed to offer more accurate reporting by applying the ratio of COVID-19 inoculation fatalities to COVID-19 illness fatalities to nationwide COVID-19 illness fatalities of 839,992. Estimated fatalities for Democrats are 109,564. Republicans and Independents yield estimated fatalities of 463,444 and 247,867, respectively. There may also be differences in perceptions by inoculation status. A person who has been inoculated may be less inclined to observe and acknowledge potential vaccine-induced injuries, whereas the uninoculated may be looking for potential harm; each person has an incentive to validate one’s decision. To examine this type of bias, the sample is divided by vaccination status: The inoculated ratio of COVID-19 inoculation fatalities to COVID-19 illness fatalities is 14/106 and the unvaccinated reported ratio is 44/56. For the vaccinated group, there are an estimated 110,942 fatalities, whereas with the unvaccinated group there are 659,995 fatalities.

***Low Vaccination Rate in the Survey Compared to Vaccination Rate Reported by the CDC***

From the survey the vaccination rate is 51% whereas the CDC reported a vaccination rate of 72% at the time the survey was conducted. Thus, the relatively low vaccination rate in the survey compared to CDC data on the vaccination rate could be evidence of selection bias.

First, note that the survey closely matches the US population in demographic, educational, and political make-up. However, there is difference in the COVID-19 vaccination rate. Which reported vaccination rate is more accurate? In December 2021, US News and World Report posted an article by Smith-Schoenwalder and Lurye (6) highlighting overcounting vaccination in many areas of the country because “first, second, and booster doses were not always linked”.

As one example, “Georgia’s Chattahoochee County appears to be the most vaccinated county in the U.S. – but the number of vaccinated people is four times as large as its population. The real full vaccination rate is 20%, according to the state’s dashboard (7).

A spokesperson from the Georgia Department of Public Health said that the CDC is counting additional vaccinations from the Fort Benning military base.” Thus, at the time the survey was administered, there was a question about whether the CDC reported nationwide vaccination rate was too high.

According to an article by Hilbert (8), the CDC is overestimating the vaccination rates by 23%. Distinguished Professor David Lazer of Northeastern University says the reason is simple: The CDC is relying on information reported by states, which in some cases counts individuals going for booster shots as separate individuals getting the first shots in the series, especially in cases when people forget to bring their vaccination cards for the boosters.

Evidence suggests that the CDC data on the nationwide vaccination rate may be too high.

Consider the case where the degree of overestimation by Lazer is assumed to be correct. If one takes the 72% vaccination rate from the CDC at the time of the survey multiplied by 0.77 (1 - 0.23), the vaccination rate would be about 55%. The survey could be weighted to account for this 51% to 55% difference, but the revision would be very minor. Nevertheless, it important to compare results when the survey is reweighted based on vaccination status assuming the CDC vaccination rate is correct, even though evidence suggests this is an overcount. Once the survey is reweighted based on the CDC vaccination rate, estimated vaccine fatalities are about 216,000.

***Omission of Questionable Reported Covid Illness and Covid Vaccine Fatalities***

There was one case where respondent indicated the vaccinated person died of cancer. Also, there are also two cases among reported COVID-19 illness deaths where cancer is highlighted. According to Moriyama et al. (9), COVID-19 illness can suppress the immune response and thus result in reduced ability for the body to eliminate precancerous cells. By extension, it is also possible that the vaccine, by reprogramming cells to produce spike protein could also result in immune suppression. However, the vaccination status of patients would have to be studied to identify potential vaccine-induced suppression. The point is that for both the COVID-19 illness and the COVID-19 vaccine, rapid onset of cancer is possible. Further, Orient (10) notes safety signals with regard to potential linkages between the COVID-19 vaccine and cancer found in public databases such as VAERS and calls for formal oncopharmacological studies.

Nevertheless, perhaps one should eliminate the two cancer-related fatalities from the reported COVID-19 illness deaths and the one cancer-related fatality from the reported COVID-19 vaccine deaths and recalculate the nationwide estimate of Covid vaccine fatalities. This new calculation yields about 289,000 estimated fatalities.

COVID-19 vaccine-related deaths reported in the survey indicate that three people contracted COVID-19 and subsequently died. There was also a case where a pregnant person is reported to have lost a baby and this was counted as a vaccine-related death. A recent study conducted by the Cleveland Clinic provide evidence that the COVID-19 vaccines may increase risk of getting COVID-19 over time (11). Thorp, et al. (12) uses VAERS data to compare the COVID-19 vaccine with the influenza vaccine to show that the rates of reporting of pregnancy and menstruation abnormalities, showing a substantial safety signal for the COVID-19 vaccine.

In addition, by court order Pfizer and the FDA released a document covering the performance of the mRNA vaccine in the early months of the roll out.  The judge ordered the release of information only after the FDA and Pfizer requested that it not be released for 55 years (Public Health and Medical Professionals for Transparency, [5.3.6-postmarketing-experience.pdf (phmpt.org)](https://phmpt.org/wp-content/uploads/2021/11/5.3.6-postmarketing-experience.pdf) (13)) A summary of vaccine adverse events in the first weeks of the vaccine rollout is provided in the document, which indicated more than 1,200 fatalities, 158,893 adverse events and 42,086 case reports including nervous system disorders (25,957), musculoskeletal and connective tissue disorders (17,283), gastrointestinal disorders (14,096), skin and subcutaneous tissue disorders (8,476), respiratory, thoracic and mediastinal disorders (8,848), infections and infestations (4,610), injury, poisoning and procedural complications (5,590) cardiac disorders (3,070), and so on. Among the adverse events tracked by Pfizer, COVIC-19 is listed as the third most common side effect as listed “drug ineffective” and “Covid infection”. The Pfizer document also lists 270 cases of spontaneous abortion among pregnancy cases.

Nevertheless, for comparison projected vaccine fatalities after removing these cases is calculated. If the three Covid illness death cases that were reported as COVID-19 vaccine death as well as the cancer and spontaneous abortion cases are eliminated, estimated nationwide COVID-19 fatalities are about 265,000.

A mirror issue is that there is no account for the number of people who may have died regardless of contracting the COVID-19 illness. There are several cases where respondents indicated that the person who they report as having died from COVID-19 may have died as a result of other underlying health problems. Specifically, three are reported to have died from heart attacks, five from pneumonia, two from cancer, and one by suicide. Should these 13 events be categorized as COVID-19 illness fatalities, or did these people die of other causes? If one were to remove these 13 reported deaths in the COVID-19 illness category along with the questionable reported COVID-19 vaccine fatalities discussed above, estimated nationwide COVID-19 vaccine fatalities are about 287,000. Eliminating these questionable fatalities generates qualitatively similar estimated nationwide COVID-19 vaccine-related fatalities that is reported in the body of the article.

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