

Worldwide Big Data Analysis Suggests COVID Vaccination Increases Excess Mortality Of Countries Months After Initiation

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Abstract : COVID vaccines were reported to be effective for reducing COVID infection, hospitalization, mortality rate and as a result, suppressing excess mortality during the pandemic period. However, since they were developed in limited period of time and didn't complete the regular Drug-Approval process, there is high uncertainty on long-term side effects. Serious long-term side effects will increase the non-COVID mortality rate, which may even leads to increasing excess mortality. Therefore, whether the COVID vaccines could reduce or increase excess mortality in both short term and long term needs to be studied. In this study, relationships between different Time Periods After Vaccination Initiation(TPAVI) and excess mortality are evaluated. Other factors that affect global excess mortality like COVID death, and ever-infected rate related factors are also discussed to make sure the relationship between TPAVI and excess mortality is exclusive. Multiple Linear regression(MLR) model is used to evaluate the relationships between these factors and excess mortality. Data of 55 countries representing 1.7 billion population are used in the models, which is the largest dataset as far as we know. The result clearly shows that COVID vaccination is increasing excess mortality after several months, especially when after around 10 months or later. Furthermore, according to our model, the excess mortality caused by COVID vaccination is even higher than pandemic level. The massive vaccination campaign is proven to be a huge mistake and should be stopped immediately.

Keywords: COVID vaccine, COVID vaccination, excess mortality, linear regression model, time period after vaccination initiation

1. Introduction

1.1 COVID-19 pandemic and COVID vaccines

SARS-CoV-2 virus emerged in 2019 and caused a global pandemic named COVID-19 as a result of its high infectiousness[1]. Until Mar. 2023, over 6.83 million death has been confirmed all over the world[2]. COVID vaccines were approved for emergency use since Dec. 2020[3] and were the first officially admitted solution for the pandemic. They were reported to be effective for reducing infection, hospitalization and mortality[4].

1.2 Concerns on COVID vaccine side effects

Since the COVID vaccines are developed within less than one year, there are concerns on how the mid-term and long-term side effects will affect human health. Among all types of COVID vaccines, generating or containing partial or whole length spike proteins of the virus is the key goal[5][6], or anti-spike antibodies play a key role in their immunity mechanism[7]. However, it is soon proved that SARS-CoV-2 spike protein alone can cause disease[8]. And the review paper [9] summarized multiple studies and concluded "the spike protein on its own can recapitulate key aspects of the pathogenesis observed following infection with SARS-CoV-2". These studies provide a theoretical basis for concerns about the side effects of all current COVID vaccines. It is possible that taking spike protein to avoid damage by SARS-CoV-2 virus could actually result in more similar negative effects. In paper[10], it was already demonstrated that COVID vaccines could cause comparative or even more myocarditis than COVID infection in under 40 age group. Besides the long term

side effects, it is also possible the vaccinated population could have higher COVID mortality risk than that of the unvaccinated. It is shown that the 2 dose vaccinated population are having higher infection risk than that of the unvaccinated population several months after vaccination[11-14]. Data in [11] shows effectiveness of 2 dose vaccination turns negative after 9 months during dominance of Delta variant. Data in [12-14] show effectiveness of 2 dose vaccination turns negative after 5~7 months during dominance of Omicron variant. Furthermore, the study[15] based on 51,017 employees from Cleveland Clinic has shown the correlation that the more dose vaccinated, the higher infection rate. Although it is still possible that COVID vaccines decrease the mortality risk after infection, however, the infection risk of different dose groups are elevated to a certain extent. For example, 3.5 times in over 3 doses vaccinated group[15], which also means the COVID mortality risk increased up to 3.5 times. These facts show that the COVID mortality risk among vaccinated group could be increasing over time, and even also result in causing excess mortality in long term. To verify this, the relationship between each Time Period After Vaccination Initiation(TPAVI) and excess mortality need to be studied among worldwide countries.

1.3 Approaches in this study

In this study, relationships between different TPAVIs with excess mortality of worldwide countries are evaluated. Factors that affect global excess mortality like COVID death, and ever-infected rate related factors are also discussed. In session 2, excess mortality data and the current situation across countries are introduced. In session 3, how the ever-infected rate related factor could affect excess mortality is discussed. In session 4, Multiple Linear regression(MLR) model is used to evaluate the relationships between the factors like COVID death, TPAVIs, and ever-infected rate related factors and the outcome excess mortality. In session 5, the amount of excess mortality rate caused by TPAVIs are mainly discussed. In session 6, the conclusions are made. In session 7, possible future work is introduced.

The source code used in this study is published in [16].

2. Excess mortality data across countries

2.1 Excess mortality and its importance

Excess mortality is a term used in epidemiology and public health that refers to the number of deaths from all causes during a crisis above and beyond what we would have expected to see under ‘normal’ conditions[17].

During COVID-19 pandemic, excess mortality captures not only the confirmed COVID-19 deaths, but also those were not correctly diagnosed and reported. Therefore, in order to evaluate the total impact of the pandemic on deaths, excess mortality is considered to be a more comprehensive measure than the confirmed COVID-19 death count alone[18].

2.2 Our World In Data(OWID) dataset

OWID published their excess mortality rate data of 116 countries[18], which is the most comprehensive among all available datasets to the best of our knowledge. Excess deaths are defined as the difference of reported deaths and expected deaths, as in Eq.(1). The excess mortality rate is defined as the ratio of excess deaths to projected deaths, as in Eq.(2). The expected deaths are estimated from a regression model fitted by reported deaths of past years. In OWID’s data, the model is fitted by the number of deaths data of 2015-2019 and used to project the number of deaths of 2020-2022[18].

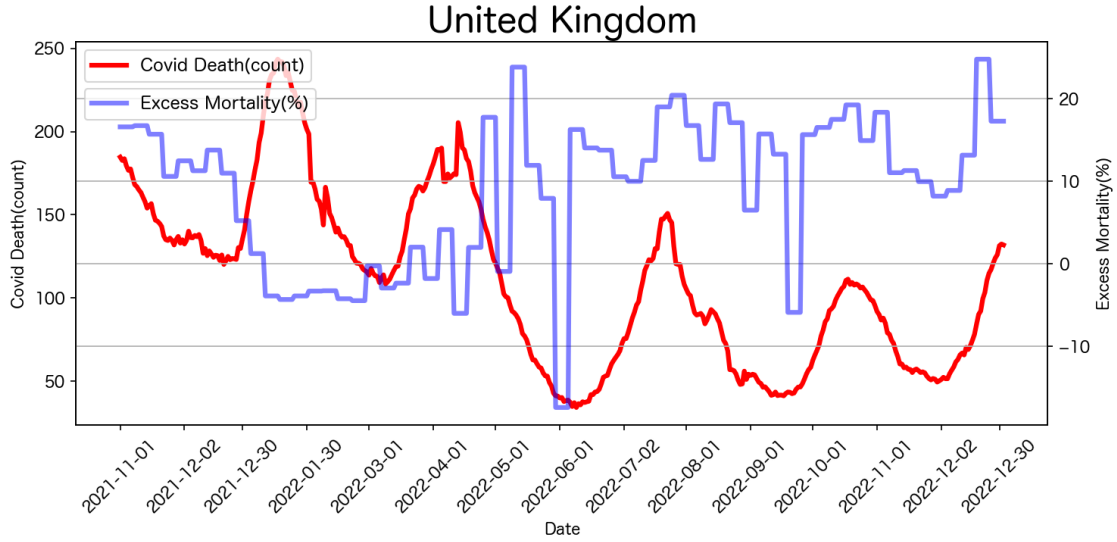


Figure 1. COVID death and excess mortality overtime in UK.

$$\text{Excess Deaths} = \text{Reported Deaths} - \text{Expected Deaths} \quad (1)$$

$$\text{Excess MortalityRate} = \frac{\text{Reported Deaths} - \text{Expected Deaths}}{\text{Expected Deaths}} \quad (2)$$

OWID dataset also includes new confirmed COVID death data of 219 countries/regions extracted from “JHU CSSE COVID-19 Data”[19], and calculated the 7 day average. Another statistics included is the daily cumulative COVID vaccination rates for all countries and all dosages. This can be used to confirm the date of vaccination initiation.

2.3 Abnormality in excess mortality in several countries

In England’s recent COVID-19 vaccine surveillance report, it is shown that their COVID ever-infected rate has passed 80% since around the 40th week in 2022[20]. This means over 80% population in England should have the anti-COVID(Nucleocapsid) antibodies, which accordingly should lead to less new COVID infection cases and deaths. As a result, a declining excess mortality rate should be expected. We used the 7 day average of new confirmed COVID deaths and excess mortality data from OWID to verify this assumption, as plotted in figure 1. The time period is set to be from Nov. 2021 in order to observe the period after omicron variant first appeared[21]. Omicron variant is much more infectious than previous variants and leads to a rapidly increasing infection rate. As in figure 1, largely increased post-infection antibody cover rate caused COVID deaths to be declining after the first peak of the omicron-wave in Jan. 2022. However, the excess mortality has been in an increasing trend. This means there are other reasons increasing excess mortality during this period. It is reasonable to suspect that COVID vaccines’ long term side effects are causing increased excess mortality.

Similar phenomenons are also found in other countries. COVID deaths and excess mortality rate of several other countries, such as Austria, Belgium, Denmark, Germany, Lithuania, Netherlands, Sweden and Switzerland are plotted, as in figure 2.

Data from the 8 countries clearly shows that while COVID deaths decline gradually during omicron wave, however the excess mortality data still stays at a high level. Therefore, it verifies again that there are other

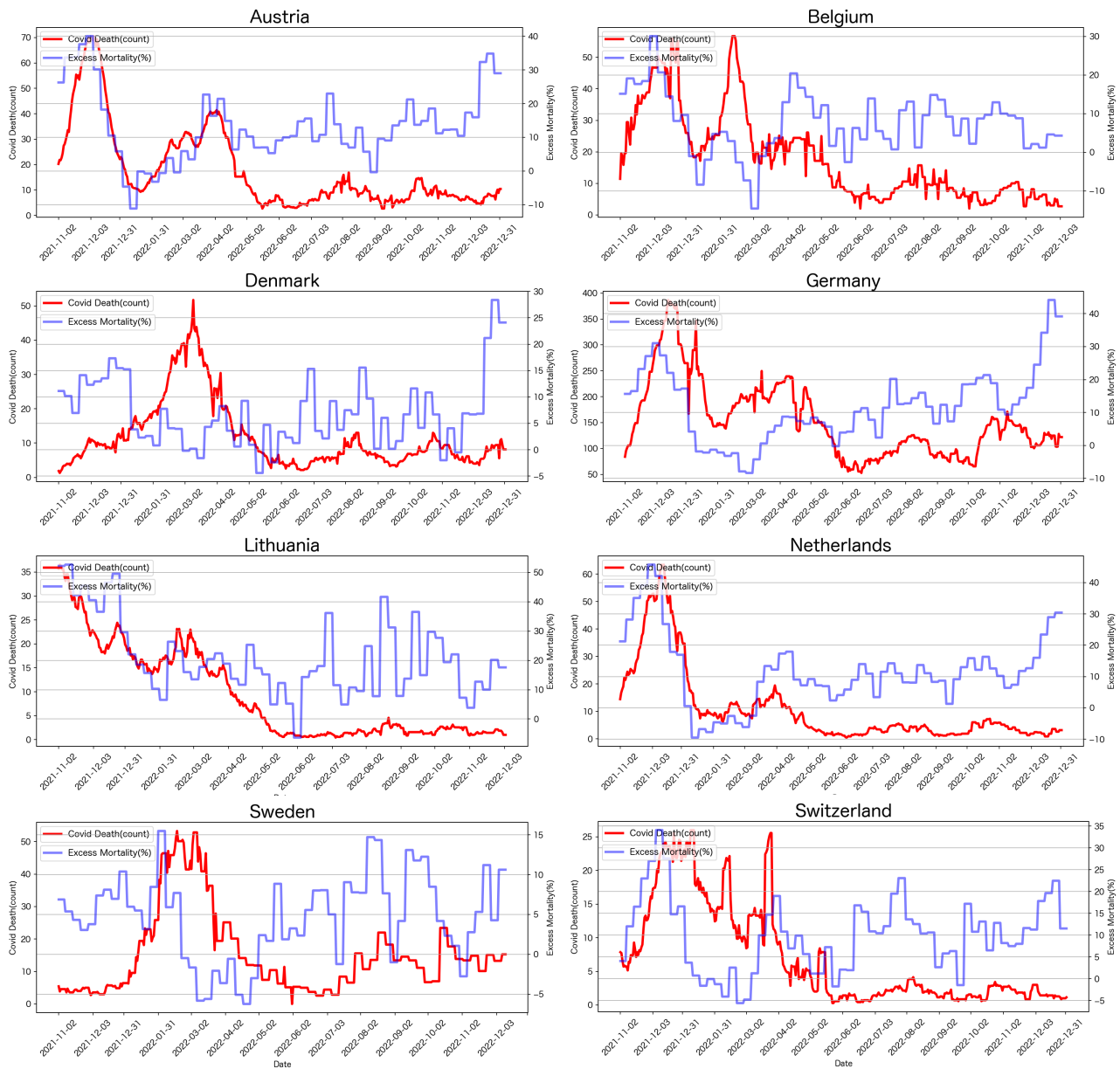


Figure 2. COVID death and excess mortality overtime for 8 countries

reasons that causing excess death since around 2022. Those countries are suffering an around 10% or higher excess mortality rate, which is at comparative or even higher level than that caused by the COVID pandemic. For example, as in figure 3, UK is experiencing 10%~20% excess mortality rate in recent months, which is even higher than the average value in 2021. Whether this pandemic level excess mortality is caused by the massive vaccination campaign should be studied.

3. Ever-infected rate related factor

3.1 Effect on excess mortality

To understand whether there is causal relationship between TPAVI and excess mortality, other factors possibly related to excess mortality also need to be discussed. Since we are studying data from worldwide countries, only global factors should be considered. COVID death is obviously one possibility.

The other possibility could be lethal long-term post-COVID sequelae. According to US CDC, 3544 people died because of long COVID[23]. It seems to be a very small amount comparing to the whole population at

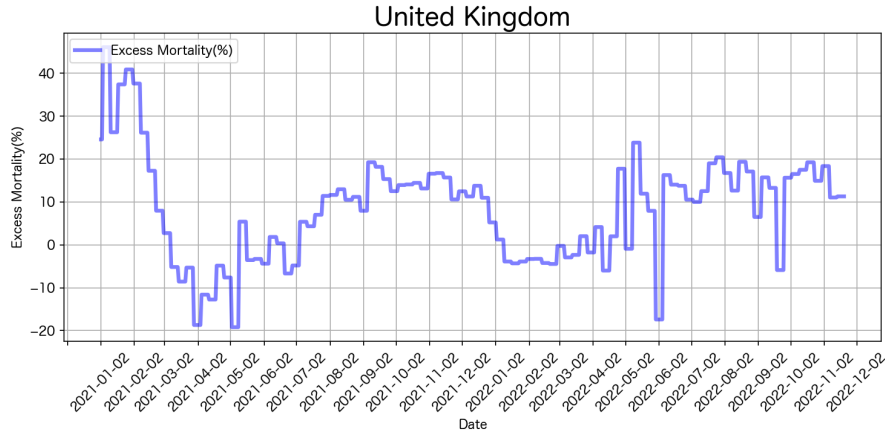


Figure 3. Excess Mortality in United Kingdom

the first glance. However, it is still possible that this number is underestimated, since it may take time to identify which death cases are caused by lethal long-term post-COVID sequelae. Under this assumption, the increasing ever-infected rate should lead to more people to suffer from lethal long-term post-COVID sequelae, and may finally lead to continuous positive excess mortality rate globally. Therefore, effect of ever-infected rate on excess mortality need to be studied and excluded from effect of TPAVIs to make sure the latter one are only vaccination related.

On the other hand, high ever-infected rate will trigger effect of “Herd Immunity”, which will reduce COVID mortality, and accordingly excess mortality. Then it is a trade-off effect to lethal long-term post-COVID sequelae effect. Therefore, while studying the effect of ever-infected rate variable to excess mortality, it is highly possible that we can observe two types of result. One is positive correlation to excess mortality, which means lethal long-term post-COVID sequelae dominates between the two effects. The other is negative correlation to excess mortality, which means “Herd Immunity” dominates between the two effects.

3.2 Time Period After Reference Date(TPARD)

The ever-infected rate data itself is difficult to obtain, since only a few countries have been regularly collecting. However, since ever-infected rate positively correlates with the elapsed time since the pandemic started, we can study the elapsed time instead of ever-infected rate. In order to calculate how many time elapsed, a reference date needed to be decided before hand. The new variable proposed to represent elapsed time is named as Time Period After Reference Date(TPARD). TPARD variables can be used to measure how the different time periods correlate with excess mortality rate.

4. Modeling relationship between TPAVIs and excess mortality

As the assumption in 1.2, the effect of vaccination on excess mortality would change over time, and finally result in increasing long term excess mortality. It should be assumed that this effect will affect the excess mortality of a country several months after it starts the massive vaccination campaign. Accordingly, it should be assumed that a later TPAVI should have a positive correlation with excess mortality. In this session, this assumption is studied. We proposed using multiple linear regression(MLR) model for modeling the relationships between explanatory variables like averaged new COVID deaths, TPAVIs, TPARDs and the response variable excess mortality rate.

TPAVI Variables	Definition	TPAVI Variables	Definition
1dose_1_3m	After 1st dose, 1-3 months	2dose_10_12m	After 2nd dose, 10-12 months
1dose_4_6m	After 1st dose, 4-6 months	2dose_13+m	After 2nd dose, 13 months and more
1dose_7_9m	After 1st dose, 7-9 months	3dose_1_3m	After 3rd dose, 1-3 months
1dose_10_12m	After 1st dose, 10-12 months	3dose_4_6m	After 3rd dose, 4-6 months
1dose_13m+	After 1st dose, 13 months and more	3dose_7_9m	After 3rd dose, 7-9 months
2dose_1_3m	After 2nd dose, 1-3 months	3dose_10_12m	After 3rd dose, 10-12 months
2dose_4_6m	After 2nd dose, 4-6 months	3dose_13m+	After 3rd dose, 13 months and more
2dose_7_9m	After 2nd dose, 7-9 months		

Table 1 Definition of Time Period After Vaccination Initiation(TPAVI) variables

4.1 Linear Regression models

The concept of linear regression was first proposed by Sir Francis Galton in 1894[22]. It attempts to establish relationship between two types of variables, explanatory variable and response variable. In multiple linear regression(MLR), there are more than one explanatory variables and one response variable. The relationships are modeled by fitting a linear equation to the learning data as shown in Eq. (3).

$$y = \sum w_i x_i + b + \epsilon \quad (3)$$

In Eq.(3), y is the response variable, x_i ($i = 1, 2, \dots, k$) are the explanatory variables, ϵ is the residual error, b is the intercept on y axis while all explanatory variables $x_i = 0$. w_i ($i = 1, 2, \dots, k$) are the regression coefficients, which indicate the correlation between explanatory variables x_i and response y .

4.2 COVID deaths, TPAVI and TPARD

4.2.1 COVID deaths

Since COVID deaths directly correlated to excess mortality, it is used as one explanatory variable to predict the response variable excess mortality rate. 7 day average of daily new COVID deaths is used in this study.

4.2.2 TPAVIs

As our assumption in 1.2, long term side effects of COVID vaccines could be increasing excess mortality, which should occurs at later TPAVIs. As a result, different TPAVIs should be contributing differently to the excess mortality. Therefore, categorical variables that describe the TPAVIs of a country should also be used as explanatory variables. Considering there is only limited data from OWID for modeling, we reduce the variables amount by using 3 months time period variables rather than 1 month and apply to all dosages. Since the entire length of time after vaccination initiation is also limited, periods later than 12 months are merged. The variables are as in table 1. 4th dose(or second booster) or more doses can not be studied here, since the data of higher doses are merged to 3rd dose(or booster) rate in OWID data for all countries.

4.2.3 TPARDs

TPARDs are also designed to be categorical variables similar as TPAVIs. Before selecting the reference date,

TPARD Variables	Definition	TPARD Variables	Definition
overall_1_3m	After Jan. 1st 2021, 1-3 months	overall_13_15m	After Jan. 1st 2021, 13-15 months
overall_4_6m	After Jan. 1st 2021, 4-6 months	overall_16_18m	After Jan. 1st 2021, 16-18 months
overall_7_9m	After Jan. 1st 2021, 7-9 months	overall_19_21m	After Jan. 1st 2021, 19-21 months
overall_10_12m	After Jan. 1st 2021, 10-12 months	overall_22m+	After Jan. 1st 2021, 22 months and more

Table 2 Definition of Time Period After Reference Date(TPARD) variables

the selection of data period is discussed.

Data after Dec. 1st 2020 is selected for two reasons. Firstly, data in the early period is unreliable. At the beginning of the pandemic, shortage of resources like test kit would result in underestimated COVID deaths. Secondly, data from Dec. 2020 should be included, since massive COVID vaccination started at Dec. 15 2020. Therefore, data before Dec. 2020 are dropped. Therefore, the reference date need to be a date after Dec. 2020.

Since infectious diseases are seasonal[24], we also use 3 months time period variables for TPARD. The first season is the winter of 2020, which starts from Dec. 1st 2020. Considering this variable could represent “Herd Immunity” effect, COVID death should also be considered. According to the study[25], COVID death occurs 2-8 weeks after infection, COVID death from people get infected in this season should occur from after about 1 month, which is Jan. 1st 2021. Therefore, the reference date for TPARD is set to be Jan. 1st 2021. Since only about two years data is available, time periods later than 21 months are merged. The designed TPARD variables are as in table 2.

4.3 Model proposal

To study how the COVID death, TPAVI and TPARD variables could affect excess mortality, we proposed a MLR model to model the correlations. In the model, COVID death, TPAVI and TPARD are explanatory variables and excess mortality is response variable. The TPAVI variables within each dosage group are encoded to one-hot values. The TPARD variables are also encoded to one-hot values.

To remove the bias of data from different countries, 7 day average COVID deaths within each country is normalized to [0,1], by dividing the maximum value of 7 day average COVID deaths in each country, as in Eq. (4). x_{cov_death} and \hat{x}_{cov_death} stands for the original and normalized 7 day average COVID deaths, t stands for the date, c stands for a country, and T_c stands for all dates included in the country c 's data.

$$\hat{x}_{cov_death}(t, c) = \frac{x_{cov_death}(t, c)}{\max_{\forall t \in T_c} x_{cov_death}(t, c)} \quad (4)$$

The response variable excess mortality rate for each country also need to be normalized. However, before normalization, excess mortality rate needs to be re-estimated. In fact excess mortality rate was underestimated as a result of overestimation of expected deaths in OWID. This is because restrictions

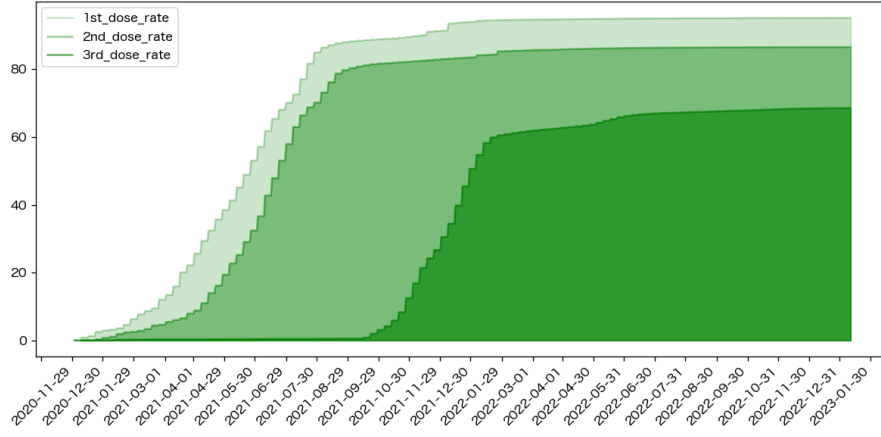


Figure 4. Portugal vaccination rate over time

conducted on travel, recreation events during the COVID pandemic reduced death risk from those events, which makes the actual deaths lower than that estimated in OWID. To re-estimate more appropriate excess mortality rates, we assume the minimum value of excess mortality rate of each country to be the baseline value. Then the excess mortality rate for each country can be re-estimated as in Eq. (5), and then normalized to $[0,1]$ as in Eq. (6).

$$\tilde{x}_{ex_mortality}(t, c) = \frac{(x_{ex_mortality}(t, c) + 100\%) - \min_{\forall t \in T_c} (x_{ex_mortality}(t, c) + 100\%)}{\min_{\forall t \in T_c} x_{ex_mortality}(t, c) + 100\%} \quad (5)$$

$$\hat{x}_{ex_mortality}(t, c) = \frac{\tilde{x}_{ex_mortality}(t, c)}{\max_{\forall t \in T_c} \tilde{x}_{ex_mortality}(t, c)} \quad (6)$$

In Eq. (5), $x_{ex_mortality}$ and $\tilde{x}_{ex_mortality}$ stands for the original and re-estimated excess mortality rate. The numerator $(x_{ex_mortality}(t, c) + 100\%) - \min_{\forall t \in T_c} (x_{ex_mortality}(t, c) + 100\%)$ is the actual excess mortality amount in percentage, while the denominator $\min_{\forall t \in T_c} x_{ex_mortality}(t, c) + 100\%$ is the actual baseline mortality amount in percentage. 100% is add to $x_{ex_mortality}$, because it could be negative value. In Eq. (6), $\hat{x}_{ex_mortality}$ stands for the normalized value for re-estimated excess mortality rate.

4.4 Data processing

OWID dataset is updated Daily. The data version used in this study is downloaded on Feb. 14 2023. Data of the explanatory variables and response variable from OWID are processed in the following steps.

- 1) As discussed in 4.2.3, data before Dec. 2020 are dropped.
- 2) Weekly data are used. For countries only providing monthly excess mortality rates, monthly data is used to approximate weekly data.
- 3) Data from countries with less than 10 effective 7-day average COVID death data and less than 5 effective excess mortality rate data are dropped. This is because 7-day average COVID death and excess mortality rate data published in some countries are of too small amount that would be biased.
- 4) Data from countries with final 3rd dose rate greater than the median value among all countries are used.

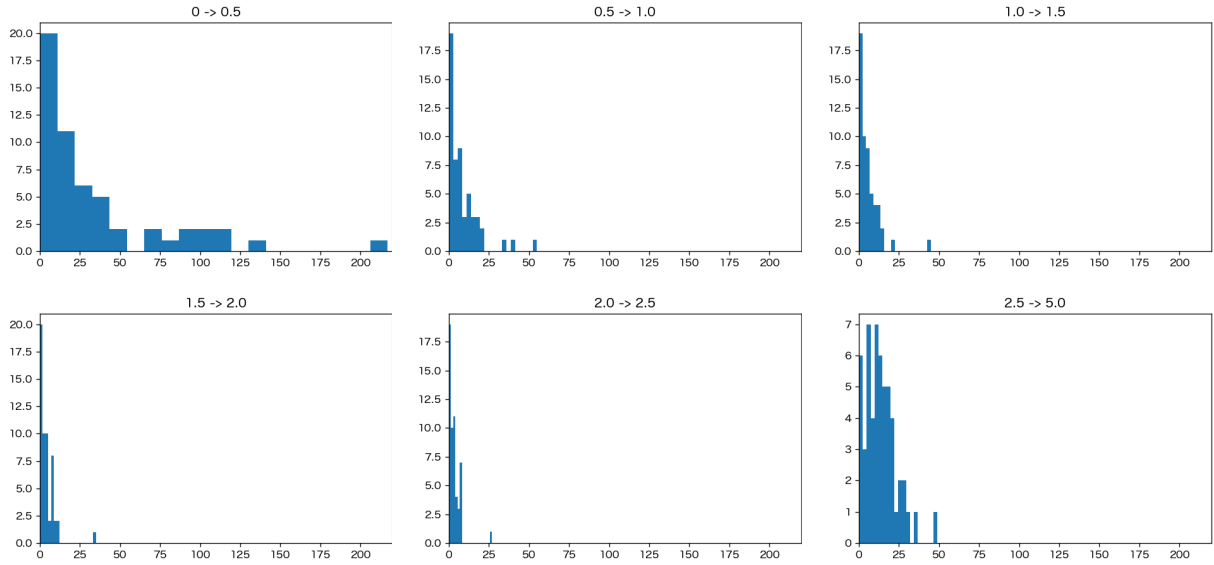


Figure 5. Distributions of the number of days required for all 6 percentage gaps

This is because 3rd dose rate is low in many countries, and accordingly 3rd dose TPAVI variables in those countries should only have weak effects on excess mortality. Those data should be avoided. As a result, data from 55 countries are used in this study.

- 5) For 1st dose and 2nd dose, the first date with non-zero vaccination rate data is set to be the date of vaccination initiation, and accordingly the TPAVIs are defined. However for 3rd dose's case, a new definition rule is needed since it is a more complicated case. 3rd dose rate grows slowly in many countries at the beginning, which results in a "long tail" phenomenon. For example, as in figure 4, it took more than 7 months for the 3rd dose rate to reach 0.5% in Portugal. The time period containing 0.5% 3rd dose rate would be defined as 3dose_7_9m in Portugal, however, a period containing the same value would be defined as 3dose_1_3m in countries that don't have a "long tail" phenomenon. The solution is normalizing the date of vaccination initiation. "Long tail" can be removed by setting a date with a higher 3rd dose rate than the first non-zero rate as vaccination initiation date. To find a proper low 3rd dose rate, distributions of the number of days required to increase the 3rd dose rate from 0.0% to 0.5%, 0.5% to 1.0%, 1.0% to 1.5%, 1.5% to 2.0%, 2.5% to 5.0% are plotted as in Figure 5. As in Figure 5, it took 11 out of 55 countries more than 2 months to reach 0.5% 3rd dose rate, however, it only took less than 3 countries more than 1 month for the remaining percentage gaps. This means by using 0.5% as the date of vaccination initiation, over-2-months "long tails" of 11 countries can be removed, but using higher rate(eg.1.0%) can at most further remove 1-month "long tails" of 3 countries. Therefore using 0.5% is proper to remove "long tails" in most counties and using a higher value won't improve much. As a result, date of 0.5% vaccination rate is set to be 3rd dose vaccination initiation date.

4.5 Model evaluation metric

R-Square is used for performance evaluation metric of the proposed MLR model.

R-Square : Represents the proportion of the variance for the response variable that is explained by an explanatory variable or variables in a regression model. An effective model should have the value within (0,1]. Higher value indicates better model performance.

Models	R-Square	Confidence Interval
COVID death + TPAVIs + TPARDs	0.355 ± 0.107	(0.145, 0.569)

Table 2. Performances of COVID death model and COVID death + TPAVIs model

4.6 Models performance results and analysis

4.6.1 R-Square result

The proposed model is trained and evaluated with 5 fold cross-validation data. Since there could be huge bias among data from different countries, the cross-validation is conducted in country-wise. The R-Square result is as in Table 2. The R-square is 0.355, showing proposed model successfully predicted partial variance of excess mortality rate.

4.6.2 Regression coefficients and analysis

The regression coefficients of each explanatory variables in the proposed model are as in Table 3, which show strength of correlations between explanatory variables and excess mortality rate. The reliable regression coefficients ($p < 0.05$) are in bold face. The coefficients of 2 dose, 3 dose TPAVIs and TPARDs are plotted as in figure 6(a-c). The coefficients which are statistically significant ($p < 0.05$) are in solid dot, while the others ($p > 0.05$) are in dashed circle. Variable names of TPARDs are mapped into seasons.

There are several findings from results in Table 3 and Figure 6:

- 1) As in Table 3, the number of COVID death correlates the most positively with excess mortality rate.
- 2) As in Table 3, among the reliable regression coefficients ($p < 0.05$), 2dose_1_3m, 2dose_4_6m

Explanatory Variable(s)	Regression Coefficients	p value	Explanatory Variable(s)	Regression Coefficients	p value
7 days average COVID death	0.674	<u>0.000</u>	3dose_4_6m	0.040	0.055
1dose_1_3m	0.010	0.599	3dose_7_9m	0.073	<u>0.003</u>
1dose_4_6m	0.010	0.725	3dose_10_12m	0.100	<u>0.000</u>
1dose_7_9m	-0.007	0.841	3dose_13m+	0.129	<u>0.000</u>
1dose_10_12m	0.089	0.026	overall_1_3m(W)	-0.085	<u>0.000</u>
1dose_13m+	0.023	0.610	overall_4_6m(SP)	0.019	<u>0.429</u>
2dose_1_3m	-0.044	<u>0.008</u>	overall_7_9m(SU)	0.023	<u>0.397</u>
2dose_4_6m	-0.051	<u>0.029</u>	overall_10_12m(F)	-0.108	<u>0.001</u>
2dose_7_9m	0.030	0.308	overall_13_15m(W)	-0.214	<u>0.000</u>
2dose_10_12m	0.090	<u>0.008</u>	overall_16_18m(SP)	-0.153	<u>0.000</u>
2dose_13m+	0.068	<u>0.081</u>	overall_19_21m(SU)	-0.144	<u>0.000</u>
3dose_1_3m	0.039	<u>0.010</u>	overall_22m+ (F)	-0.147	<u>0.001</u>

Table 3 Regression coefficients of COVID death + TPAVIs + TPARDs model
(W = winter, SP = spring, SU = summer, F = fall)

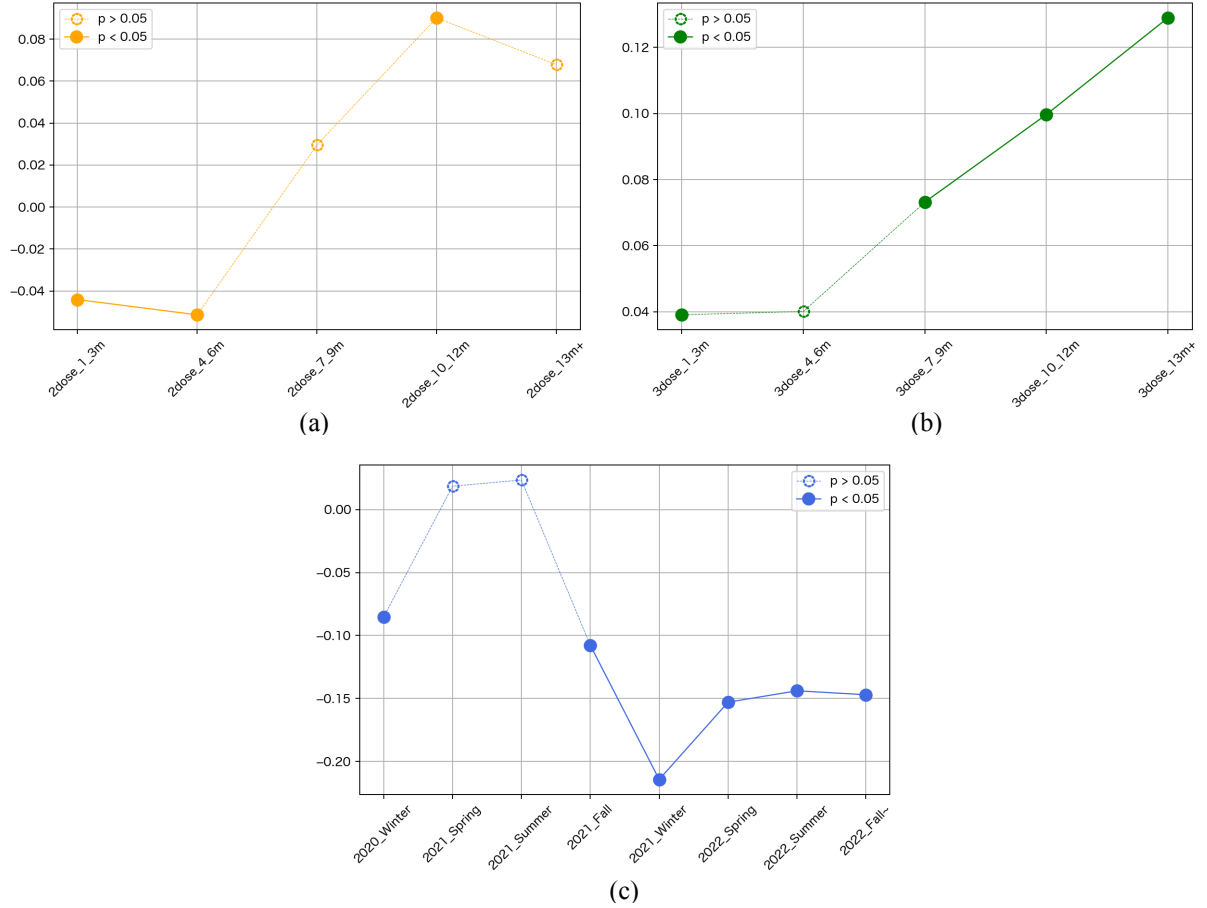


Figure 6. Regression coefficients of 2 dose(a), 3 dose(b) TPAVIs, and TPARDs(Seasonal)(c)

correlated with negative excess mortality rate. This is in accordance with the narratives that 2 dose vaccination could reduce COVID death and accordingly excess mortality in the early months.

- 3) As in Table 3, among the reliable coefficients ($p < 0.05$) of 2nd and 3rd dose TPAVIs, those within the same dosage group generally have greater values while the TPAVIs are later. The coefficients of TPAVIs turn positive several months after vaccination initiation. It means generally later TPAVIs positively correlate with higher excess mortality rates. This shows the possibility that COVID vaccination could increase excess mortality in the long run.
- 4) As in Figure 6(a) (b), reliable coefficients of 2nd and 3rd dose TPAVIs correlated with excess mortality in an ascending trend.
- 5) As in Figure 6(c), reliable coefficients ($p < 0.05$) of TPARDs correlated with excess mortality generally in a descending trend. This means the effect of “Herd Immunity” dominates, and post-COVID sequelae effect doesn’t seems to be obvious. Although there is an increase from 2021_winter to 2022_summer, it is not in accordance with the increasing pattern in coefficients of 2 dose, 3 dose TPAVIs in two ways. First, the coefficients of TPARDs only have a sudden increase from 2021_winter to 2022_spring, and almost doesn’t change after that. However, coefficients of TPAVIs are gradually increasing in the whole process. Second, the magnitude of increase is different. The coefficients of 3 dose TPAVIs increases from 0.039 to 0.129, which is a 0.9 magnitude. However, coefficients of TPARDs increases from -0.214(2021_Winter) to -0.147(2022_Summer). It is only a 0.7 magnitude, which is smaller. Therefore, the ascending trend among coefficients of TPAVIs can not be caused by the TPARDs. If we take the

unreliable($p>0.05$) coefficients of 2021_Spring and 2021_Summer into consideration, the increase from 2021_Winter to 2022_Spring should be considered as a seasonal effect which happens between winter and spring. And although the coefficient of 2022_Fall~ was going to decrease dramatically, it was affected by the increasing coefficient of 3dose_13m+ since they have overlapped period.

Due to national differences in factors such as policies on the time interval between doses of vaccine and the timing of vaccination initiation, TPAVIs do not correlated with TPARDs. Therefore effects of elapsed time related factors like ever-infected rate, are excluded from coefficients of TPAVIs, since they are well modeled by TPARDs. As far as we know, there is currently no other global factors that affect positively on excess mortality rate and at the same time the effects keep increasing over time. Therefore, we can conclude that it is the COVID vaccine that is causing the current global increase in excess mortality.

5. Discussion

5.1 Positive coefficient of 3dose_1_3m

The positive coefficient of 3dose_1_3m means excess mortality is being elevated, however, studies [26][27] are showing positive effectiveness in early months, which means excess mortality should be being reduced. These seem to be contradicting at the first glance. However, this is because there is time overlap between 3dose_1_3m and the later 2nd dose TPAVIs. Since the 3rd dose is given generally around 6~12 months after the 2nd dose, coefficient of 3dose_1_3m partially includes the effect of 2dose_7_9m and 2dose_10_12m and results in a positive value. Although in the similar time period, the coefficients of 2dose_10_12m and 3dose_1_3m are 0.090 and 0.039 respectively, which shows 3dose_1_3m actually have a much lower coefficient. This can be interpreted that 3dose_1_3m have effect on reducing excess mortality.

5.2 Compare impact on excess mortality by COVID deaths and vaccination

COVID vaccination has been shown to contribute to the current increase in excess mortality in countries around the world. Then we want to evaluate how much it has increased excess mortality. For this evaluation, the effect on excess mortality caused by the vaccination is compared with that caused by COVID death.

	COVID death (average)	Vaccination / TPAVIs (most current)
Effect on excess mortality rate	0.1334	0.2072

Table 4 Effect on excess mortality by COVID deaths and vaccination

For COVID death, average daily effect on excess mortality is calculated as in the following steps. Firstly, the mean value of all daily 7 days average COVID deaths among all 55 countries used in this study is used as the average value of daily global COVID death. Then it is multiplied with coefficient value of 7 days average COVID death in table 3. The result is used as average daily effect on excess mortality by COVID death. Here the 7 days average COVID death are in normalized value as in Eq.(4).

For vaccination, the most current daily effect on excess mortality is calculated as follows. The last day's data in the dataset for each country is used to calculate the most current effect. We take the dot products of the coefficients of TPAVIs in table 3 and the last day's TPAVIs of all 55 countries. Then the average value is taken as the most current daily effect on excess mortality by COVID vaccination.

The results are as in table 4. The effect on excess mortality are in normalized value as in Eq. (6). The result clearly shows that the current excess mortality caused by COVID vaccinations are even higher than COVID itself. This well explains why we are observing the pandemic level excess mortality rates of many countries as in 2.3.

6. Conclusion

By analyzing the current largest dataset of 55 countries, it is clearly proven that COVID vaccination will result in increasing excess mortality at least from 10 months after 2nd dose and 3rd dose vaccination initiation. Furthermore, according to our model, the excess mortality currently caused by COVID vaccination is of an even higher level than the COVID pandemic itself. This means although the COVID pandemic will eventually end, the pandemic level excess mortality rate will be artificially perpetuated and even increased further. The massive vaccination campaign is proven to be an unacceptable failure and should be terminated immediately.

7. Future work

Since COVID vaccine is proven to be increasing excess mortality, it is possible that higher vaccination rate would result in higher excess mortality. This should be discussed in future study.

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Note:

The authors are independent researchers and intent to stay anonymous on this work.