Is high COVID-19 vaccination reducing natural immunity?

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Abstract. This analysis, using published authentic data, will explore the existing/guided strategy of the global mass vaccination program to combat the COVID-19 crisis. It mainly focused on countries that experienced unprecedented deaths in the later period and the period covered is till 21st March 2022. The peak of deaths in later months reached an all-time high since the beginning of the pandemic. Nine countries identified in that category are Singapore, South Korea, Australia, Hong Kong, Iceland, New Zealand, Denmark, Finland and Japan. Almost all of those countries had nominal cases and deaths prior to September 2021 (the vaccine's third dose was initiated). Interestingly, all those nine countries had very high vaccination rates and were among the topmost vaccinated countries during the covered period. Israel started mass vaccination first and initiated the fourth dose at the beginning of January 2022; soon afterward, not only cases but also deaths reached an all-time high. Israel also introduced vaccine doses among children of various age groups first and was in fact, leading or guiding the vaccine roll-out strategy. Gibraltar on the other hand, implemented the most successful mass vaccination programme, from the beginning. Gibraltar was the country that achieved the highest target for vaccination at the earliest. It attained and maintained 100% vaccination since May 2021, though cases of the latest peak in March 2022 reached an unprecedented high for the whole of the pandemic. All the data analysed here started from the beginning of the pandemic and was presented using the government's official COVID tool Ourworldindata. Moreover, cases as well as deaths in later periods among vaccinated groups, were also compared with the unvaccinated ones, for the UK, based on the country's government report. That indicated an unusual surge of cases as well as deaths in recent periods among vaccinated groups compared to the unvaccinated ones. Various observed facts, supported by well-known and established scientific theories, indicate that high vaccination may weaken the natural immune response which needs urgent policy action.

Key Words: COVID-19, vaccine, mass vaccination, adverse effect, natural immunity

Highlights:

*Nine countries identified where peak of deaths in later months reached all-time high

*Period covered till 21 Mar '22 and all nine were among topmost vaccinated countries

*Cases and deaths were nominal in those countries before the start of third dose

*Observation shows unusual surge in cases/deaths among fully vaccinated groups

*Scientific theories indicate high vaccination can weaken natural immune response

1. Introduction.

The pandemic of **CO**rona**VI**rus **D**isease 20**19** (COVID-19) killed more than 6.09 million people globally till 21st March 2022 [1] and severely impacted the economy and mental health. The first patient reported to get admission to a hospital in China was on 12 December 2019 [**1**a] and at the beginning of February 2020, the pandemic began to spread all over the world [1]. Soon afterward major lockdowns were imposed across most of the globe, leading to further worsening of the situation. The responsible virus for the disease is Severe Acute Respiratory Syndrome CoronaVirus 2 (**SARS-CoV-2***)* and detailed discussions on the nature of the disease and characteristics of the virus are nicely outlined in current research [2, 3]. The continuous emergence of various viral variants is a major threat to countermeasures of pandemics due to the antibody neutralization escape [3a] and enhanced transmission [3b, c, d]. This paper has compiled evidence from official and government records for several countries, that collectively suggest a new dimension to existing exit strategy and have policy implications.

To combat the COVID-19 crisis, various vaccination groups took leading initiatives with coordinated efforts. Till two years of the pandemic, vaccines were considered the only pathway to overcome the crisis [World Health Organisation (WHO)] and were heavily promoted. More than 65% of the world's population already received at least one dose of the COVID-19 vaccine till date [1]. Various types of vaccines are in place and the technology and compositions are discussed in detail [4, CDC[1]]. At least 4 principally different COVID-19 vaccines are in use: i) m-RNA Vaccines, ii) vector-borne vaccines, iii) inactivated viruses from China and India, and iv) viral surface proteins. Among these vaccines, Pfizer-BioNTech is most widely used in the US and Europe followed by Moderna [Fig. S1]. Both vaccines use m-RNA technology. Various other vaccines are also available [Fig. S1]. Vector-borne vaccines are widely administered among which are Johnson & Johnson and AstraZeneca. Sputnik V is an Adenovirus viral vector vaccine, which is mainly used in Russia. Chinese companies Sinopharm and Sinovac use inactivated viruses. Indian company Bharat Biotech developed Covaxin using a similar technology to Sinovac. Whereas, Novavax is a protein-based vaccine.

Approval of the COVID-19 vaccine was unusually prompt though relating to COVID-19 vaccine trials, concerns were initially raised that studies seem designed to answer not the most clinically relevant questions and trials were not designed to say whether these vaccines can save lives [5]. Following speedy vaccine approval, another study discussed '"Science by press release" is just one of many flaws in the way new treatments are evaluated, brought into stark relief by the pandemic' [6]. That quoted comment indicated that more coordination and coherence was indeed required for timely comparisons and evaluations between various treatments to combat crises like the COVID-19 pandemic. Studies further evaluated exit strategy via vaccination and discussed some striking resemblance of Flu with COVID-19 and also discussed various direct and indirect effects of mass vaccination [7, 7a]. Regarding exit pathways via vaccination, scientists followed observation and were right to mention that rapid regulatory approval and roll-out of several vaccines have ignited much optimism, but such optimism is unwarranted in the face of the occurrences of many new variants which are less sensitive to vaccine-induced antibodies [8]. An exit strategy other than vaccination is also suggested in earlier research [8a, with reference there].

After the initiation of mass vaccination, many adverse effects from vaccines, even deaths were reported (CDC[2]); though medium and long-term effects are yet to be investigated properly. The percentage of reporting adverse reactions is much higher compared to other existing approved vaccines (CDC[2]). For a small country UK, more than one lakh (100,000) adverse events were

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CDC : Centers for Disease Control and Prevention
CDC[1], https://www.cdc.gov/coronavirus/2019-ncov/vaccines/stay-up-to-date.html
CDC[2], https://www.cdc.gov/coronavirus/2019-ncov/vaccines/safety/adverse-events.html

reported between 09/12/20 and 06/04/22 only for mRNA Pfizer/BioNTech vaccine [UHSA[3], total reactions: 4,85,939; total reports: 1,68,927; fatal outcomes: 746). The basis of various adverse reactions to COVID-19 vaccines from a biological science perspective was analysed thoroughly [9]. A recent review also nicely depicted the scientific basis of many adverse effects of the SARS-CoV-2 vaccines in an excellent way [10].

After the second dose, antibodies induced by the vaccines dissipate in as little as 3–10 weeks' time [11], and hence people are advised to get booster shots at regular intervals (CDC[4]). With two doses of Moderna or Pfizer vaccine, effectiveness was found to drop from around 65 to 70% down to around 15% by 25 weeks after the second dose as discussed in the UK Health Security Agency (UHSA) government report [UHSA[5], page 4]. Whereas, two to 4 weeks after a booster dose, effectiveness ranges from around 60 to 75%, dropping to 25 to 40% after 15 weeks. These findings raise questions about vaccinating the whole global population every few months interval and prompt the need to analyse thorough risk-benefit analyses with a critical viewpoint. Despite knowing that the effects of vaccination fade in a few months' time and the death rate due to COVID-19 among children is practically negligible, child vaccinations have been initiated. Apart from other usual adverse effects of the COVID-19 vaccine, children disproportionately reported (based on gender, age and dose) heart-related inflammation (known as Myocarditis/ Pericarditis). Disproportionate and much higher percentages were reported for males than females and also for younger age groups below 18. Effects were noted much higher after the 2nd dose. [CDC[6]: CDC's COVID-19 Vaccine Safety Technical Work Group]. A cohort study considering students from two schools in Thailand, aged 13–18 years explored Cardiovascular manifestation in adolescents after BNT162b2 mRNA COVID-19 vaccination [11a]. Cardiovascular manifestations were found in 29.24% of patients, ranging from palpitation or tachycardia to myopericarditis [11a] though long-term effect is not possible to identify yet.

The current study mainly focused on the later months of the pandemic from the study period (till 21st March 2022). Since the initiation of the third dose, many topmost vaccinated countries experienced an unusual surge in deaths; whereas, deaths and cases for those countries were nominal prior to that. Countries that took the most coercive measures including vaccine mandates, stringent vaccine rules and restrictions are among the worst hit in the later period in terms of deaths (and of course cases too) e.g., Canada, New Zealand and Australia. New Zealand and Australia were least affected due to COVID-19 in earlier periods though transmission and deaths became unprecedented in later times. Such observation prompted the need to explore the situation further and examine critically the overall planned vaccine strategy. The current analyses critically evaluate those situations and have urgent policy implications.

In Israel, 80% of the eligible population got two doses of vaccine alongside the booster dose. Those include 90% of people over the age of 60 years. Israel started vaccinating 5–11 year old

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UHSA[3], https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/1069177/COVID-19_Pfizer-BioNTech_Vaccine_Analysis_Print_DLP_6.04.2022.pdf

CDC[4], https://www.cdc.gov/coronavirus/2019-ncov/vaccines/booster-shot.html accessed 25/4/22

UHSA[5] : https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/1066759/Vaccine-surveillance-report-week-13.pdf

CDC[6],https://www.cdc.gov/vaccines/acip/meetings/downloads/slides-2021-06/03-COVID-Shimabukuro-508.pdf, accessed 15/04/21

children in November 2021 and initiated the 4th dose in January 2022 [12]. Hence Israel can be looked upon for monitoring purposes in terms of the performance of vaccines among the global mass community. It can indicate an advanced overview of how mass vaccination fares and how immunity wanes over time. Those observations can play a crucial role in setting and reforming vaccine rollout strategies in other countries. The focus will also be on another country Gibraltar which can be set as an example of the vaccine success story. It maintained a 100 percent vaccination rate since May 2021 [1].

This analysis, using already published authentic data, will explore the existing/guided strategy of the global mass vaccination programs to combat the COVID-19 crisis. It discussed whether COVID-19 vaccines are increasing risk to infection and even death after the initial boost in antibody levels has fallen off. The period covered is till 21st March 2022. It will examine critically some risk-benefit issues among a few countries in chosen categories pointwise.

2. Methodology:

The research design of the study can be described as follows. Some countries which showed success in managing COVID-19 during the earlier period of the pandemic are the main focus here. Those countries gathered enough attention with very low case and death rates, while most countries struggled hard with very high fatality rates around the same period. Surprisingly, when those countries with very low cases and deaths suddenly showed a surge since September 2021, the period when the third dose started in most countries, it indicated that those particular countries need to be explored further what other situations changed there, that caused such an adverse outcome. This analysis focused the period from the beginning of the pandemic (start of 2020) till the 21st of March 2022 and covered more than two years period. Countries are randomly placed all over the globe. The only criteria for choosing the countries are that all showed an unusual surge in cases as well as deaths in the later six-month period, though had nominal fatalities in the earlier period of the pandemic.

Questions could be there for reasons of low fatality rates in those countries during the earlier period. Strong innate natural immunity of people in some countries could be one reason. Clinical trial experiments indicated some foods and vitamins can strengthen natural immunity. In some countries specific food habits may have played roles in low transmissions and deaths in the earlier periods (e.g., South Korea, Japan, Hong Kong); whereas low population density could also have an influence on some countries (Australia, Iceland, Finland).

In regard to choosing the target population in this analysis, no specific age ranges or sex were focused on, nor any particular demography, ethnicity or food habits were considered. Countries discussed here were scattered all around the globe- some were tropical countries and some were from polar regions; some were from the northern hemisphere and some from the southern hemisphere; neither particular season received attention. Some countries have very high population density, while some have very low. The main focus is the comparison of cases and deaths between a later period (around six months or less) to that from the earlier period of the pandemic and attention is on vaccination status in those countries. To eliminate the effects of population density and compare different countries together, parameters (e.g., cases, deaths and vaccine doses) are presented in terms of the number of overall populations of each country.

The hypothesis we are going to test is that if we eliminate all other confounding factors, whether it is possible to identify any reasons that can cause such unusual rates of deaths and cases to some specific countries in the later period, those performed really well in the earlier period. In this study, to test that hypothesis, some countries were chosen based on the following three categories:

i) *Countries with unusual deaths in the later few months:* For some countries deaths in later months reached an all-time high since the beginning of the pandemic. The latest peak of deaths, after the start of the third dose, became the highest peak in respective countries: Nine countries were identified viz. **Singapore, South Korea, Australia, Hong Kong, Iceland, New Zealand, Denmark, Finland and Japan**. [1]. Those countries are shown in Fig.1A, which are not localised to closer latitude and longitude bands. Those are not neighbouring countries and are located all around the globe. Moreover, some countries are smaller in size and some are larger; while some countries have higher population density and others have lower. The effect of seasonal climatic conditions is not dominating results as some countries are located in the northern hemisphere and some are in the southern hemisphere.

ii) *Country leading/ guiding the vaccine roll-out strategy:* The country **Israel** started the mass vaccination first and pioneering in terms of initiating new doses among the population and starting vaccination among the new age groups of children. Israel is leading the direction of vaccine roll-our strategy and is much ahead, in time than other countries [1, 12].

iii) *Highest vaccination:* **Gibraltar** is the country that achieved the highest target of vaccination first. It attained and maintained 100% vaccination since May 2021 [1].

2.1. Data Analyses.

The study carried out various time-series analyses and applied simple statistical concepts, while critical approaches were adopted to interpret statistical results. The period covered is till 21st March 2022 and open data sources are used [1]. The main data used are COVID-19 deaths, cases and vaccine doses in specified countries. Data are generated by the Center for Systems Science and Engineering (CSSE) at Johns Hopkins University (JHU) [1].

For time series analyses, data for daily deaths, cases and vaccine doses, all for 7-day averages, in terms of the overall population are used. Cumulative measures of those parameters have also been analysed in some cases to grasp certain variations better. For vaccine doses, the number of daily COVID-19 doses administered is considered, where all doses are counted individually (including boosters). Horizontal bar charts are used to depict shares of people vaccinated against COVID-19 with various doses. Analyses were shown for a few countries with the breakdown of people who completed the initial protocol of vaccine dose and those only partially vaccinated. A further breakdown, in terms of initial doses and boosters per 100 people for some countries is also presented. The total number of doses administered is broken down by whether they are part of the initial protocol or booster doses, divided by the total population of the country [1]. Such representation, in terms of population, makes comparison among various countries easier. COVID-19 vaccine doses administered based on the manufacturer are also shown for the European Union and the US. There, all doses, including boosters, were counted individually.

Cases, as well as deaths in later periods among vaccinated groups, were also compared with the unvaccinated ones, for the UK, based on the country's government report, the UK government weekly report [UK Health Security Agency (UHSA) and Public Health Scotland (PHS)]. Finally, all observed and analysed facts discussed in this study were linked with well-known, established scientific theories to provide directions to urgent policy action.

3. Results and Discussion:

Data were analysed and presented for some specified countries as follows:

3.1. Countries with unprecedented deaths in the later period and vaccination status

Here the main focus is on deaths in the later period. As most countries started the third dose around September 2021, the period after 3rd dose is considered the later period which is the focus here. We chose only those countries that experienced unprecedented deaths in that period (and of course cases too) and those countries are Singapore, South Korea, Australia, Hong Kong, Iceland, New Zealand, Denmark, Finland and Japan. All those nine countries are seen as the topmost vaccinated countries in that plot (Fig. 1B). For easy comparison, a few other likely vulnerable countries are also included at the bottom of that plot; among those are highly populated countries e.g., India, Bangladesh alongside countries that had very high overall Death rates per million for the whole of the pandemic e.g., US, UK, Europe etc. For all those top nine countries, not only cases but deaths also reached an all-time high in the latter period (Fig. 2). Interestingly, those 9 countries starting from Singapore are the most vaccinated countries as seen in Fig. 1B. Countries at the bottom of that list, although they administered much less vaccination, performed relatively well in recent surges compared to those nine countries. For the US and European countries, cases this winter peaked all-time high though deaths were lower than the highest peak in their respective countries. Figures of cases and deaths for the US, Europe, UK and India are also shown (Fig. S2). For India, a heavily populated country, the latest peak of cases was even lower than the previous peak and the latest peak of deaths was the weakest of all peaks (Fig. S2, d). Interestingly, in terms of vaccination, India is placed at the bottom of the list (Fig. 1B). Another highly populated country Bangladesh also fared well like India during the latest surge [1].

Countries like Canada, New Zealand and Australia which took the most coercive measures including vaccine mandates, stringent vaccine rules and restrictions are among the worst hit in the recent period in terms of deaths. Those countries not only administered high vaccination but with less population density, also experienced an increased rate of transmission following vaccination. On the other hand, based on high population density Singapore and South Korea had disadvantages. Surprisingly, deaths and cases were nominal in those countries in the first one and a half-year of the pandemic. Whether it was guided by strong natural immunity due to high population density or not, needs to be investigated further. However, deaths/cases skyrocketed in the later months. Singapore and South Korea are not only the topmost vaccinated countries in that list (Fig. 1B) but also administered one of the highest percentages of booster doses (steepest rise compared to Europe, the US and India as shown in Fig. S3). Cases and deaths in the later periods were unprecedented and all-time high (Fig. 2).

It is a ~~S~~ similar story for Japan and Hong Kong - apart from high population density and very high vaccination rates, both had high booster intakes (Fig. S3). Moreover, there was a sudden very steep increase in vaccine uptake in Hong Kong and Japan starting at the beginning of January 2022; while, interestingly, during the same time period, most other countries saw a decrease in vaccine doses (Fig. S4). Among all those nine countries, Hong Kong performed the worst, as daily deaths (7-day average) even exceeded 30 per million (Fig 2, shown by the Y axis). For Hong Kong, the latest rise in vaccine doses was not only at the steepest rate since the start of mass vaccination, but the peak of doses also exceeded an all-time high (Fig. S4). It is

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Note: In the whole analysis, alternative definitions of full vaccination, e.g., having been infected with SARS-CoV-2 and having 1 dose of a 2-dose protocol, are ignored to maximize comparability between countries. [Source: Our World in Data (1)]

noteworthy to mention that after the initiation of the initial mass vaccine programme, or a sudden rise in doses, almost all countries experienced a rapid surge in transmission and most countries had to impose strict lockdown measures [BMJ[7], 7].

Such observation with all those 9 countries that experienced unusual surges in deaths (though almost all had nominal cases and deaths in the earlier period) raises an obvious question of whether vaccination might be causing impairments in natural immunity.

Additional Comments:

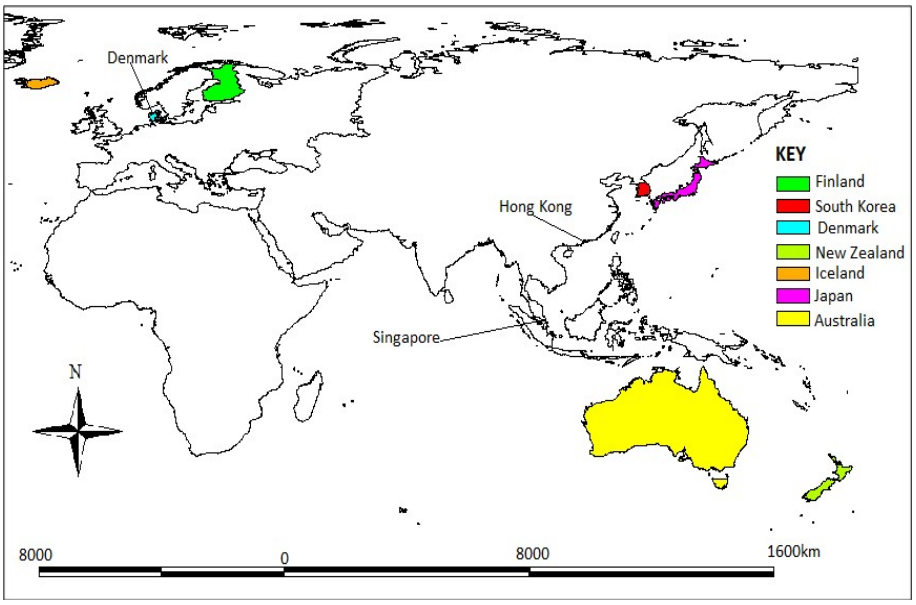
a) Reverse may not be true for all very highly vaccinated countries: The observation for very highly vaccinated countries can still be different as other confounding factors can also influence results. There are of course various other factors involved too e.g., increase/decrease rate of vaccination (hence, we are focusing only upto 21st March 2022), number of third doses, environmental factors, dominated by people of old age etc. Thus, the reverse may not be always true for all topmost vaccinated countries.

b) *Observation can be altered if the end date of this analysis is extended:* There are also possibilities that the observation noted here may be altered by changing vaccine doses in some countries after 21st March 2022. After that particular date, if vaccine doses in some particular countries suddenly are varied or new vaccine doses are initiated or new age groups of children are included, all those can heavily impact observed/ discussed results too.

However, the main point here is that in spite of all those influences and confounding factors, the observation presented here considering the period up to 21st March 2022 **can not be disregarded or overlooked by any means.** It has important policy implications.

BMJ[7] **,** https://www.bmj.com/content/371/bmj.m4037/rr-20 dt 22/03/21

A)



B)

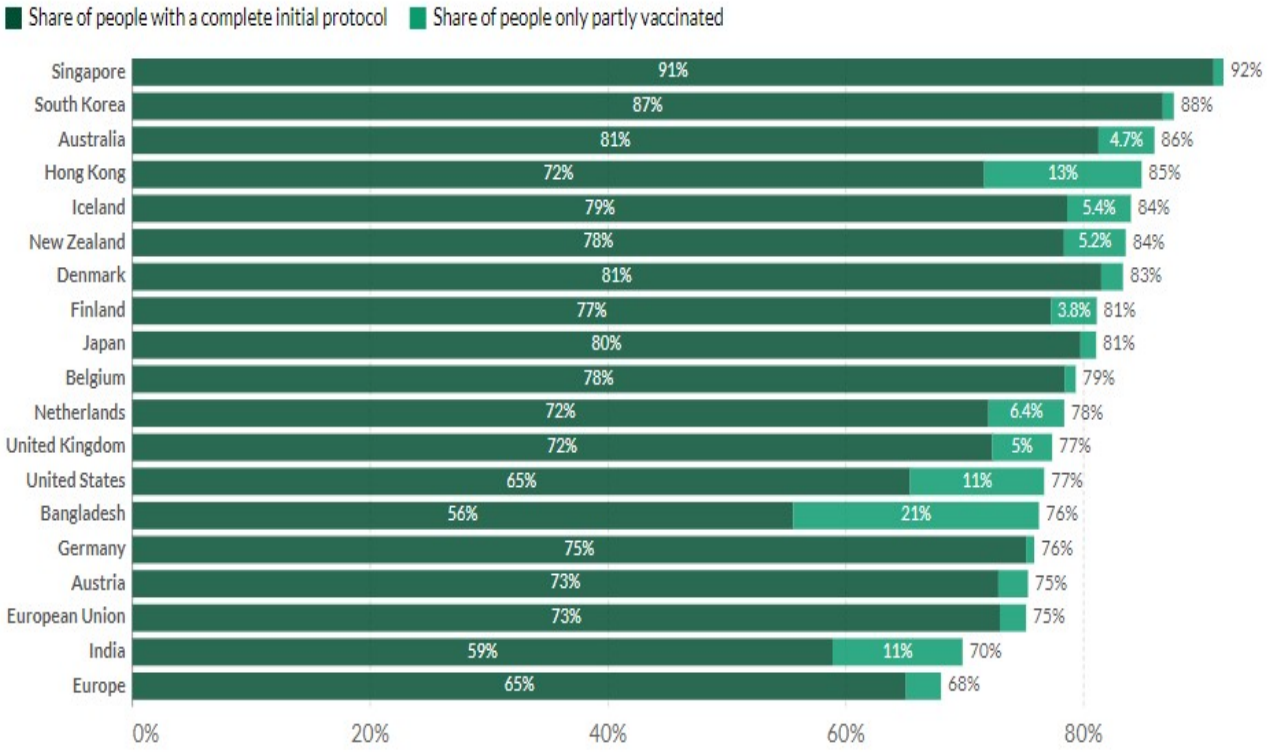
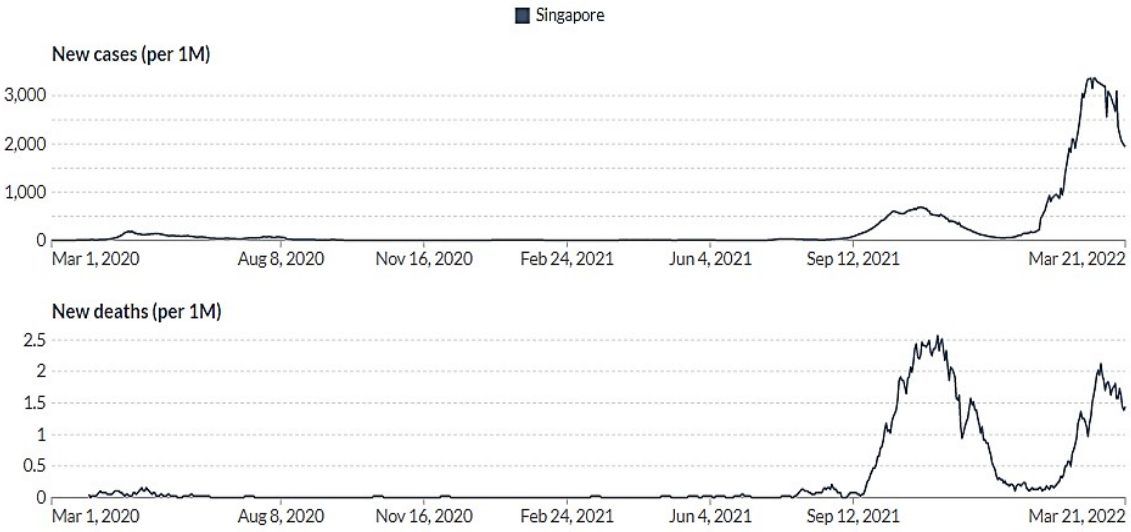


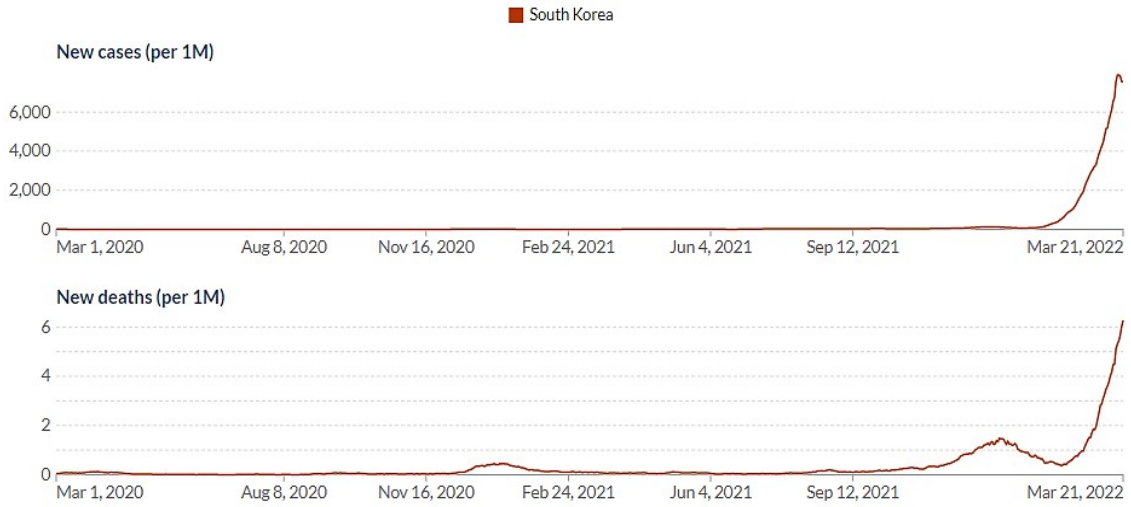
Fig. 1: A) Map of the globe marking nine countries that experienced unprecedented deaths and transmission rates in the later period (period from the beginning of the pandemic till 21st March 2022). Countries in that category are: a) Singapore, b) South Korea, c) Australia, d) Hong Kong, e) Iceland, f) New Zealand, g) Denmark, h) Finland and i) Japan. Two very small countries Hong Kong and Singapore are difficult to show by colour coding and hence marked directly, though the

rest seven countries are marked with colours. For almost all those nine countries, deaths and cases were nominal prior to the start of the third dose. B) Shares of people vaccinated against COVID-19 are shown for some countries (till 21st March 2022). The nine countries mentioned in 'A' had highest vaccination and hence placed at the top, starting with Singapore. [Source: Our World in Data (1)].

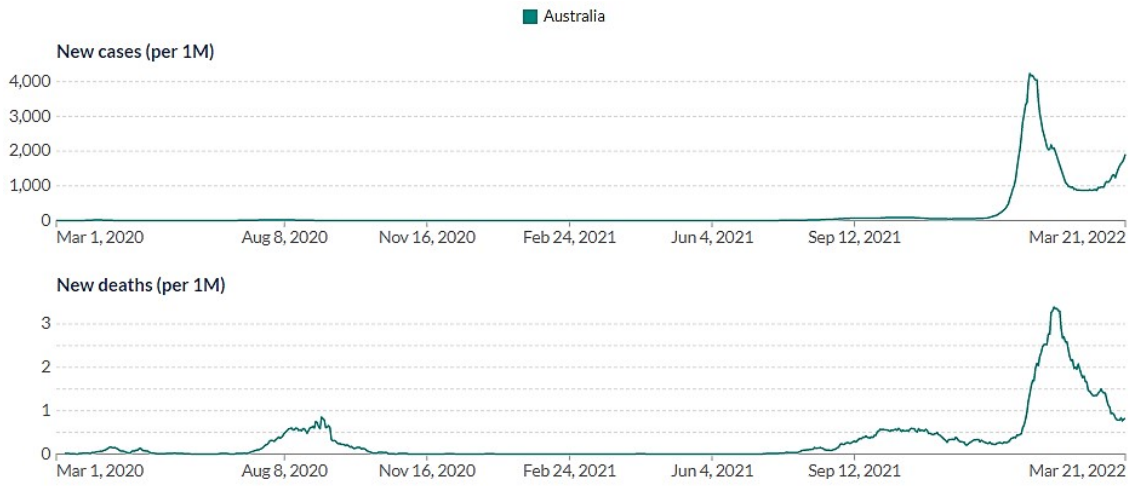
a)



b)



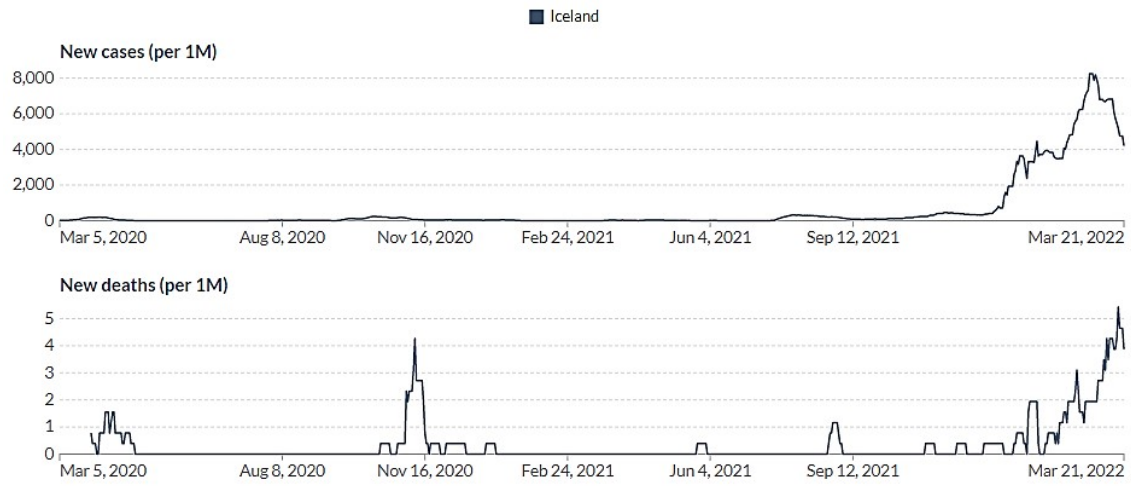
c)


Australia
New cases (per 1M)
4,000
3,000
2,000
1,000
0
Mar 1, 2020
Aug 8, 2020
Nov 16, 2020
Feb 24, 2021
Jun 4, 2021
Sep 12, 2021
Mar 21, 2022
New deaths (per 1M)
3
2
1
0
Mar 1, 2020
Aug 8, 2020
Nov 16, 2020
Feb 24, 2021
Jun 4, 2021
Sep 12, 2021
Mar 21, 2022

d)


Hong Kong
New cases (per 1M)
8,000
6,000
4,000
2,000
0
Mar 1, 2020
Aug 8, 2020
Nov 16, 2020
Feb 24, 2021
Jun 4, 2021
Sep 12, 2021
Mar 21, 2022
New deaths (per 1M)
30
20
10
0
Mar 1, 2020
Aug 8, 2020
Nov 16, 2020
Feb 24, 2021
Jun 4, 2021
Sep 12, 2021
Mar 21, 2022

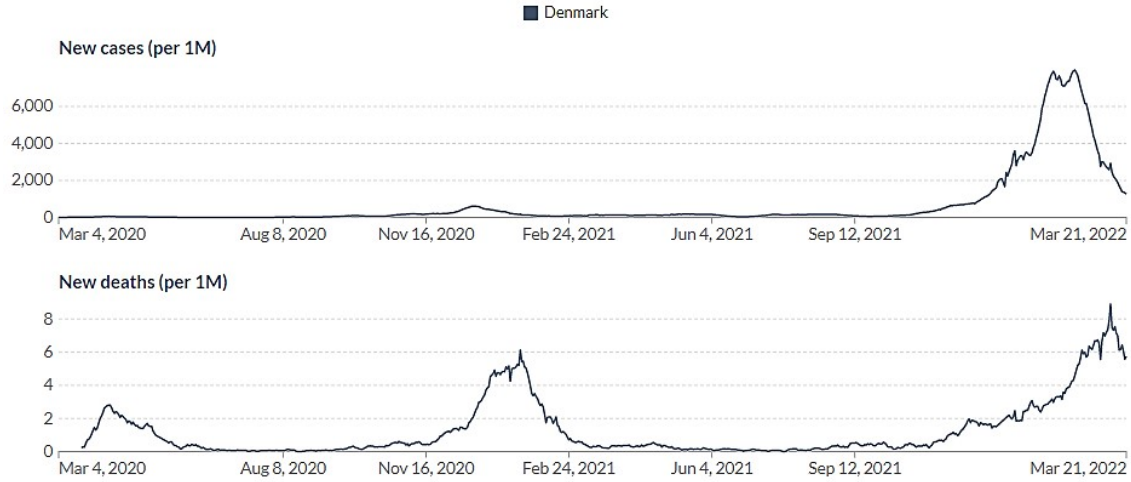
e)


Iceland
New cases (per 1M)
8,000
6,000
4,000
2,000
0
Mar 5, 2020
Aug 8, 2020
Nov 16, 2020
Feb 24, 2021
Jun 4, 2021
Sep 12, 2021
Mar 21, 2022
New deaths (per 1M)
5
4
3
2
1
0
Mar 5, 2020
Aug 8, 2020
Nov 16, 2020
Feb 24, 2021
Jun 4, 2021
Sep 12, 2021
Mar 21, 2022

f)


New Zealand
New cases (per 1M)
4,000
3,000
2,000
1,000
0
Mar 5, 2020
Aug 8, 2020
Nov 16, 2020
Feb 24, 2021
Jun 4, 2021
Sep 12, 2021
Mar 21, 2022
New deaths (per 1M)
2
1.5
1
0.5
0
Mar 5, 2020
Aug 8, 2020
Nov 16, 2020
Feb 24, 2021
Jun 4, 2021
Sep 12, 2021
Mar 21, 2022

g)


Denmark
New cases (per 1M)
6,000
4,000
2,000
0
Mar 4, 2020
Aug 8, 2020
Nov 16, 2020
Feb 24, 2021
Jun 4, 2021
Sep 12, 2021
Mar 21, 2022
New deaths (per 1M)
8
6
4
2
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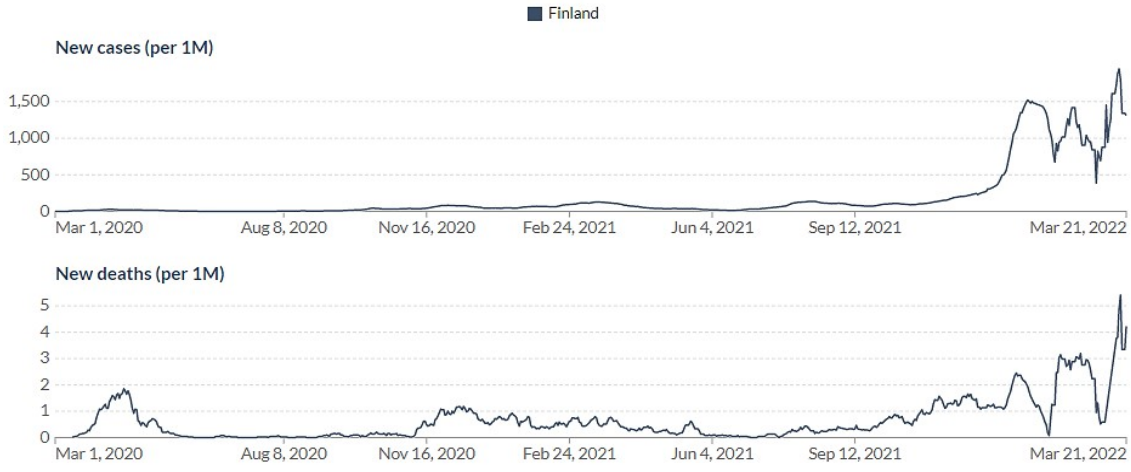
Mar 4, 2020
Aug 8, 2020
Nov 16, 2020
Feb 24, 2021
Jun 4, 2021
Sep 12, 2021
Mar 21, 2022

h)


Finland
New cases (per 1M)
1,500
1,000
500
0
Mar 1, 2020
Aug 8, 2020
Nov 16, 2020
Feb 24, 2021
Jun 4, 2021
Sep 12, 2021
Mar 21, 2022
New deaths (per 1M)
5
4
3
2
1
0
Mar 1, 2020
Aug 8, 2020
Nov 16, 2020
Feb 24, 2021
Jun 4, 2021
Sep 12, 2021
Mar 21, 2022

i)

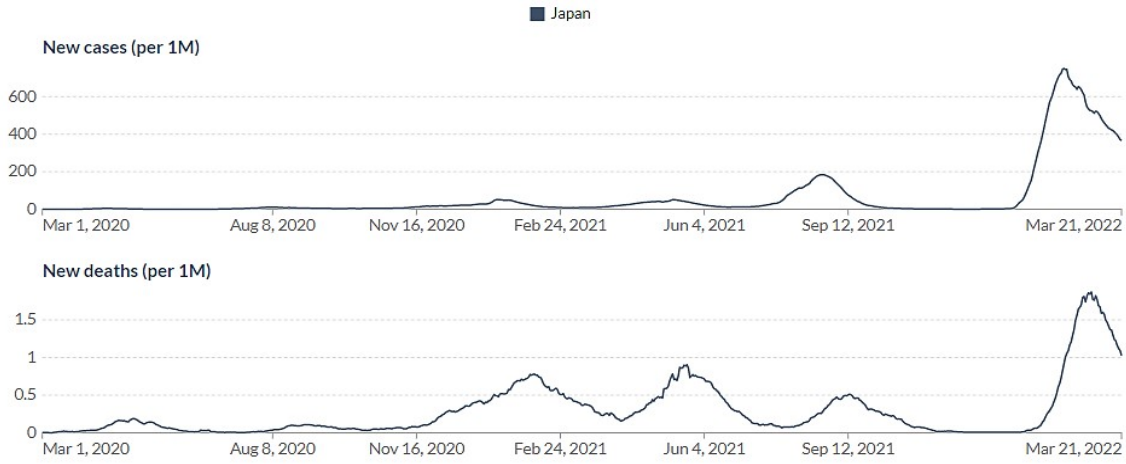


Fig. 2: Daily new confirmed COVID-19 cases and deaths per million people, 7-day rolling average, for countries that experienced unprecedented deaths in the later period. Countries in that category are: a) Singapore, b) South Korea, c) Australia, d) Hong Kong, e) Iceland, f) New Zealand, g) Denmark, h) Finland and i) Japan. The period of the analysis is till 21st March 2022 and the vaccine status of those countries is also shown in Fig 1B. [Source: Our World in Data (1)]

3.2. Latest performance of the country that leads/ guides vaccine roll-out strategy: Israel

In Israel, 90% of people over the age of 60 years got two doses of vaccine alongside the booster dose. Israel is the country that first started vaccinating 5–11 years of age group children and also first initiated the 4th dose in January 2022 [12]. Israel can be looked upon for monitoring purposes by other countries, in terms of the performance of vaccines among the mass community.

Israel also started 3rd dose earlier (in July) than other countries (most countries started from September 2021) and from 1st August Israel suddenly increased the third dose [1]. A new peak in cases, as well as deaths, appeared [Fig. 3a]. Israel is the first country that started the fourth dose at the earliest, which is at the beginning of January [12] and interestingly, the timing coincided with the start of the highest peak of waves in cases and deaths. Both the latest peak in cases and deaths appeared to be all-time highs over the whole of the pandemic [Fig. 3a].

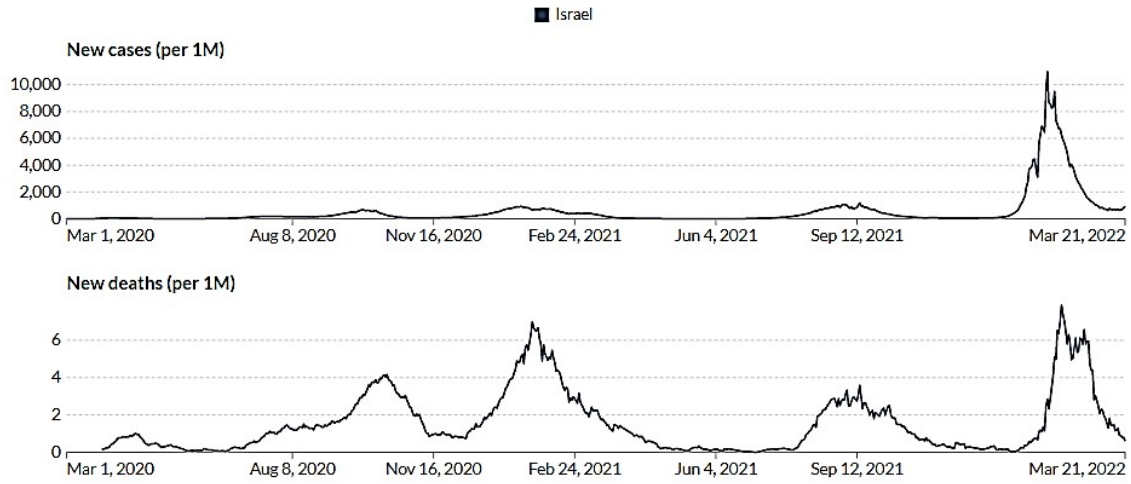
Before starting the 4th Dose in any country, careful analyses of the situation in Israel can offer a useful perspective. Observation from Israel can play a crucial role in reforming and implementing vaccine rollout strategies in other countries too.

3.3. Highest vaccinated country: Gibraltar

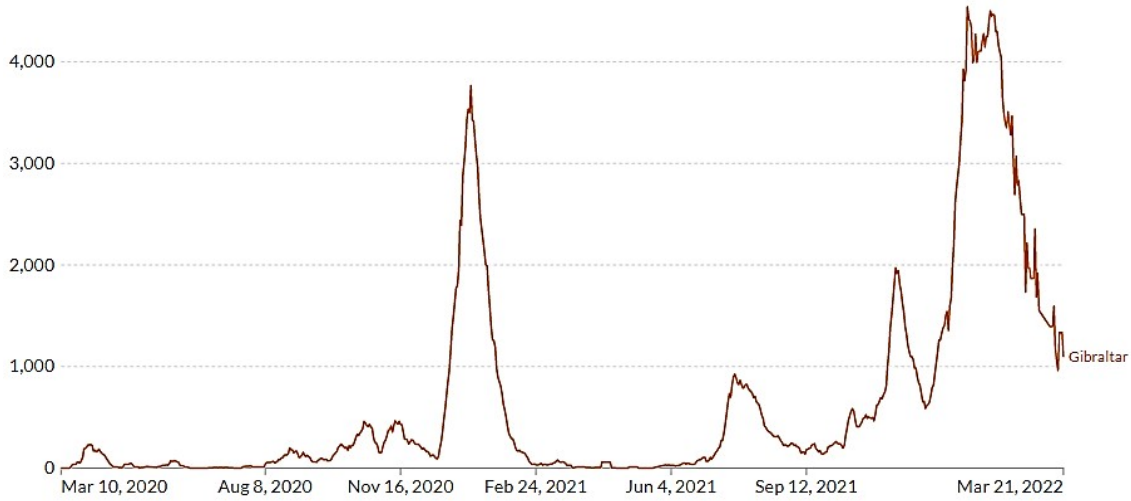
Gibraltar is the country that maintained a 100 percent vaccination rate for a long time. It attained and maintained 100% vaccination since May 2021. However, cases in the winter of 2021-'22 reached an all-time high (Fig. 3b and c). The recent peak in cases is not only the highest peak of all, but in terms of the width of waves too it exceeded all previous records (Fig. 3b). Gibraltar shows vaccination status even exceeding 100% (Fig. 3c) as they vaccinated all non-residents too and do not allow anyone to enter the country without full vaccination. Fig. S5 further shows Gibraltar is highly ranked not only in terms of cumulative vaccine doses but also in terms of cumulative cases.

All the observed data and analyses are consistent with the idea that a high vaccination rate results in a loss of natural immunity. That supports the latest unprecedented surges in COVID-19 deaths in Singapore, South Korea, Australia, Hong Kong, Iceland, New Zealand, Denmark, Finland, Japan and Israel.

a)



b)



c)

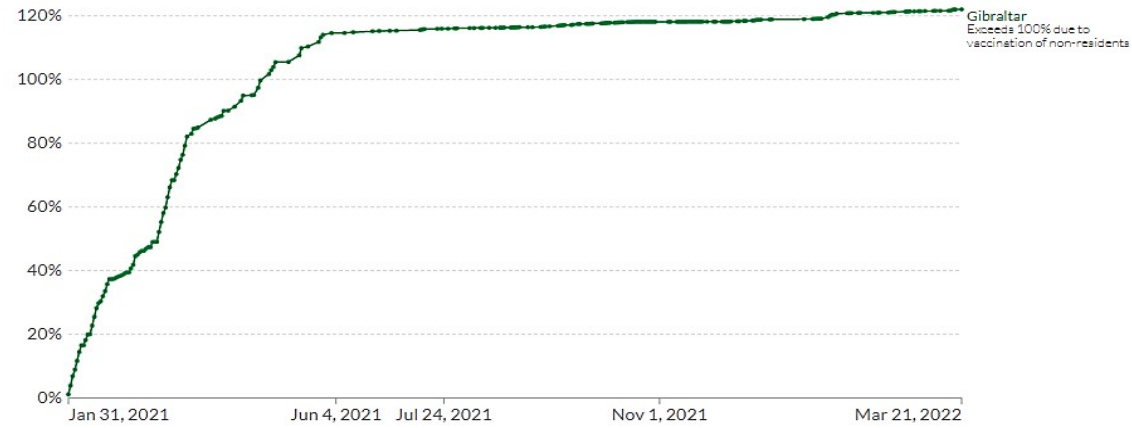


Fig. 3. Daily new confirmed COVID-19 cases and deaths, per million people (7-day rolling average) for **Israel** (a). The same for only cases for **Gibraltar** (b). Share of people in **Gibraltar**

who completed all doses prescribed by the initial vaccination protocol (c). The period covered is till 21st March 2022 [Source: Our World in Data (1)]

3.4. Unusual surge in cases/deaths among vaccinated groups compared to unvaccinated.

The UK government weekly report [UK Health Security Agency (UHSA)] included vaccinated vs. unvaccinated statistics that indicated the absolute number of deaths among vaccinated was increasing at a much higher rate than the unvaccinated group. Record of deaths within 28 days or 60 days of positive COVID-19 test by date of Death suggested approximately for every 6 deaths from COVID-19 of above 50 years age group **(**the period covered between week 43 and 46, 2021, UHSA[8]), only 1 was unvaccinated and the rest received at least one dose, Table S1)**.** In terms of the percentage of total deaths during those weeks, approximately 17 % were unvaccinated, while 80 % were fully vaccinated [Table S1, UHSA[8]]. Whereas, in the later period, for weeks 9-12, 2022, deaths within 28 days (60 days) of positive COVID-19 suggest approximately 9.5% (7.3%) were unvaccinated, and even 73.4% (76.1%) were triple jabbed (Table S1, UHSA[5]). As time passed from 28 days to 60 days, the percentage of deaths among unvaccinated decreased (by more than 2%), while deaths among triple jabbed increased from 73.4% to 76.1% (Table S1). People aged 50 years and above are presented here, as they are the most vulnerable categories in terms of deaths.

When the focus is on cases, it is seen percentages of unvaccinated (ii) populations are also getting less infected compared to the fully vaccinated (i) proportion (Table 1). The same UHSA reports for week 47, 2021 (UHSA[8]) and week 13, 2022 (UHSA[5]) show that cases (in terms of percentage) among fully vaccinated people, even with third doses [column- b, (i)] have also risen at a much higher rate compared to the unvaccinated (ii) groups and is true for various age groups too (Table 1). Case numbers for individuals testing positive for the virus are seen persistently lower amongst the unvaccinated, while case numbers among the triple-jabbed increased at a very high rate [Table 1, column- b, (i)]. In fact, column b(i) suggests the highest value in each row for every age group. In later period 'b', when the third dose was in place, all age groups showed a decrease (even between 2.5 times to 5 times) in cases for the unvaccinated population (ii) compared to that from people of respective age groups with third doses (i). Whereas, in the earlier period 'a', the performances between vaccinated (i) and unvaccinated (ii) were mixed and not so consistent as 'b'. In all age groups, where unvaccinated performed better in 'a', (30 to 79 years range), the ratio of cases for vaccinated to unvaccinated was not as high as 'b' and never exceeded 2.5 times. All those are contrary to the claim that people with the third dose are much protected from the transmission. It indicates quite the opposite of the claim.

Scotland's health authority, the Public Health Scotland (PHS) also publishes more detailed representations of weekly progression among vaccinated and unvaccinated categories. Table S2 shows the progression of cases between 11th December '21 to 7th January '22 (PHS[9]). The report suggests that infections with COVID-19 are more common among people who have had at least one dose than in the unvaccinated group (Table S2, PHS[9]). It is true for hospitalisation too (not shown here). Also, mortality is considerably more probable for people with 2 doses than for those who are unvaccinated (PHS[9]). As time progresses, how people with third doses will fare in Scotland compared to the unvaccinated group will be more evident, though can easily be speculated by looking at data from later periods from UHSA[5]. However, both the UK and Scotland

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UHSA[8] :
https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/1036047/Vaccine_surveillance_report_-_week_47.pdf

PHS[9]: https://publichealthscotland.scot/media/11076/22-01-12-covid19-winter_publication_report.pdf

Table-1: Unadjusted rates of COVID-19 infection in vaccinated (i) and unvaccinated (ii) populations in the UK. Cases reported by specimen date between, a) week 43, 2021 (25th October) and week 46, 2021 (15 November) [UHSA[8], Table 11] ; b) week 9, 2022 (w/e 6 March 2022) and week 12, 2022 (w/e 27 March 2022) [UHSA[5], Table 14].

Age Groups	a) Week 43 to 46		b) Week 9 to 12	
	i) Unadjusted rates among persons vaccinated with at least ***2 doses*** (per 100,000)	ii)Unadjusted rates among persons ***not vaccinated*** (per 100,000)	i) Unadjusted rates among persons vaccinated with at least ***3 doses*** (per 100,000)	ii) Unadjusted rates among persons ***not vaccinated*** (per 100,000)
18 to 29	757.1	837.6	3,118.8	941.6
30 to 39	1,373.1	967.0	4,324.7	1,085.6
40 to 49	2,022.9	933.8	3,957.8	955.3
50 to 59	1,422.5	697.0	3,303.4	779.8
60 to 69	1,015.6	504.1	2,814.9	572.8
70 to 79	538.2	422.7	2,161.5	532.1
80 or over	320.7	410.0	2,023.7	775.6

N.B. The rates are calculated per 100,000 in people who have received either 2nd doses (a), or 3rd doses (b), of a COVID-19 vaccine or in people who have not received a COVID-19 vaccine. Calculations are updated every week as the number of unvaccinated people and individuals vaccinated with 2nd or 3rd doses in the population changes.

governments stopped publishing the same data on vaccinated vs. unvaccinated in a recent period; Scotland stopped in mid-February, while the UK from April 2022. Our previous discussion suggests it is very likely that the UK and more specifically highly vaccinated Scotland will show a major surge in cases and deaths among vaccinated people with the third dose, as time progresses. Scotland the topmost vaccinated country in the UK (also one of the topmost vaccinated, globally) showed a maximum surge in cases/deaths in recent periods, though most stringent measures (face covering and many other restrictions) continued longer unlike most of the UK.

Such observation may explain why there was an unprecedented rise in cases and deaths in all those nine highly vaccinated countries after the initiation of the third dose.

3.5. Frequent vaccination, 'Exhaustion of T cells' and impaired immunity:

Further explanations based on scientific perspectives can also be offered that might support unusual COVID-19 situations as discussed for those countries. A well-known effect of vaccines known as 'exhaustion of T cells' may provide an explanation [13, 14]. The destructive effects of tampering with T cells are acknowledged in some popular articles [13, 14]. The findings presented here confirm concerns as expressed by the European Union's top drug regulator. Dr Marco Cavaleri, the European Medicines Agency's head of vaccines strategy, raised that issue at

a news briefing (Newspaper[10]). Dr Cavaleri mentioned a concern that seeing antigens, (those generated by vaccines), over and over again can lead to T cell anergy or 'exhaustion'. Prof Sarah Fortune, a professor at the Harvard TH Chan School of Public Health Department of Immunology and Infectious Diseases seconded such a possibility (Newspaper[10]). T cells play a key role in fighting COVID-19 once it has entered the body [14]. Multiple doses of vaccine can exhaust the T cells and subsequently weaken the immune response.

Published research is also available that further discusses the suppression of immune response [9]. Their research suggested that in human cells, anti-COVID-19 vaccines actively suppress type I interferon (IFN) signalling. In general, type I and II interferons are accountable for activating and regulating the immune response [15]. Suppression of type I IFN responses results in impaired innate immunity. Subversion of innate immunity, primarily via suppression of interferon type I and its associated signalling cascade can have various wider consequences. It might cause the reactivation of latent viral infections and can reduce the capability to fight effectively future infections [9].

Moreover, the antibodies fade over time, and once antibody levels are no longer high, the virus is able to enter cells more readily, and it is at this point that a type 1 interferon response is essential for clearing the virus. If the type 1 interferon response remains suppressed due to the vaccine after the antibody levels have fallen, it could set up a situation where susceptibility to infection is worse than it was prior to any vaccine.

Other studies also explored mechanisms that could add to bolster arguments that the vaccines are suppressing the immune system (16,17). The former study (16) discusses that PD-L1 (Programmed cell Death Ligand 1) which is a known factor involved in immune suppression is affected after vaccination with SARS-CoV2 mRNA or vector vaccine. The later research (17) explored on IgG4 (Immunoglobulin G4) which is a unique IgG isotope that is not effective at blocking viral entry, and even interferes with the action of other IgGs. Their research (17) mentioned that repeated vaccination can induce IgG4 antibodies which may generate immune tolerance to the SARS-CoV-2 spike protein. It constitutes mechanisms of immune tolerance to the spike protein that could promote unopposed infection of SARS-CoV2 and replication by suppressing natural antiviral responses.

All those published research strengthened the mechanism parts and provided explanations for why there is an unusual surge of COVID-19 cases as well as deaths in later periods among vaccinated groups compared to the unvaccinated ones [Table 1, Table S1 and S2].

4. Conclusions

This study mainly focused on countries that experienced unusual surges of deaths and cases in the later period and the period covered is till 21st March 2022. Considering the unprecedented recent COVID-19 situations in the following groups- a) among some topmost vaccinated countries e.g., Singapore, South Korea, Australia, Hong Kong, Iceland, New Zealand, Denmark, Finland and Japan; b) country that leads the vaccine roll-out programme viz. Israel; and c) country that is fully vaccinated for the longest period viz. Gibraltar - an obvious question arises as to what purpose was being served to those countries. Knowing the many adverse effects of vaccines, noting the effectiveness of vaccination wanes in only a few months' time and considering the heavy economic burden of mass vaccination globally every few months, many burning questions erupt on mass vaccination strategy. If situations became worse and

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Newspaper[10]: https://www.dw.com/en/covid-do-multiple-boosters-exhaust-our-immune-response/a-60447735 dt 18.01.22 accessed on 15/04/22.

unprecedented in the later part of the study period for the whole of the pandemic, what objectives have those leading countries achieved in controlling COVID-19 transmission? These are a few critical questions discussed and addressed on current COVID-19 exit strategies based on global mass vaccination.

Furthermore, observations indicate an unusual surge of cases as well as deaths in later periods among fully vaccinated groups compared to the unvaccinated ones. Hence one apparent issue arises whether high vaccination among the general population is causing them to lose natural immunity or not. All observed facts are supported by a well-known scientific theory relating to vaccination known as 'Exhaustions of T Cell'. It indicates high vaccination may weaken innate immune response. Other research further discussed that anti-COVID-19 vaccines actively suppress type I interferon signalling which can result in impaired innate immunity. As type I interferons are heavily responsible for activating and regulating the immune response, such a process can cause the reactivation of latent viral infections and reduce the capability to fight effectively against future infections. Other published research also explored mechanisms that could add to bolster arguments that the vaccines are suppressing the immune system. Those discussed that PD-L1 which is a known factor involved in immune suppression is affected after vaccination with SARS-CoV2 mRNA or vector vaccine. Another study explored on IgG4 and mentioned that repeated vaccination can induce IgG4 antibodies which may generate immune tolerance to the SARS-CoV-2 spike protein. That mechanism of immune tolerance to the spike protein can promote unopposed infection of SARS-CoV2 and replication by suppressing natural antiviral responses. Various published research strengthened the mechanism parts and provided explanations for an unusual surge of COVID-19 cases and deaths in later periods among vaccinated groups compared to the unvaccinated ones. It is now high time to check these observed data and take urgent policy actions worldwide. Other additional policy measures are also proposed that will have enormous socio-economic impacts and will help bring back normalcy sooner.

- **Additional Policy Recommendations:**

A few propositions are also mentioned here. People all over the world will appreciate such endeavour, regardless of who agrees or disagrees with frequent vaccine doses and child vaccinations.

a) Countries should investigate adverse reactions and if responsible, vaccine companies should be made liable to compensate for harms and deaths.

b) Out of any announced global crisis and emergency, no one should be allowed to make profits. The huge profits so far made by vaccine companies and related businesses should be taxed under a specific COVID-19 tax scheme.

These two measures (a and b) not only have enormous socio-economic impacts but will also help bring us back to normalcy sooner.

Abbreviations

CDC: Centers for **D**isease **C**ontrol and Prevention

COVID-19: **CO**rona**VI**rus **D**isease 20**19**

CSSE: **C**enter for **S**ystems **S**cience and **E**ngineering

IFN: **I**nter**f**ero**n**

IgG: Immuno**g**lobulin **G**

IgG4: Immuno**g**lobulin **G4**

JHU: **J**ohns **H**opkins **U**niversity

PD-L1: **P**rogrammed cell **D**eath **L**igand **1**

PHS: **P**ublic **H**ealth **S**cotland

SARS-CoV-2: Severe **A**cute **R**espiratory **S**yndrome **Co**rona**V**irus **2**

UHSA: UK **H**ealth **S**ecurity **A**gency

WHO: World **H**ealth **O**rganisation

Declarations

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Consent for publication: Yes
Availability of data and material: All data used are open source.
Competing interests: No competing interest
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Supplementary Section

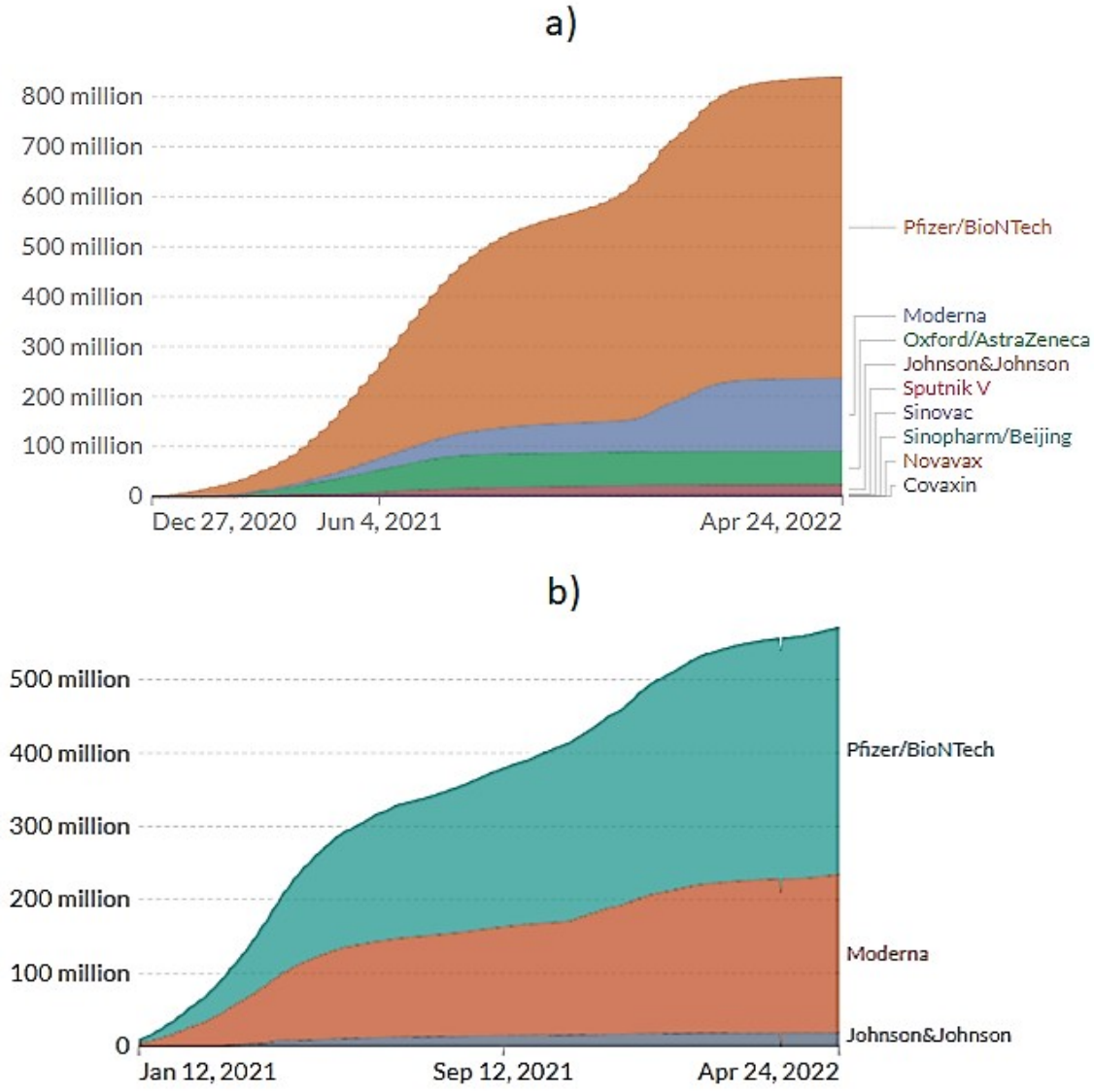
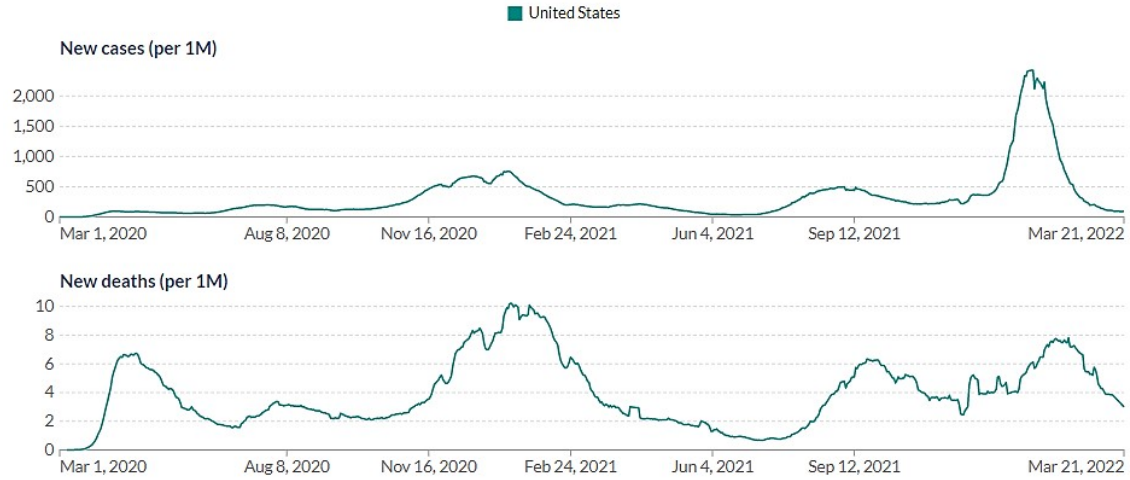


Fig. S1. COVID-19 vaccine doses are administered based on manufacturer for a) the European Union and b) the US. All doses, including boosters, are counted individually. In both cases, the majority are shown administered Pfizer-BioNTech vaccine followed by Moderna.

[Source: Our World in Data (1)]

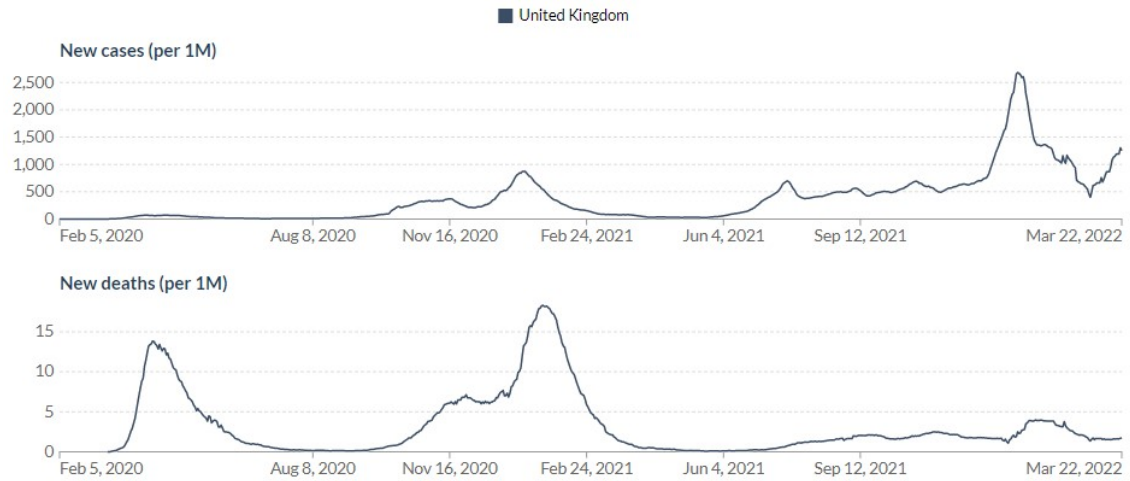
a)


United States
New cases (per 1M)
2,000
1,500
1,000
500
0
Mar 1, 2020
Aug 8, 2020
Nov 16, 2020
Feb 24, 2021
Jun 4, 2021
Sep 12, 2021
Mar 21, 2022
New deaths (per 1M)
10
8
6
4
2
0
Mar 1, 2020
Aug 8, 2020
Nov 16, 2020
Feb 24, 2021
Jun 4, 2021
Sep 12, 2021
Mar 21, 2022

b)


Europe
New cases (per 1M)
2,000
1,500
1,000
500
0
Mar 1, 2020
Aug 8, 2020
Nov 16, 2020
Feb 24, 2021
Jun 4, 2021
Sep 12, 2021
Mar 21, 2022
New deaths (per 1M)
6
4
2
0
Mar 1, 2020
Aug 8, 2020
Nov 16, 2020
Feb 24, 2021
Jun 4, 2021
Sep 12, 2021
Mar 21, 2022

c)


United Kingdom
New cases (per 1M)
2,500
2,000
1,500
1,000
500
0
Feb 5, 2020
Aug 8, 2020
Nov 16, 2020
Feb 24, 2021
Jun 4, 2021
Sep 12, 2021
Mar 22, 2022
New deaths (per 1M)
15
10
5
0
Feb 5, 2020
Aug 8, 2020
Nov 16, 2020
Feb 24, 2021
Jun 4, 2021
Sep 12, 2021
Mar 22, 2022

d)

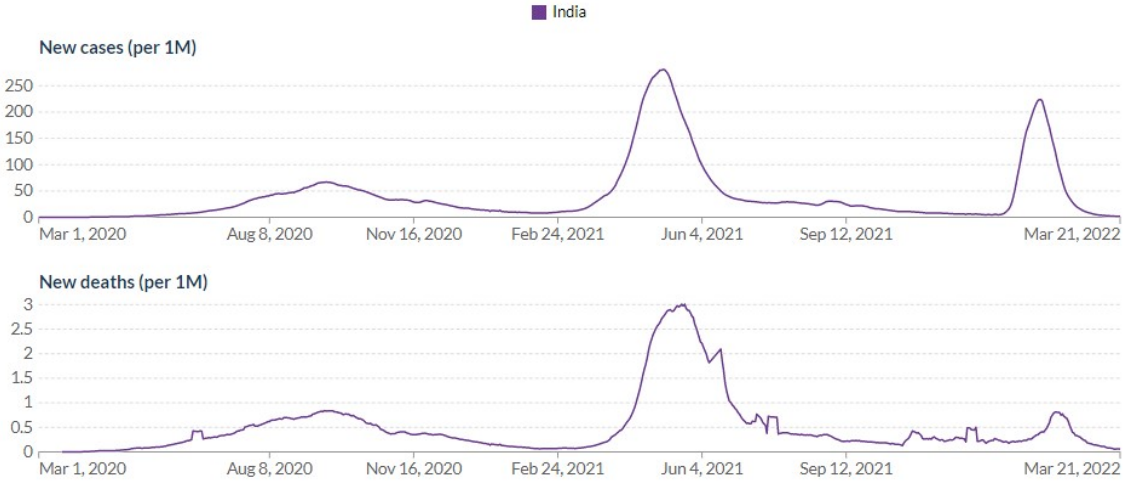


Fig. S2. Daily new confirmed COVID-19 cases and deaths per million people, 7-day rolling average, till 21st March 2022 for a) the United States, b) Europe, c) UK and d) India.
[Source: Our World in Data (1)]

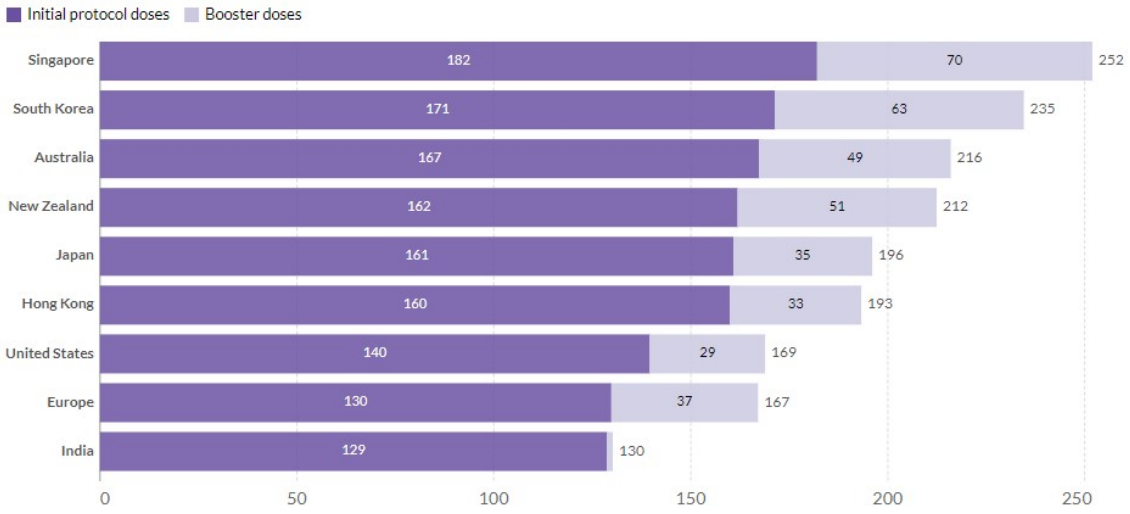


Fig. S3. COVID-19 vaccine doses, further breakdown, in terms of initial doses and boosters per 100 people upto March 21, 2022, for a few countries from Fig 1B. The total number of doses administered, broken down by whether they are part of the initial protocol or booster doses, is divided by the total population of the country.

[Source: Our World in Data (1)].

a)

b)

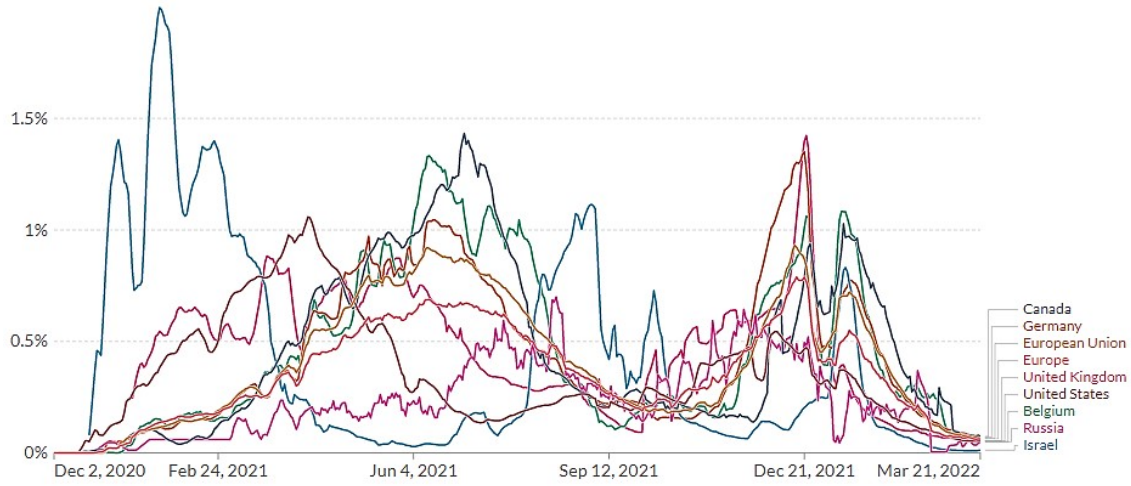


Fig. S4. Daily share of the population receiving a COVID-19 vaccine dose (7-day rolling average). All doses, including boosters, are counted individually. a) Hong Kong and Japan showed a sudden rise in vaccine doses in the later period. b) Most countries decreased vaccine doses at the later time. [Source: Our World in Data (1)]

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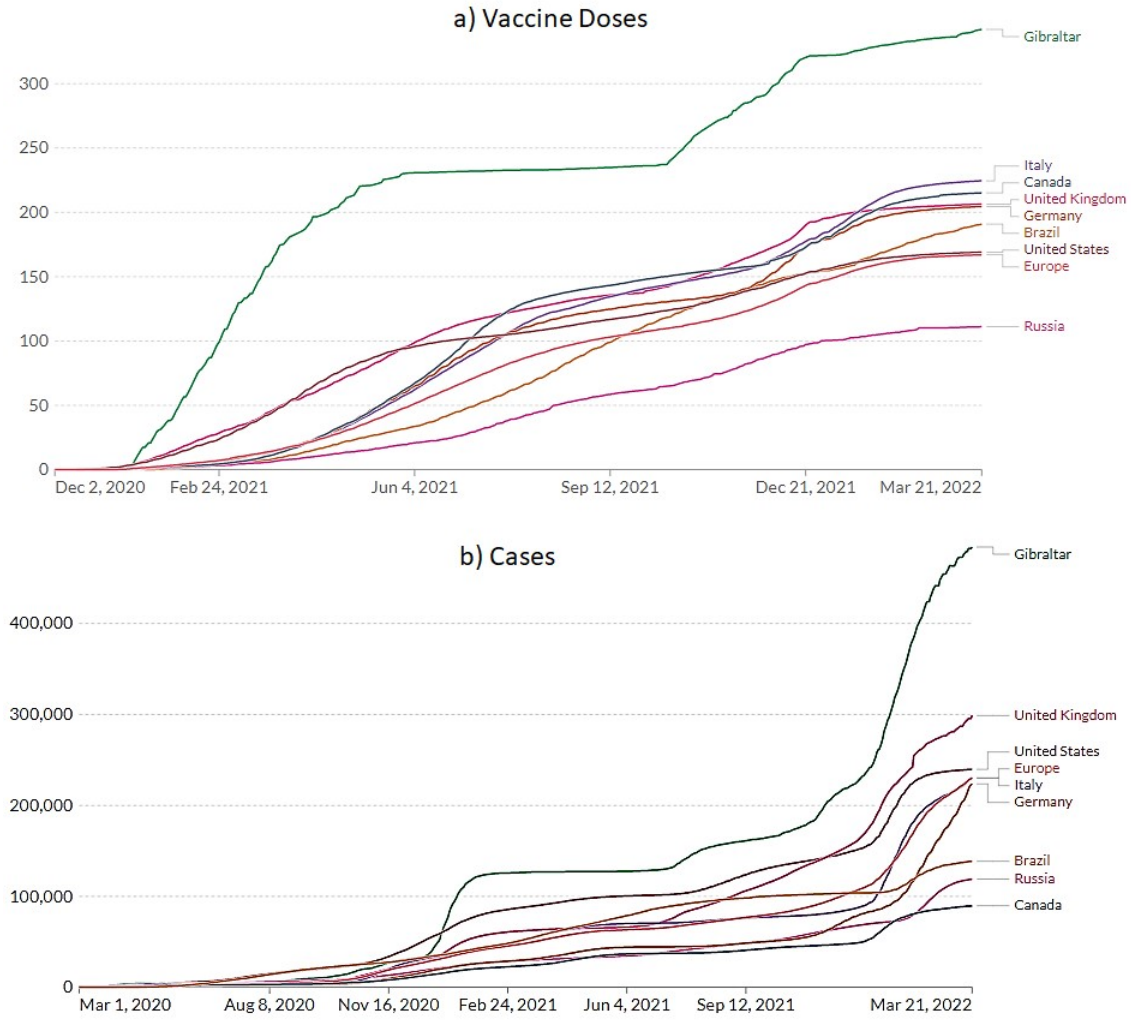

Fig. S5. The country Gibraltar is highly ranked in terms of cumulative vaccine doses as well as cases. a) COVID-19 vaccine doses (cumulative) administered per 100 people. All doses, including boosters, are counted individually. b) Cumulative confirmed COVID-19 cases per million people. [Source: Our World in Data (1)].

Table S1. COVID-19 deaths (≥ 50 years age groups) (I) within 28 days, (II) within 60 days of a positive specimen or with COVID-19 reported on death certificate, by vaccination status between a) week 43- 46, 2021 [UHSA[8], Table 10 a, b]; b) week 9-12, 2022 [UHSA[5], Table 13 a, b].

Week /Age groups (10 years band)	Total		Unlinked		Not Vaccinated		Received one dose, (1-20 days before specimen date)		Received one dose, ≥21 days before specimen date		Second dose≥14 days before specimen date		Third dose≥14 days before specimen date	
	I	II	I	II	I	II	I	II	I	II	I	II	I	II
a)Week (43-46)														
50-59	250	312	5	6	108	134	0	0	11	14	126	158	Na	
60-69	555	658	3	5	154	181	0	0	18	20	380	452		
70-79	1025	1195	6	7	163	175	1	1	9	16	846	996		
≥80	1726	2054	7	7	187	207	5	6	35	47	1492	1787		
Total	3556	4219			612	697					2844	3393		
(% of deaths)					(17.2,	16.5)					(79.9,	80.4)		
b)Week (9-12)														
50-59	72	155	0	0	16	24	0	0	5	8	17	45	34	78
60-69	163	350	1	1	31	48	0	0	11	16	39	77	81	208
70-79	435	825	3	3	48	72	0	0	6	19	70	120	308	611
≥80	1420	2614	5	5	104	145	1	2	23	36	175	320	1112	2106
Total	2090	3944			199	289							1535	3003
(% of deaths)					(9.5 ,	7.3)							(73.4,76.1)	

Table-S2: Age-standardised case rate per 100,000 people by vaccination status and week in Scotland between 11 December 2021 to 7th January 2022. Unvaccinated are performing the best in all weeks compared to any vaccinated groups. Double vaccinated are performing the worst every week. [Source: PHS[9], their Table 11]

	Unvaccinated		1 Dose	
Week	No. tested positive by PCR	Age Standardised case rate per 100,000 with 95% confidence intervals	No. tested positive by PCR	Age Standardised case rate per 100,000 with 95% confidence intervals
11 December - 17 December 2021	6,545	**482.87** (464.41 - 501.34)	2,952	**574.16** (538.46 - 609.85)
18 December - 24 December 2021	9,070	**721.39** (698.44 - 744.34)	4,639	**958.62** (911.03 - 1,006.20)
25 December - 31 December 2021	14,465	**1,242.10** (1,209.27 - 1,274.94)	7,657	**1,693.71** (1,631.31 - 1,756.11)
01 January 2022 – 07 January 2022	12,485	**1,092.80** (1,063.90 - 1,121.71)	6,702	**1,527.57** (1,462.52 - 1,592.63)
	2 Doses		Booster or 3rd Dose	
Week	No. tested positive by PCR	Age Standardised case rate per 100,000 with 95% confidence intervals	No. tested positive by PCR	Age Standardised case rate per 100,000 with 95% confidence intervals
11 December - 17 December 2021	20,788	**826.49** (809.83 - 843.16)	3,926	**458.39** (400.49 - 516.29)
18 December - 24 December 2021	35,123	**1,527.87** (1,501.86 - 1,553.88)	10,193	**902.02** (841.06 - 962.98)
25 December - 31 December 2021	54,860	**2,897.58** (2,859.92 - 2,935.23)	30,327	**1,755.69** (1,701.98 - 1,809.40)
01 January 2022 – 07 January 2022	35,119	**2,499.52** (2,462.50 - 2,536.53)	33,415	**1,466.76** (1,418.18 - 1,515.33)