
Vaccine efficacy:
Ability of a vaccine to work as intended to protect from illness.
Vaccine-associated risk:
Probability increased adverse event that harm the individuals or population.

Vaccine Statistics

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1.1 Vaccine Perspective

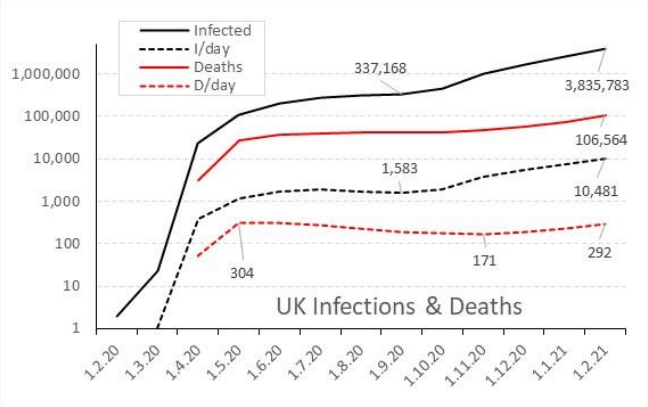
The video *Covid-19 Vaccines* is an informative summary of the three vaccines produced by Moderna, Pfizer and Astrazenca, where the efficacy of these vaccines is to be discussed. However, before discussing this video, the following statistics, dated 20-Jan-2021, are presented to provide some wider perspective of the impact of the Covid-19 virus in terms of infections and deaths for the 10 top countries shown taken from the *virus.com* database. For without some understanding of the wider statistics surrounding the impacts of the Covid-19 virus, the need and effectiveness of any vaccine is difficult to assess.

#	Country	Pop	Infected	%I/P	Deaths	%D/P	%D/I
1	USA	329,227,746	24,806,964	0.75%	411,486	0.12%	1.66%
2	India	1,352,642,280	10,596,442	0.78%	152,754	0.01%	1.44%
3	Brazil	212,347,956	8,575,742	4.04%	211,511	0.10%	2.47%
4	Russia	144,438,554	3,612,800	2.50%	66,623	0.05%	1.84%
5	UK	67,772,000	3,466,849	5.12%	91,470	0.13%	2.64%
6	France	67,000,000	2,938,333	4.39%	71,342	0.11%	2.43%
7	Italy	60,500,000	2,400,598	3.97%	83,157	0.14%	3.46%
8	Turkey	84,078,320	2,399,781	2.85%	24,328	0.03%	1.01%
9	Spain	50,800,000	2,370,742	4.67%	54,173	0.11%	2.29%
10	Germany	82,800,000	2,071,473	2.50%	49,244	0.06%	2.38%

Let us first consider the infection figures, shown as both a number and as a percentage of the population (%I/P), where we might immediately notice the wide variance in values between 0.75% and 5.12%. From a causal perspective, we might initially try to rationalize this difference as simply reflecting the number of tests being carried out in each country. However, there is an issue of error rates associated with the *PCR test*, which is highly dependent on the cyclic threshold.

> *Note: On 14-Dec-2020, the WHO accepted that PCR tests can produce too many false positives. For many experts have highlighted that a cyclic threshold (CT) of 30, i.e. cyclic amplification of a factor of a billion, should be the upper limit, but where many tests were being declared positive based on a CT of 40, i.e. cyclic amplification of a trillion. In Oct-2020, a research group showed that if a person gets a positive PCR test result at a cycle threshold of 35 or higher, the chance that the person is infectious is less than 3%.*

As the table above highlights, the UK appears to have the highest infection rate per population in the world, such that we might wish to better understand the causal factors that have led to this situation. On this basis, we might consider some of the details in the next chart, which shows the UK infections and deaths up to Feb-2021, both as total numbers and daily rate, where the black curves relate to infections and the red curves to deaths.



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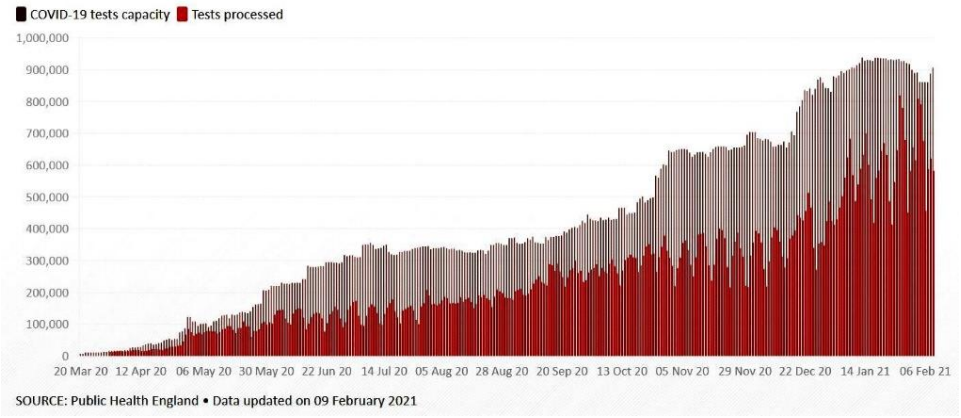
Various sources suggest that the UK has been administering over 100,000 tests per days since May-2020, although peaking to over 700,000 in Dec-2020 and Jan-2021. So, even based on the lower rate, this could amount to 27.6 million tests and equate to 40% of the UK population. However, even a 5% error rate would equate to 1.38 million false positives, possibly suggesting that 39.8% of the UK 3,466,849 infections may been false positive, which would reduce the UK infections per population to 3.1% and be more in-line with other countries.

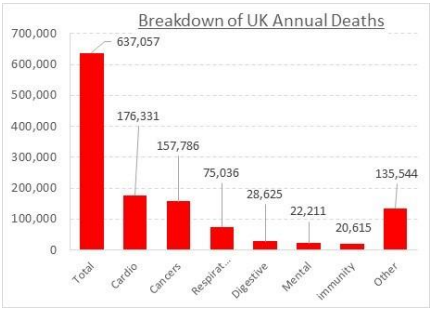


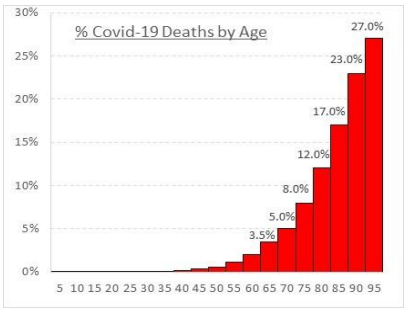
Note: Despite the false-positive problem, the generally low percentage infection figures in all countries, relative to population size, probably does not reflect the reality of a virus that has been in circulation for over a year, especially when the efficacy of lockdowns has been questioned in 29 international accepted papers. So, for all the reasons highlighted, the number of recorded infections in the UK may have little value in any statistical analysis.

So, if infection numbers and percentages are not really that helpful, what might be said about the number of deaths? If infections are misleading, we might make a comparison of the recorded deaths in the UK and Germany, both as a number and as a percentage of the population.

#	Country	Pop	Deaths	%D/P
5	UK	67,772,000	91,470	0.13%
10	Germany	82,800,000	49,244	0.06%

On the basis that the UK death rate is twice as high as Germany, we might question whether the UK figures could have been skewed by confusing deaths caused by Covid-19 rather than the virus simply being present at death, especially if proof of infection was often never proved in many of the cases. However, as shown in the first table, the %-deaths per population in the top 10 worst affected countries only equates to an average of 0.086% and while most might find this reassuring, there appears to have been little attempt to present this statistic to the general public by the UK government or mainstream media. However, the figure of 0.086% might also be put in context of an average all-cause mortality rate being around 1% per year, which equated to 637,057 in the UK (2019), where over 90% of these deaths were associated with age groups over 60. This age profile is also generally reflected in the age distribution of Covid-19 deaths, shown right, where cardiovascular and cancer deaths, shown left, account for 334,117 or 52% of all-cause deaths.





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At this point, let us try to summarise some of the information in the previous '*UK infection & Deaths*' chart. If we initially focus on the deaths per day, the black-dotted curve, there was a peak of 304 in May-2020, falling to 171 and then rising to 292 in Feb-2021. If we interpret these figures in terms of the seasonality of a summer and winter period of 182.5 days, a summer season of an average of 171 deaths per day would extrapolate to 31,208 deaths, while a winter season, based on 304 deaths per day, would extrapolate to 55,480 deaths. This would then lead to a yearly estimate of 86,688 deaths. However, based on statistics taken from the website *virusncov.com*, the UK had recorded 73,512 Covid-19 associated deaths by 31-Dec-2020, such that the seasonal estimates appear high. The figure of 73,512 would equate to 11.5% of the UK 637,057 all-cause deaths cited in the previous chart, left, although we possibly need to question this statistic, which is twice the rate of Germany as highlighted in the second comparative table above.

> *Note: While possibly more anecdotal than proven statistics, one UK study looked at the cases of 122 people who died outside of a hospital setting, either at home or in a care home, whose deaths were attributed to Covid-19. Half of this group were aged 88 or over. Of the 122 cases, 111 (90%) were judged to have extensive comorbidities and 11 had moderate comorbidities. Therefore, not one of those who died was in good health and only 15% were judged to have died directly as a cause of the Covid-19 virus. While also possibly anecdotal, this study might be supported by Professor Walter Ricciardi, scientific adviser to Italy's minister of health, who suggested that only 12% of the deaths in Northern Italy were directly caused by the Covid-19 virus, where 88% of patients who died had at least one pre-morbidity, many had two or three. See video* Vitamin D Status and Viral Interactions *as another potential causal factor.*

Again, like infections, the accuracy of some death statistics must be questioned and while it is accepted that many people have undoubtedly lost their life to the Covid-19 virus in 2020, the exact figure is in doubt. Mixed in with such doubts is the issue of *'excess deaths'* that might have been caused by the lockdown restricting access to normal health services, such that people suffering from cancer and cardiovascular conditions did not get the appropriate level of treatment – see video *Excess Deaths* and paper *Life-Years and Lockdown* for more details plus the paper *Economic Costs*, which summarises some of the additional economic cost to society.

> *Note: Ivor Cummins has also produced several videos related to the statistics surrounding the Covid-19 virus and excess deaths - see* Viral Issue Crucial Update *and* High Level View of Viral Epidemic Mortality*. The first video produced in Sep-2020 provides an estimate that the number of excess deaths in Europe in the 2019/20 winter season was possibly 30,000 to 40,000 greater than the 2018/19 winter season. The second video produced in Feb-2021 provides a summary of the Euromomo statistics, see* Z-scores by Country*, which provides comparative statistics by country and different age groups, where the UK statistics might, again, be questioned.*

As a broad generalisation, with the notable exception of the UK, younger people below the age of 45 appear to have a mortality rate within the normal range. This increases slightly in the age groups up to 64 with a more mixed picture across Europe in the age range up to 74. Within the 65-74 age range some countries show *'spike'* periods of excess death, which are not really reflected in Germany's statistics, which might possibly be explained in terms of geography and demographic variances across Europe as a whole. Finally, only in the 75-84 age groups do we see a more consistent pattern of excess deaths, as statistics have shown these people are more *'susceptible'* to viral infection when the immune system becomes weaken with age.

> *Note: Statistically, it has been estimated that 80% of those infected may only have mild symptoms, while another 15% will have more severe symptoms possibly requiring some medical treatment. Finally, the last 5% may experience life threatening symptoms, although statistically less than 0.1% of even the worst affected populations will die. However, over 90% of those deaths are associated with people in the 70+ age groups, invariably with comorbidities.*

While being a somewhat speculative summary, it does not appear unreasonable to suggest that many of the deaths attributed to Covid-19 involved people at the end of life with multiple comorbidities. Likewise, retrospective analysis of Covid-19 death statistics may eventually have to be revised downwards, especially in the UK, such that they may not be so different from previous bad influenza seasons. Likewise, excess deaths may eventually have to be revised to more accurately account for deaths caused by lockdowns, not the virus itself.

Note: While the Daily Mail is not a preferred source of statistics, its headline on 30 November 2018 reads: "Winter death toll highest since 1975. Failure of flu jab to combat severe outbreak resulted in more than 50,000 extra people dying in England and Wales last year". Clearly, the figure of 50,000 influenza deaths is not that far from the 2020 figure attributed to Covid-19, especially if eventually revised downwards.

This note leads us back to the issue of vaccines and how we might appraise their overall efficacy outside of the controlled environment of a clinical trial, where actual statistical data may not be fully disclosed by the companies producing the vaccines and running the trials. For example, in 2015, the WHO called for the full release of clinical trial results for all drugs and vaccines, while the United Nations health agency stated that failure to fully disclose trial results led to misinformation and skewed the formulation of public health policy.

Note: Typically, the efficacy of the influenza vaccine is calculated based on an average efficacy of 60%, administered to about 50% of the population, giving an aggregate efficacy of 30%. It is estimated that 20,000 people die of influenza every year in the UK, such that the influenza vaccine might save 6,000, although statistically over 90% will be over 70 years of age. It is difficult to be precise about the UK deaths from influenza in any given year because unlike the Covid-19 virus, the presence of influenza is not mandated on the death certificate. Therefore, influenza may have also been present at death in the +70 age groups, but not reported and certainly with no calls for lockdown of the entire population. However, as per the Daily Mail report cited earlier, influenza deaths in 2018 may have been as high as 50,000, such that they would have been higher than the 33,917 deaths recorded for Covid-19 in Germany in 2020.

So, finally we shall return to the efficacy of the *Covid-19 Vaccines* produced by Moderna, Pfizer and Astrazenca, as explained in the video. However, as highlighted at the outset, without some understanding of the wider statistics surrounding the impacts of the Covid-19 virus, the need and effectiveness of any vaccine is difficult to assess. Let us start by quantifying the efficacy of the vaccine as defined in the video, which is based on a comparative measure of positive PCR results in a placebo group versus a similar group that has been vaccinated, as shown in [1].

[1] $$Efficacy\ for\ postive\ PCR = \frac{placebo - vaccine}{placebo} * 100 = \%$$

This is not an unreasonable definition as we might assume that any inaccuracies, false positives, in the PCR test results would apply equally to both groups, such that any difference in infections might be attributed to the vaccine. However, while we might assume that nobody necessarily wants to be exposed to the Covid-19 virus, general statistics suggest that most (80%) will not really have any serious subsequent symptoms after being tested and will simply become part of an increasing '*herd-immunity*' population, with or without the vaccine. The next 15% of the population who may experience more unpleasant symptoms, akin to influenza, might well elect to have the Covid-19 vaccine for similar reasons as the influenza vaccine. If so, the effectiveness will depend on the efficacy shown in [1] and the percentage of the population who have this vaccine, which are statistics we do not have at this time. However, there is another 5%, which statistics suggest will become seriously ill and require hospitalisation, although only a small percentage of the population, less than 0.1%, has died.

Note: The outline above is not necessarily how the developers of the various Covid-19 vaccines want to present the efficacy of their product to the general public, where figures in excess of 90% are now being touted.

In the context of the *Covid-19 Vaccines* video, it starts with an overview of the various phases of clinical trials that a vaccine is required to go through before approval to be used on the general public. However, the interested reader might wish to review a wider presentation entitled '*How Do Clinical Trials Usually Work?*' before proceeding. Following the introduction of vaccine trial phases, the video then explains how the different vaccines work before it discusses the issue of vaccine efficacy at 25:30, starting with the Moderna vaccine. It is assumed that the data presented is based on a Phase-3 trial before approval was given for any of these vaccines to be used on the general public. This discussion will first present the efficacy results for each vaccine, as presented, but then accompanied by a table that possibly provides some wider context. So, in the case of the Moderna vaccine, the phase-3 trial was based on 30,000 people divided into two equal groups, placebo and vaccine, and subject to double-blind controls. After the vaccine was administered, each group was monitor for infection, presumably based on a PCR positive result, where the statistical data was then divided between those who were simply deemed infected

and those who were more seriously affected, but where none were reported to have died. In the video the efficacy of the vaccine was calculated as follows:

[2]
$$\textit{Efficacy for postive PCR} = \frac{\textit{placebo} - \textit{vaccine}}{\textit{placebo}} = \frac{185 - 11}{185} = 94.5\%$$
$$\textit{Efficacy for severe infection} = \frac{\textit{placebo} - \textit{vaccine}}{\textit{placebo}} = \frac{30 - 0}{30} = 100\%$$

The following table presents the same basic data, but now shown as percentages of the placebo and vaccinated population, 15,000, where the difference between 185 and 11 infected leads to the figure of 94.5% efficacy. In the table, we see both the infected and severe figures represent low percentages when compared against the 15,000-trial size.

Manufacturer	Sample	Numbers	Positive	%	Severe	%	Deaths	%
Moderna Temp: -20°C Cost: £30	Placebo	15,000	185	1.23%	30	0.20%	0	0.00%
	Vaccine	15,000	11	0.07%	0	0.00%	0	0.00%
	Total	30,000	196	0.65%	30	0.10%	0	0.00%

What is not entirely clear in the presentation, or within the data above, is the make-up of the demographics of the people selected for the trial. However, it is stated that none of the trials included anybody under 18, which statistics suggest are relatively immune from any serious effects. While this 0-18 group may not have changed the *'positive'* numbers, they would have impacted the '*severe*' statistics, although the definition of '*severe*' is not quantified. However, in order to fully evaluate any of the trials, we would need to know the statistical breakdown by age, health conditions, ethnicity, and geography, which may have all influenced the results. Next discussed was the Pfizer vaccine, where the efficacy was based on a trial involving 43,000 people, as shown in [3].

[3]
$$\textit{Efficacy for postive PCR} = \frac{\textit{placebo} - \textit{vaccine}}{\textit{placebo}} = \frac{162 - 8}{162} = 95.06\%$$
$$\textit{Efficacy for severe infection} = \frac{\textit{placebo} - \textit{vaccine}}{\textit{placebo}} = \frac{9 - 1}{9} = 88.89\%$$

Again, the table below presents a wider interpretation of the data in [3], now shown as percentages of the placebo and vaccinated population, 21,500, where the difference between 162 and 8 infected leads to the figure of 96.05% efficacy based on low percentages when compared against the 21,500-trial size.

Manufacturer	Sample	Numbers	Positive	%	Severe	%	Deaths	%
Pfizer Temp: -90°C Cost: £20	Placebo	21,500	162	0.75%	9	0.04%	0	0.00%
	Vaccine	21,500	8	0.04%	1	0.00%	0	0.00%
	Total	43,000	170	0.40%	10	0.02%	0	0.00%

The Pfizer vaccine has a similar result for infection efficacy, such that the general comments raised against the Moderna vaccine might also apply. However, we might note that the Pfizer trial groups were 30.2% bigger than Moderna, 21,500 versus 15,000, but where conversely the Moderna infection rate was 39.5% larger than Pfizer, 1.23% versus 0.75%. While not too much can be read into this difference, it might suggest a difference in the demographics of the participants. So, while both trials might have been subject to double-blind controls, we do not necessarily know who selected the participants and why. Again, we know that age groups below 18 were excluded, but what percentage of these trial populations were made up of the most vulnerable age-groups above 70 and what, if any, pre-existing comorbidities existed? Finally, we turn to the results for the Asterzenca vaccine, where the figures presented in the video appeared somewhat confusing. In this respect the efficacy figure below may be incorrect and should only be seen as a general approximation.

[4] $$\textit{Efficacy for postive PCR} = \frac{placebo - vaccine}{placebo} = \frac{131 - 30}{131} = 70.3\%$$

Again, the table below presents a slightly different interpretation, shown as percentages of the placebo and vaccinated population, 6,000, which is the average of the Brazil trial of 9,000 and the UK trial of 3,000.

Manufacturer	Sample	Numbers	Positive	%	Severe	%	Deaths	%
Astrazenca Temp: -20°C Cost: £30	Placebo	6,000	101	1.68%			0	0.00%
	Vaccine	6,000	30	0.50%			0	0.00%
	Total	12,000	131	1.09%			0	0.00%

As far as it is understood, the figure of 131 was the total number of infections, when averaged over the trials in Brazil (9,000) and the UK (3,000), resulting in the placebo and vaccinated groups of 6,000. Likewise, because of the dosage confusion between the Brazil and UK trials, the average efficacy of 70.3% used in the video has been used to divide the 131 infections across the placebo and vaccinated group. This trial appeared to offer up no meaningful analysis of the efficacy of severe cases, although the severe numbers in both the Moderna and Pfizer trial appear so small as to be statistically unreliable.

What other general comments might be made at this point?

For the reasons outlined in the comments above, the efficacy figures based on these limited phase-3 trials must be speculative at this time. Likewise, without details of the geography and demographics of the trial populations plus the details of who and why these participants were selected, it is difficult to extrapolate these results onto any real-world population, especially when any side-effects may only be realised over a much longer timeframe. Of course, we now know that all these vaccines have been given preliminary approval, such that they are being administered to the general public with the caveat that any adverse side-effects must be monitored as part of the phase-4 protocol requirements.

> *Note: As of Feb-2021, the following side-effects of the various vaccines have been reported: pain at the site of the injection, swollen lymph nodes in the arm where vaccinated, tiredness, headache, muscle and joint aches, nausea and vomiting, fever or chills, although there appears to be no statistical analysis of the numbers. Of a more serious nature, there are some reports of a severe allergic reaction and while possibly life-threatening, statistics suggest a very low risk. However, there have been some reports of unexplained deaths, e.g., there is a report of 23 deaths among elderly vaccine recipients in Norway. While these deaths were explained in terms of these people already being at the 'end of life', we might wish to know why these people were given the vaccine in the first place. Likewise, we might need to further question the rigor of clinical trials to show whether these vaccines are safe, and effective, for people with weak immune systems, already compromise by age or illness.*

For now, it might be assumed that these vaccines are statistically safe and effective when administered to most age groups. However, the risk to older age-groups still needs more statistical data, especially in respect to those with weaken immune systems. For while these groups are the ones most at risk to the virus, because their immune systems are weak, it is not clear whether the vaccine response will be equally weak, irrespective of any potential side-effects. So, initially we might generally accept the efficacy figures of the vaccines, but then try to make some further statistical assessment against a revised model of the UK population. This model is first summarised in the note below and then justified in terms of comparative data from Germany and Sweden up until 31-Dec-2020.

> *Note: Based on the data provided by the website virusncov.com, date 31-Dec-2020, the UK had reported 73,512 deaths, equivalent to 0.108% of its population. However, in contrast, Germany had reported 33,917 deaths despite having a bigger population, such that this figure equated to 0.041% of its population, where a UK-Germany comparison represents a 264% difference. For this reason, this 2021 model will revise the UK Covid-19 deaths in 2020 downwards by 50% to 36,756. However, it does not seem unreasonable to further reduce this figure to 25,000 in 2021 on the assumption that a secondary viral season will result in fewer deaths, if the natural 'herd-immunity' increases and medical treatments can increasingly mitigate the worst effects of the virus. The UK all-cause mortality figure of*

637,057 is retained for 2021, which equates to 0.94% of the population. While accepting that this is a speculative model, it will now be argued that the assumptions outlined do have some justification.

What might be initially argued is that even a vaccine with a 100% efficacy across all age groups and administered to 100% of the population would only reduce the model 25,000 virus-related deaths by 0.037% within the UK population. Likewise, based on the assumed all-cause mortality figure of 637,057, a 100% effective vaccine might maintain this figure, but represent a figure 3.92% of the 0.94% who die every year on average. As of Feb-2020, the UK is claiming to have vaccinated about 10 million people, or 14.75% of its population, although the statistical breakdown by age-group risk is not clear at this time. Based on previous years, the worst of the winter seasonal deaths in the UK will be over by May, such that the efficacy of the vaccine within this model population may have to be weighted towards the next 3 months. While speculative, a reasonable estimate of the number of people that might be vaccinated in this timeframe might be 50%, but where we might also need to reduce the real-world efficacy of the vaccines to prevent death in the most at-risk age groups over 70 with weaken immune system to 70%. If so, the overall efficacy of the vaccine would be 35% and if extrapolated across 2021, the vaccine might save 8,750 of the 25,000 lives at risk to the virus. If so, the reduced figure of 8,750 would equate to 0.013% of the population and 1.37% of the projected all-cause mortality figure assumed by the model population.

Note: It is realised that many may object to the assumptions of this speculative model and argue that even a grossly under-estimated figure of 8,750 still represents lives that can be saved by the vaccine.

However, the primary argument being presented by this model is that the efficacy of the vaccine cannot be simply based on clinical trials, where the demographics of the trial population probably did not truly reflect any real-world national population in terms of age, health conditions, ethnicity, and geography. Likewise, seasonality is a known factor that needs to be taken into consideration, which may also reduce the efficacy of the vaccine when aggregated over 2021. It has also been argued that the death statistics from Germany are more representative of Covid-19 in 2020 than the UK, as highlighted in the following table, which now includes Sweden that did not implement a lockdown policy, but rather favoured '*smart distancing*'. The figures in red show the relative comparison with Germany.

#	Country	Pop	Infected	%I/P	Deaths	%D/P	%D/I
6	UK	67,772,000	2,488,780	3.672%	73,512	0.108%	2.954%
10	Germany	82,800,000	1,735,819	2.096%	33,917	0.041%	1.954%
	ΔUK	81.85%	752,961	175.17%	39,595	264.80%	151.168%
31	Sweden	10,377,781	437,379	4.215%	8,727	0.084%	1.995%

If we dismiss infection numbers and percentages as statistically unusable, then we are only left with the percentage deaths per population as highlighted in grey. While these figures will naturally be subject to some geographic and demographic difference, the UK figures still appear excessive when realising that all these countries are rank in the top 31 of 220 states listed in the *virusncov.com* database. If these arguments have validity, then we must return to the actual number of lives that might be saved. Based on the UK 2021 model, this number is estimated to be in the region of 25,000 for the reasons cited. However, as argued, it seems unrealistic to assume that a vaccine can save all these lives, if its real-world efficacy is reduced from 90% to 70% and the rollout only manages to vaccinate 50% of those most at risk, reducing the aggregated efficacy to 35%, which might then save the 8,750 lives cited. Even if this figure was doubled, the vaccine would still only save 0.026% of the model population or 2.74% of the projected all-cause mortality figure assumed by the model population.

But surely this model is ignoring that the vaccine can help reduce infections?

At face value, a vaccine that can prevent somebody becoming infected may be the strongest argument for the vaccine and possibly the best way that herd immunity can be achieved. However, as outlined, if the real-world efficacy of the vaccine is reduced from the trial efficacy of 90% to 70% and the percentage of the population vaccinated in 2021 is 50%, then the aggregated efficacy of the vaccine to prevent infections also falls to 35%. Of course, on an individual basis, the vaccine may make sense to those most at risk, but again highlighting that statistically only 0.037% of the UK population may be at risk of death due to the virus in 2021.

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Note: A search of the web will find any number of discussions that question the efficacy of the various vaccines. While there is not yet enough real-world statistical data to contradict the clinical trials results, the idea that different demographics linked to age, health conditions, ethnicity, and geography will not affect the efficacy might be considered optimistic. However, even some vaccine scientists have questioned the efficacy of a vaccination program, if a specific vaccine becomes increasingly ineffective against new variants. If so, herd immunity *even with vaccines may not be achieved.*

The video '*Herd Immunity: Understanding Covid-19'* might be a good basic introduction to the issue surrounding herd immunity, where the level of exposure in a population depends on the *Reproductive R0 Number* of the pathogen in question. In the case of measles, the R0 value is very high (12-18), while normal strains of influenza are relatively low (1.5). Estimates for the Covid-19 vary, but have been estimated within the range of (2-3). The level of herd immunity required in a population can be calculated as a function of R0, as shown in [5].

[5] $$Herd\ Immunity = \left(1 - \frac{1}{R0}\right);\ measles > 90\%, influenza \sim 25\%,\ Covid \sim 50\text{-}66\%$$

Again, at this point, it possibly needs to be reiterated that statistically 80% of those infected may only have mild symptoms, another 15% will have more severe symptoms possibly requiring some medical treatment. While the last 5% may experience life threatening symptoms, statistics suggest that less than 0.1% will succumb to the infection, where new medical treatments may further reduce this figure. It might also be highlighted that there is a real possibility that better health advice about dietary nutrition, inclusive of key vitamins and minerals like D3 and Zinc, could dramatically strengthen the ability of the human immune system to fight off the more serious cases of infection. However, see video '*Vitamin C, Vitamin D and Prevention of Covid-19*' and '*How to Survive Coronavirus: The Role of Diet*' for a more informed outlined. It might also be argued that the idea of allowing virus infections to spread through a population on the basis of relatively low R0 values in order to create a form of herd immunity, would not be irresponsible, but possibly the only practical long-term solution. Up until 2020, this was the accepted approach support by the WHO to common cold, influenza and previous strains of coronaviruses – see video *Coronavirus, Long Term Immunity* for more details.

But must all lives be saved at any cost?

In truth, the idea that lives must be saved at any cost is often the ideological rhetoric used by politicians and institutions pursuing their own self-interests. For while statistics can be perceived as cold and impersonal, they invariably highlight the wider reality of the world, where 1-billion people go to bed hungry with 25,000 dying, every day, as a result of malnutrition and hunger-related diseases. Possibly more tragic in human terms is that 18,000 of this number is estimated to be children under 5 years old. While these people will not be immune to the virus, they are often the worst affected by any downturn in the global economy. Even within the confines of a relatively wealthy country like the UK, we need to face up to the economic reality that the UK government spent over £280 billion on the Covid-19 pandemic in 2020, which might be compared against the 2019 NHS budget of £150 billion. In essence, we have spent twice as much on preventing Covid-19 deaths as for all other causes of death. Of course, this economic cost does not include all the excess deaths caused by the lockdown policy and the knock-on social impacts on so many other lives.

Note: In conclusion, this discussion was not an argument against any of the Covid-19 vaccines, only that the efficacy of the approach has to be put into some wider and more realistic perspective.