Why Did Russia Fare So Poorly during COVID: An Analysis of Why One of the Best Prepared Countries Could Not Control Excess Deaths*

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Despite Russia being deemed well-prepared for pandemics, it faced an unprecedented rise in death rates compared to other nations. This study aims to replicate Nuzzo and Ledesma's findings, examining COVID-19's impact on Russia while considering variables such as the Global Health Security (GHS) Index and excess death rates. Our analysis revealed a significantly elevated excess death rate in Russia, contrasting with the lower rates in more prepared countries. This research sheds light on the COVID-19 outbreak's impact on Russia and identifies areas for improvement for well-prepared countries to mitigate future pandemics' effects, emphasizing the importance of better planning and regulations.

Table of contents

*Code and data are available at: https://github.com/Ary4m3n/covid-effect-russia.git; Replication on Social Science Reproduction platform available at: https://www.socialsciencereproduction.org/reproductions/8938b287-6681-4a5e-8993-42011a51be58/index

1 Introduction

The COVID-19 pandemic has led to an enormous loss of life over the world and has presented an unprecedented challenge to public health, foreign policy and has additionally had an adverse effect on countries' economies around the world, over the past 5 years (Chriscaden 2020). There have been over 774 million reported confirmed cases of the virus being contract and the outbreak has caused over 7 million deaths, which are claimed to be "under counted" and "under reported", suggesting that the actual number is even higher around 18.2 - 33.5 million based on the excess mortality estimates (Wikipedia 2024). This excessively high number of deaths has alerted the world to assess how countries assumed to be well-prepared to tackle such outbreaks were affected to this extent.

There were a subset of countries, namely India, the United States of America, Brazil, Russia and Mexico which were impacted the most in terms of having the highest cumulative total deaths (Pašović et al. 2021). According to the global data, Russia's COVID-19 related deaths since the start of the pandemic have been over 230,000. Russia also holds the highest mortality rate in Europe and the second-highest rate in Asia (Stronski 2021). For these reasons and more, Russia and its residents have suffered a lot over the past few years, wherein the adverse impact of the outbreak has lead to a plethora of impacts on the country's economy and standard of living.

This paper will follow a reproduction of Jennifer B. Nuzzo and Jorge R. Ledesma's paper (Nuzzo and Ledesma 2023), where they used The Global Health Security (GHS) Index an indicator of how well prepared or "secure" a country is against epidemics or pandemics like the COVID-19 outbreak. We in-turn will use these findings and apply a Russian-facing lens to discuss the impact of the COVID-19 outbreak on Russia and what could have been done better and can be improved for the future in order for the impact of any upcoming pandemics

can be lessened. Our paper aims to replicate their claim of how well-prepared countries did so poorly during the COVID-19 outbreak, where the Nuzzo and Ledesma have concentrated solely on the United States but in this paper we look at Russia with the same regards and analyse the impact of the pandemic on the death toll, and finally provide for ways to improve the laws, regulations and plans to tackle such outbreaks in the future. Our reproduction found out that how ever well prepared Russia seemed to be, it experienced an unprecedented rise in the death rate compared to other countries, and its excess death rate was one of the highest amongst all countries. This leads us to make an important judgement that better planning and regulations can help reduce the impact of such outbreaks in the future, which will be studied in this paper.

This paper is structured using the following sections: Data, Results and Discussion. In the Data (Section 2) section, the data source of the datasets from the paper being replicated (Nuzzo and Ledesma 2023) is discussed and the measurement and data cleaning process is outlined. In the Results (Section 3) section, the paper summarizes the data findings and presents relevant maps and plots in order to study the trends. The paper ends with the Discussion (Section 4) section, where the findings of the paper have been analysed and delved deeper into by studying the measures that can be taken to prevent the country from experiencing such an extensive effect of future pandemics. Additionally, the limitations and a further scope for the paper has been discussed here and concluded in the end.

2 Data

As mentioned above, the data analysed in this paper is from the reproduction package of the paper by Nuzzo and Ledesma (Nuzzo and Ledesma 2023). The data was cleaned and analysed using the open source `R` programming language (R Core Team 2023). R libraries and packages such as `tidyverse` (Wickham et al. 2019), `janitor` (Firke 2023), `ggplot2` (Wickham 2016), `knitr` (Xie 2023), `readr` (Wickham, Hester, and Bryan 2023), `dplyr` (Wickham et al. 2023), `rnaturalearth` (Massicotte and South 2023) and `sf` (Pebesma 2018). Since, we have replicated the process of data cleaning and analysis, the data used in this paper is the same as the data used in the original paper. The estimands for this analysis are preparedness of countries to tackle pandemic, specifically Russia, and their degree of success in controlling the pandemic. To estimate these, we utilize metrics such as the Global Health Security (GHS) Index and the excess death rate respectively.

In the following sections, we will discuss the raw data in (Section 2.1), the data cleaning process in (Section 2.2) and then move on to discussing the measurement in (Section 2.3).

2.1 Raw Data

This paper will replicate the data that was obtained from the replication package of the paper (Nuzzo and Ledesma 2023). Specifically, in the paper we use 3 datasets that will help us analyse

the claim of Russia not being able to control the wave of the COVID-19 pandemic well. In general, there is a lot of data available on the effect of COVID-19 on countries, however, all the data we needed for this paper was included in the paper by Nuzzo and Ledesma.

The first raw dataset includes data on the Global Health Security index for all countries. This dataset has a plethora of data on indices that are not relevant to us for this paper. Additionally, the dataset contains data for years 2019 and 2021. For our analysis, we only require data for the GHS index of countries for 2021.

The second raw dataset includes data on all cause death rates for all countries from 1960-2021. Within this dataset, a plethora of information exists, the majority of which proved extraneous for the purposes of our paper. Specifically, data preceding the year 2010 is deemed unnecessary for our analysis, since we are only focusing on COVID-19 we will use this dataset to study the trend in death rates for countries around the world from 2010-2021.

The third raw dataset originates from the Institute of Health Metrics and Evaluation (IHME) and provides information on COVID death rates, excess deaths, excess death rates, and the ratio of excess death rates to COVID death rates for all countries worldwide. Similar to the previous datasets, this dataset also contains extraneous information that is irrelevant to our study. However, we addressed this issue through the data cleaning process outlined in Section Section 2.2.

In the next section (Section 2.2), we will outline the data-cleaning process and also show the structure of the cleaned data.

2.2 Cleaned Data

As stated above in Section 2.1, we start with the first dataset on GHS indices for all countries in the world. Table 1 shows the first 6 countries and their GHS indices. Here we only have 2 variables, namely the Country Name and the respective GHS index. We cleaned this dataset by selecting only the two columns for the respective variables and filtering the data for the year of 2021.

Table 1: Cleaned Data showing GHS indices for first 6 countries

Country Name	GHS Index
Afghanistan	28.8
Albania	45.0
Algeria	26.2
Andorra	34.7
Angola	29.1
Antigua and Barbuda	30.0

Second, we have a raw dataset on all cause death rates for all countries from 1960-2021. We cleaned this dataset by selecting a subset of countries that helped us analyse how Russia fared against other countries in death ratesover the years. Table 2 shows the structure of the cleaned data after we filtered it for the time period of 2010-2021 for India, South Korea, Russia and the United States.

Table 2: Cleaned Data showing all cause death rates for 4 countries

Country Name	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
India	7.385	7.267	7.118	6.960	6.790	6.67	6.603	6.593	6.644	6.71	7.35	9.448
South Korea	5.100	5.100	5.300	5.300	5.300	5.40	5.500	5.600	5.800	5.70	5.90	6.200
Russia	14.200	13.500	13.300	13.000	13.100	13.00	12.900	12.400	12.500	12.30	14.60	16.700
United States	7.995	8.073	8.102	8.215	8.237	8.44	8.493	8.638	8.678	8.70	10.30	10.400

The final raw dataset, as mentioned in Section 2.1, that we have is the IHME data on the COVID death rate, excess deaths, excess death rate and ratio of excess death rate over COVID death rate for all countries in the world. In this paper we only needed the two variables excess death rate and the country name, however for better analysis of Russia's ability to control the pandemic's effect, we combined this data with the respective GHS index as shown in Table 3. Hence, there are three variables, the country name, and the respective excess death rate and GHS index.

Table 3: Cleaned Data showing Excess Death Rate and GHS index for first 6 chosen countries

Country Name	Excess Death Rate	GHS Index
Australia	-37.6	71.1
Austria	107.5	56.9
Brazil	186.9	51.2
Canada	60.5	69.8
Denmark	94.1	64.4
France	124.2	61.9

Now that we have cleaned our raw datasets and have generated clean tables for analysis, we will go on to the Results Section (Section 3) and delve deeper into studying the effect of the COVID-19 pandemic on Russia and if it was impacted significantly more than other countries.

2.3 Measurement

With respect to measurement and accounting for the GHS index, it encompasses various measurements grouped into six broad categories: (1) prevention, (2) detection and reporting, (3) rapid response, (4) health system, (5) compliance with international norms, and (6) risk environment. These values are calculated based on the data available for each country which are self-reported and are then used to calculate the overall GHS index (Impact 2021).

A crucial data point for the COVID-19 pandemic is the excess death rate, representing the number of deaths occurring within a specific period above the expected baseline. The process of collecting this data is primarily overseen by Institute for Health Metrics and Evaluation (IHME), which collates information from various sources available for each country. Deaths included in the excess death rate calculation consists of those directly attributed to COVID-19, or in which COVID-19 appeared on the death certificates. For instance, deaths resulting from delayed treatment due to healthcare system strain caused by the pandemic are also accounted for.

Observation of deaths involves various mechanisms. Initially, healthcare facilities and authorities report COVID-19-related deaths through diagnostic tests and medical records. Deaths with an underlying cause of death of COVID-19 are not included in these estimates. For example, in some cases, COVID-19 may have contributed to the death, but the underlying cause of death was another cause, such as terminal cancer. Additionally, mortality statistics are compiled from death certificates and official registries. Tallying these deaths are then put into the Government's official records.

However, discussions surrounding COVID-19 present several challenges, including: (1) issues related to underreported or missing data, which can occur due to societal stigma at the local level, or countries intentionally concealing data to portray preparedness; (2) the absence of a universally accepted definition for COVID-19 deaths, leading to potential measurement inaccuracies; (3) the vast geographical expanse of countries, posing logistical hurdles in data collection and reporting efforts; and (4) disparities in testing methodologies and resource availability across regions, further complicating data interpretation.

Many countries, particularly nations such as India, Brazil, and Russia, which had the highest death count, faced the aforementioned challenges. This presents a significant obstacle in accurately gauging the pandemic's toll within a country. For instance, the excess death rate, a key metric in our analysis, serves to estimate the pandemic's impact. However, due to data truncation and measurement errors, the actual death rate may not always be precisely captured. Consequently, inaccuracies arise in calculating the excess death rate, introducing measurement errors that undermine the reliability of both the actual death rate and the excess death rate in data analysis.

3 Results

The results section is divided into four parts where all together we aim to look at Russia's capability according to the GHS index to tackle pandemics (Section 3.1), then compare Russia's death rates trends with those of other countries like India, South Korea and the United states (Section 3.2), then using those trends we dive into Russia's excess death rates while comparing them with other countries (Section 3.3) and finally study the relationship between the excess death rate and GHS index for Russia along with a subset of countries in the world (Section 3.4).

3.1 Global Distribution of Global Health Security Index (GHS) in 2021

As explained in Section 2.1, the GHS index is an indicator of how well prepared a country is to tackle epidemics or pandemics like the COVID-19 outbreak. The GHS index gives one an idea of how the sound health care system as well as the rules and regulations of a certain country are in the context of facing pandemics. Generally, the higher the GHS index of a country, the more well-prepared and secure they are. Figure 1 shows a representation of the world map with countries shaded on the basis of their GHS indices. This map is a replication of figure 1 in Nuzzo and Ledesma paper (Nuzzo and Ledesma 2023) that is being replicated in this report.

We can observe here that there are countries like the United States and Australia whose GHS indices are one of the highest, implying that they were deemed extremely well prepared for epidemics. Then we see countries like Russia and China who were, although moderately when compared to the aforementioned countries, but still well prepared to tackle pandemics. Finally, we see countries such as Venezuela and Yemen which were said to be the least secure of all.

Figure 1 provides this report with a background on how secure Russia was in tackling epidemics and pandemics, which as seen in the map, it was in a good position to face such outbreaks where numerous countries were deemed less prepared than Russia. This will aid us in drawing meaningful analyses throughout the paper, specifically in Section 3.2, sec-results-death-rates and Section 4.

3.2 Trend in Death Rates for Russia, India, South Korea and United States

Now we move on to analyzing the trends in the all cause death rates per 1000 population over 2010-2021, which includes COVID deaths as well as general deaths which were not caused by the outbreak, and the trend in the excess death rates per 100 population in 2020 and 2021. The excess death rates in this section were calculated by finding a difference between the expected death rate and the actual death rate for that year.

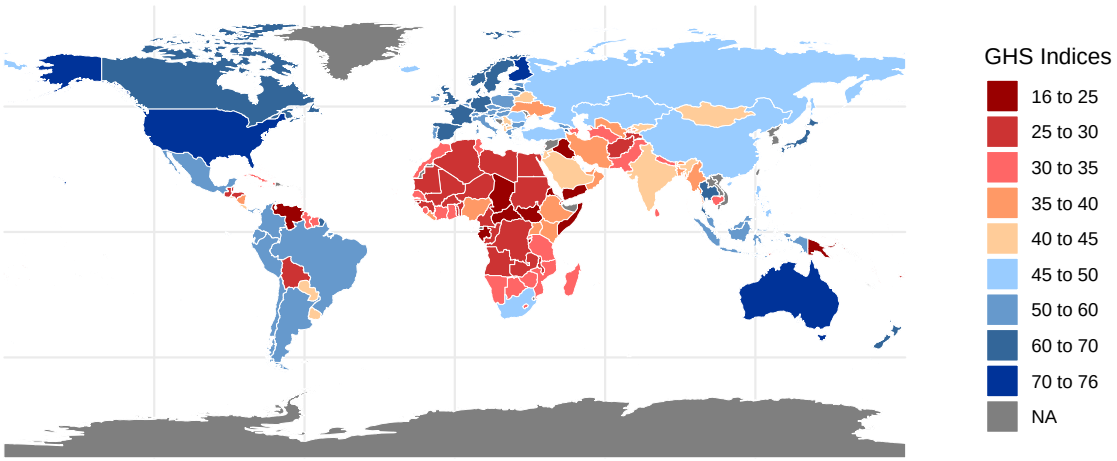

Figure 1: Global Distribution of Global Health Security (GHS) Index Scores in 2021

Figure 2 shows us the trend for the all cause death rates per 1000 population over 2010-2021 for India, South Korea, Russia and the United States using the data presented in Table 2. We observe here that from the years 2010-2019, there is a general gradually decreasing trend in the death rates in the case of Russia and India, and a gradually increasing trend in the death rates in the case of South Korea and the United States. The dashed line represents the line of best fit for the trend from 2010-2019.

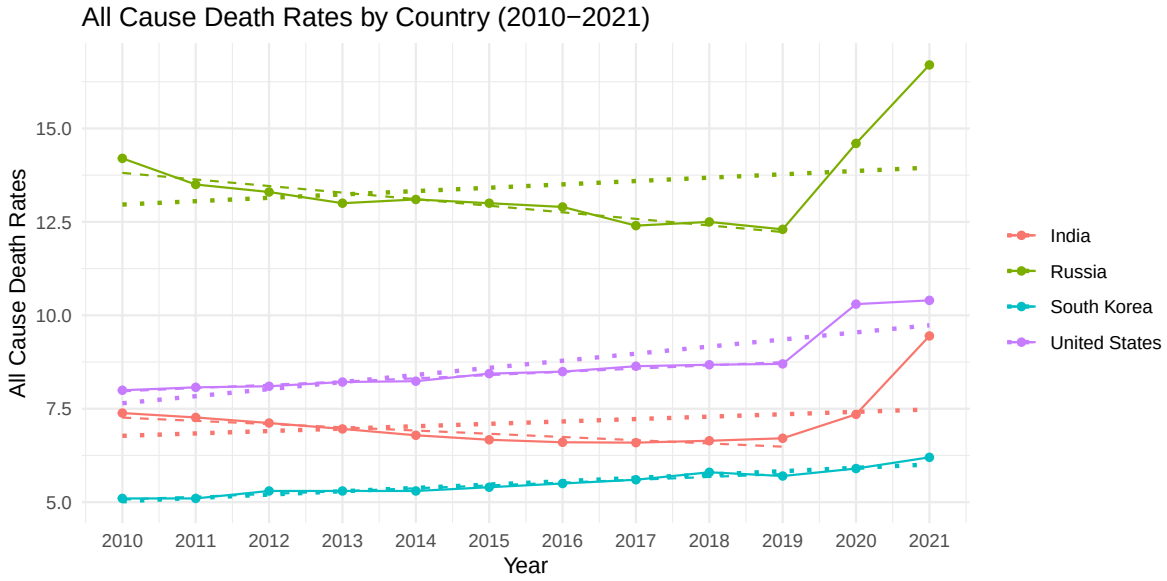

Figure 2: All Cause Death Rates per 1000 Population for India, South Korea, Russia and United States (2010-2021)

We see here in Figure 2 that there is a sudden increase in the death rate in 2020 and 2021, and the increase in Russia's death rate is much higher than that of the other countries. The essential point to note here is that in the case of India, which has a GHS index lower than that of Russia, the rising trend observed in 2020 and 2021 was still not as excessive as in the case of Russia. The dotted line represents the line of best fit for the trend from 2010-2021. As we go from comparing Russia to South Korea, we see that in the case of South Korea, both the dashed (2010-2019) and the dotted (2010-2021) are very close together implying that the country did not experience an unanticipated number of deaths during COVID. However, in the case of Russia, we see the two lines diverging implying that there were unforeseen deaths during that period.

3.3 Excess Death Rates

This observation leads us to Figure 3, where we present the excess death rate for the four countries for 2020 and 2021. As mentioned above, the excess death rates were calculated by

extrapolating the dashed line of best-fit from years 2010-2019 in Figure 2 representing the trend in all cause death rates to 2020 and 2021. This way we were able to find the expected death rate for each of the four countries and subsequently we were able to plot the difference between the expected death rate and the actual death rate called the excess death rate for 2020 and 2021 for all four countries in Figure 3.

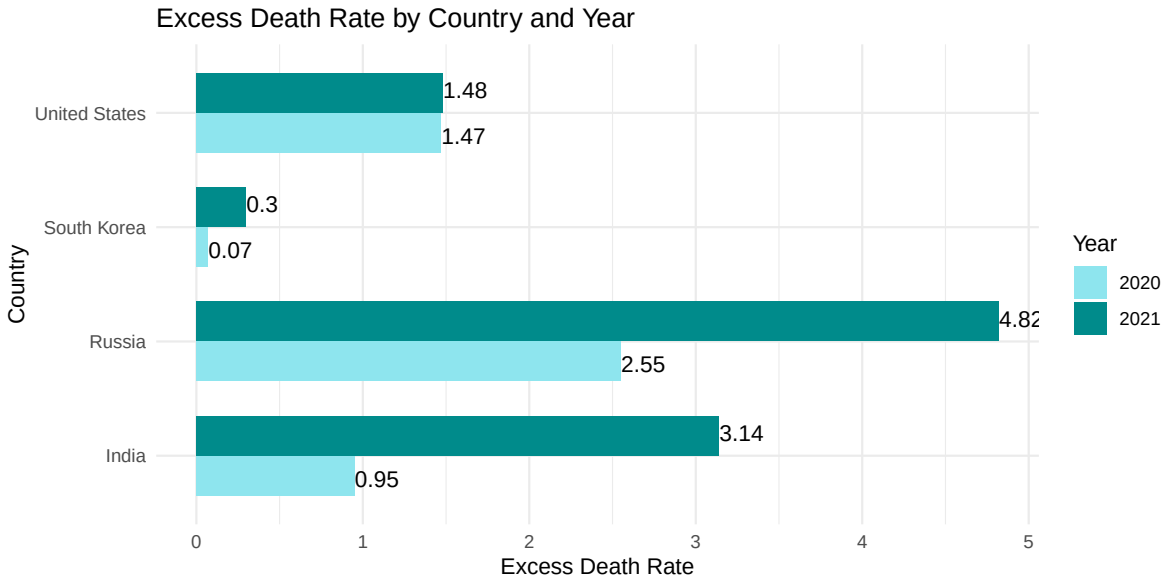

Figure 3: Excess Death Rates per 1000 Population for India, South Korea, Russia and United States, 2020 and 2021

We see in Figure 3 the massive difference between the excess death rates for Russia and the other countries. Comparing Russia to South Korea we see that, as seen in Figure 2, South Korea was very faintly affected by the COVID-19 pandemic, however Russia saw a sudden rise in deaths from 2019 to 2021. This shows us that the observations here are analogous to the plot in Figure 2. When we compare Russia with India, which as aforementioned was deemed a less secure country in the case of epidemics, we see that the excess death rates for Russia in both 2020 and 2021 are much higher than those for India. This observation will further aid us in making meaningful discussions in Section 4.

3.4 Relationship between the Excess Death Rate and Global Health Security Index (GHS)

Finally, we will now explore the relationship between the excess death rate seen above and the GHS index for a subset of countries per 100,000 population. Figure 4 shows us a subset of countries scattered around the plot according to their excess death rate and the GHS index shown in the Appendix Table 4. The green line shows the general decreasing trend which

implies that as the GHS index increases, the excess death rate tends to decrease, i.e. the excess death rate for more "secure" or well-prepared countries is generally lower.

Russia, labelled in red, is seen to be significantly higher than the line of best fit, which implies that Russia's excess death rate was much worse than it should have been. We observe that countries like Brazil and Indonesia, which have approximately the same GHS index as Russia, are nearer to the line of best fit than Russia. India, although having a lower GHS index than Russia is seen to have a much lower than general excess death rate.

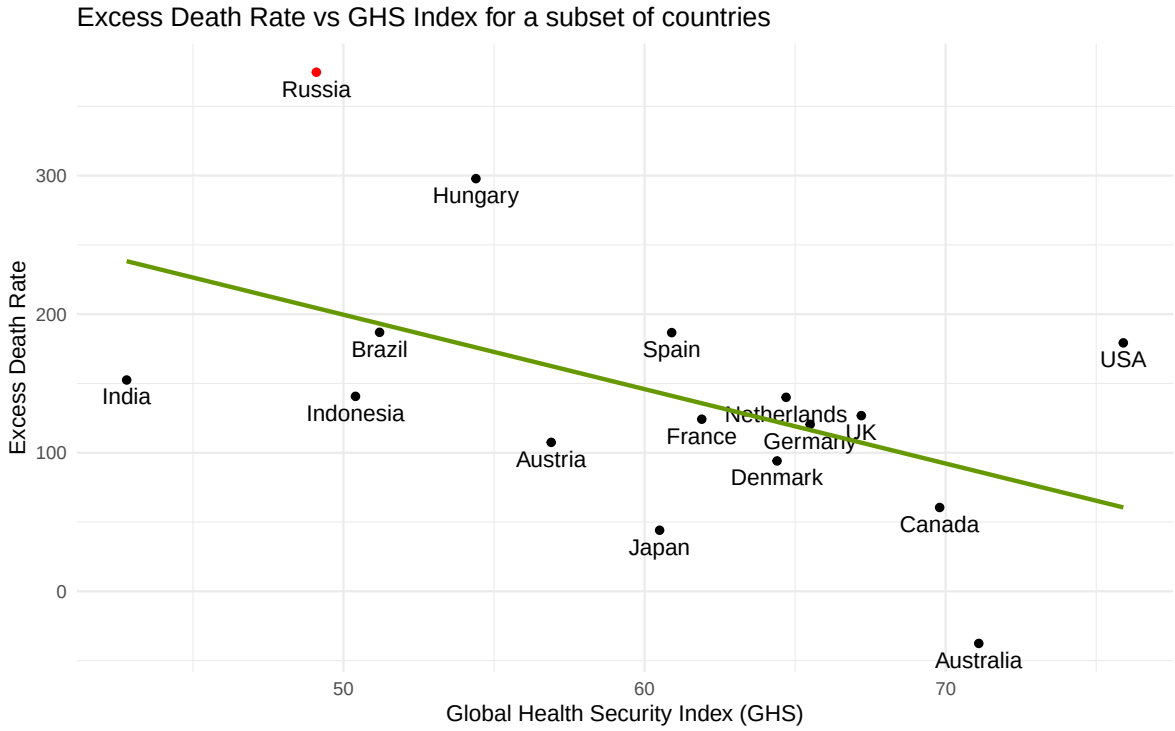

Figure 4: Relationship between the Excess Death Rate and the Global Health Security Index (GHS) per 100,000 Population for a subset of countries, 2020-2021

The implications from this figure will be further studied in Section 4.

4 Discussion

4.1 Findings: Russia, Excess Deaths and what went wrong during the COVID-19 pandemic

In this paper, we have replicated the paper by Nuzzo and Ledesma (Nuzzo and Ledesma 2023), where they focused their analysis on the United States and studying how the world's

best prepared country still couldn't control the pandemic. Our paper has instead shifted the focus to another global power and fairly well prepared country Russia, where we found out that Russia, when compared to a subset of other countries:(1) had one of the highest increase in all cause death rate in 2020, and (2) had one of the highest excess death rate caused by the pandemic in 2020 and 2021, as observed in Figure 2 and Figure 3. Our paper also found and observed the relationship between the GHS index of a country and its excess death rate in Figure 4, where Russia was seen as an outlier, where it lied a lot higher than the line of best fit implying a higher excess death rate than the other countries around it, even with a similar GHS index.

The main question that this paper tackles is, what exactly did Russia do wrong during the pandemic considering it was the first country to roll out a vaccine? According to a report by Carnegie Endowment for International Peace, by late October 2021, only one-third of the Russian Population had been fully vaccinated against the virus, where other countries like Argentina and China had 56% and 76% of their populations respectively, fully vaccinated by then (Stronski 2021). According to reports, one of the main concerns for people being skeptical about the Sputnik V vaccine was that they did not trust that the vaccine would be effective or even safe to use. Another reason for the residents of Russia being skeptical was that Russian President Putin hesitated for months after the release of the vaccine to himself get vaccinated (Stronski 2021). I believe that this must have slowed down the rate at which people in Russia were getting vaccinated hence leading to unprecedented deaths as a result.

Another possible reason for Russia not being able to tackle the pandemic well was that the quarantine measures during the outbreak in 2020 and 2021 were generally very sporadic and short (Yaffa 2021). It was reported that at a time when the cases testing positive reached nearly ten thousand a day, the government put lockdown restrictions but that too only for a week, before everything opened back up. I believe this would have been a huge contributing factor to the extremely high excess deaths as more people would have contracted the virus coming in contact with each, hence spreading it more. Additionally, keeping in mind that at this time, as aforementioned, Russia only had approximately one thirds of its population vaccinated, this would have hit the residents of the country really hard.

In Section 4.2, we will discuss the measures that Russia could have taken to tackle the pandemic in a better way, and also measures that can be taken for future pandemics.

4.2 Russia and Improvements for the future

I believe that, as fast as Russia was at releasing the vaccine, maybe the government could have focused on mass producing and advertising the vaccine as a necessity as well. I believe that as soon as there is any skepticism in regards with vaccines, people will choose not to get one. As mentioned above, this will lead to the virus spreading even faster and eventually to more deaths too. In order to prevent this, the government should show the residents of the country that the vaccine is trustworthy and effective. It is essential to note that in order for this to

work, the vaccine's efficacy and safety will also have to be proven to prevent from any ethical implications rising.

It was claimed that at the beginning of the outbreak, Russia was trying to downplay the threat of virus, however, with time they realized how lethal it actually was (Stronski 2021). According to me, it is very essential for a country to recognize the potential threat from any epidemic or outbreak and then make laws, and rules and regulations around it to quickly contain the situation before it gets worse. For countries as large as Russia, it might be a particularly challenging task to get such a large population that is spread out under control, but if the right procedures are set in place to tackle such situations, it can be manageable. Additionally, it is essential in these situations to also have firm rules in place for quarantining and lockdowns to prevent the virus from spreading. This is especially even more important in the early stages of the outbreak when there is no vaccine in place to prevent the citizens of a country from contracting the virus. Some countries during the COVID-19 pandemic were very strict with their restrictions and lockdowns, and hence experienced way lesser deaths when compared to other countries which were more relaxed. In the future too, for Russia to be able to control the situation early on, better and more strict regulations will be required.

4.3 Accounting for Bias and Ethical Implications

It is essential to take into account an unintended but highly likely bias that might have taken place in this paper. While working on the paper, we realized that in creating Figure 2, Figure 3 and Figure 4, selection bias might have been involved in make decisions on which countries to plot on the graphs. Specifically, we used 4 countries in Figure 2 and Figure 3 to show the unique trends for Russia during the pandemic. Maybe if we chose a set of different countries, some countries would have performed more like Russia and consequently would have impacted our analysis. Similarly, in Figure 4 choosing a different subset of countries might generate a completely different line of best fit which might not have satisfied our exploration in the paper. However, at the same time, it is essential to note that the set of countries chosen in this paper has mostly been random and some countries like India and the United States have been shown constantly to create parallels between the impact of the pandemic on both the countries.

It should be noted that different countries employ varying methods of reporting their data, including mortality rates and excess death rates. Therefore, this study primarily relied on observational data, but it's crucial to account for differential biases in the data. For instance, some countries might underreport their deaths, while others might overreport them. Such discrepancies directly impact the analysis conducted in this paper.

Furthermore, COVID-19 policies were predominantly implemented at the state and local levels, introducing variability throughout the pandemic. Differences in policy implementation among these communities, coupled with the presence of unmeasured differences, complicate the ability to draw causal inferences.

There are a few ethical implications that we found while working on the paper. Mainly, sometimes the data can be incomplete or hidden which is misleading while analyzing that data. It is essential to keep that into account when looking at a report as, if for in this case any data for the deaths were incomplete, that would directly impact how we deem Russia to have tackled the pandemic. This is not just applicable for Russian data, but if other countries' data was missing, it would alter a major part of the analysis done above.

4.4 Weaknesses and Further Scope

While working on the paper we came across a few weaknesses that can be built on to make the report even more sound. Firstly, we could have tried to take into account the selection bias by choosing the countries except Russia randomly. It is obviously impractical to include all 195 countries in all plots, hence choosing a completely random subset of countries could have reduced the selection bias. However, it is also essential to note that it is preferable to compare Russia with countries with the same infrastructure and stature in the world, as that makes the comparisons more sound. Comparing Russian data with random countries might have led to this paper being less informative and less analytical. Then, another weakness was that while making Figure 1 it was observed that the raw data file did not actually contain the GHS indices for all the countries around the world, for example, specifically Greenland was excluded from the dataset, which was the reason why some of the countries in the figure are shaded in grey showing that data was not available for them. If all the data was present for the figure, the analysis could have been even more sound.

As a further scope, an extension to this report could include taking into account the proportion of population vaccinated for a country in 2021. Taking this factor into account, we would be able to clearly point out one of the prominent reasons why Russia might have lacked in their attempt to tackle the pandemic. Alternatively, we can flip the question for this paper around and delve deeper into the countries with the lowest GHS indices which surprisingly did better than expected. This would help us analyze the paper in positive notion, taking into account all the right things they did that led to them tackling the outbreak better than many well-prepared countries.

In conclusion, we have observed that over 2020 and 2021, Russia failed to properly control the spread of the pandemic, and also effectively get its population vaccinated, which consequently lead to a large number of positive cases and deaths around the country. For future epidemics and outbreaks, Russia needs to make strict regulations and procedures which will help them contain the virus and not let it spread in the country and cause enormous amount of deaths.

Appendix

A Additional data details

Table 4: Cleaned Data showing Excess Death Rate and GHS index for a subset of countries

Country Name	Excess Death Rate	GHS Index
Australia	-37.6	71.1
Austria	107.5	56.9
Brazil	186.9	51.2
Canada	60.5	69.8
Denmark	94.1	64.4
France	124.2	61.9
Germany	120.5	65.5
Hungary	297.8	54.4
India	152.5	42.8
Indonesia	140.7	50.4
Japan	44.1	60.5
Netherlands	140.0	64.7
Russia	374.6	49.1
Spain	186.7	60.9
UK	126.8	67.2
USA	179.3	75.9

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