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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GHS Index

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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.

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

Country Name	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
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

When discussing COVID-19, (1) issues with underreported or missing data, particularly related to non-responses, are prevalent, (2) the lack of a standardized definition of COVID-19 deaths, which can lead to measurement errors (3) vastness of countries poses logistical challenges in reporting and conducting surveys, making it difficult to gather comprehensive data (4) variations in testing methodologies and availability of resources across regions can further distort the data.

Many countries, especially developing nations like India, Brazil, and Russia, poses above issue. This poses a significant challenge in accurately measuring the pandemic's impact on a country.

For example, the excess death rate, a variable in our analysis, measures the number of deaths occurring in a specific period above the expected number. This metric helps estimate the pandemic's impact. However, due to data truncation, the actual death rate isn't always precise, leading to inaccuracies in calculating the excess death rate. This introduces measurement errors, undermining the accuracy of both the actual death rate and the excess death rate.

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. However, various measurement errors and qualitative biases can arise from the subjective nature of these categories. For example, the "prevention" category includes measurements such as "vaccination coverage" and "biosecurity and biosafety." However, the definition of "biosecurity and biosafety" can vary across countries, leading to measurement errors. Additionally, the GHS index is based on self-reported data, which can be subject to biases and inaccuracies. This can lead to measurement errors in the GHS index, which can further distort the analysis.

3 Results

This section will be divided into three parts where all together we aim to look at Russia's capabilty according to the GHS index to tackle pandemics (Section 3.1), then compare Russia's trend in all cause death rates and excess death rates with those of other countries like India, South Korea and the United states (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 3.3).

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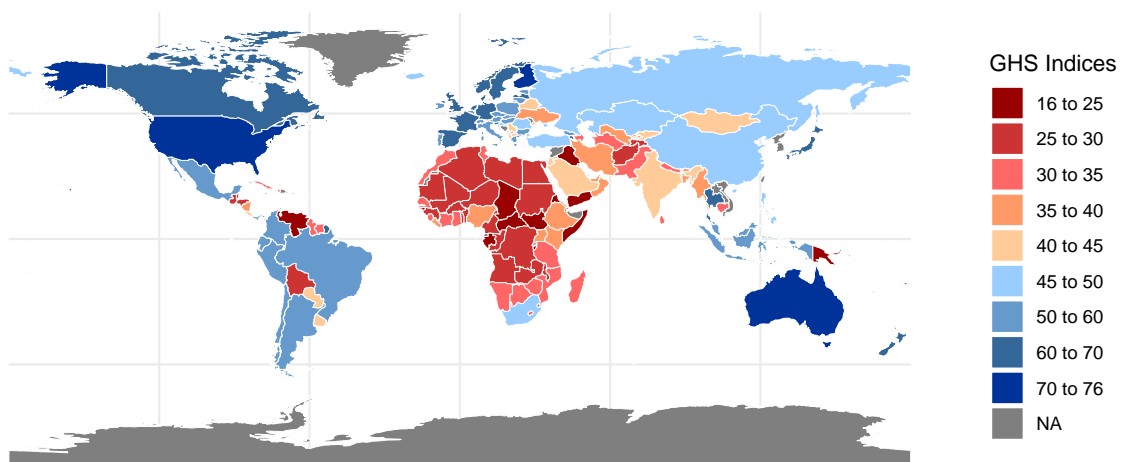
Figure 1: Global Distribution of Global Health Security (GHS) Index Scores in 2021

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 3.3, 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 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.
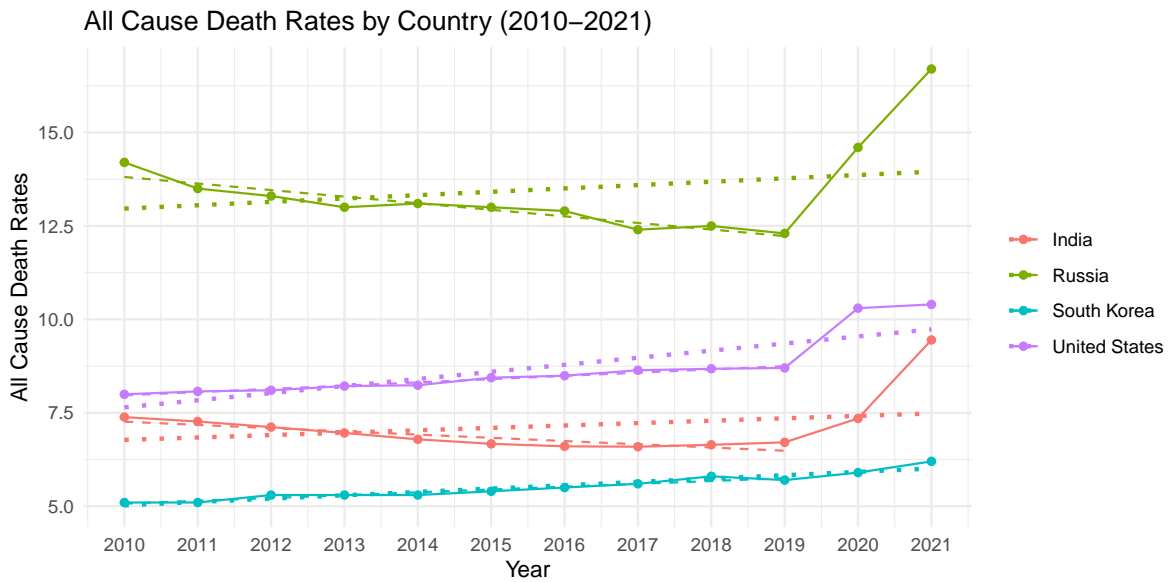

Figure 2: All Cause Death Rates per 1000 Population for India, South Korea, Russia and United States (2010-2021)

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.

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.
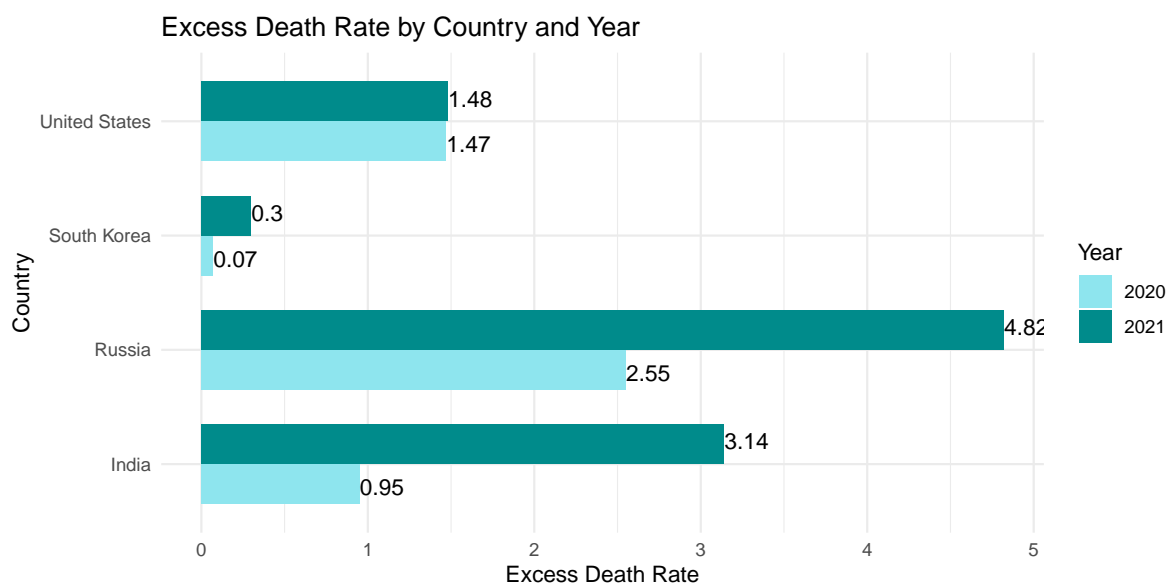

Figure 3: Excess Death Rates per 1000 Population for India, South Korea, Russia and United States, 2020 and 2021

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.

3.3 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.
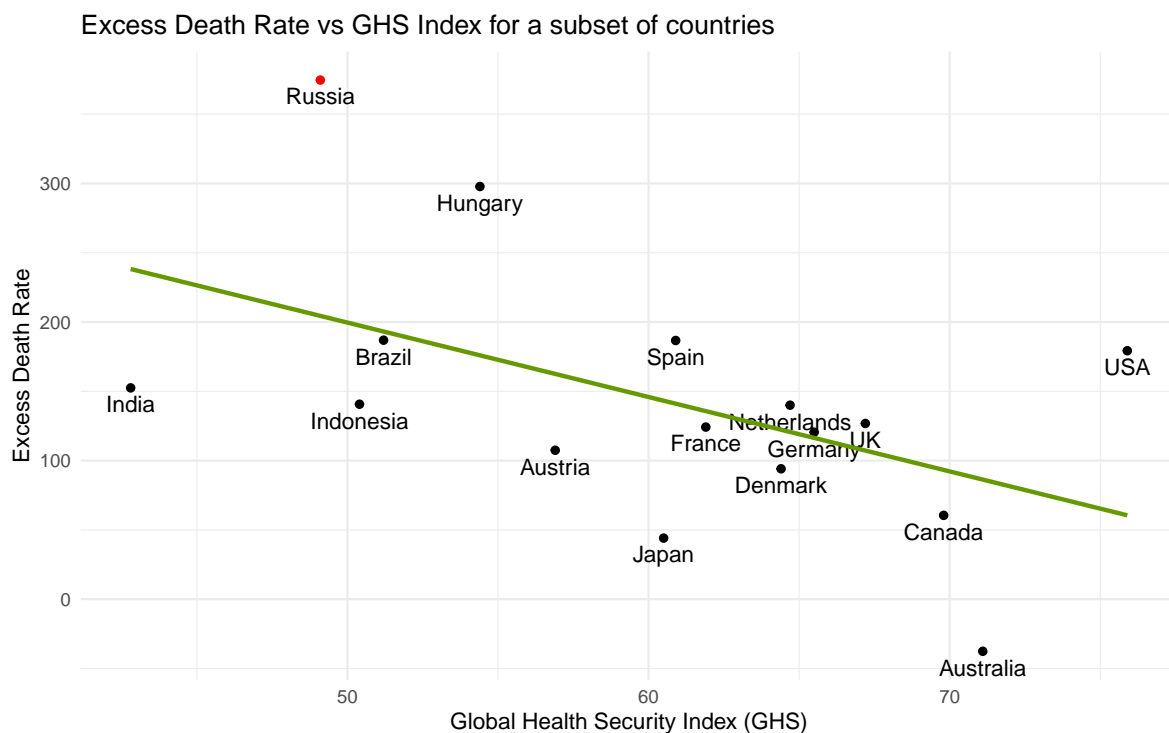

Figure 4: Relationship between the Excess Death Rate and the Global Health Security Index (GHS) per 100,000 Population for a subset of countries, 2020-2021

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

4 Discussion

4.1 First discussion point

If my paper were 10 pages, then should be be at least 2.5 pages. The discussion is a chance to show off what you know and what you learnt from all this.

4.2 Second discussion point

4.3 Third discussion point

4.4 Weaknesses and Further Scope

Weaknesses and next steps should also be included.

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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