Covid-19 Trends

A study of the virus's affect across countries and time

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Executive Summary

The goal of this report was to identify the key trends and changes of the COVID-19 pandemic. By gathering daily information from a variety of countries, we were able to investigate how the pandemic changed over longer periods of time. Our first discovery was that in January 2023, both the USA and UK had similar slowly decreasing rates of daily confirmed cases. However, the number of daily deaths in the UK dropped much more significantly than in the USA. Secondly, Mainland China saw consistent growth of the number of confirmed until February 13th 2020, when there was a massive spike. Moreover, during the month of January in the UK we can see a stark contrast with the confirmed cases of covid per annum where in 2022 the apex of infections was at a high of around 200,000 whereas, in 2023 it drops to the thousands. Finally, we saw there were notably more deaths in a winter month versus the number of deaths in a summer month.

1. Introduction

This report delves into the trends observed with data concerning confirmed cases, deaths, and recoveries of COVID-19. Data was obtained daily (now weekly) from several locations across the globe. This report specifically looks at:
- UK and USA during January 2023 (Section 2)
- Mainland China between 22nd Jan and 1st March 2020 (Section 3)
- UK in January of each year during the data collection (Section 4)
- Netherlands: comparing summer and winter seasons of 2021 (Section 5)

COVID-19 is an easily transmitted virus that attacks the immune system. The virus was first detected in Wuhan, China in 2019, before spreading globally and resulting in a pandemic during 2020. Common symptoms include fever, coughing and shortness of breath.

The data from this report was sourced from: COVID-19 Data Repository by the Center for Systems Science and Engineering (CSSE) at Johns Hopkins University. The python code that generated the graphs seen in this report can be found at https://github.com/JEO8-1/DS-Practice-Projects.
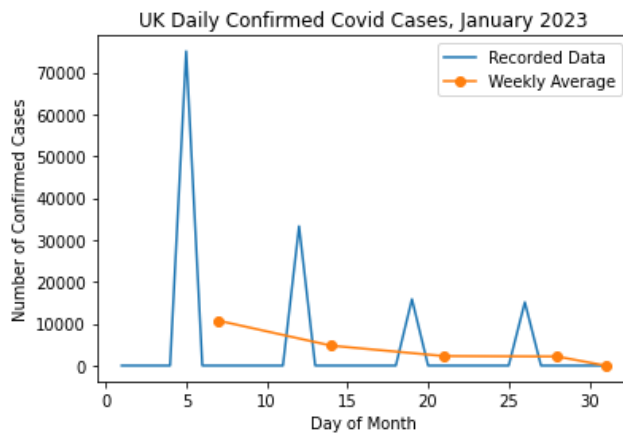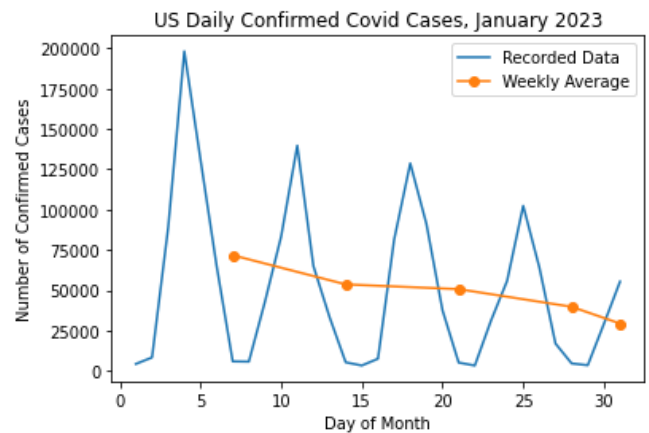
2. UK and USA During January 2023

In this section, we examine the different trends in daily number of deaths and confirmed cases between the United States and the United Kingdom. The number of recovered cases had stopped being recorded at this point (Appendix 1A), so no data was available for analysis. Table 2.1 shows the summary statistics for the average daily values, both in terms of total values and per million people. The table shows that deaths per million people were similar, however, the US had more than double the number of daily cases.

Table 2.1 Summary Statistics of UK and US, January 2023

Country	Average Daily Deaths	Average Daily Confirmed Cases	Deaths / 1 million people	Confirmed / 1 million people
UK	96	4,493	1.42	66.36
US	514	51,533	1.54	154.2

Figures 2.1 and 2.2 show the difference in number of confirmed cases over the month of January. The sawtooth shape of these graphs is due to the fact that at this stage in the pandemic, countries had stopped updating their data on a daily basis (Appendix 1B). This caused once per week spikes as a large number of cases were updated at once. For that reason, the weekly average is plotted to give a better understanding of the trend over time. This weekly average was simply the average of the previous seven days, and was computed once a week. The graphs show a similar downwards trend for both the UK and the US.

Figure 2.1

UK Daily Confirmed Covid Cases, January 2023

Figure 2.2

US Daily Confirmed Covid Cases, January 2023

Figures 2.3 and 2.4 show the daily number of deaths over the month of January. The US data had a similar issue as figures 2.1 and 2.2, but the UK data did not suffer from these large spikes. As seen in figure 2.3, the number of daily deaths in the UK was in steep decline over the month of January. The US was not similar to this trend, and daily deaths per week remained fairly constant with a small decline in the latter part of the month.

Figure 2.3

UK Daily Covid Deaths, January 2023

Figure 2.4

US Daily Covid Deaths, January 2023
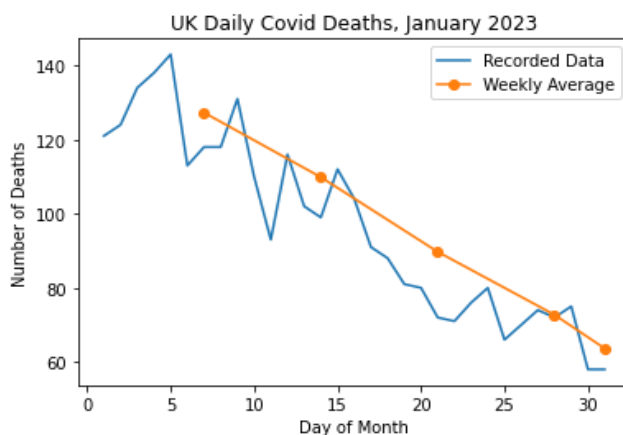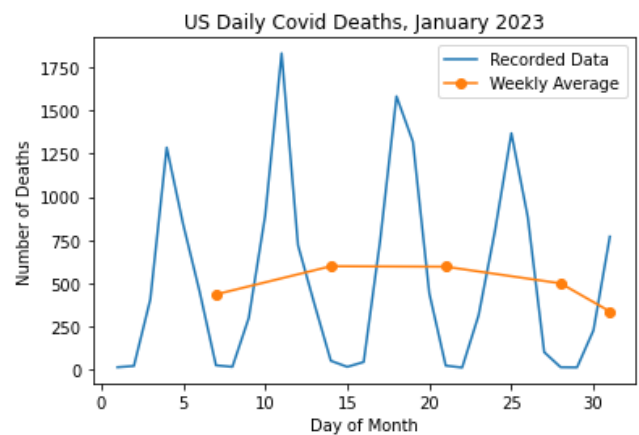
3. Mainland China In The Beginning of The Pandemic

In this section, we look at the trend in confirmed cases, deaths, and recoveries for Mainland China, specifically towards the very start of the pandemic. The graph at figure 3.1 shows the development of COVID-19 in Mainland China between 22nd January 2020 and 1st March 2020.

Confirmed cases grew at a gradual rate, up until the 13th of February, where there was a spike. The confirmed cases in Mainland China grew by almost one hundred and fifty percent within 24 hours, and over one hundred times the cases since the start of the period. The number of deaths shows minor change during this period. There is a slight increase in the number of deaths overall. This

suggests that more people were able to recover from the virus than to die from it. Although the number of recoveries was more than the number of deaths, the recovered cases remained low until about halfway through the period, where there is also a gradual increase in numbers, similar to the increase made for confirmed cases towards the start of the period. The spike in confirmed cases has an impact on the number of recoveries and deaths, as this is the point in the period where the numbers are notably increasing.
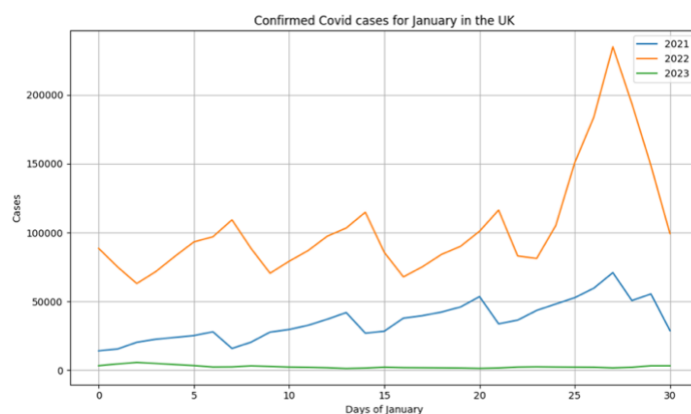
Figure 3.1
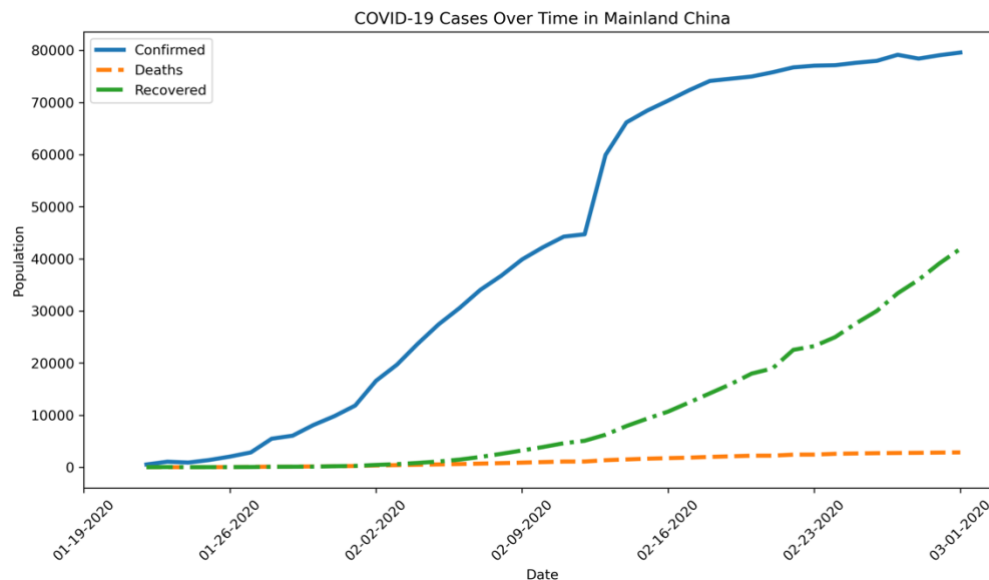
4. UK Across The Years

In this section, we delve into the UK as an individual and look at the relationship per Annum between the confirmed cases, deaths as well as the recoveries of Covid-19 for the month of January.

Figure 4.1

As we can infer from the data presented in the graph above there is a stark contrast between each year with the number of confirmed covid cases, where we can see that 2022 had the most cases in January, even more than the other two years combined.

We can further deduce that there has been a surge of infections from the start of 2021, and this could be due to Lockdown sanctions being eased and children were advised to

return to school after the winter break while in 2022 restrictions weren't as heavily imposed and figures show that one in every 15 people had covid around New Year's Eve.

Despite this, it is clear to see that there are similarities which echo throughout each year for example, the apex of each year occurs around the same time so from this we can infer that around this period many people decide to go out or get together causing a rise in covid.

After each year we can see that covid starts to dwindle within the population such as from 2021-2022 there is a massive drop in cases and then again in 2023 so this could suggest that the reinfection rates have gotten lower, and more people are becoming immune.

Moreover, data shows that once the omicron variant came into effect around the end of 2021 and start of 2022, vaccines had a less significant effect on this new variant rather than delta so we can astute this to a growth of reinfections. For example, Analysis shows that protection against symptomatic disease 2 to 4 weeks after a booster dose ranges from around 65% to 75%, dropping to 55% to 65% at 5 to 9 weeks – and 45% to 50% 10 weeks or more following the booster dose COVID-19 variants identified in the UK – latest updates - GOV.UK (www.gov.uk)

Figure 4.2

Covid deaths for January in the UK
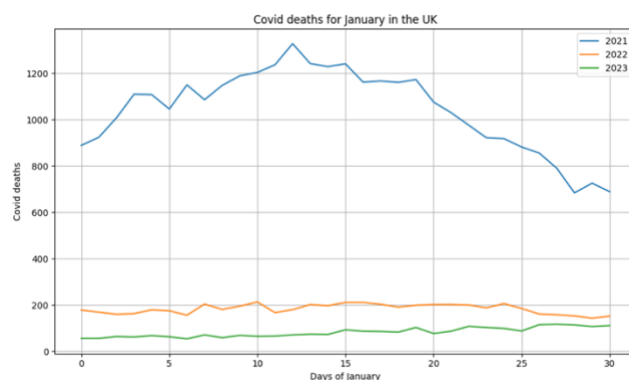
From 4.2 the number of deaths vary each year, but we can see that in 2021 there was a deplorable number of deaths compared to the two other years which makes sense considering the introduction of vaccines just the month before which many didn't trust. Furthermore, towards the end of 2020 there was an outbreak of the Alpha variant. During the years 2022 and 2023 we can infer that most of the population have become immune due to the improvements in vaccines and the reinfection rates being kept low.

Finally, we can see that per year there is a decreasing trend in the number of deaths which we can attribute to immunity over time, better public health safety measures such as social distancing, and an overall better understanding of the virus.

# 5. Comparative Analysis of Covid-19 Trends in the Netherlands (2021)

In this section, Netherlands was the country of choice. Here we compare the trends in deaths, confirmed cases and recoveries of Covid-19 across January 2021, July 2021, and the seasonal changes in 2021.

Plots 5.1, and 5.2 are the January 2021 plots for deaths and confirmed cases respectively. While as plots 5.3 and 5.4 show the same values for July 2021. The recovery data for the Netherlands was not recorded (Appendix 1A).

For plot 5.1, the deaths increase proportionally over time with about 3000 across January, whereas in plot 5.3 the deaths had a gradual increase near 100.
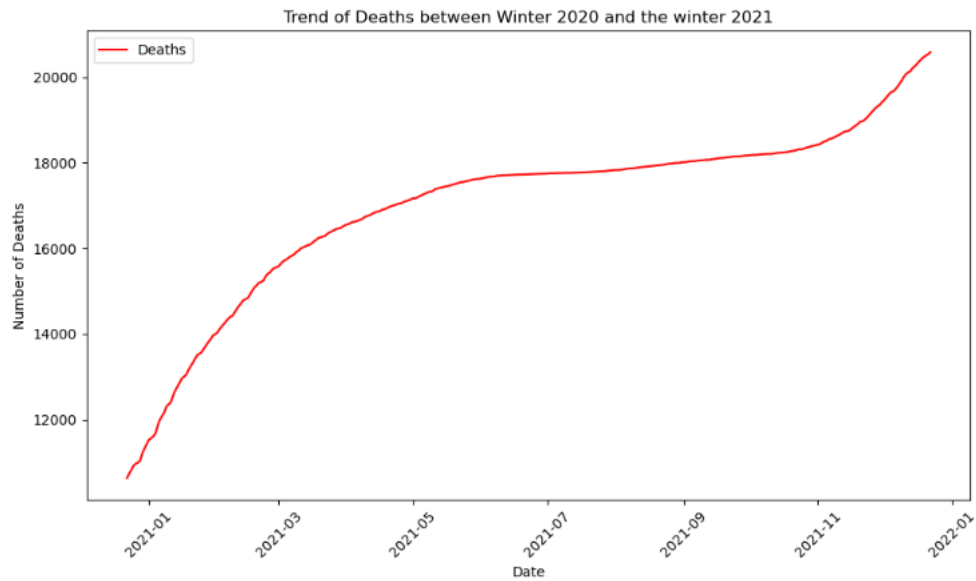
Plot 5.1

January 2021 Trend in Deaths

Plot 5.3

July 2021 Trend in Deaths
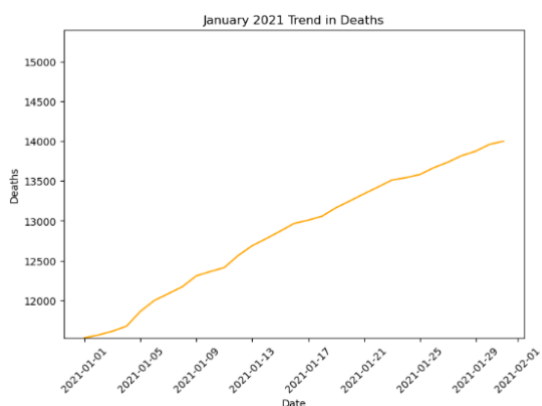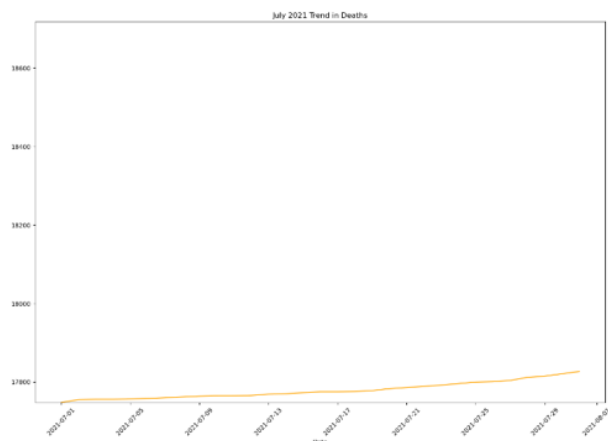
In Plot 5.2, the confirmed cases increase proportionally in January, however in plot 5.4 the confirmed cases have a slow increase in cases between the 1st and 5th of July. then increase rapidly then it begins to level out after the 21st of July. This suggests there may have been a difference in the testing strategies, or the transmission rates during the winter and summer months.

Plot 5.2

January 2021 Trend in Confirmed Cases

Plot 5.4

July 2021 Trend in Confirmed Cases
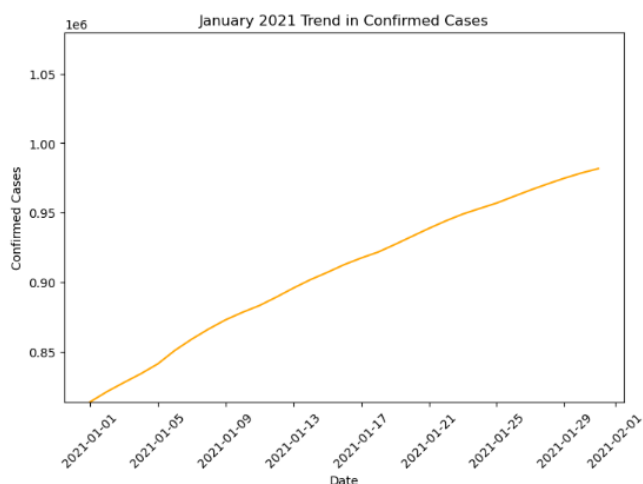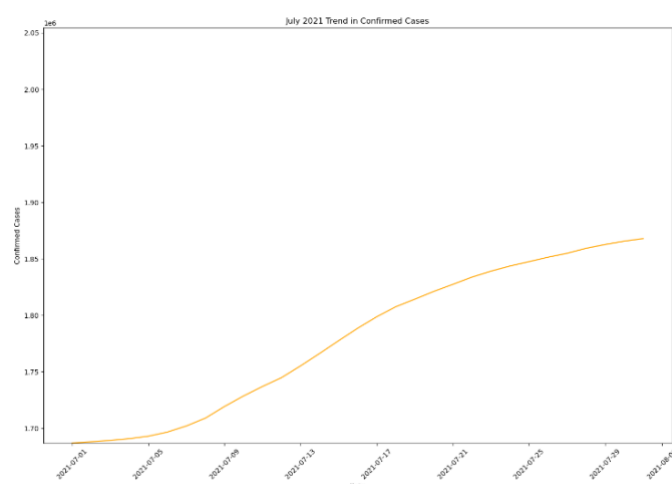
In plot 5.5 the deaths increased directly proportionally with days during the winter but had a more gradual increase during Spring, where it levelled out during the Summer, only to start increasing at a quicker pace towards the end of the year. In Plot 5.6 which shows the trend of confirmed cases throughout 2021, the cases increase proportionally during the winter and spring seasons but have a slower increase the summer. However, after November the cases increase directly proportionally, with that start of winter towards the end of the year having the largest increase in cases compared to any period within the year. This implies that the Netherlands had a correlation of seasonal factors with its deaths, which may include the number of infected people in hospitals and the public health responses handling Covid-19.

Plot 5.5

Plot 5.6
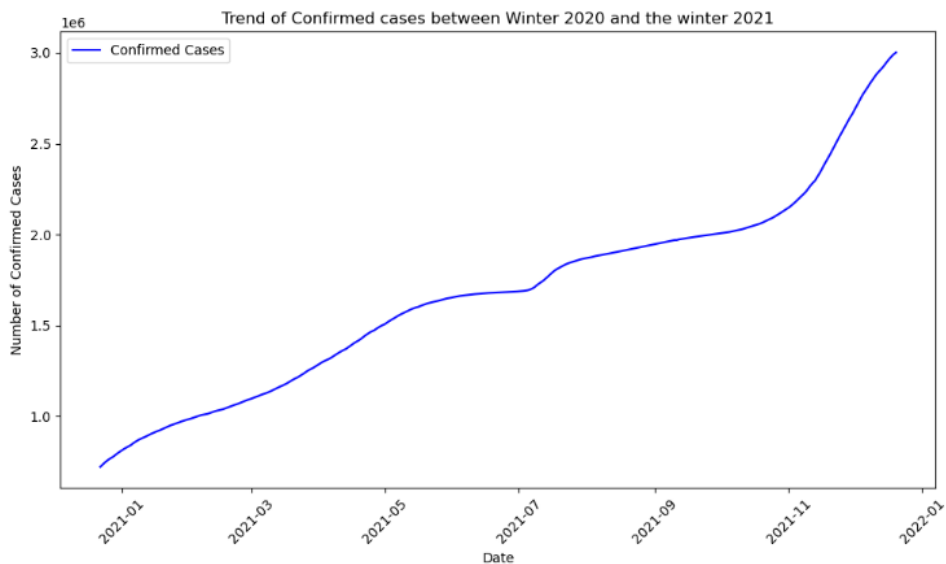
6. Conclusion

Both the UK and the USA had reduced numbers of daily confirmed cases over the course of January 2023. These trends both followed a spike in the early part of the month, with a similar decline in the days following. However, the UK experienced a significant downwards trend in the number of daily

deaths per day, while the US had a slower rate of reduction. If more accurate day-to-day data was available, more accurate and concise conclusions could be made.

The data from mainland China in the initial stages of the pandemic showed a common trend with confirmed cases, deaths, and recoveries all increasing. There is an uphill spike in confirmed cases in the middle of the period, which affects death and recovery rates, and they took a likewise uphill after the cases spike. Comparing data to later years in the pandemic, the figures are notably much higher for cases, but deaths and recoveries keep comparative numbers. This could be because of vaccines rolling out, and measures being taken to keep confirmed cases down to a minimum.

When looking at cases in the UK across years, we notice how the different trends in daily deaths and confirmed cases could be influenced by outside factors. For instance, even though the daily number of confirmed cases was much higher in 2022, there were significantly less deaths than in 2021. This could be attributed to the different variants of the virus, which spread more rapidly, but had a lower mortality rate.

The comparative analysis of the Covid-19 trends in the Netherlands, during 2021 demonstrates unique seasonal patterns in cases and deaths. For confirmed cases, both summer and winter months demonstrated similar daily numbers. Confirmed cases would grow at consistent level in the winter but had a slightly slower start in the summer. However, there was a noticeable difference in the number of daily deaths between winter and summer months. This can also be seen when looking at the whole of 2021, where deaths are much more prevalent in the winter than in the spring/summer. This drastic difference in mortalities may be due to the vaccine rollout starting in the spring of 2021, which has been shown to significantly lower mortality rates.

Appendix

1A

https://github.com/CSSEGISandData/COVID-19/issues/4465

1B

Irregular Update Schedules

As the pandemic has progressed, several locations have altered their reporting schedules to no longer provide daily updates. As these locations are identified, we will list them in this section of the README. We anticipate that these irregular updates will cause cyclical spikes in the data and smoothing algorithms should be applied if the data is to be used for modeling.

https://github.com/CSSEGISandData/COVID-19/blob/master/csse_covid_19_data/README.md#irregular-update-schedules