

The pattern of infection in relation to the lockdown measures implemented against the spread of Covid-19 in Europe: An exploratory data analysis.

Abstract

We discovered from our analysis that the UK, Russia, Italy, Spain, France, and Germany had the same pattern in the number of active cases in 2020.

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Table of Contents

Introduction

Response to spread

Data Exploration

Results

Conclusion

References

Introduction

In early 2020, the news of a novel disease-causing pathogen was making its way into media around the globe. This was a new virus that had never been encountered. The origin of this virus was confirmed to be Wuhan, a city in China, where several cases of pneumonia by an unknown cause were reported.¹ The virus was soon identified. On 7th January 2020, the Chinese authorities identified it to be a virus in the coronavirus family and named it 2019 nCov later being renamed to Sars-Cov-2 which causes the COVID-19 illness. ²

This virus was established to be very infectious, having caused outbreaks locally, its potential to spread quickly and cause an epidemic was clear. By 23rd January 2020, the city of Wuhan where the virus was first identified went into a lockdown. ⁹ This was a measure to reduce spreading the virus by restricting human activity thereby minimising exposure.

The first case outside China was reported in Southeast Asia, in Thailand on 13th January 2020.³ This was confirmed as a case imported from Wuhan, China. Soon after, Japan, the Republic of Korea and the United States of America all identified cases that were imported from Wuhan, China.^{4,5} By 24th January 2020, the first case in Europe was reported in France. ⁶

On 30th January 2020, under the International Health Regulations (2005), the World Health Organisation declared COVID-19, (then named 2019 nCov) as a Public Health Emergency of International Concern. ⁷ The WHO Director-general declared Covid-19 outbreak a pandemic on 11th March 2020, after cases had been reported in Europe, Asia, America, the Middle East, and Sub-Saharan Africa. ⁸.

Response to spread

Airport screening was one of the first measures implemented to reduce spread. At the beginning, with limited knowledge on this novel pathogen, officials were guided by mathematical and statistical modelling in determining complex relationships with the pattern of disease spread, planning resources, disease incubation period, economic and social consequences.

In March 2020, many countries in Europe went into their first lockdown. 10 With growing evidence on person-to-person transmission of Sars-Cov- 2 through direct transmission, contact transmission and airborne, 11 many national and local authorities implemented a lockdown with closure of schools and business premises which gradually started to reopen from May towards July. This exploratory analysis aims to identify the patterns of infection as can be related to the lockdown policy.

Data Exploration

Analysis of COVID-19 cases and deaths in 2020, the dataset used was published by the Centre for Disease Prevention and Control [12]. This contained worldwide COVID-19 data and was consequently filtered to show data for European countries alone as this was the focus of our investigation. Key columns within this dataset that were identified for analysis were the daily number of cases, the daily number of deaths, and population data for each country based on 2019 population data.

For the analysis of COVID-19 rates in 2021, the first dataset used was published by the European Centre for Disease Prevention and Control [13]. This contains COVID-19 data only for countries in the EU/EAA, and as the United Kingdom formally withdrew as a member of the EU on the 31st of January 2020 they were not included in this dataset. It contained the same key columns for analysis as the previous 2020 worldwide dataset mentioned, but population data for each country based on 2020 population data instead. To include 2021 COVID-19 data for the UK for analysis, data was taken from the official UK government website for coronavirus [14]. For the analysis of daily deaths caused by COVID-19, the metric 'newDailyNsoDeathsByDeathDate' was used. For the analysis of the number of daily COVID-19 cases, the metric 'newPillarFourTestsByPublishDate' was used. These metrics, combined with a mid-2020 UK population recording of 67,081,234 according to Office for National Statistics data [15], were merged with the previous EU/EAA 2021 COVID-19 dataset to fill in the missing data for the United Kingdom and thus allow direct comparison of COVID-19 trends.

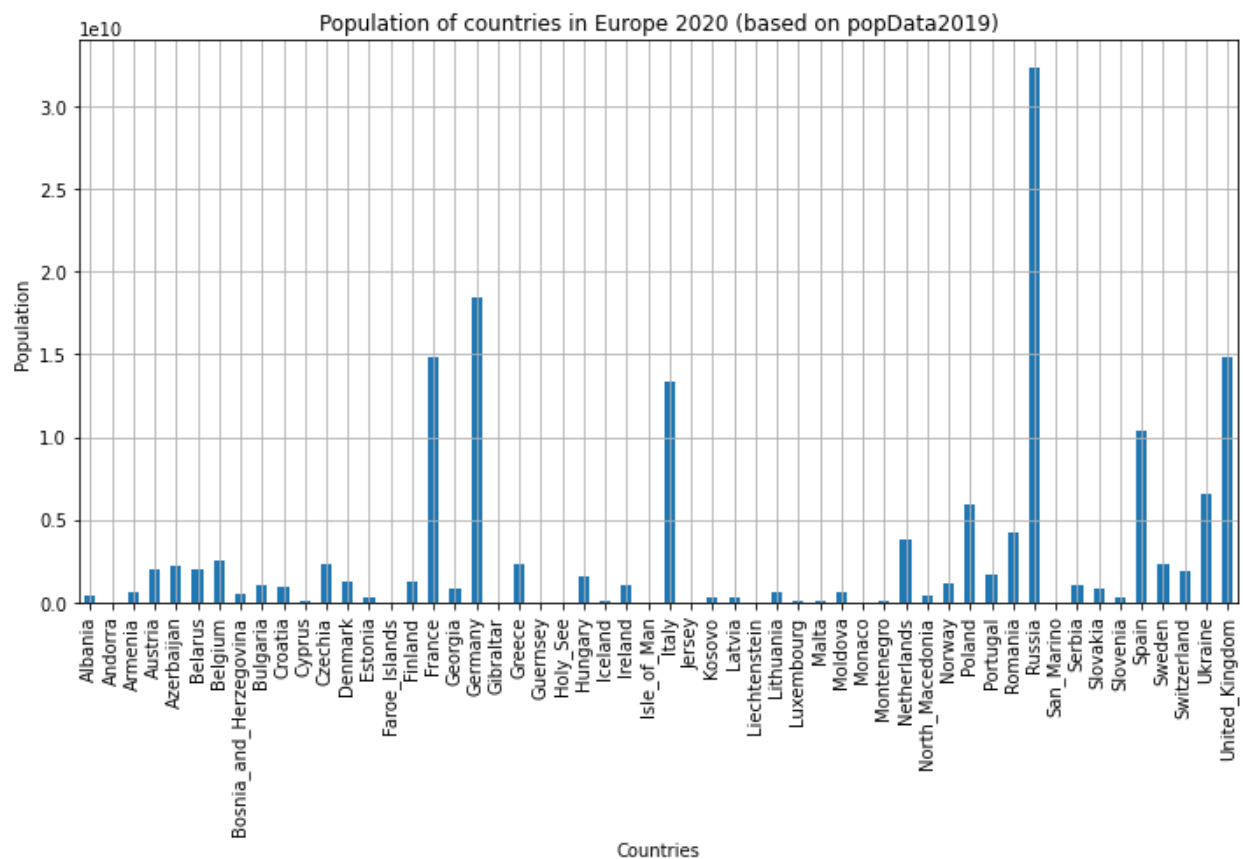
Methods

This project used Python 3.0 and Jupiter notebook to carry out all analysis for the investigation and comparison of COVID-19 cases and deaths between 2020 and 2021. All datasets were downloaded in the format of '.csv' files and loaded into data frame for processing. Libraries required for the processing and manipulation of data included NumPy and Pandas, and for plotting and data visualisation, the program

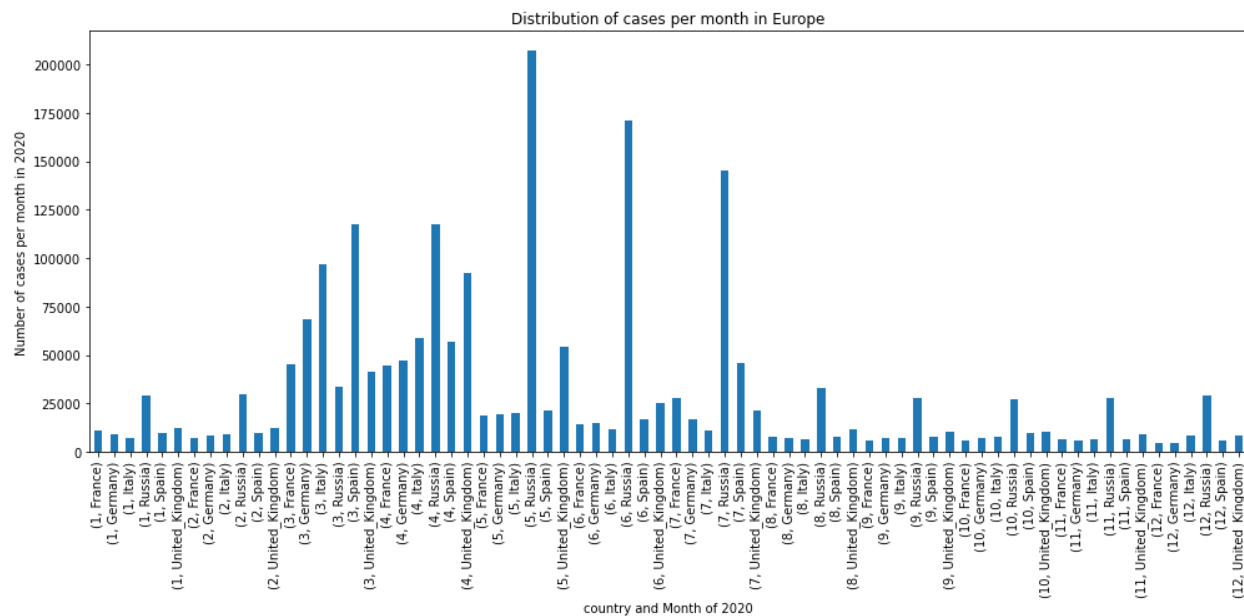
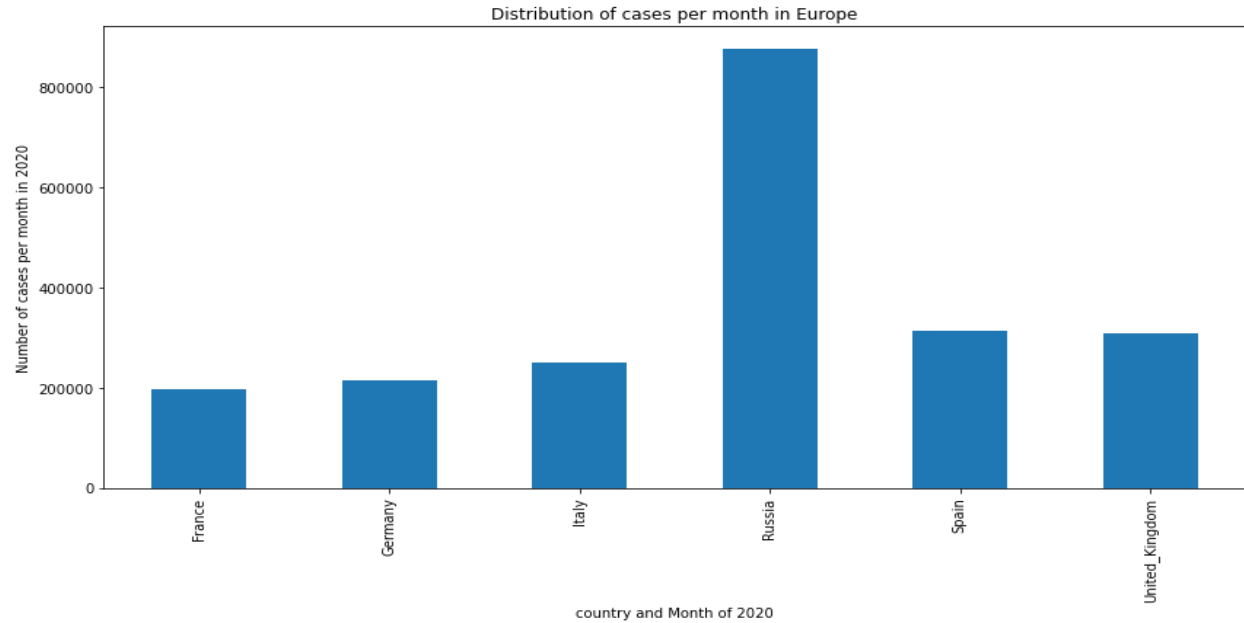
Matplotlib and Seaborn library were also imported. For the analysis of 2021 COVID-19 trends in Europe, data from the EU/EAA dataset and from the UK government coronavirus website had to be merged to get a more complete dataset including the UK. Bar plots were then used to analyse and compare population sizes, yearly COVID-19 cases, and yearly COVID-19 deaths between countries for both 2020 and 2021 data. In addition, to explore the trends in COVID-19 in the UK in relation to the timeline of coronavirus lockdowns and restrictions implemented by the government, figures were produced for the UK showing the monthly changes for cases and deaths.

Results

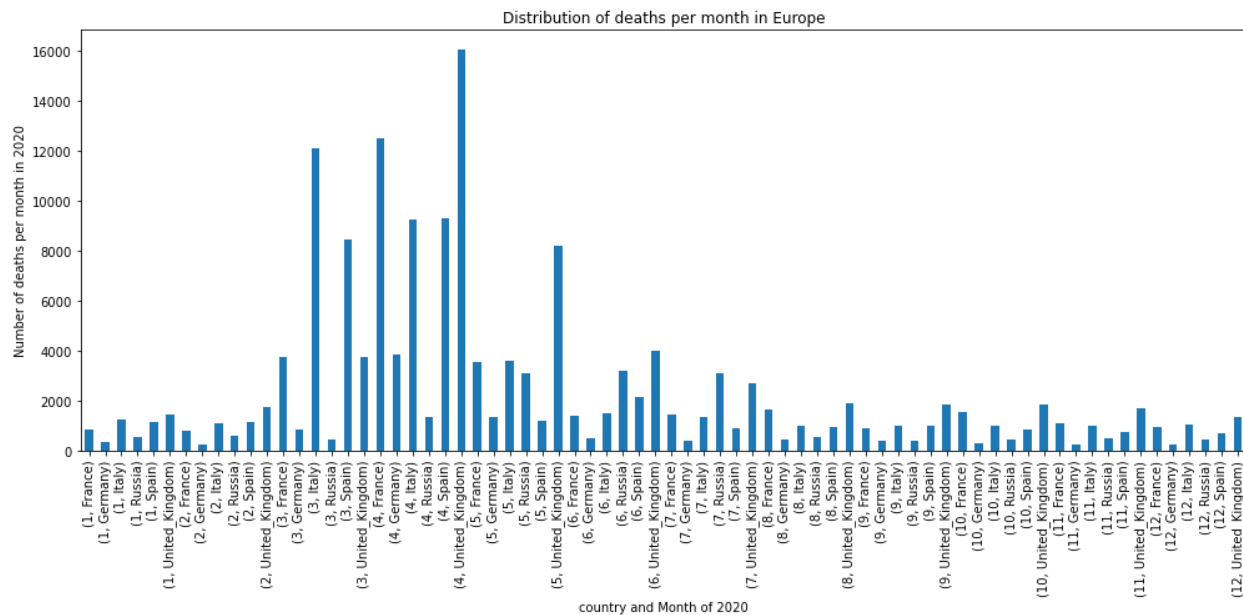
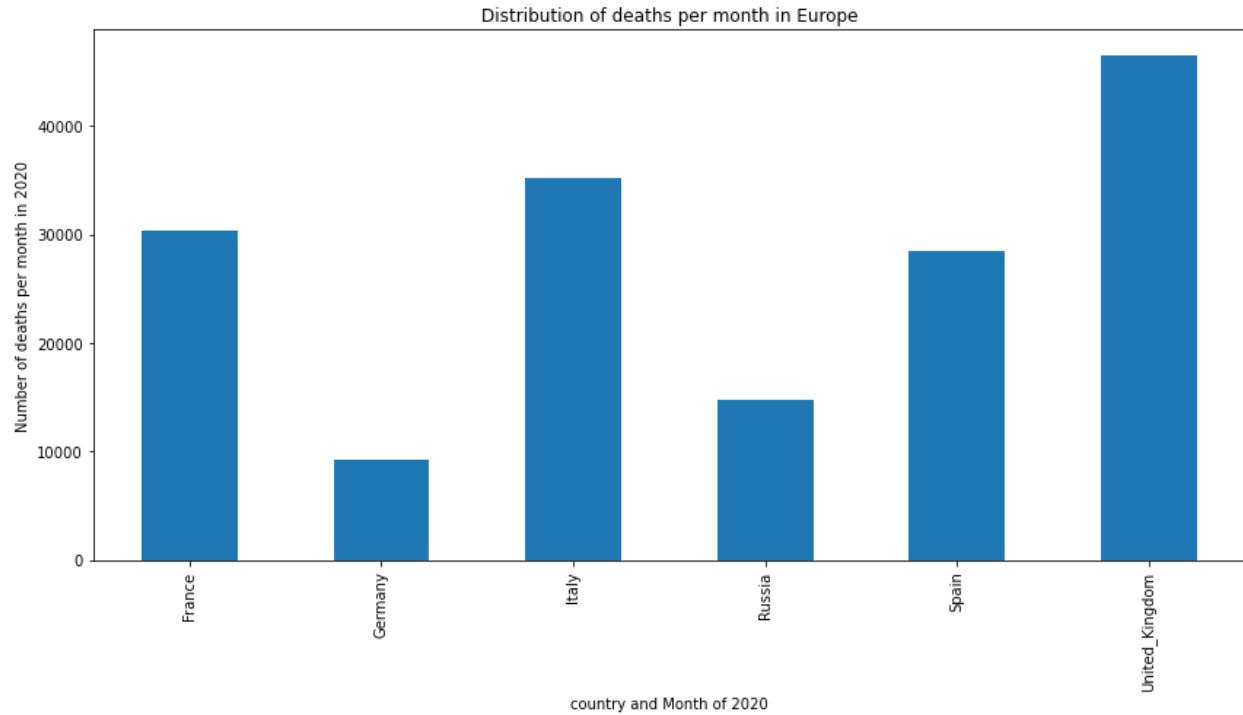
The plot below shows that Russia, Germany, France, United Kingdom, Italy, and Spain respectively have the highest population in Europe. We consider these countries in terms of the patterns of cases and deaths from COVID-19 disease.



Shown in the plot below, Russia, having the highest population in the region, has the highest number of cases compared to other countries. Russia also had the highest cases across all months in the year 2020 except in March when Spain was slightly higher with about twenty thousand cases.

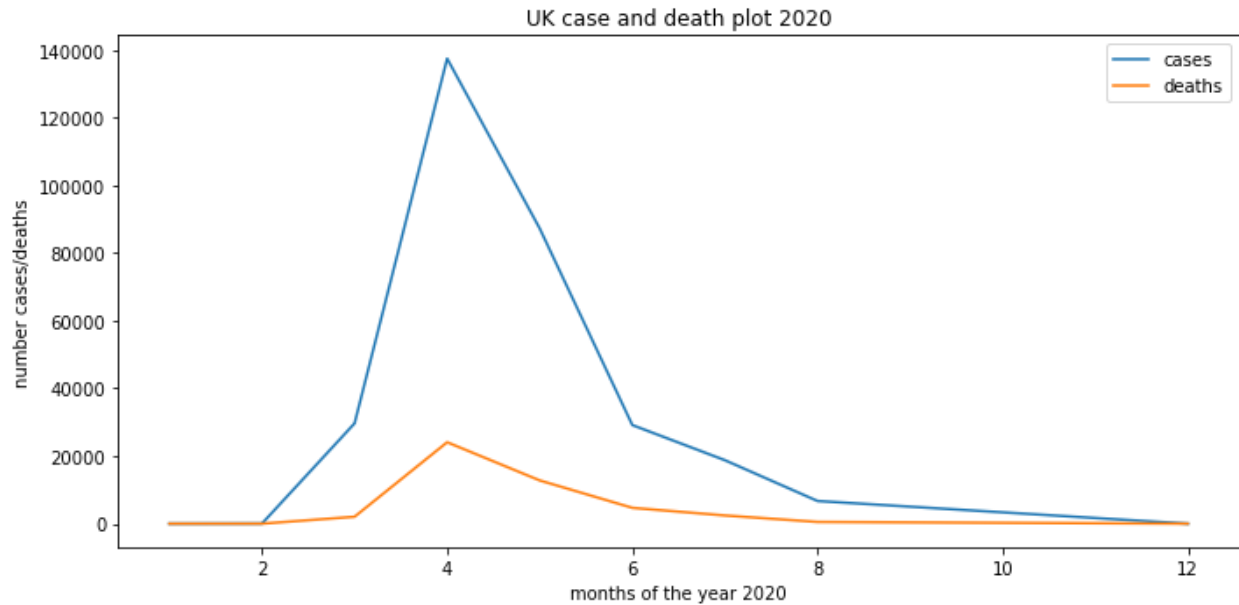


Although the UK is fourth most populated and has the third largest number of cases in Europe, it had the highest number of recorded deaths in 2020, consistently recording the highest deaths from April to December of 2020.

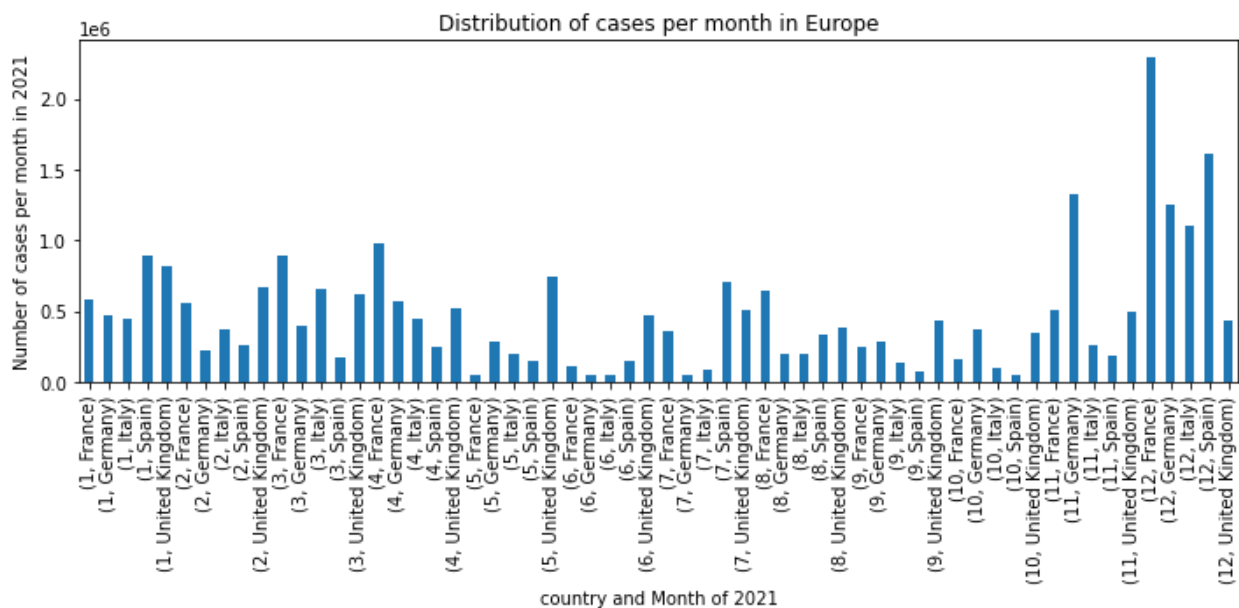


In trying to discover the possible cause of this increased death in the UK, we explored the data submission pattern to determine if it was caused by data entry or submission errors. Seeing that the respective dates data were recorded is Uniform across the countries, we assumed here (as seen in the plot) that since it is one official provider responsible for entering the data, that all data were entered on the same day in each month for all countries.

The UK specifically, showed a sharp decline in the number of cases and deaths from April throughout the rest of the year 2020.

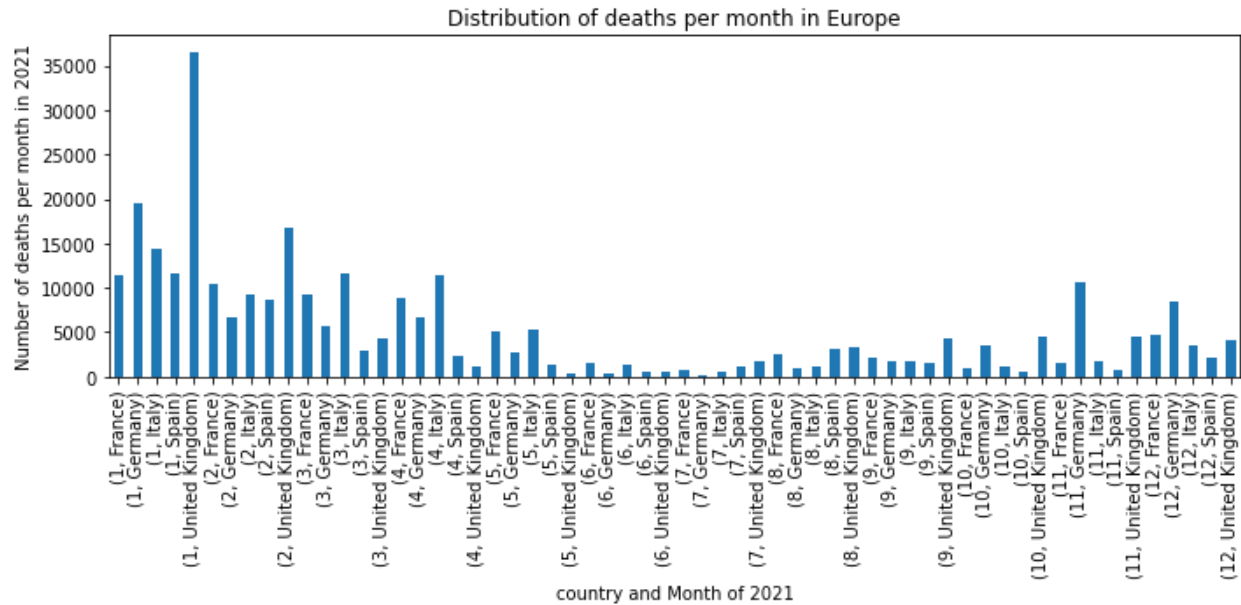


In 2021, Although the cases seemed to be reducing month by month up to the third quarter of the year, there was a sharp rise in cases in November and December of 2021.

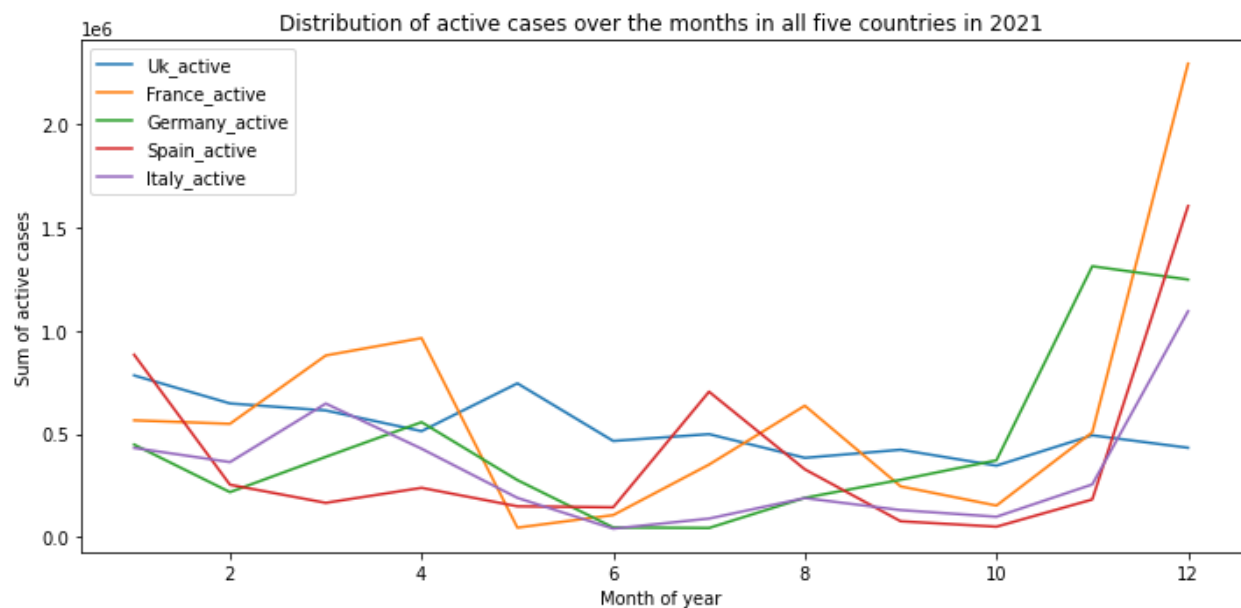


The number of observed deaths continued to rise across the countries in the first months of 2021. This may probably be due to deaths from active cases in 2020 who lasted till 2021. This pattern of deaths was

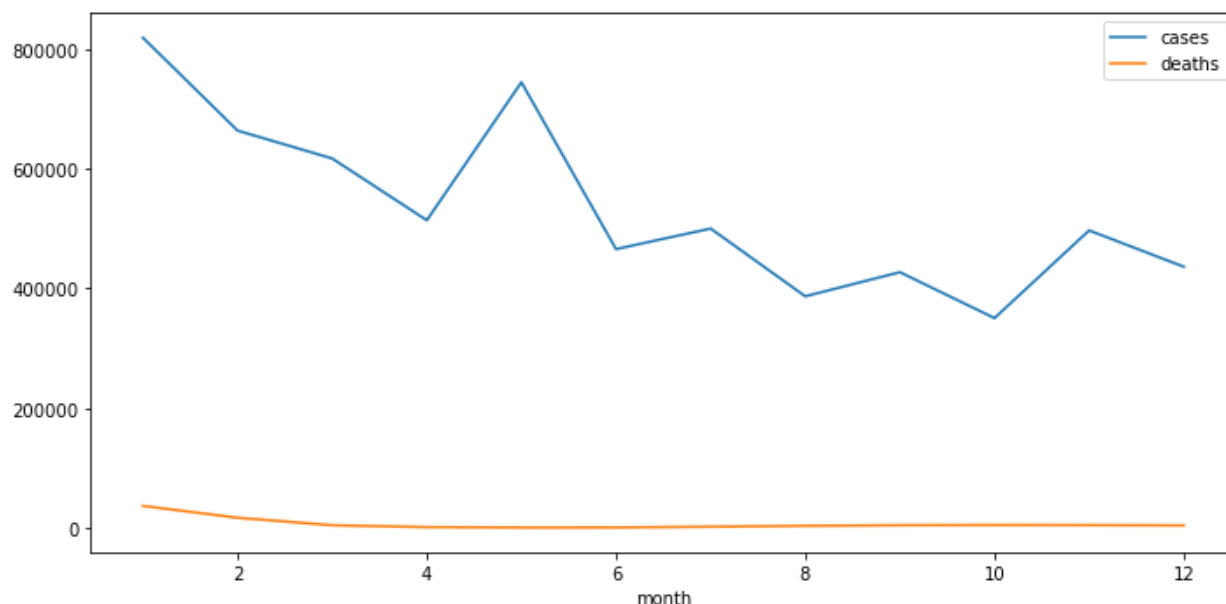
seen to later diminish later in the year, rising again in November and December. This may be explained by the increased number of infections seen in these months.



Overall, in all the countries, the number of active cases was in a steady decline until November and December of 2021 when there was a rise in case numbers.



Like in 2020, although 2021 began with high numbers of the infections, it declined steadily throughout the year. The number of covid related deaths recorded were almost constant throughout the year.



Conclusion

In this analysis, we realise that there was a sharp rise in the in COVID-19 related cases and deaths in 2020, the fall in these numbers across the most populated countries in Europe reflects the effectiveness of the lockdown policies implemented in these countries. In 2021 however, the pattern changed slightly with rising cases at the beginning and end of the year with a depression in the numbers at the middle of the year. While lockdown was very instrumental in reducing the spread of Covid-19 in the UK and in other countries, gradual progress was made on vaccine development, which may have also accounted for the patterns seen late in 2020 and 2021. By the 2nd of December 2020, the first Covid vaccine was approved, following that on the 8th of December 2020, the first person in the world was given the vaccine, here in the UK. Although other factors affect the pattern of spread, future analysis may highlight the significance of the roll out of the vaccination program.

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