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An Investigation into the Response of the US and EU5 to the COVID-19 Disease

Convergence of Two Pandemics: COVID-19 and NCDs

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Introduction

Late December 2019, a coronavirus disease (COVID-19) was identified in Wuhan, China. COVID-19 was a result of the novel severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2), which has resulted in a worldwide sudden and substantial increase in hospitalizations for pneumonia with multiorgan disease. As of October 6, 2020, SARS-CoV-2 has affected more than 200 countries, resulting in more than 35 million identified cases with more than 1 million confirmed deaths.

This is a cross-sectional, non-interventional, observational study in patients infected with the novel coronavirus (SARS-CoV-2) or Covid-19, using the John Hopkins University (JHU) Coronavirus database, and Institute for Health Metrics and Evaluation (IHME) database. The data collected from the JHU Coronavirus database and IHME database will be used to create a MATLAB program, which will produce graphs with standardized data that will be used to investigate, describe and compare the circumstances during the past year in the US and the EU5 (UK, Germany, France, Italy and Spain). The experiment compared the number of confirmed cases and confirmed deaths because of the Covid-19 disease. Furthermore, the experiment compared each country's deaths from non-communicable diseases (NCDs), smoking, and obesity. The experiment found the most important risk factors and comorbidities associated with mortality of patients infected by COVID-19.

The countries chosen were picked based on the following facts:

- All 6 Countries are considered high-income countries
- The EU5 have a public healthcare system versus the private healthcare system in the US
- All 6 countries have similar education and health literacy level
- All 6 countries had the first COVID-19 case during January 2020
- All 6 countries are a popular hub for travelers and tourists

If proven successful, this project can identify some of the factors that increase the severity and mortality of the disease among the discussed countries, and in turn shine a light on some of the areas where healthcare services and public education need improvement.

Methods

The responses of each country were researched and studied to isolate any key actions that impacted the rate of spread of the virus, including, but not limited to, first case date, number of tests per case, percent of positive tests, local and national mandates description and dates, and contact tracing.

Prior research articles were considered and analyzed to explore and discover the relation between COVID-19 and other factors that could significantly increase the severity and mortality of the disease.

Data was obtained from JHU and IHME databases. The data for confirmed cases was then imported and standardized using MATLAB through the following mathematical equation:

$$N_{CC} = \left(\frac{\text{Number of Confirmed Cases}}{\text{Country Population}} \right) * 100,000$$

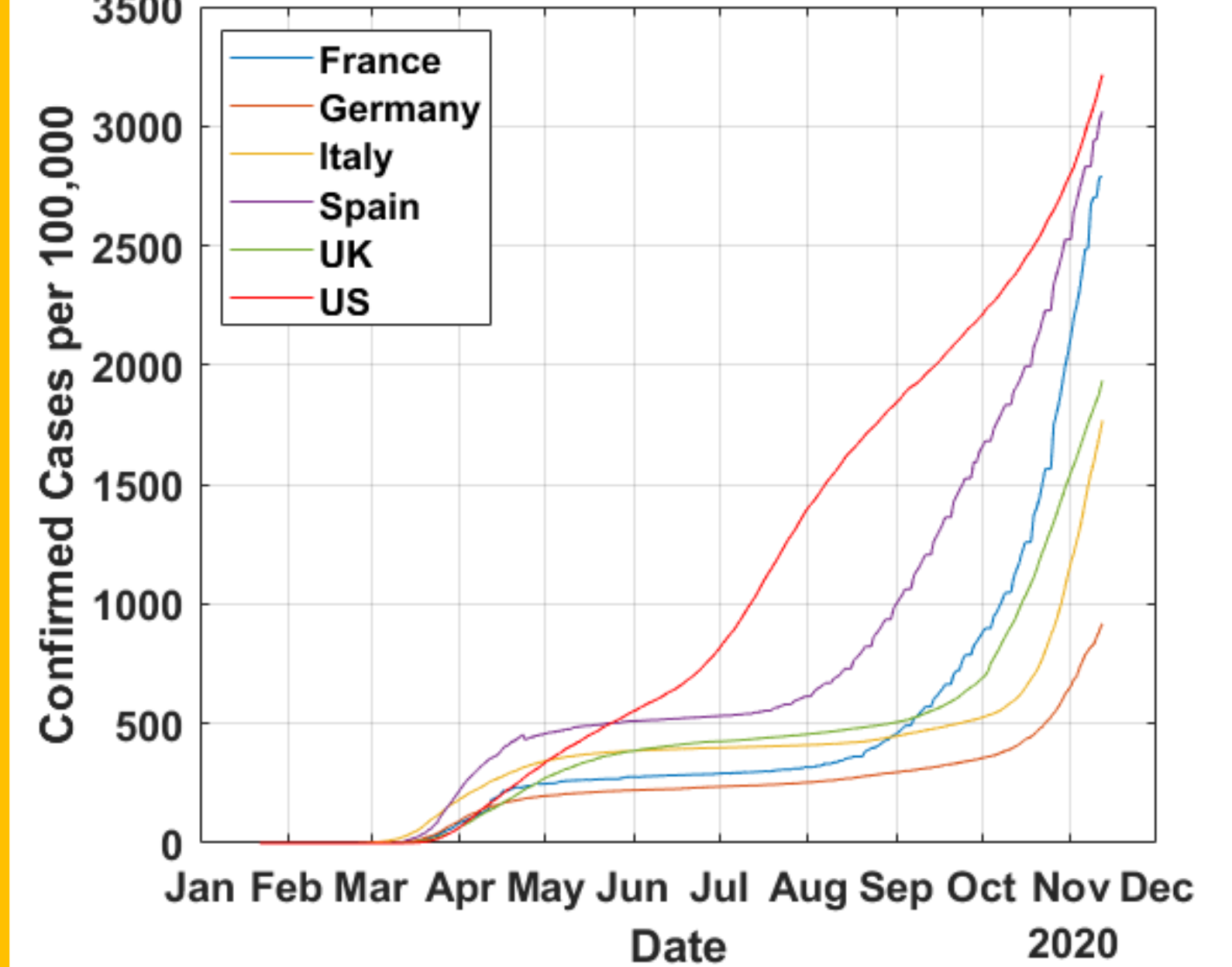
Data for confirmed deaths, from COVID-19, and identified factors, was standardized using a similar mathematical equation:

$$N_{CD} = \left(\frac{\text{Number of Confirmed Deaths}}{\text{Country Population}} \right) * 100,000$$

The line graphs were created using the *plot* function. The bar graphs were created using the *bar* function. Graph titles were added using the *title* function. Axis labels were added using the *xlabel* and *ylabel* functions for the x-axis and y-axis, respectively. The size of graphs 1 and 2 had to be modified using *gca* or current axes. The font was increased and bolded for graphs 3 and 4 using *gcf* or current graph handle. The legends were added using the *legend* function. For graphs 3 and 4, the legends had to be altered to horizontal orientation using the *legend* function.

Results

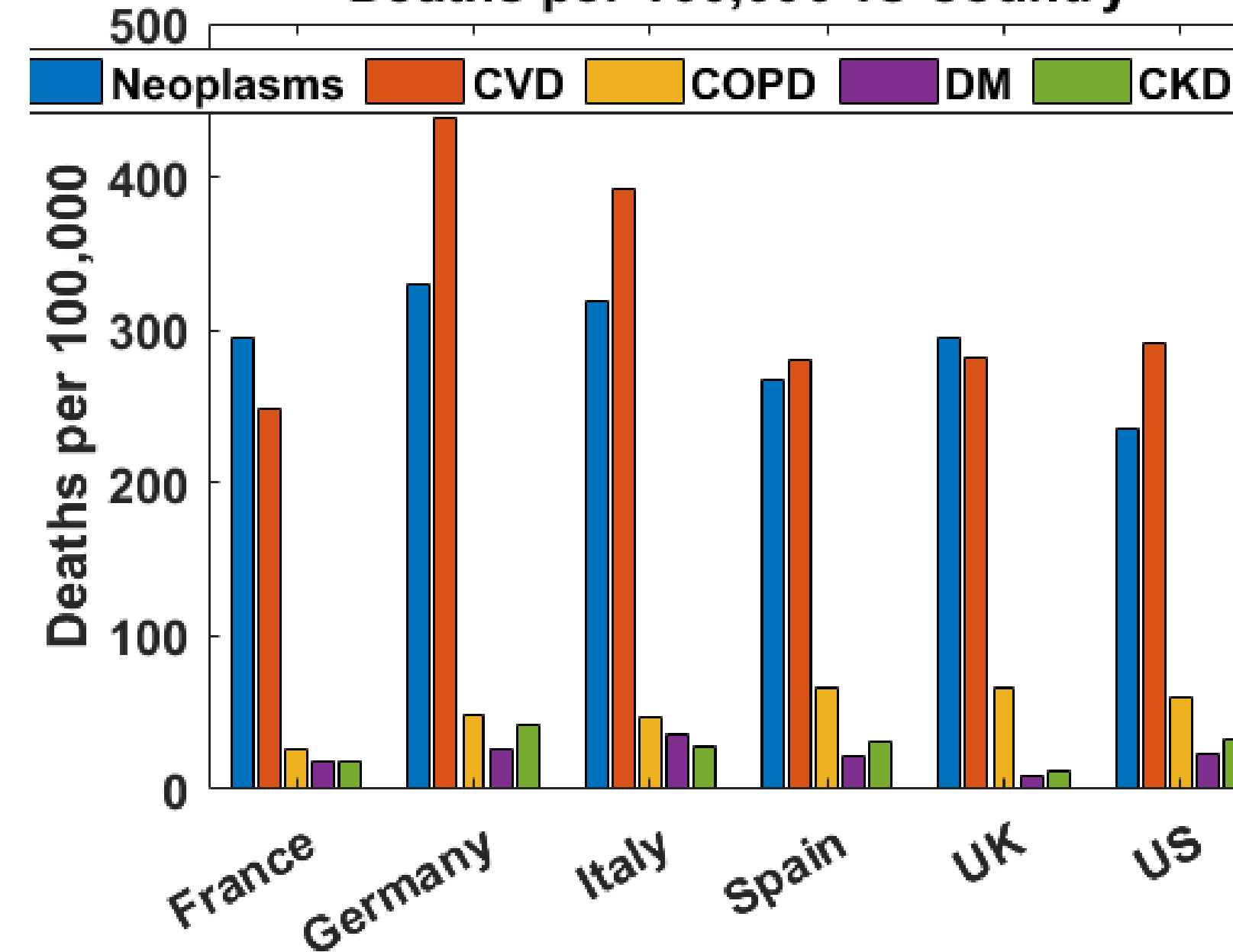
Confirmed Cases of COVID-19 per 100,000 vs Date



Graph 2

- Number of confirmed deaths per 100,000 in the US maintained a semi-constant rate of increase from April to November 2020
- Spain predominantly maintained the highest number of confirmed deaths per 100,000 since April 2020
- Germany maintained the lowest number of confirmed deaths per 100,000 since April
- Number of deaths in Europe (except Germany) began rising exponentially towards the end of the summer 2020
- European countries (except Germany) had a semi-vertical rise in confirmed deaths per 100,000 between March and April 2020

Deaths per 100,000 vs Country



Graph 4 (2019)

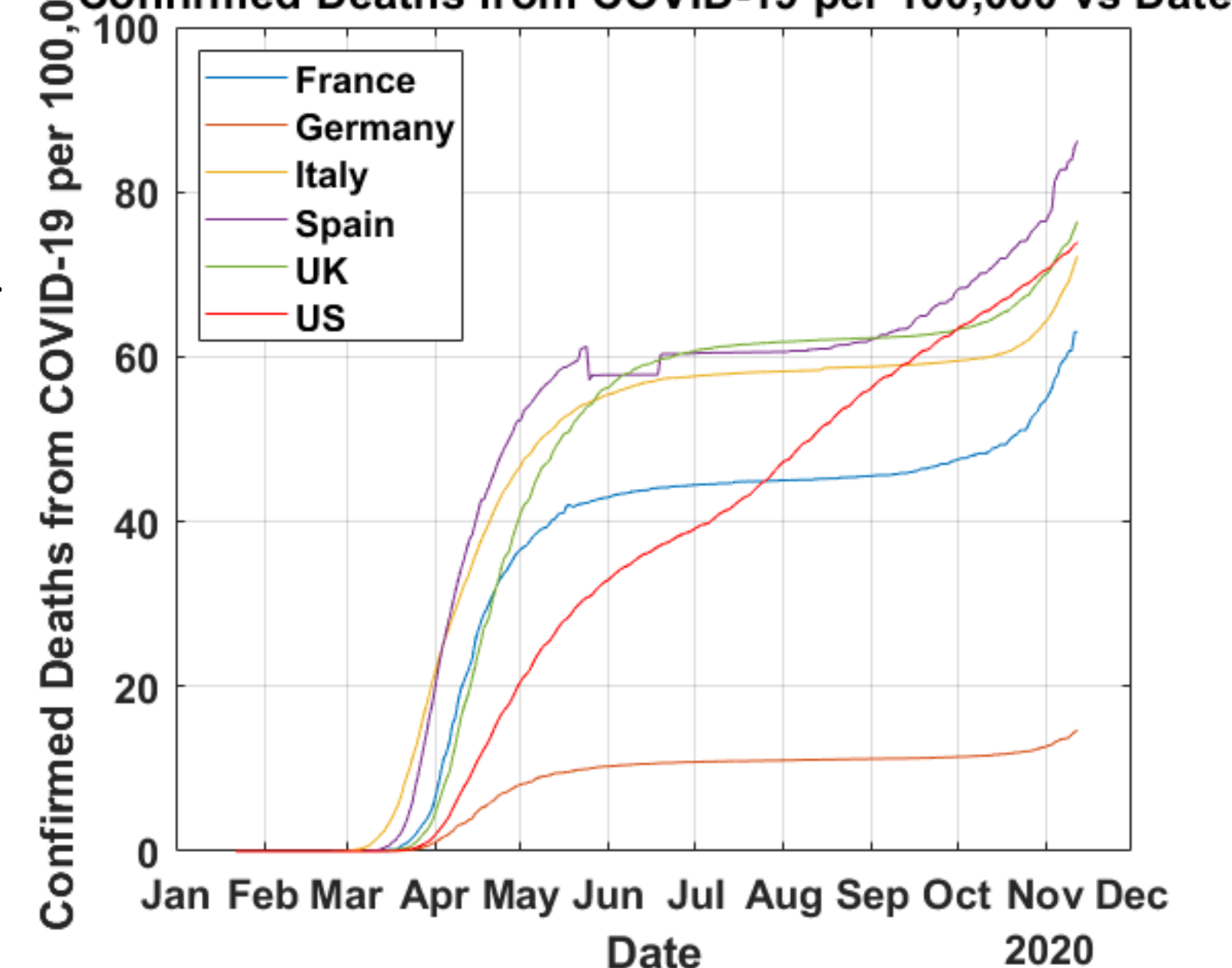
- US has the highest number of deaths from smoking per 100,000
- US has a significantly higher number of deaths caused by obesity (>30 Body Mass Index [BMI]) per 100,000
- France has the lowest number of deaths per 100,000 caused by obesity
- Italy has the lowest number of deaths per 100,000 caused by smoking

Germany has the highest number of deaths per 100,000 for 3 NCDs and 2nd highest number of deaths per 100,000 caused by obesity and smoking

Graph 1

- US never flattened the curve, unlike European countries between May and August 2020
- US maintained the highest number of confirmed cases per 100,000 since June 2020
- Germany maintained the lowest number of confirmed cases per 100,000 since April 2020
- Number of case in Europe (except Germany) began rising exponentially towards the end of the summer 2020
- Spain and France are nearing the US's number of cases per 100,000 and are rising at a steeper rate
- Germany didn't rise until October, unlike other European Countries, but still had the overall lowest number of cases per 100,000

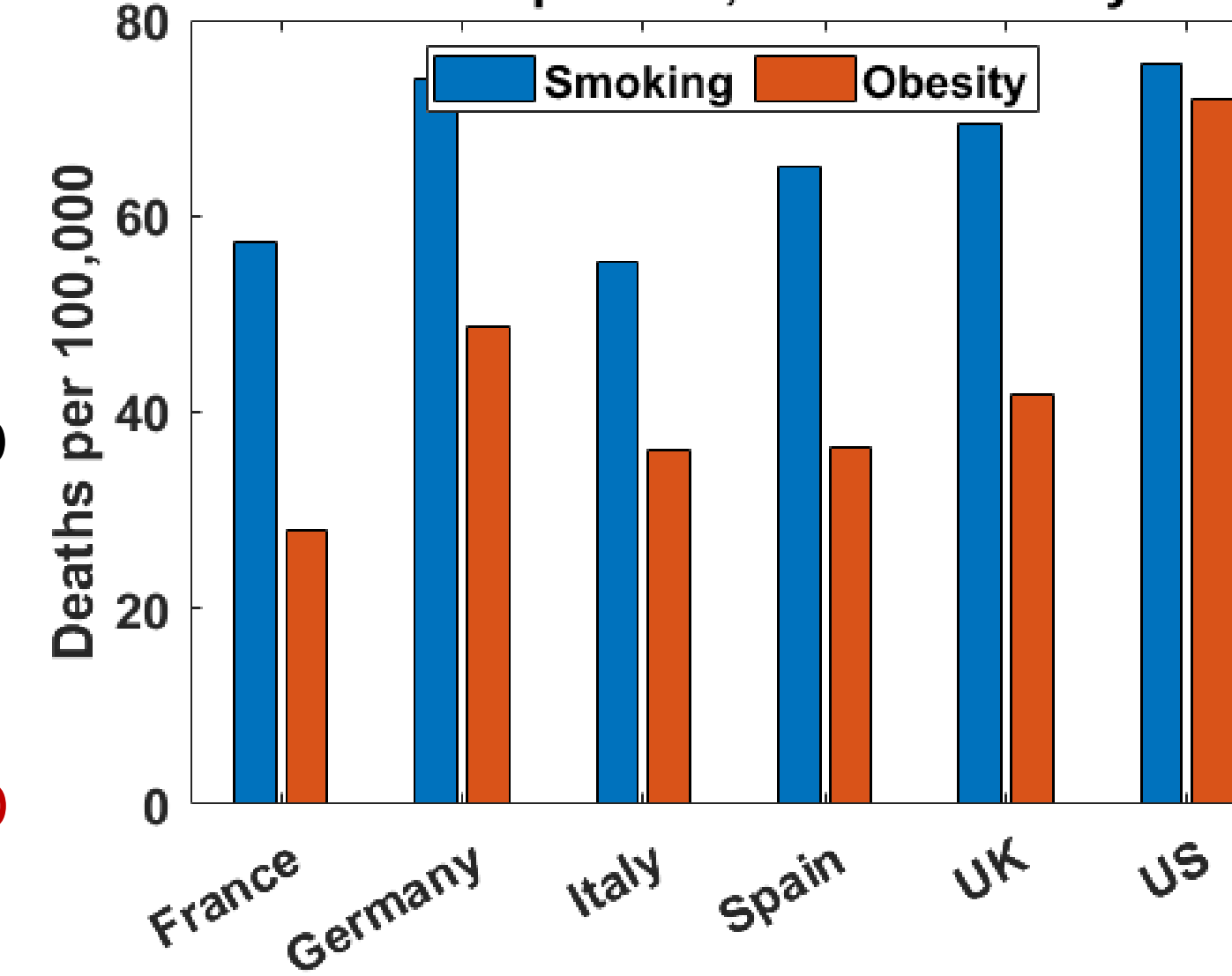
Confirmed Deaths from COVID-19 per 100,000 vs Date



Graph 3 (2019)

- Germany has the highest number of deaths per 100,000 from Cardiovascular disease (CVD), Neoplasms (Cancers), and Chronic Kidney disease (CKD)
- Italy has the highest number of deaths per 100,000 from Diabetes Mellitus (DM)
- Spain has the highest number of deaths per 100,000 from Chronic Obstructive Pulmonary Disease (COPD)
- France has the lowest number of deaths per 100,000 from CVD and COPD
- US has the lowest number of deaths per 100,000 from Neoplasms
- UK has the lowest number of deaths per 100,000 from DM and CKD

Deaths per 100,000 vs Country



Discussion and Conclusions

All the concluding statements are only regarding the discussed countries.

The risk factors and comorbidities found to increase the severity and mortality of COVID-19 were as follows: Cardiovascular Disease, Neoplasms, Chronic Obstructive Pulmonary Disease, Diabetes Mellitus, Chronic Kidney Disease, Obesity (>30 BMI), Smoking, and old age (65+).

In conclusion, Germany was the most successful in minimizing the number of cases and deaths from COVID-19 per 100,000, even though the country leads in deaths per 100,000 from 3 NCDs, second to the US in smoking and obesity related deaths per 100,000, and 21.1% of the population is above 65 years old. On the contrary, Spain was the least successful in terms of the number of deaths from COVID-19 per 100,000. The US was the least successful in controlling the spread of the virus as they have predominantly maintained the highest number of cases of COVID-19 per 100,000.

Germany was early and efficient in beginning to prevent the spread of the virus. "Robert Koch Institute (RKI) and scientists at other institutions mobilized in early January to launch national crisis management to understand the epidemiology of the pandemic." ¹ Furthermore, Germany continued in its success to detect the virus as they were one of the very first countries to develop a diagnostic test for COVID-19 and have conducted rigorous contact tracing. Moreover, Germany's government worked along public and private laboratories to maximize the potential and efficiency for testing. Another aspect Germany was successful in, with regards to the spread of the virus, was limiting the transmission in long-term care establishments, which led to a significantly lower number of cases among the older population, further lowering the case-fatality rate. Finally, Germany has the highest number of hospital beds per 10,000 (80.0) and with careful planning alongside educated actions, the healthcare system did not become overstressed, allowing for continuous treatment for all severely affected cases.

Spain maintained the highest number of deaths per 100,000 caused by COVID-19 since April 2020. Spain exercised an extremely strict national lockdown from March 14th till May 9th, 2020. Unlike its neighboring countries to the east, Spain has a significantly lower number of hospital beds per 100,000 (29.7) (France: 59.8). "The first HCW infected was confirmed on March 9th. A total of 791 HCW and personnel were confirmed to be infected by March 29th, representing 38% of those tested and 11.6 % of all the hospital workers." ²

US maintained a steady increase in the number of COVID-19 cases per 100,000 and currently hold the highest number of cases worldwide. Unlike its European counterparts, the US never flattened the curve. Furthermore, the US federal government failed to devise a national strategy to lead, direct, and support the states. Overall, the US response was primarily on a state level only, with only a few states enacting state level lockdowns.

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