COVID-19 Death Rate In Developed vs. Developing Countries

Isatou Saho, Marie Baker, Reda Semlani, Rinad Salkham

BACKGROUND

COVID-19, an infectious disease caused by the coronavirus, has affected nearly 4 million people in the world and caused a little less than 300,000 deaths. We believe that this is a very unique opportunity to analyze how a country's capabilities relate to its ability to aid its population through this pandemic.

HYPOTHESIS

Specifically, we sought out to investigate the hypothesis that developed countries will experience a lower death rate than developing countries as a result of COVID-19 . We have defined, in accordance with the World Bank, developed countries as countries with a GDP per capita higher than $12,000.

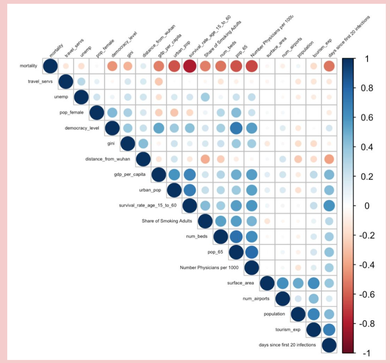
DATA INFORMATION AND COLLECTION

Our data is asymmetric because the virus was not uniformly introduced to all countries at the same time. We included the number of days since the first 20 confirmed cases in a country in order to account for the varying to the best of our ability.

Additionally, we recognize that due to the nature of the virus and the accuracy of reporting of some countries the numbers of cases and deaths may be under reported.

Data specification and sources are included in the project github: https://github.com/rsalkham/virus_analysis

METHODOLOGY



We used a correlation matrix to find the variables that are dependent on each other. In the cases where the variables are negatively correlated, we omit one of the variables from each pair of extremely correlated variables (with a threshold of 0.8), in order to avoid multicollinearity in our regression models.

Performed multiple linear regression where the dependent variable was COVID-19 death rate and independent variables were development indicators and COVID-19 specific data included in the condensed correlation matrix.

RESULTS

We refute our hypothesis that the more developed a country is the higher the death rate. We have found that none of the development indicators are significant and their p-value was higher than 0.05. The variables that were significant were related to the movement of people into and out of the country (number of airports, expenditure on tourism).

However, their coefficients are very low and do not offer a sufficient explanation of the death rate of the country. These variables were much more significant and with higher coefficients when regressed against total cases and total deaths per country. Additionally, the number of total tests is extremely significant for these regressions.

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Coefficients:
                                Estimate Std. Error t value Pr(>|t|)
(Intercept)                   -1.216e-01  2.316e-01  -0.525 0.605367
gdp_per_capita                -9.452e-07  9.212e-07  -1.026 0.317124
population                    -1.653e-11  3.375e-11  -0.490 0.629657
urban_pop                     -5.569e-04  5.420e-04  -1.027 0.316473
pop_65                         2.355e-03  2.500e-03   0.942 0.357458
pop_female                    -1.026e-03  2.857e-03  -0.359 0.723285
mortality                      4.962e-04  7.488e-04   0.663 0.515175
surface_area                   4.141e-10  3.182e-09   0.130 0.897755
num_beds                      -8.527e-04  4.758e-03  -0.179 0.859588
tourism_exp                    2.710e-12  6.650e-13   4.075 0.000591
travel_servs                   5.031e-04  3.851e-04   1.306 0.206299
unemp                         -2.427e-03  2.057e-03  -1.180 0.251805
gini                          -1.207e-04  4.764e-04  -0.253 0.802512
survival_rate_age_15_to_60     2.733e-01  2.425e-01   1.127 0.273076
`Number Physicians per 1000`   3.460e-03  7.052e-03   0.491 0.629050
`Share of Smoking Adults`      8.461e-04  8.379e-04   1.010 0.324696
distance_from_wuhan            2.408e-09  2.667e-09   0.903 0.377349
`days since first 20 infections` -1.355e-03  8.077e-04  -1.678 0.108908
num_airports                  -2.147e-05  8.780e-06  -2.445 0.023869
total_tests                   -1.528e-09  1.837e-08  -0.083 0.934548
regime_typeFlawed democracy    8.663e-03  4.098e-02   0.211 0.834710
regime_typeFull democracy     -2.410e-02  4.937e-02  -0.488 0.630781
regime_typeHybrid regime      -4.387e-03  3.875e-02  -0.113 0.911001
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CONCLUSION

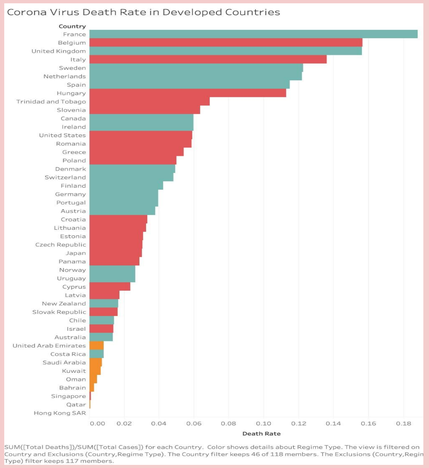
We have found that the level of development cannot be used to explain the death rate of a country. On the other hand, indicators of mobility into and out of the country in addition to the democracy level may be better at explaining the death rate of a country. We think that this is because the most important part of not increasing the number of cases and not getting infected is related to social distancing and staying away from infected people.

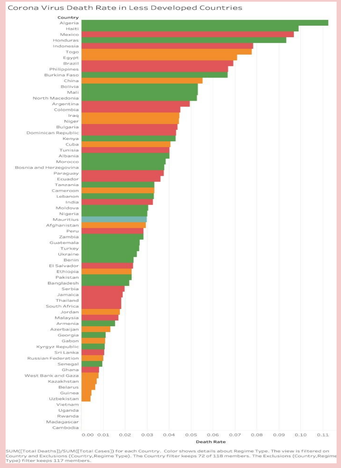
FUTURE RESEARCH/LIMITATIONS

Considering that COVID-19 is a current and ongoing phenomenon, new data concerning the pandemic and its reach will certainly emerge beyond the scope of our project. Therefore, it would be interesting to perform the same regressions once the pandemic ends and compare it with our current results, as we would have more comprehensive data spanning more countries.

Many other factors not included in our dataset likely contribute to each country's experience with COVID-19, including but not limited to whether the country has a culture of wearing masks, how people in a given country interact with one another (i.e. greetings) and the country's general "preparedness" to deal with a pandemic (i.e. had protocols and infrastructure in place for effective pandemic response). A retroactive analysis of COVID-19 may better account for issues concerning accurate case count.

VISUALS





Legend:

Authoritarian: Orange

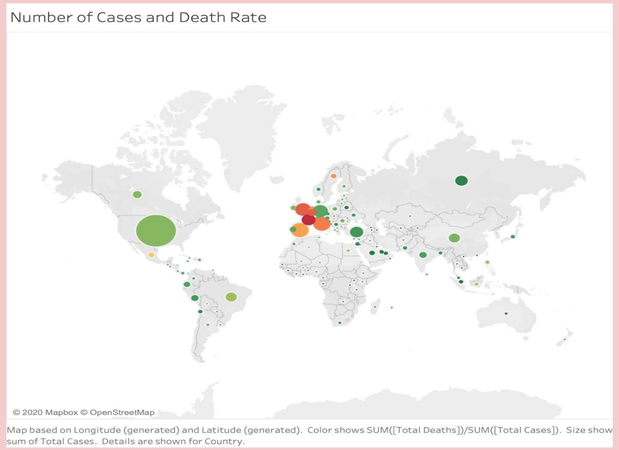
Flawed Democracy: Red

Full Democracy: Blue

Hybrid Regime: Green

Among developed countries, the countries that have a lower democracy level tend to have a lower death rate. In the first graph, we notice that the countries that are authoritarian have the lowest death rates. On the other hand, less developed countries have a more distributed type of regime. These countries have a lower capacity to go on lockdown and to hospitalize.

Note: authoritarian regimes are more likely to not accurately report the number of cases and deaths.



This graph shows the death rate (color of bubble) and the total number of cases (size of bubble). Although the number of cases is a lot higher in the United States, its death rate is a lot lower than European countries with lower numbers of cases.