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Review

Common factors of COVID-19 cases and deaths among the most affected 50 countries

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ABSTRACT

Aims: The Coronavirus (COVID-19) is a global pandemic requiring global responses. The objective of this paper is to identify the common factors of COVID-19 cases and deaths among the 50 most affected countries.
Methods: We performed Ordinary least squares among a wide range of socio-economic, environmental, climatic and health indicators to explain the number of cases and deaths.
Results: The findings are: (i) obesity is the only significant global denominator for the number of COVID-19 cases and deaths; (ii) the percentage of the population over the age of 65 and number of hospital beds per 1000 population inversely correlated to mortality from COVID-19.
Conclusions: Obesity increases vulnerability to COVID-19 infections and mortality. Global awareness of obesity and social investment in health infrastructure are pre-requisite for a pandemic adaptive future. However, the study is limited to cross-sectional data of April 17, 2020.

1. Introduction

The coronavirus (COVID - 19) pandemic is surging globally with more than 141 million confirmed cases and 3.01 million deaths as of April 20, 2021 [1]. Many potential factors are noted in the literature explaining the rate of infection. Population density and urbanization, health (i.e., obesity and diabetes), environmental (i.e. $PM_{2.5}$), climatic (i.e. temperature and humidity), and socio-economic inequality – all of these factors are widely documented [2–11]. Understandably, most of the confirmed cases are based on test results against symptomatic cases and asymptomatic cases are generally undocumented. Underlying health conditions i.e., diabetes, obesity, and heart diseases can create severe complications and deaths from COVID-19, which are widely documented in the literature (see for example [3,7]). Most of the literature is country-specific and document multiple factors for the infection and death from COVID-19.

Response to the pandemic varies across countries. The common suppressive measures applied with varying success to curb down the COVID-19 infections and subsequent deaths are: complete lockdown over a certain period, restriction on mobility, contact tracing, social distancing and masking, and mass vaccination [12]. Except for mass vaccination, which is limited in supply with varying effectiveness, there is hardly a clear-cut way-out in sight from the pandemic. As the current pandemic is expected to prolong and pandemic frequency is expected to rise in the future [13,14], pandemic adaptive social, economic and environmental planning is of utmost importance.

This article considers a range of social, economic and environmental factors of 50 countries with the highest COVID-19 cases (Fig. 1) to explore the common factors of cases and death. In doing so, the article has the potential for a global understanding to channel social energy and finance to develop pandemic adaptive social policy and infrastructure.

2. Methods and data

We have selected 50 countries with the highest infections (as of April 17, 2021) from COVID-19. A total of 14 factors is selected to explain the number of confirmed cases and deaths per 100,000 population (see the factor lists in Tables 2 and 3). These factors are selected from an extensive literature review. Ordinary least square (OLS) is used for regression analysis. SPSS software package is used to perform the statistical analysis. By equally weighing the normalized COVID-19 case and death rates, a COVID-19 severity

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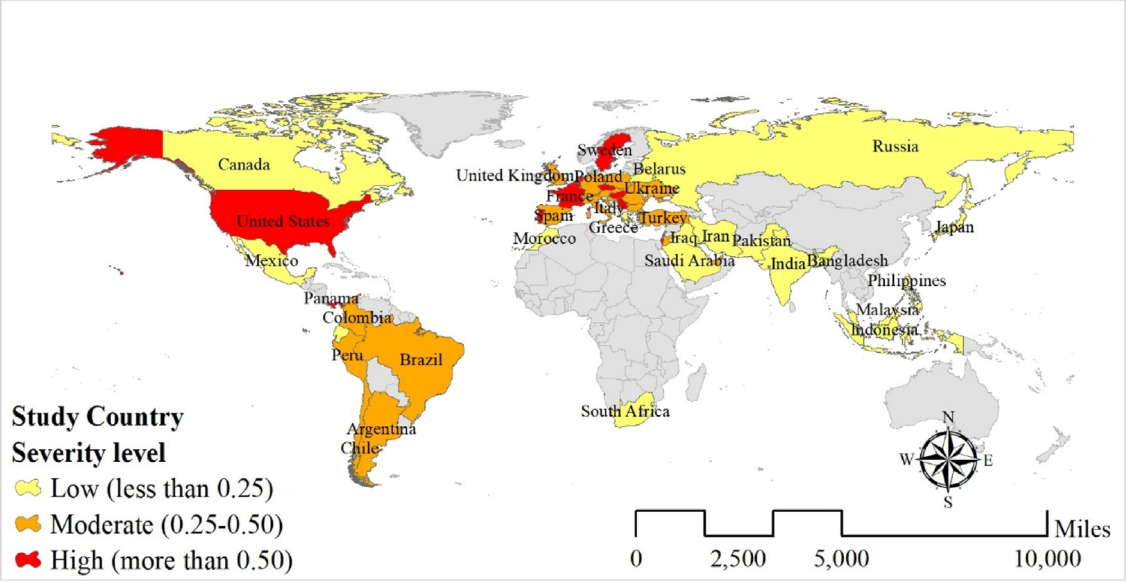

Fig. 1. Selected 50 countries with the highest COVID-19 severity.

map (Fig. 1) is created using ArcGIS 10.5.

We have used online open-source data from several sources for the selected factors. Table 1 is the descriptive statistics of the data used in this research. We refrained from data normalization because of the in-built scale of the dataset, and the min-max data normalization does not generate different results.

3. Results

3.1. Factors of COVID-19 cases

The COVID-19 cases per 100,000 population show that the Czech Republic has the highest infection rate followed by the United States. The OLS of factors affecting the COVID-19 cases are summarized in Table 2. With a 95 % confidence interval ($R^2 = 0.519$, ANOVA significance at 0.009), only the obesity rate is positively and significantly affecting the number of COVID-19 cases.

3.2. Factors of COVID-19 deaths

Columbia has the highest and Indonesia has the lowest deaths per 100,000 population from COVID-19. The OLS results of the factors affecting COVID-19 deaths are summarized in Table 3. With a 95 % confidence interval ($R^2 = 0.574$, ANOVA significance = 0.002), only the percentage of population over the age of 65 positively and significantly affects the COVID-19 deaths.

Table 1
Descriptive statistics.

Data	Minimum	Maximum	Mean	Std. Deviation	Source
Confirmed COVID-19	303598	32256982	2601562	5120209	[1]
COVID-19 deaths	1365	579357	56363	99283	
Population density	4.13	1239.58	165.52	211.52	[2]
% of population over the age of 65	1.16	28	13.45	6.89	
% of urban population	34.47	98.04	73.01	15.14	
Life expectancy at birth	63.86	84.21	77.21	4.53	
% of population with diabetes between age 20-79	3.9	19.9	8.35	3.55	
No. of hospital beds per 1000 population	0.6	13.4	4.03	3	
No. of Doctors per 1000 population	4.3	54.8	27.56	13.43	
GDP per capita	1482	82818	21523	19560	
Air quality $PM_{2.5}$	6.18	90.87	23.59	18.88	
Health care index	42.7	80.99	64.37	9.81	[3]
Obesity rate	3.6	36.2	22.74	7.85	[4]
Death from cardio-vascular diseases per 100000	30.99	328.39	125.85	74.95	[5]
Human Development Index	0.56	0.96	0.83	0.09	[6]
Air connectivity index	1.79	77.78	7.69	10.6	[15]
Governance effectiveness	−1.34	1.97	0.48	0.8	[7]
Gini coefficient	0.48	0.9	0.74	0.09	[8]

[1] https://www.worldometers.info/coronavirus/.
[2] https://data.worldbank.org.
[3] https://www.numbeo.com/health-care/rankings_by_country.jsp.
[4] https://obesity.procon.org/global-obesity-levels/.
[5] https://www.worldlifeexpectancy.com/cause-of-death/coronary-heart-disease/by-country/.
[6] http://hdr.undp.org/en/content/latest-human-development-index-ranking.
[7] https://www.theglobaleconomy.com/rankings/wb_government_effectiveness.
[8] https://worldpopulationreview.com/country-rankings/gini-coefficient-by-country.

Table 2
Factors of COVID-19 cases.

Coefficients[a]					
Model	Unstandardized Coefficients		Standardized Coefficients	T	Sig.
	B	Std. Error	Beta		
(Constant)	−15264.749	14833.788		−1.029	.311
Population density	2.648	2.298	.178	1.152	.257
% of population over the age of 65	125.447	115.669	.275	1.085	.286
% of urban population	−48.762	40.777	-.235	−1.196	.240
Health care index	42.911	60.769	.134	.706	.485
Life expectancy at birth	129.572	199.356	.187	.650	.520
% of population with diabetes between age 20-79	−64.963	159.406	-.073	-.408	.686
Obesity rate	**224.019**	**83.739**	**.560**	**2.675**	**.011**
Death from cardio-vascular diseases per 100000	1.377	7.635	.033	.180	.858
GDP per capita	-.006	.050	-.035	-.111	.913
Human Development Index	534.979	14438.005	.016	.037	.971
Air quality $PM_{2.5}$	−38.214	30.289	-.230	−1.262	.215
Air connectivity index	44.778	52.705	.151	.850	.401
Governance effectiveness	−203.983	1323.193	-.052	-.154	.878
Gini coefficient	6390.984	6153.476	.173	1.039	.306

[a] Dependent variable: cases per 100,000 population.

Table 3
Factors of COVID-19 deaths.

Coefficients[a]					
	Unstandardized Coefficients		Standardized Coefficients	T	Sig.
	B	Std. Error	Beta		
(Constant)	310.463	404.456		.768	.448
% of population over the age 65	**8.235**	**2.991**	**.801**	**2.753**	**.009**
Health care index	1.506	1.293	.211	1.164	.252
No. of hospital beds per 1000 population	**−10.354**	**5.375**	**-.440**	**−1.926**	**.062**
No. of doctors per 10000 population	-.003	1.014	-.001	-.003	.998
Life expectancy at birth	−7.911	5.673	-.464	−1.394	.172
% of people with diabetes 20-79	−2.375	3.424	-.119	-.694	.493
Obesity rate	**3.647**	**1.860**	**.408**	**1.961**	**.058**
Air Quality $PM_{2.5}$	-.990	.637	-.268	−1.554	.129
Population density	.026	.050	.079	.529	.600
% of urban population	-.275	.886	-.060	-.310	.758
Death from cardio-vascular diseases per 100000	-.100	.200	-.107	-.499	.621
GDP per capita	.000	.001	-.073	-.277	.784
Human Development index	307.907	324.776	.405	.948	.350
Governance Effectiveness	−34.346	28.406	-.394	−1.209	.235

[a] Dependent variable: deaths per 100,000 population.

However, with a 90 % confidence interval, the number of hospital beds per 1000 population negatively and the obesity rate positively affect the number of COVID-19 deaths.

4. Discussion

Among the 14 factors, the obesity rate stands out to be the only common factor affecting the number of COVID-19 cases among the topmost affected 50 countries. However, country-specific studies on the correlation between obesity and COVID-19 infection are numerous (see for example [3]). Additionally, per capita GDP is positively correlated (person correlation 0.43 at 0.01 significance) to COVID-19 infection, meaning the richer countries are more susceptible to infection than the poor ones. However, per capita GDP and obesity rate are not significantly correlated, which indicates that obesity is not linked to economic status.

The age factor affecting the severity of illness and death from COVID-19 is widely documented. The study findings also indicate that age dividend – the higher the age the higher the risk – significantly determines the death rate from COVID-19 [16]. Secondly, countries with low hospital beds per 1000 population signifies low health investment, and consequently have higher mortality from COVID-19. The topmost countries with COVID-19 mortality are Columbia, Lebanon, Belgium, Morocco, Belarus, Slovakia, Chile, UAE, Poland, Mexico, Bangladesh and so on, respectively. Finally, the obesity rate appears to be a common factor for both the number of COVID-19 cases and deaths.

5. Conclusion

This research has two conclusive findings on the 50 most COVID-19 affected countries. First, obesity increases susceptibility to COVID-19 infection and consequent deaths. Secondly, lack of health infrastructure i.e., per capita hospital beds increases COVID-19 mortality. Our paper calls for global awareness on obesity and increasing social investments for a pandemic adaptive future.

This research lacks panel data analysis. Therefore, temporal variation of COVID-19 cases and deaths are not accounted for. With the new coronavirus variants i.e., the Delta variant, there is a need for spatio-temporal analysis on COVID-19 cases and deaths. Secondly, the factors of COVID-19 cases and deaths of this study are at the country level, which provides little understanding on spatial distribution i.e., the disparity in health care facilities and concentration of COVID-19 cases between urban and rural areas.

Declarations

Funding

None.

Data availability

The dataset of this study is available from the corresponding author upon reasonable request.

Conflicts of interest

The authors declare no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Ethical approval

The authors declare No ethical approval required. Ethical approval for this type of study is not required by our institution.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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