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Short Communication

Factors influencing the COVID-19 mortality rate in the European Union: importance of medical professionals



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ABSTRACT

Objective: The aim of this paper is to analyze whether health variables such as the total number of physicians, available beds, and public spending on health care influence the number of deaths. The influence of other variables such as the Human Development Index and public health measures is also analyzed.

Study design: Statistical study. Evaluation of variables associated with COVID-19 mortality in the EU.

Methods: A multiple regression analysis is performed for the countries of the European Union.

Results: Health expenditure, public health measures and the number of physicians influence the total number of deaths. The more physicians, the lower the number of deaths. However, the number of beds or the Human Development Index are not determinants of the number of deaths.

Conclusions: A greater number of medical professionals will improve health care and reduce the number of deaths.

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Introduction

A new coronavirus outbreak, known as SARS-CoV-2 emerged on December 31, 2019 in Wuhan, (China), spreading rapidly throughout the world.¹ According to data provided by Johns Hopkins University there are more than 99.7 million infected with the virus and more than 2.14 million deceased as of January 26, 2021. The most common symptoms produced by COVID-19 are fever, cough, shortness of breath,² and, in some cases, decreased or loss of smell and taste.³ The virus is transmitted through respiratory droplets released when a person with the virus coughs, sneezes or speaks.⁴ The infection can become complicated and produce respiratory problems and severe chest symptoms, leading to acute pneumonia.^{5,6} Elderly people are at highest risk of coronavirus lethality.⁷

The coronavirus has also called into question whether countries have the necessary tools to deal with the pandemic. Given the great expansion of the virus, the collapse of many hospitals and the considerable increase in the number of infected and dead, it is important to carry out a study to determine whether variables such as the number of physicians, public spending on health care or the

number of hospital beds available have a significant influence on the total number of deaths due to COVID-19.

The main objective of this work is to determine whether various health variables have a significant influence on the total number of deaths per million inhabitants in the countries of the European Union. The aim is also to know whether countries with a greater number of public health measures or restrictive policies (which do not indicate effectiveness) have had fewer deaths due to coronavirus.

In addition, we included the Human Development Index (HDI), an indicator created by the United Nations Development Programme (UNDP) to determine the degree of progress of each country taking into account health, economic, and educational factors and which could have an impact on the number of deaths.⁸

Methodology

A multiple linear regression was carried out, with the dependent variable being the total number of deaths per million inhabitants (*Mortality*). The independent variables included health variables such as the total number of physicians per 100,000 inhabitants (*Physicians*), available beds per 100,000 inhabitants (*Beds*), and public spending on health (*Health Expenditure*) as a percentage of gross domestic product (GDP). These variables were obtained from

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Table 1
Multiple regression model.

Variables	Unstandardized coefficients	Standardized coefficients	P-value
Constant	3734.78 (2499.91)		0.14
HDI	−4662.41 (2952.37)	−0.434	0.12
Policies	12.62 ^b (6.85)	0.396	0.07
Health Expenditure	109.99 ^a (54.08)	0.502	0.05
Beds	0.23 (0.49)	0.100	0.64
Physicians	−1.75 ^b (0.99)	−0.378	0.09

Standard error in parentheses.
HDI, Human Development Index.

^a Significant at the 5% level.

^b Significant at 10% level.

the Eurostat database. We have also considered the HDI, information provided by the World Bank, and the restrictive policies imposed by the countries (*Policies*), measured through the Government Response Stringency Index,⁹ obtained from One World Data. This index shows the level of stringency or harshness of the policies implemented by the various countries; however, it does not imply that they are effective. It is based on nine response indicators, including school closures, workplace closures, or travel bans, and can take a value from 0 to 100 (100 = most stringent). The information on the data concerning COVID-19 refers to cases accumulated up to the second week of January 2021.

The equation to be estimated is as follows:

$$\widehat{Mortality}_i = \beta_0 + \beta_1 HDI_i + \beta_2 Policies_i + \beta_3 Health\ Expenditure_i + \beta_4 Beds_i + \beta_5 Physicians_i + \epsilon_i$$

Results

Mortality rates vary considerably among the countries analyzed. The highest incidence is in Belgium (1709.27 per million population) and the lowest in Finland (106.26 per million population). The highest public health expenditure, expressed as a percentage of GDP, is in Germany (11.47%) and the lowest in Luxembourg (5.29%). Germany has the highest number of beds per 100,000 inhabitants (800.23) and Sweden the lowest (213.79). Greece has the most medical professionals per 100,000 inhabitants (561.81), while Poland has the fewest (257.47). Ireland has the highest HDI (0.955) and Bulgaria the lowest (0.816). The highest Government Response Stringency Index is that of Italy (87.96), and the lowest is that of Croatia (41.67), with the average for the European Union countries standing at 68.58. This indicates that the most restrictive measures have been those imposed by Italy.

The multiple regression analysis (Table 1) shows that the level of restriction of the policies adopted by governments (at 10%), health spending (at 5%), and the total number of physicians (at 10%) have a significant influence on the COVID-19 mortality rate. If we look at the value of the standardized coefficients, health spending is the variable with the greatest influence.

More physicians contribute significantly to lower rates of COVID-19 deaths. The more medical professionals in healthcare, the more personalized care can be given to COVID-19 infected patients.

On the other hand, those countries that have allocated greater economic resources (more healthcare expenditure) to the healthcare system have had higher death rates, coinciding with the results

of the work of Khan et al.¹⁰ at the global level. The number of deaths due to COVID-19 has not been determined by the fact that less income has been allocated to the health care system, but perhaps by an irregular redistribution of these economic resources, where there has been a low recruitment of health care personnel. On the other hand, despite the collapse of some hospitals, the number of beds does not influence the number of deaths. The opening of new floors with beds or the creation of field hospitals has allowed the continued care of patients infected with coronavirus. However, the lack of personnel has had an impact on the number of deaths; thus, it will be necessary for governments to hire more health personnel to deal with the pandemic and prevent the number of deaths from continuing to grow.

In addition to these health variables, there is a positive relationship between the severity of restrictive measures and the number of deaths. This is explained by the fact that, in countries where the incidence of the virus has been lower, it has not been necessary to implement such a restrictive policy as in those where the number of deaths and infected persons grew exponentially at a very worrying rate. The HDI, which, among other things, provides information on the degree of health progress of a country, is not a determining factor in estimating the number of deaths.

Conclusions

The spread of COVID-19 has affected the European continent with great virulence. For this reason, in this work we have analyzed, by means of multiple regression, whether various health variables influence the number of deaths due to COVID-19 in the countries of the European Union.

It was found that the number of medical professionals has a significant influence and that the greater the number of professionals the lower the number of deaths. Health expenditure is important to allocate more money to the purchase of medical equipment, respirators, and resources. However, it has been proven that the redistribution of these resources is not being adequate. The expenditure or budget earmarked for the health sector should make it possible to hire more health personnel, so that more and better services can be offered to those infected. However, in many cases the number of staff hired is insufficient for the large number of people affected. Restrictive measures (closure of schools or essential activities) are needed to help contain the pandemic. Even so, those countries with more restrictive measures have had a higher number of deaths because of their high incidence of cases.

This paper warns of the importance of having sufficient numbers of medical professionals to deal with the pandemic.

Human resources are almost more important than economic resources, and the recruitment of a greater number of healthcare professionals will allow more effective care of patients infected with coronavirus; as a consequence, the number of deaths can be slowed down. Therefore, it is necessary that the redistribution of resources is done in an effective way and that the budget and expenditure allocated to public health is used, in part, for the recruitment of health personnel.

Author statements

Ethical approval

Ethical approval was not required for this study as no patients are involved.

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Competing interest

There is no conflict of interest.

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