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## **Assessing of Factors Effecting COVID-19 Mortality Rate on a Global Basis**

*COVID-19 Ölüm Hızını Etkileyen Faktörlerin Küresel Bazda Değerlendirilmesi*

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**Abstract:** In this study, it was aimed to investigate the effect of some health indicators of selected countries on COVID-19 pandemic death/case rates. In this study, which was conducted using retrospective data, the health indicators of countries with more than 50,000 COVID-19 cases were compared with the COVID-19 cases and death rates in these countries. The data used in the research process were obtained by the World Health Organization, the World Bank, and OECD sources. Results: Considering the findings obtained in the analysis, the USA ranks first in the highest number of deaths (89271), while Saudi Arabia is the last (329). The highest rate of death/case belongs to France (19.8), the lowest rate to Saudi Arabia (0.5%). In the correlation analysis based on the death/case ratio, a significant relationship was found in cancer deaths, congenital life expectancy, life expectancy above 65 years old, population 65 years and older (positive direction), and air pollution variables (negative direction). According to the results of the regression analysis for meaningful relationship variables, all independent variables affect the death/case ratio. The highest influencing variable is congenital life expectancy ( $R^2 = ,462$ ). As a result, deaths from cancer and especially congenital life expectancy and population over 65 years of age have a positive effect on COVID-19 death/case ratio. In this context, it is necessary to continue taking measures to protect the elderly population and individuals with chronic anxiety.

### **Structured Abstract: Introduction and Aim of the Study**

In terms of human history, pandemics have had important effects on societies (Gondauri and Batiashvili, 2020). All people over the world are under the influence of an outbreak caused by a virus called SARS-CoV-2. As of May 29, 2020, the virus affected approximately 6 million people in the world and 360 thousand people died because of this virus (WHO, 2020c). The hardest part is that there is no specific treatment or vaccine for the virus (European Centre for Disease Prevention and Control, 2020). Therefore, determining which deaths related to the virus are affected by health-related variables is crucial in terms of precautions to be

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taken and policies to be developed. In this study, it was aimed to investigate the effect of some health indicators of selected countries on COVID-19 pandemic death/case rates.

### Method

The data related to the research were obtained from the published statistics that belong to the World Health Organization (2020), the World Bank (2020), and the OECD (2020a). The death/case rate was got to dividing into the number of deaths of the number of cases. The scope of the study was included 17 countries that those with 50,000 COVID-19 cases and over, and 13 variables that foreseen being effected the death/case rate. The case and death statistics were got according to the Situation report - 121 of the WHO dated May 20, 2020 (WHO, 2020b). The data were analyzed by SPSS 22.0 program. For the data that were normally distributed, parametric test techniques were used. The relationship between the dependent and independent variables was analyzed by the Pearson Correlation test. On the other hand, simple regression analysis was done by using the Enter method to reveal the effect of independent variables on the death/ case rate. It was studied with a 95% confidence interval and a 5% margin of error.

### Results

France is the highest country in death/ case rates with 19.8%. Then it is Belgium (16.3%) and the UK (14.2%). The rates of the UK and Italy are equal (14.2%). The lowest countries according to the death/case rates are Saudi Arabia (0.5%), Russia (1%), and Turkey (2.8%). Although the USA is the uppermost country in terms of both the number of cases and the number of deaths, it is the ninth country according to the death/case rate (6%). According to the findings of correlation analysis, there is a positive correlation between deaths from cancer ( $r = .524$ ); life expectancy at birth ( $r = .680$ ); life expectancy at age 65 ( $r = .571$ ); population ages 65 and above (% of total population) ( $r = .651$ ) and the death/case rates. But there is a negative correlation between air pollution ( $r = -.528$ ) and the death/case rates (Table 1). However, with the death/case rate was not found a relationship between smoking prevalence, alcohol consumption, influenza vaccination, length of hospital stay, physicians, nurses and midwives, current health expenditure per capita, forest area. According to the findings of regression analysis, deaths from cancer ( $t = 2.381$ ;  $R^2 = .274$ ), life expectancy at birth ( $t = 3.588$ ;  $R^2 = .462$ ), life expectancy at age 65 ( $t = 2.508$ ;  $R^2 = .326$ ), population ages 65 and above ( $t = 3.317$ ;  $R^2 = .423$ ) affect the death/case rates, positively. But air pollution affects the death/case rates ( $t = -2.406$ ;  $R^2 = .278$ ), negatively.

### Conclusion

Overall, COVID-19 death/case rates were found to be positively associated with age-related variables. Life expectancy at birth, which is one of these variables, represents 46.2% of the change in death/case rates; the population ages 65 and above, 42.3%; life expectancy at age 65 explains 32.6%. The high population of the elderly is also an indicator of increased living standards, improved lifestyle, better education, and greater access to quality healthcare (OECD, 2020b). This contradicts the death/case rates. Because, according to the results of the research, the death/case rates increase as the elderly population increases. This contradiction can be explained by reasons such as the fact that some countries that normally provide quality health care have to compromise this quality during the epidemic process, that some countries' health care capacity is forced due to the epidemic and that the presence of patients those not able to receive the service although necessary, and that the virus affecting older people more (Shaw et al. 2020). Deaths from cancer is another variable that is positively associated with COVID-19 death/case rates and accounts for 27.4% of the variation in the death/case rates. The risk of developing the cancer increases with age (OECD, 2020c). This information is consistent with the results of the study. The fact that the increase in cancer disease with age means that in countries with a high elderly population, cancer cases will also be high. The only variable that is negatively related to COVID-19 death/case rates is air pollution. This variable explains 27.8% of the change in death/case rate. The fact that COVID-19 disease is due to an infectious virus and the older population in countries with less air pollution, in general, can be shown as a reason for the negative relationship.

**Keywords:** Healthcare Management, COVID-19, Mortality, Comparisons of Country, Case Numbers, Death Numbers.

**Öz:** Bu çalışmada, seçilmiş ülkelerin bazı sağlık göstergelerinin COVID-19 pandemisi ölüm/vaka oranları üzerindeki etkisinin araştırılması amaçlanmıştır. Retrospektif veriler kullanılarak yapılan bu çalışmada, 50.000'den fazla COVID-19 vakası olan ülkelerin sağlık göstergeleri ve bu ülkelerdeki ölüm oranları ile

karşılaştırılmıştır. Araştırma sürecinde kullanılan veriler Dünya Sağlık Örgütü, Dünya Bankası ve OECD kaynakları tarafından elde edilmiştir. Analizden elde edilen bulgular göz önüne alındığında, ABD ölüm sayısında (89271) birinci sırada yer alırken, Suudi Arabistan son sıradadır (329). En yüksek ölüm/vaka oranı Fransa'ya (% 19,8), en düşük ölüm oranı ise Suudi Arabistan'a (% 0,5) aittir. Ölüm/vaka oranına dayalı korelasyon analizinde kanser ölümleri, doğumdan yaşam beklentisi, 65 yaş üstü yaşam beklentisi, 65 yaş ve üstü nüfus (pozitif yönde) ve hava kirliliği değişkenleri (negatif yönde) arasında anlamlı bir ilişki bulunmuştur. Anlamlı ilişki bulunan değişkenler için yapılan regresyon analizi sonuçlarına göre, tüm bağımsız değişkenler ölüm/vaka oranını etkilemektedir. En fazla etki eden değişken, doğumdan yaşam beklentisidir ( $R^2 = ,462$ ). Sonuç olarak kanserden ölümler ve özellikle doğumdan yaşam beklentisi ve 65 yaş üstü nüfus, COVID-19 ölüm vaka oranları üzerinde olumlu bir etkiye sahiptir. Bu bağlamda, yaşlı nüfusu ve kronik anksiyetesi olan bireyleri korumak için önlemler almaya devam etmek gerekmektedir.

**Anahtar Kelimeler:** Sağlık Yönetimi, COVID-19, Ölüm Oranı, Ülke Karşılaştırmaları, Vaka Sayıları, Ölüm Sayıları

## Introduction

The World Health Organization reported that the world experienced an outbreak of coronavirus 3 times in less than twenty years (Kelvin & Rubino, 2020). Among these, SARS-CoV first emerged in 2002, then MERS followed in 2012 (Al-Ahdal et al. 2012) and now nCoV (Wuhan) appeared at the end of 2019 (Kelvin & Rubino, 2020).

Human coronavirus (HCoV) infection is a virus that causes severe respiratory diseases. Most people who get COVID-19 recover from mild-to-moderate symptoms and do not need special treatment. In the past 15 years, two zoonotic, highly pathogenic HCoV have emerged. These; the coronavirus, which occurs with the severe acute respiratory syndrome, is SARS-CoV, and the coronavirus type generally seen in the Middle East is MERS-CoV (Fung & Liu, 2019). Coronavirus is a virus transferred from person to person (Sabino-Silva et al. 2020). Important transmission routes of coronavirus are with contamination of the environment by infected patients and biological human remains (Ong et al. 2020).

For the outbreak of COVID-19 which has no specific treatment with proven reliability and effectiveness (Chen et al. 2020; Cascella et al. 2020; Murthy et al. 2020), there are significant advances and developments for treatment by many countries around the world, both as a requirement of state policy and within the framework of independent working procedures of scientists. Multidisciplinary teams have to do long-term studies to find the COVID-19 vaccine and to offer to heal people. Elderly people and people with chronic diseases are waiting for the vaccine or treatment against COVID-19. Because elderly people with chronic disease (HIV, lung diseases, those with immune system deficiency, etc.) are among the groups that are sensitive to this disease. And it is seen that death cases are frequently in elderly individuals and those with chronic disease (General Office of National Health Committee, 2020; Wang et al. 2020; Li et al. 2020; Jin et al. 2020). In this context, various measures are taken for risky groups to reduce death cases. Since the risk of transmission of the coronavirus is obvious, in many provinces around the world, some precautions such as curfew, social isolation, and quarantine practices are taken to protect the elderly, therefore preventing the spread of coronavirus (Armitage & Nellums, 2020; Studdert & Hall, 2020). By WHO, whether it is a risky group, it has touched on using masks properly and discarding the masks used and made some suggestions (WHO, 2020a).

Many factors can affect the number of COVID-19 cases and death rates. Among these factors, there are some commonly accepted basic variables. The most remarkable of these is the prevalence of the elderly population and the prevalence of chronic diseases. In this study, it was aimed to investigate the effect of some health indicators of selected countries on COVID-19 pandemic death/case rates.

## Methods

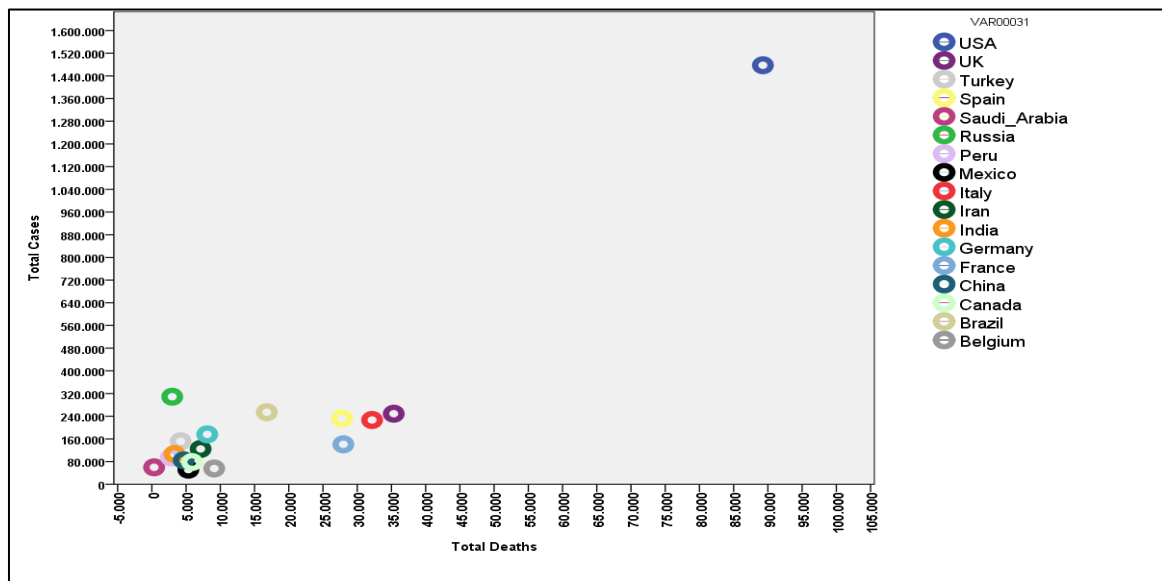
The data related to the research were obtained from the published statistics that belong to the WHO (2020), the World Bank (2020), and the OECD (2020a). The death/case rate was got to dividing into the number of deaths of the number of cases. The scope of the study was included 17 countries that those with 50,000 COVID-19 cases and over, and 13 variables that foreseen being effected the death/case rate. The case and death statistics were got according to the Situation report - 121 of the WHO dated May 20, 2020 (WHO, 2020b).

The data were analyzed by SPSS 22.0 program. For the data that were normally distributed, parametric test techniques were used. The relationship between the dependent and independent variables was analyzed by the Pearson Correlation test. On the other hand, simple regression analysis was done by using the Enter method to reveal the effect of independent variables on the death/ case rate. It was studied with a 95% confidence interval and a 5% margin of error.

To conduct this study was obtained approval from the Ministry of Health. Also, ethical permission was obtained with the decision of Isparta University of Applied Sciences Scientific Research and Publication Ethics Committee dated 18.05.2020 and number 2.

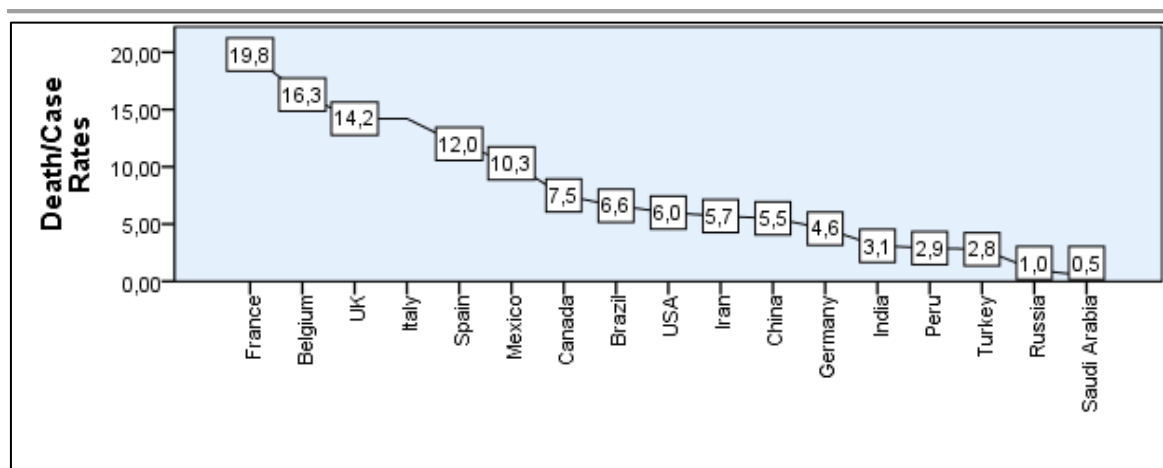
## Results

In this section, the countries' COVID-19 death/case numbers, and the death/case rates, and descriptive statistics, correlation, and regression analysis results of the study variables were examined.



**Chart 1:** The Number of Death and Cases, According to Countries

When analyzed the countries' number of deaths, the USA is by far ahead with 90,000 deaths. The USA is followed by England (35341) and Italy (32169). The lowest number of deaths belongs to Saudi Arabia (329). In the number of cases, the USA is the first with close to 1.5 million cases. The USA is followed by Russia (308705) and Brazil (254220), respectively (Chart 1).



**Chart 2:** The Death / Case Rates, According to Countries

It is given the death/case rates of the countries in Chart 2 above. France is the highest country in death/ case rates with 19.8%. Then it is Belgium (16.3%) and the UK (14.2%). The rates of the UK and Italy are equal (14.2%). According to the World Bank data, Russia ranks ninth in the world population, ranking 16th in the death/case rate (1%). The lowest countries according to the death/case rates are Saudi Arabia (0.5%), Russia (1%), and Turkey (2.8%). Although the USA is the uppermost country in terms of both the number of cases and the number of deaths, it is the ninth country according to the death/case rate (6%).

**Table 1:** Descriptive Statistics and the Correlation Analysis Findings

Variables	Death/Case Rate		Descriptive Statistics			
	r	N	$\bar{x}$	sd	min	max
Total Cases			227828	331661	51633	1477459
Total Deaths			16651	21944	329	89271
Death/case rate	1.000		7.82	5.69	.50	19.80
Deaths from cancer (total, per 100 000 persons)	.524*	17	130	88.61	6	216
Smoking prevalence (total, ages 15+, %)	.369	17	20.61	10.55	.20	39.30
Total alcohol consumption per capita (liters of pure alcohol, 15+ years of age)	.437	17	8.38	3.61	1	13.40
Influenza vaccination rates (total, % of population aged 65+)	.506	17	26.61	29.68	7	72.60
Length of hospital stay (acute care, days)	.327	17	4.31	3.56	4.10	9.30
Physicians (per 1,000 people)	.411	17	2.61	1.08	.80	4.20
Nurses and midwives (per 1,000 people)	.346	17	6.44	3.75	1.40	13.20
Current health expenditure per capita (PPP, current international \$)	.356	17	3182	2578	253	10246
Life expectancy at birth (total, years)	.680*	17	78.29	4.15	69	83
Life expectancy at age 65 (years)	.571*	17	10.53	10.29	16	22.20
Population ages 65 and above (% of total population)	.651*	17	13.29	6.33	3	23
Air pollution (PM2.5, mean annual exposure, micrograms per cubic meter)	-.528*	17	28.09	26.73	6	91
Forest area (% of land area)	-.031	17	29.96	16.24	.50	58.90

\*. Correlation is significant at the 0.05 level (2-tailed).

CI= 95%; N= Countries' number; r= correlation coefficient

According to the findings of correlation analysis, there is a positive correlation between deaths from cancer ( $r = .524$ ); life expectancy at birth ( $r = .680$ ); life expectancy at age 65 ( $r = .571$ ); population ages 65 and above (% of total population) ( $r = .651$ ) and the death/case rates. But there is a negative correlation between air pollution ( $r = -.528$ ) and the death/case rates (Table 1). However, with the death/case rate was not found a relationship between smoking prevalence, alcohol consumption, influenza vaccination, length of hospital stay, physicians, nurses and midwives, current health expenditure per capita, forest area.

**Table 2:** The Findings of Regression Analysis

Dependent Variable	Independent Variable	B	se	t	F	R <sup>2</sup>	p
The Death/Case Rates	Constant	3,443	2,204	1.562			
	1. Deaths from cancer	.034	.014	2.381	5,671	.274	.031
	Constant	-65,087	20,348	-3.198			
	2. Life expectancy at birth	.931	.260	3.588	12,871	.462	.003
	Constant	4,810	1,829	2.630			
	3. Life expectancy at age 65	.317	.126	2.508	6,290	.326	.026
	Constant	.057	2.579	.022			
	4. Population ages 65 and above	.584	.176	3.317	11,005	.423	.005
	Constant	10,973	1,783	6.155			
	5. Air pollution	-.112	.047	-2.406	5,787	.278	.030

The results of the regression analysis conducted according to those significant relationships in a correlation analysis are shown in Table 2. It was only conducted the model of simple regression in the analysis. Deaths from cancer ( $t=2.381$ ;  $R^2=.274$ ), life expectancy at birth ( $t=3.588$ ;  $R^2=.462$ ), life expectancy at age 65 ( $t=2.508$ ;  $R^2=.326$ ), population ages 65 and above ( $t=3.317$ ;  $R^2=.423$ ) affect the death/case rates, positively. But air pollution affects the death/case rates ( $t= -2.406$ ;  $R^2=.278$ ), negatively.

### Conclusion

In terms of human history, pandemics have had important effects on societies (Gondauri & Batiashvili, 2020). All people over the world are under the influence of an outbreak caused by a virus called SARS-CoV-2. As of May 29, 2020, the virus affected approximately 6 million people in the world and 360 thousand people died because of this virus (WHO, 2020c). The hardest part is that there is no specific treatment or vaccine for the virus (European Centre for Disease Prevention and Control, 2020). Therefore, determining which deaths related to the virus are affected by health-related variables is crucial in terms of precautions to be taken and policies to be developed. In this study, 13 variables expected to influence COVID-19 death/case rates are examined.

Overall, COVID-19 death/case rates were found to be positively associated with age-related variables. Life expectancy at birth, which is one of these variables, represents 46.2% of the change in death/case rates; the population ages 65 and above, 42.3%; life expectancy at age 65 explains 32.6%. The increase of all 3 variables stated means an increase in the elderly population in a country. The high population of the elderly is also an indicator of increased living standards, improved lifestyle, better education, and greater access to quality healthcare (OECD, 2020b). This contradicts the death/case rates. Because, according to the results of the research, the death/case rates increase as the elderly population increases. This contradiction can be explained by reasons such as the fact that some countries that normally provide quality health care have to compromise this quality during the epidemic process, that some countries' health care capacity is forced due to the epidemic and that the presence of patients those not able to receive the service although necessary, and that the virus affecting older people more (Shaw et al. 2020).

Deaths from cancer is another variable that is positively associated with COVID-19 death/case rates and accounts for 27.4% of the variation in the death/case rates. Factors such as

tobacco and alcohol use, air pollution, unhealthy nutrition, insufficient physical activity, insufficiency of the health system are some of the causes of cancer death. In this study, no relationship was found between tobacco and alcohol use and COVID-19 death/case rates. Another factor associated with cancer is age. The risk of developing the disease increases with age (OECD, 2020c). This information is consistent with the results of the study. The fact that the increase in cancer disease with age means that in countries with a high elderly population, cancer cases will also be high.

The only variable that is negatively related to COVID-19 death/case rates is air pollution. This variable explains 27.8% of the change in death/case rate. Fine particulate matter (PM<sub>2.5</sub>) poses a great risk to health. Long-term exposure to this pollutant significantly increases respiratory and cardiovascular system diseases (OECD, 2020d). However, the fact that COVID-19 disease is due to an infectious virus and the older population in countries with less air pollution, in general, can be shown as a reason for the negative relationship.

Since the increase in mortality rates in the COVID-19 pandemic has a positive relationship and effect with the elderly population, the major purpose of isolation of the aged population is to reduce the obstacles that may emerge due to excessive demand both to protect them and to get health services. Since the risk of transmission of the coronavirus is obvious, in many provinces around the world, some precautions such as curfew, social isolation, and quarantine practices are taken to protect the elderly, thus preventing the spread of coronavirus (Armitage & Nellums, 2020; Studdert & Hall, 2020).

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