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DETERMINANTS OF COVID-19 DEATHS IN THE EARLY STAGE OF THE PANDEMIC: WORLDWIDE PANEL DATA EMPIRICAL EVIDENCE

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ABSTRACT

The COVID-19 pandemic has caused both economic and public health crises in all countries. Thus, the discovery of determinants of COVID-19 deaths at the early stage is important in order to provide a better execution of resources allocation, management and mitigation policies. Using panel data of 182 countries, we aim to examine the relationship between COVID-19 deaths and three independent variables at the early stage of the pandemic from March to July 2020 at six regional and global levels. The results show that there was a positive relationship between total COVID-19 deaths with total confirmed cases and new deaths, while a negative relationship between total COVID-19 deaths with new confirmed cases in all countries and regions (except the Americas). The European region was the worst affected region as compared to other regions. Several policies are advanced for the improvement of global public health.

1. Introduction

The cumulative number of COVID-19 cases and deaths reported globally reached 216 million and 4.5 million respectively in early September 2021 since its outbreak in early 2020 (World Health Organisation [WHO), 2021). Field hospitals were set up to treat COVID-19 patients due to the over-stretched hospital capacity. Vaccinations have been administrated at a large scale, and economic sectors have reopened to adapt to the new normal. Communities are living with the virus under some social restrictions.

The consequences of the pandemic are severe and cause various problems at the global level such as deaths, economic crisis, public health crisis, declining productivity, mental health problems, protests and riots, social distancing, and depletion of human and financial resources. New variants of COVID-19 are identified from time to time and the mortality rate continues to surge. Thus, the determinants of COVID-19 deaths warrant an empirical investigation for better governance of global public health.

There is burgeoning literature on the determinants of COVID-19 deaths, as examined by scholars. In general, the factors are complex and include epidemiological characteristics, clinical factors, comorbidities, socio-economic, demographics, logistics, health care capacity, education, gross domestic product, climate change, and environmental factors (Elliot et al., 2021; Upadhyay & Shukla, 2021;). The extent of determinants of COVID-19 deaths is varied among countries and regions.

Each region and country demonstrates different and complex conditions of the COVID-19 pandemic. For instance, the Western Pacific region recorded lower cases of COVID-19 deaths as compared to Americas (WHO, 2020). Malaysia, as part of the Western Pacific region, documented zero COVID-19 death case in the first wave of the outbreak in January 2020, but eventually accumulated 36,198 death cases up to 28 August 2022 (Ministry of Health [MOH], 2022). The pandemic has caused loss of income and productivity, and changed the living lifestyle in Malaysia.

Various strategies and interventions have been implemented worldwide in fighting the pandemic with mixed results. Currently, there are various studies on COVID-19 at individual hospitals and across countries but limited to the early stage of the pandemic, and regional and global levels. Thus, this study provides an avenue to shed additional insight on the determinants of COVID-19 deaths at regional and global levels at the early phase of the pandemic.

Based on the data of WHO (2020), Figure I shows the average cases of COVID-19 of all countries and six regions from March to July 2020. The Americas unveiled the highest average number in all the important indicators, namely, total deaths, total confirmed cases, new confirmed cases and new deaths. On the other hand, the African region documented the lowest cases in total deaths and total confirmed cases, while the Western Pacific region recorded the lowest cases in new confirmed cases and new deaths.

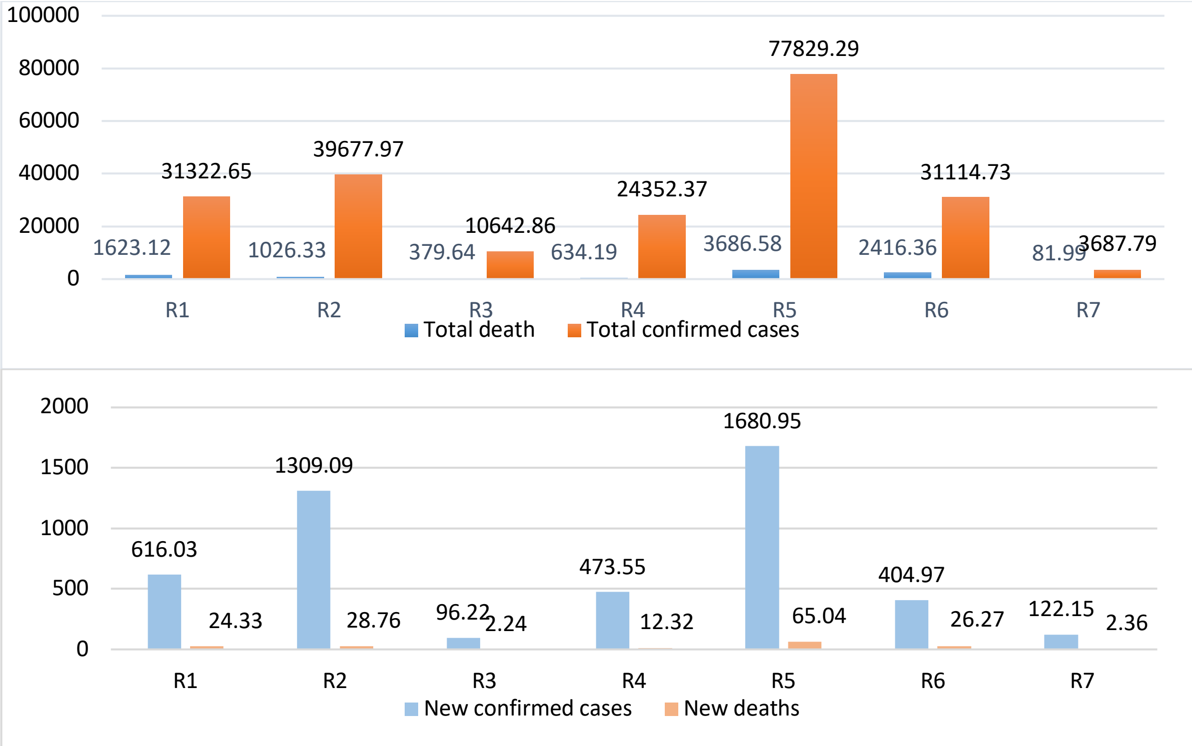

Figure I: The average of COVID-19 cases in all countries and six regions, March-July 2020

Note: R1 = All countries, R2 = South-East Asia, R3 = Western Pacific, R4 = East Mediterranean, R5 = Americas, R6 = Europe, R7 = Africa.
Source: World Health Organisation (WHO), 2020

In this study, we aim to examine the relationship between COVID-19 deaths and three determinants: (a) total confirmed cases, (b) new confirmed cases, and (c) new deaths at the early phase of the pandemic from March to July 2020 at the regional and global levels. The number of COVID-19 cases and deaths fluctuates and varies between regions and thus requires further analysis to shed additional insight into the COVID-19 deaths. The comparison of COVID-19 management between regions is important for policies mitigation, research and development (R & D), and better public health care collaboration in the future.

The rest of the paper is divided into four main components. Section 2 provides a synoptic review of the scholarly literature on the determinants of COVID-19 deaths. Section 3 outlines the methodology used in the study. Section 4 discusses the empirical results. The paper ends with concluding remarks in Section 5.

2. Literature Review

There is burgeoning literature on the studies of COVID-19 deaths since its outbreak in early 2020. The reported number of total deaths, total confirmed cases, new confirmed cases and new COVID-19 deaths vary between the regions. All countries have adopted various interventions and policies in fighting the pandemic, such as the closing of non-essential economic sectors, lockdowns, social distancing, border control, quarantine and isolation orders (Alandijany et al., 2020; Fuller et al., 2021; Robert, 2020; Rozaliyani et al., 2020). The results of the interventions and policies are mixed in all regions.

The Americas recorded the highest average number of all COVID-19 cases and deaths at the early stage of the pandemic compared to other regions such as Africa (Kaba et al., 2020; Musa et al., 2021; Salyer, et al., 2021) and Western Pacific (Mei & Hu, 2020). The Western Pacific region imposed various stringent interventions and policies at the early stage in fighting the pandemic (Fook et al., 2020; Kuguyo, et al., 2020; Robert, 2020; Tan et al., 2021).

The determinants of COVID-19 deaths are varied among countries, as examined by scholars. In this study, we only focused on the literature on the determinants of the COVID-19 death. There are two main categories of studies about determinants of the COVID-19 death, as demonstrated by scholars, namely: (a) micro factors: epidemiological characteristics (gender, age, clinical factors), comorbidities, human resources, socio-economic, health care capacity, demographics, and (b) macro factors: international arrivals, education, gross domestic product (GDP), politics, weather, urbanisation, population, and population density.

Upadhyay and Shukla (2021) discovered that life expectancies, obesity, COVID-19 positive cases, and H1N1 death rates recorded a positive correlation with COVID-19 death rates in India. In Thailand, Chailek et al. (2021) reported that male, elderly and delayed diagnosis were found to be positively associated with death cases. In Nepal and Indonesia, comorbidities and gender increased the COVID-19 death cases (Panthee et al., 2020; Surendra et al., 2021). In China, Yang et al. (2021) contended that socio-economic factors, spatial distance and climate factors determined the confirmed cases and fatality of COVID-19 patients. Pillay-van et al. (2020) and Elimian et al. (2020) observed that socio-demographic and clinical characteristics determined the death cases of COVID-19 in South Africa and Nigeria respectively.

Using data of 17 Spanish regions, Garcia (2021) revealed that nursing home beds, gross domestic product (GDP) per capita, travel, urban density and island region had a significant effect on the mortality rate. Using a sample of 2653 symptomatic COVID-19 patients, Giorgi et al. (2020) argued that epidemiological characteristics determined the COVID-19 cumulative incidence, hospitalisation and death rates in Reggio Emilia, Italy. Using a UK Biobank cohort of 473,550 cases, Elliot et al. (2021) unveiled that demographic, social, lifestyle, biological, medical and environmental factors determined COVID-19 deaths. Tarteret et al. (2021) discovered that hospital-dependent nursing homes had lower COVID-19 mortality due to better health care, compared to non-hospital dependent nursing homes. Using retrospective cohort analysis of 1487 cases, Kirillov et al. (2021) recorded that male, elderly and comorbidities determined the COVID-19 mortality rate.

Villalobos et al. (2021) found that demographic, health and socioeconomic variables played a significant role in influencing COVID-19 cases and deaths in the municipality region in Chile in the early stage of the pandemic. Using data of COVID-19 mortality with comorbidities background, Ferrari et al. (2021) revealed that epidemiological characteristics determined the COVID-19 mortality rate. In Ecuador, Ortiz-Prado et al. (2021) discovered that male, elderly, and presence of comorbidities were important determinants of mortality. Using a sample of COVID-19 deaths data of 50 districts in Metropolitan Lima, Peru, Hernandez-Vasquez et al. (2020) reported that men, the elderly and the lowest human development index had a higher mortality rate. Vidal-Cevallos et al. (2021) disclosed that biochemical markers were associated with higher in-hospital mortality risk in Mexican COVID-19 patients. In Pakistan, Sarfaraz et al. (2021) showed that the elderly, gender and clinical factors determined the mortality of COVID-19. Mansour et al. (2021) documented that the elderly, hospital beds, population density, and diabetes rates determined the COVID-19 cases in Oman.

Overall, there are various determinants of the COVID-19 cases, as demonstrated above. These empirical studies of COVID-19 deaths are analysed at the levels of country, hospital, cohort or individual. However, the studies of determinants of COVID-10 deaths across regional and global levels are limited. In addition, the determinants of COVID-19 death such as new COVID-19 cases and new deaths are less explored by scholars, even after extraordinary efforts have been put in by policymakers in fighting the COVID-19 pandemic.

3. Methodology

3.1 Data and descriptive statistics

We examined the relationship between COVID-19 mortality and three independent variables, as demonstrated in Table 1. The panel data consisted of average monthly data from March to July 2020 from 182 countries worldwide and was obtained from the World Health Organisation (WHO, 2021). This data was further grouped into six regions namely: (a) South-East Asia (10), (b) Western Pacific (15), (c) East Mediterranean (21), (d) the Americas (35), (e) Europe (54), and (f) Africa (47). All variables are in natural logarithm to reduce variations in the data and are denoted with "ln".

Table 1
Data sources and variables

Variables	Abbreviation	Unit of measurement	Sources	Expected Relationship
Total confirmed cases	TCC	Number of cases	WHO	+
New confirmed cases	NCC	Number of cases	WHO	+
New death	ND	Number of cases	WHO	+
Total death	TD	Number of cases	WHO	+

Note: WHO = World Health Organisation

Table 2 shows the descriptive statistics of variables in the early phase of the COVID-19 pandemic in all countries. The number of observations in the study is 898. The total confirmed cases had the highest mean (31322.65), followed by the total death (1623.12), the new confirmed cases (616.03) and the new death (24.33). The lower standard deviation for the new death group illustratedthat the new death distribution was more consistent. There was a large variation between the minimum and maximum figures of each variable.

Table 2
Descriptive statistics of all variables

Variables	Obs	Mean	Std. Dev.	Min	Max
Total confirmed cases (TCC)	898	31322.65	171450.7	0	3435190
New confirmed cases (NCC)	898	616.03	3265.74	0	54914
New death (ND)	898	24.33	119.28	0	1667
Total Death (TD)	898	1623.12	8397.36	0	136732

Source: WHO, 2020

Table 3 presents the correlation matrix of the variables employed in the analysis.

Table 3
Correlation matrix of all variables

		Total Confirmed Cases (TCC)	New Confirmed Cases (NCC)	Total Death (TD)	New Death (ND)
Total Confirmed Cases (TCC)	Pearson Correlation	1			
	Sig. (2-tailed)				
	N	898			
New Confirmed Cases (NCC)	Pearson Correlation	.403**	1		
	Sig. (2-tailed)	.000			
	N	898	898		
Total Death (TD)	Pearson Correlation	.399**	.784**	1	
	Sig. (2-tailed)	.000	.000		
	N	898	898	898	
New Death (ND)	Pearson Correlation	.498**	.789**	.693**	1
	Sig. (2-tailed)	.000	.000	.000	
	N	898	898	898	898

**. Correlation is significant at the 0.01 level (2-tailed)

3.2 Empirical models

The number of confirmed cases and mortality have vast variations at the levels of regions and global. Based on the literature review, we hypothesised that all the independent variables, namely: (a) total confirmed cases (TCC), (b) new confirmed cases (NCC), and (c) new death (ND) have a positive relationship with the dependent variable, that is total death (TD) of COVID-19 cases. The empirical model specification is demonstrated, as below:

$$lnTD_{it} = \beta_0 + \beta_1 TCC_{it} + \beta_2 lnNCC_{it} + \beta_3 lnND_{it} + \varepsilon_{it} \quad \ldots\ldots(1)$$

where β_0, β_1, β_2, and β_3, are regression coefficients; TCC, NCC and ND are independent variables as explained above, ε_{it} is the error term, i = 1,…, *N* denotes the country and t =1,…., *T* represents the time. Using the Stata version 16 software, we performed three models namely: pooled ordinary least square (POLS), random effects (RE) and fixed effects (FE) model based on the above equation.

In the pooled OLS model, the error term is assumed to be identically and independently distributed and uncorrelated with the regressors. The pooled OLS postulates that the intercept and slopes are the same across countries and time. On the other hand, the RE and FE models assume that each country has its own intercept and ε_{it} is decomposed into two independent components, where $\varepsilon_{it} = \lambda_i$ (country-specific effect) + u_{it} (error term). The RE model assumes that λ_i are drawn independently from some probability distribution and the FE model assumes that λ_i are constant.

The Ramsey regression equation specification error (RESET) test was conducted to check for the functional form misspecification. We failed to reject the null hypothesis of correct specification of functional form. Thus, all three models did not suffer from omitted variables. A number of statistical tests were used to confirm which model was more suitable to be used in the analysis.

The Breausch and Pagan Lagrangian multiplier test was employed to choose whether pooled OLS or RE model was more appropriate. The result showed that the RE model was more appropriate ($p<0.05$) and thus, there were country-specific effects in the data. Subsequently, Hausman Test was used to choose between the RE or FE model. The test displayed a significant result whereby the FE model was the preferred model. The FE model, which captures the country-specific effect (λ_i) was appropriate as each country was different in terms of resource endowments, and economic growth.

The diagnostic checks, namely: (a) multicollinearity (presence of high correlations), (b) heteroscedasticity (variances are not constant), (c) serial correlation (presence of first-order autocorrelation), and (d) the Cook's Distance Outlier test, were performed on the models. The variance inflation factor (VIF) test, as demonstrated in Table 4, showed that there was few less multicollinearity problem (mean VIF<10). On the other hand, the modified Wald test indicated that there was a heteroscedasticity problem. The Wooldridge test also indicated that there was a serial correlation problem. Although the Cook's distance outlier test indicated the presence of outliers, we maintained the outliers in the data given that each country's medical capacity and medical resources were different, and thus represented the actual public health performance in each country. The [cluster()] command was used to rectify the problems of heteroscedasticity, and serial correlation (Hoechle, 2007). The R-square of all three models ranged between 97.7% and 91.4% indicating that the variation of total mortality of COVID-19 was explained by the three independent variables. The following section reports the empirical results of the three models in detail, with a focus on the FE model.

4. Results

The results of three models namely: pooled OLS, RE and FE, are reported in Tables 4, 5 and 6 respectively. Overall, the findings demonstrated that there was a positive relationship between total death of COVID 19 with total confirmed cases and new death, while a negative relationship between total COVID-19 deaths with new confirmed cases in all countries and regions for all the three models, except the Americas which was insignificant. The results of the three models were consistent across the six regions. We focused on determinants of the total COVID-19 deaths by using the FE model.

Based on Table 6, the FE model of all countries and six regions showed consistent results, whereby, there was a positive relationship between total death of COVID 19 with two independent variables, namely: total confirmed cases and new death, while a negative relationship between total COVID-19 deaths with new confirmed cases. Based on Table 6, when the total confirmed cases increased by 1%, total death increased between 0.687% to 1.192% across all countries and regions. On the other hand, when new death cases increased by 1%, total death increased between 0.130% and 0.533%. However, if new confirmed cases increased by 1%, total death decreased between 0.218% and 0.528%.

Table 4
OLS Model

Variables	All countries	Regions					
	R1	R2	R3	R4	R5	R6	R7
lnTCC	0.902*** (0.0228)	0.786*** (0.101)	0.938*** (0.0856)	1.045*** (0.0634)	0.776*** (0.0474)	1.159*** (0.0328)	0.741*** (0.0551)
lnNCC	-0.295*** (0.0265)	-0.266** (0.118)	-0.199* (0.101)	-0.854*** (0.0870)	-0.128*** (0.0464)	-0.327*** (0.0373)	-0.209*** (0.0650)
lnND	0.480*** (0.0201)	0.599*** (0.0713)	0.469*** (0.0993)	0.805*** (0.0485)	0.391*** (0.0347)	0.340*** (0.0354)	0.476*** (0.0462)
Constant	-2.097*** (0.103)	-1.750*** (0.374)	-3.053*** (0.425)	-0.983*** (0.232)	-1.600*** (0.194)	-3.864*** (0.215)	-1.382*** (0.207)
Observations	898	50	75	105	175	268	225
R-squared	0.896	0.929	0.819	0.934	0.952	0.927	0.797
Multicollinearity (vif)	3.69	7.24	2.57	6.97	7.17	2.80	3.76

Note: R1 = All countries, R2 = South-East Asia, R3 = Western Pacific, R4 = East Mediterranean, R5 = Americas, R6 = Europe, R7 = Africa. The figures in parentheses are robust standard errors in. *** p<0.01, ** p<0.05, and *p<0.1 indicate the significance levels at 1%, 5%, and 10% respectively.

Table 5:
RE Model

Variables	All countries	Regions					
	R1	R2	R3	R4	R5	R6	R7
lnTCC	0.910*** (0.0197)	0.786*** (0.101)	0.822*** (0.0783)	1.029*** (0.0551)	0.763*** (0.0452)	1.186*** (0.0241)	0.740*** (0.0478)
lnNCC	-0.329*** (0.0249)	-0.266** (0.118)	-0.228*** (0.0853)	-0.697*** (0.0818)	-0.121*** (0.0467)	-0.243*** (0.0311)	-0.242*** (0.0607)
lnND	0.437*** (0.0199)	0.599*** (0.0713)	0.249*** (0.0847)	0.643*** (0.0500)	0.414*** (0.0391)	0.180*** (0.0301)	0.490*** (0.0411)
Constant	-2.036*** (0.103)	-1.750*** (0.374)	-2.304*** (0.519)	-1.450*** (0.222)	-1.554*** (0.196)	-4.294*** (0.205)	-1.299*** (0.194)
Observations	898	50	75	105	175	268	225
R-squared	0.895	0.929	0.8078	0.926	0.952	0.922	0.796

Note: R1=Worldwide, R2= South-East Asia, R3= Western Pacific, R4= East Mediterranean, R5= Americas, R6= Europe, R7= Africa. The figures in parentheses are robust standard errors in. *** p<0.01, ** p<0.05, and *p<0.1 indicate the significance levels at 1%, 5%, and 10% respectively.

Table 6:
FE Model

Variables	All countries	Regions					
	R1	R2	R3	R4	R5	R6	R7
lnTCC	0.917***	0.785***	0.687***	1.009***	0.733***	1.192***	0.746***
	(0.0202)	(0.108)	(0.0859)	(0.0493)	(0.0486)	(0.0242)	(0.0499)
lnNCC	-0.373***	-0.408***	-0.321***	-0.528***	-0.0908	-0.218***	-0.268***
	(0.0274)	(0.140)	(0.0872)	(0.0783)	(0.0613)	(0.0327)	(0.0657)
lnND	0.407***	0.533***	0.206**	0.474***	0.465***	0.130***	0.493***
	(0.0219)	(0.0958)	(0.0824)	(0.0503)	(0.0536)	(0.0309)	(0.0432)
Constant	-1.944***	-1.304***	-1.255**	-1.928***	-1.487***	-4.402***	-1.275***
	(0.0979)	(0.386)	(0.541)	(0.188)	(0.213)	(0.205)	(0.176)
Observations	898	50	75	105	175	268	225
R-squared	0.866	0.861	0.555	0.959	0.912	0.9179	0.835
Hetero-skedasticity (χ^2 – stat)	1.1e+05***	7777.46***	54.52***	522.71***	865.36***	12216.09***	6757.23***
Serial Correlation (F-stat)	159.494***	9.392**	151.442***	30.880***	98.377***	255.540***	39.640***

Note: R1 = All countries, R2 = South-East Asia, R3 = Western Pacific, R4 = East Mediterranean, R5 = Americas, R6 = Europe, R7 = Africa. The figures in parentheses are robust standard errors in. *** p<0.01, ** p<0.05, and *p<0.1 indicate the significance levels at 1%, 5%, and 10% respectively.

The positive relationship between total confirmed cases and total deaths of the study is consistent with other scholarly studies. Goutte and Damette (2020) reported that the number of cumulated infected people was a significant predictor of the mortality rate in India. Sarkodie and Owusu (2020) discovered that an increase in confirmed cases by 1% would increase the COVID-19 death cases by 0.10% to 1.71% in China. Bhatnagar et al. (2020) contended that there was a positive relationship between the death cases and confirmed cases of COVID-19 in India, where the maximum average death rate could reach 3.49%.

The European region (R6) was the worst affected region as compared to other regions during the earlier stage of the COVID-19 pandemic, where the total death increased by 1.192% with every 1% increase in total confirmed cases. The European region recorded a higher average of total deaths as compared to other regions such as Africa and Western Pacific (see Figure I). According to the United Nations (2021), the average life expectancy in Europe was 78.6 years whereas in Africa, it was 63.2 years in 2019. The COVID-19 case-fatality rate (CFR) was recorded at 4.6%, 12.2% and 14% for Germany, Spain and Italy respectively during the early stage of the COVID-19 outbreak, especially among elderly people (Dudel et al., 2020).

Conversely, the Western Pacific region (R3) was the least affected zone, which recorded the coefficient of total confirmed cases at 0.687. The Western Pacific region reported lower cases in the early stage of the pandemic, as compared to the rest of the countries in the world (Mei & Hu, 2020). Among others, the factors of lower COVID-19 death cases in the Western Pacific region included social distancing, border control, suspension of flights, quarantine and isolation orders (Fook et al., 2020; Kuguyo et al., 2020; Robert, 2020; Tan et al., 2021). Salyer et al. (2021), Kaba et al. (2020) and Musa et al. (2021) contended the slower wave of the pandemic in the African Region was due to various factors such as the prior experience of handling infectious diseases, low volumes of international tourism, younger population, low obesity rate, low rate of urbanisation, high humidity, and insufficient testing capacity.

In addition, the results also showed that there was a negative relationship between the new confirmed cases and the number of total death in all the countries and regions except the Americas. The East Mediterranean region (R4) recorded the highest decrease in total death, as the new confirmed cases increased (coefficient of -0.528). The governments in the East Mediterranean region took various mitigation policies at the earlier stage of the pandemic such as cancellation of flights, curfew, lockdown, social distancing, closure of learning institutions, and dissemination of information (Alandijany et al., 2020; Teslya et al., 2020). The estimated death rate per country in the East Mediterranean region was recorded at 3.85% (Bahammam et al., 2020).

The South-East Asia region recorded the second-largest decrease in total death, as the new confirmed cases increased. In Indonesia and India, there was large scale social lockdown, social distancing, and sanitizing hands practices in the entire country since April 2020 which could have reduced the death cases of COVID-19 (Khalifa et al., 2020; Paital et al., 2020; Rozaliyani et al. 2020).

The European region (R6) also recorded a decline in total death as new confirmed cases increased (coefficient of -0.218). The European countries such as Italy, France, UK, Germany, and Spain implemented various stringent mitigation policies, including postponement of public events, social distancing, closure of schools and international borders, closure of public transportation, and stay-at-home orders (Fuller et al. 2021; Ghanchi, 2020; Khalifa, et al. 2020; Saez et al., 2020; Sohrabi et al., 2020). The scholars contended that earlier mitigation policies reduced the COVID-19 associated deaths in the European region.

Lastly, there was a positive relationship between new death and total death in all the countries and six regions. The South-East Asia region (R2) recorded the highest increase in total death by 0.533% if the new deaths increased by 1%, as compared to other regions. The results of the models could be caused by various reasons such as: (a) bring in deaths (Rayamajhee et al., 2021), (b) deaths from ICUs/comorbidities (Ferrari et al., 2021; Giorgi et al., 2020; Panthee et al., 2020), and (c) lack of facilities or medical capacity (Mansour et al., 2021), which were reported in the literature.

5. Conclusion

This study aims to examine the relationship between the COVID-19 deaths and its three determinants, which include: (a) total confirmed cases, (b) new confirmed cases, and (d) new deaths at the early stage of the COVID-19 pandemic from March to July 2020, by using panel data of 182 countries. The results showed that there was a positive relationship between total COVID 19 death cases with total confirmed cases and new death, while a negative relationship existed between total COVID-19 death cases and new confirmed cases. The results were consistent in all countries and six regions for all the three models of pooled OLS, RE and FE.

Overall, there were three main findings from the selected model of the study, that is the FE model. Firstly, the European region was the worst affected, as compared to other regions during the earlier stage of the COVID-19 outbreak, where total death increased by 1.192% with every 1% increase in total confirmed cases. Secondly, the East Mediterranean region recorded the highest decrease in total death by 0.528%, as new confirmed cases increased. Thirdly, the South-East Asia region documented the highest increase in total death by 0.533% if the new death increased by 1%, as compared to other regions.

The empirical study offers two contributions to the COVID-19 pandemic literature. Firstly, the study produced empirical results based on the two distinct features of panel data namely: (a) at global and regional levels, and (b) at the early stage of the COVID-19 pandemic, which were less explored by scholars. The analysis on the determinants of COVID-19 death at the early stage is important, as early detection of causes of COVID-19 deaths across regions provides a better execution of prevention policies and resources allocation. Secondly, the study has contributed new knowledge to the COVID-19 literature: the results of the FE model provide an overview of regional performance in fighting the pandemic at the early stage. The European and the South-East Asia regions recorded the highest increase in total death if total confirmed cases and new deaths increased respectively, while the East Mediterranean region showed the highest decrease in total death if new confirmed cases increased.

We recommend several policy suggestions from the above results. Firstly, the earlier interventions from governments are vital, as documented in the above literature, where the interventions could delay the spread of the pandemic. These interventions include suspension of flights, border control, social distancing, lockdowns, and quarantine and isolation orders. This would enable more strategic resources allocation in fighting the pandemic in the long term. Secondly, the collaborative work between regional countries should be reviewed and improved, especially in terms of medical capacity, vaccines, and human resources. This would enable more effective treatment and earlier prevention of the pandemic by regional governments. The Global Strategic Preparedness and Response Plan and Global Humanitarian Response Plan by the WHO should be further improved, reviewed, and supported by all countries in combating the pandemic. Lastly, the dissemination, monitoring and surveillance of COVID-19 information via the digital networks to individuals, institutions, countries and regions are important in establishing more functioning and collaborative networks in battling the COVID-19 pandemic.

This study has some limitations such as restricted variables, duration, and research methodology. The results of the study should be used with caution, given the pandemic is new and complex. We recommend that future researchers could include more variables and extend and split the sample period of the COVID-19 pandemic from the early to the latest, at the global and regional levels. In addition, researchers could diversify the research methods from current static panel data analysis to dynamic panel data analysis such as the generalized method of moments (GMM). In sum, the study shows that the empirical results are consistent, where there is a positive relationship between total COVID-19 death cases with total confirmed cases and new deaths, while a negative relationship exists between total death of COVID-19 and new confirmed cases.

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Conflict of Interest
There is no conflict of interest associated with this publication.

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