South American Development Society Journal

THE ROLE OF EDUCATION ON INFECTIOUS DISEASES MORTALITY RATES: THE COVID-19 CASE

Alcides Barrichello
Centro de Ciências Sociais e Aplicadas
Universidade Presbiteriana Mackenzie
alcidesbarrichel@uol.com.br

Rogério Scabim Morano
Instituto de Ciências Ambientais, Químicas e Farmacêuticas
Instituto de Ciência e Tecnologia
UNIFESP - Universidade Federal de São Paulo
r.morano@unifesp.br

Rafael Ricardo Jacomossi
Departamento de Administração
Faculdade de Tecnologia Termomecânica
rafaeljacomossi@gmail.com

Paulo Roberto Feldmann
Programa de Pós-Graduação em Administração / Faculdade de Economia, Administração e Contabilidade – PPGA/FEA
USP - Universidade de São Paulo - SP
feldmann@usp.br

Abstract

The COVID-19 pandemic has challenged the global medical community and government officials. This study aimed to verify whether the level of education influences COVID-19 mortality rates considering the population's average age since elderly patients are more likely to have adverse outcomes from the disease. The study used secondary data on education presented in the GCR 2019. Also, data on COVID-19 and the average age of the population was obtained from the Worldometer platform, examining a sample of 133 countries.

The results show that high levels of education tend to mitigate the effect of the average age of the population on the number of deaths per million inhabitants, indicating that education, regardless of age, makes people more prepared to avoid COVID-19.

Keywords: COVID-19, Infectious diseases, Education, Average age, Moderation

Introduction

A new SARS (severe acute respiratory syndrome) associated with coronavirus was identified at the end of 2019 and has challenged the world medical community. The virus SARS-CoV-2 has spread worldwide, and its disease, called COVID-19, was declared a pandemic (Guo et al., 2020).

The SARS-CoV-2 was first identified in Wuhan, China, in December 2019 (Mehta et al., 2020). It has demonstrated its potential to generate large outbreaks of COVID-19 in confined environments and advance across borders by following human mobility patterns (Shim, Tariq, Choi, Lee, & Chowell, 2020). Although the disease often induces mild symptoms common to other respiratory infections, it may also cause complications among certain groups – the elderly and individuals with underlying health problems, such as cardiovascular disease and diabetes. However, the new coronavirus epidemiology is still being elucidated (Nepomuceno et al., 2020).

One of the main characteristics of COVID-19 is that it is highly contagious and has higher mortality than influenza. Therefore, it is crucial to adopt immediate actions to contain its spread. Respiratory failure due to problems associated with acute respiratory syndromes is the main cause of mortality. Elderly patients with comorbidities, such as hypertension and diabetes, are more likely to have adverse outcomes (Mehta et al., 2020).

In general, COVID-19 imposes many challenges to the scientific community, particularly regarding its determinants, symptoms, forms of contagion, effects, and health conditions favoring or mitigating contagion. One of the factors that have played a different role is age, considering the high mortality rate among the elderly (Dowd et al., 2020; Esteve, Permanyer, Boertien, & Vaupel, 2020).

At the same time, studies are dedicated to establishing relationships between education and health (Barcellos, Carvalho, & Turley, 2018; Böckerman & Maczulskij, 2016;

Olshansky et al., 2012), indicating that infectious diseases decrease as the general educational level of a population increases. However, when looking at the literature on COVID-19, no studies relate education, age, and mortality in a single model, which raises the following research question: how do education levels relate to the COVID-19 mortality rates considering the population's average age? This study aims to verify the relationship of level of education with these two elements – average age and COVID-19 - related mortality rate. Therefore, this work contributes by adding other variables to the research on the determinants and effects of COVID-19.

Education and health

Among the various aspects related to health, formal education is one of the strongest (Barcellos et al., 2018; Böckerman & Maczulskij, 2016). However, the impact of education on people's health is still little explored by academia and public authorities. Knowledge of the prevalence and the main variables associated with infectious diseases can provide support to assess the dimension of an outbreak and plan and implement actions to promote health and prevent complications in health/disease processes (Pioli et al., 2016). Thus, policymakers' strategies should consider education aspects for health improvement (Zimmerman et al., 2018).

Studies such as Olshansky et al. (2012) observe significant changes in mortality rates when considering different educational levels, from primary to secondary education. According to Montez, Hummer, and Hayward (2012), each additional year of high school moderately reduced mortality rates, and high school completion was associated with an even greater decline in this indicator. According to the authors, additional years of education after high school influence significantly the reduction of mortality.

Levin, Belfield, Muennig, and Rouse (2007) researched the fight against dengue in the Caribbean region of Colombia. The authors observed that people with some knowledge acted as information multipliers in the fight and prevention, and those with a higher education level answered questions about dengue symptoms and transmission more accurately. Also, this group demonstrated a higher level of attitudes and practices towards controlling the disease, whereas populations with a lower level of education are particularly vulnerable, and their participation in control programs can be difficult. Therefore, having these populations in dengue and other disease control programs would be applied (Diaz-Quijano et al., 2018).

In regional studies carried out in countries with large territories, such as Brazil, infectious and parasitic diseases are still part of the population's daily life. All health and education indicators studied correlated significantly with mortality from these diseases. The results showed that the environmental and sanitation conditions, as well as the residents' socioeconomic conditions, together with the disclosure of basic personal, domestic, and community hygiene measures, impact the population's health, reflecting on the morbidity and mortality by diseases of different etiologies, including infectious and parasitic diseases (Pioli et al., 2016).

Martins, Boranga, Latorre, Pereira, and ABES (2002) highlight that people with a higher education level have a higher level of hygiene, reducing the mortality rates related to infectious and parasitic diseases. Low maternal education, reflecting the impossibility of discerning signs of the severity of symptoms, combined with the difficulty of access to health services and the lack of support networks for families, tends to increase mortality from infectious and parasitic diseases in this population.

Additionally, the relationship between education and health has an impact on the economy. Research suggests that in the US alone, health care costs for people with higher education are lower by trillions of dollars a year compared to people with less education (Schoeni, Dow, Miller, & Pamuk, 2011).

Education can affect health in several ways (Cutler, Lleras-Muney, & Vogl, 2012). It can be related to the general level of information, the ease of adopting new information, and valuable personal characteristics, such as self-control, the position at work, and level of wealth (Böckerman & Maczulskij, 2016). A more educated and healthier population reduces spending on health care. The return on investment involves a more productive workforce, better income, and tax revenues, lower unemployment rates, and a stronger economy. Additionally, people with higher education have less chance to be unemployed, need lower economic assistance, or use support net programs. Thus, the higher incomes of a prepared workforce increase tax revenues and regional and national economies (Zimmerman et al., 2018).

Age and COVID-19

Age is a marker of accumulation of continuous damage throughout life and is associated with disabling and chronic diseases. In this sense, age is fundamental to study and understand the diversity in mortality risks caused by COVID-19 (Nepomuceno

et al., 2020). Although different age groups may experience the severe consequences of COVID-19, the virus has a greater impact on people over 65 (Dudel et al., 2020; Onder, Rezza, & Brusaferro, 2020; Yang et al., 2020). Lakhani (2020), in a survey conducted with data from the US, concluded that over 31% of adults over 65 needed hospitalization because of COVID-19, and from 4% to 11% of adults between 65 and 84 years old died. In the population over 85, the mortality rate varies from 11% to 27%.

Davies et al. (2020) evaluated these possibilities by adjusting a mathematical model structured by age to epidemic data from China, Italy, Japan, Singapore, Canada, and South Korea. The authors concluded that the susceptibility to infection in people under 20 years is approximately half that of adults over 20. The clinical symptoms present in 21% of infections in the 10-19 age group, increase to 69% of infections in people over 70.

Thus, it was found that interventions applied to children can have a small impact in reducing the transmission of SARS-CoV-2, especially if the transmissibility of infections is low. In countries with a younger population – like many low-income countries – the expected incidence per capita of cases should be lower than in countries with an older population. However, comorbidities in low-income countries are also likely to lead to an aggravated form of the disease (Davies et al., 2020). Without adequate control measures, regions with relatively older populations could disproportionately see more cases of COVID-19, particularly in the final stages of an unmitigated epidemic.

Studies have discussed the role of specific age groups (especially children) in transmitting the virus, and countries have adopted age-specific policies, such as closing schools and prolonged confinement for older people in their homes (Esteve et al., 2020). Also, an increasing number of governments are imposing or recommending domestic quarantines to contain the virus's spread (Dowd et al., 2020).

Dowd et al. (2020) highlight the importance of demography to analyze COVID-19-related mortality. For the authors, the population's age, and the contact between individuals of different generations help explain the differences in fatality among countries and help estimate the potential impact of the pandemic on different populations.

The age structure of the population – indicating the proportion of young or older people – and the structure of co-residence – how large families are and how old their members

are – are two key factors that determine the countries' vulnerability to the COVID-19 pandemic and how effective general and age-specific home containment policies can be in reducing mortality after an outbreak (Esteve et al., 2020; Verity et al., 2020).

The COVID-19 pandemic showed a markedly low proportion of cases among children (Davies et al., 2020). The age disparities in the observed cases can be explained by the fact that children are less susceptible to infection and less likely to have clinical symptoms.

Sun, Yang, Zhang, and Cheng (2020) sought to understand the factors that influence the risks related to COVID-19 and the coping behaviors of the elderly about the disease, providing a basis for taking corresponding protective measures. The study found that elderly individuals with a higher understanding of COVID-19 had better protective behaviors to face the pandemic.

Development of the research hypothesis

The literature involving the effect of age on the number of COVID-19-related deaths has consistently shown that older people are more susceptible to die from the disease (Davies et al., 2020; Dudel et al., 2020; Lakhani, 2020; Nepomuceno et al., 2020; Onder et al., 2020; Verity et al., 2020; Yang et al., 2020). The literature also shows the influence of education on the spread and mortality from infectious and parasitic diseases: people with better levels of education are also better prepared and aware of the necessary care to contain the spread of these diseases (Barcellos et al., 2018; Böckerman & Maczulskij, 2016; Pioli et al., 2016; Zimmerman et al., 2018).

Studies by Tantrakarnapa, Bhopdhornangkul, and Nakhaapakorn (2020) and Usman et al. (2020) suggested the direct influence of education in containing the spread and mortality of COVID-19. The first study highlights the initiative of Buddhist monks involved in health promotion and education in remote rural communities, indicating that educational actions limit the disease's spread and mortality. The second work shows the role of salespeople in rural markets as disseminators of information about the care needed to control COVID-19. Thus, both examples show that the sources of information and education level play a fundamental role in building knowledge and practices about the disease.

Although existing studies show that education, the average age of the population, and COVID-19 mortality rates are related, there are no studies that deal with education as a mitigator of the relationship between average age and COVID-19 mortality rate. Thus, the following research hypothesis is proposed:

H1: Education plays a moderating role in the relationship between average age and COVID-19 mortality rate.

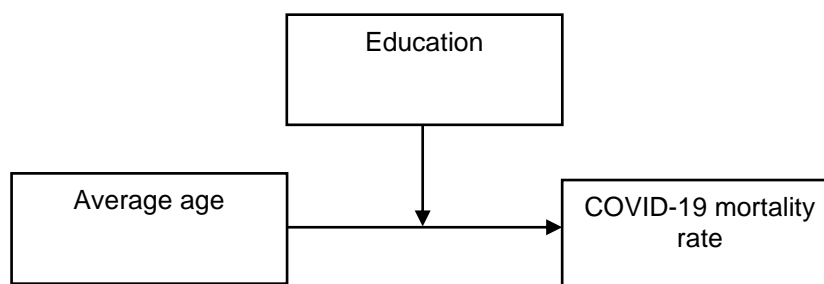Figure 1 illustrates the structural model developed according to hypothesis 1.

Figure 1 – Structural model
Source: Elaborated by the authors

Methodology

This study used secondary data on education obtained from indicators from 137 countries present in The Global Competitiveness Report (GCR) 2019, published by the World Economic Forum (WEF) (Schwab, 2019), pillar 6, which is focused on education in countries context. The variables that comprise pillar 6 are Mean years of schooling, Quality of vocational training, Extent of staff training, Digital skills among the active population, Skillset of graduates, School life expectancy, Critical thinking in teaching, Ease of finding skilled employees, and Pupil-to-teacher ratio in primary education.

Table 1 presents the definitions of the variables that make up pillar 6 of the GCR.

Table 1 – Definition of variables

Variable	Description
Mean years of schooling	The average number of completed years of

	education of a country's population aged 25 years and older, excluding years spent repeating individual grades
Extent of staff training	Response to the survey question "In your country, to what extent do companies invest in training and employee development?" [1 = not at all; 7 = to a great extent]
Quality of vocational training	Response to the survey question "In your country, how do you assess the quality of vocational training?" [1 = extremely poor among the worst in the world; 7 = excellent among the best in the world]
Skillset of graduates	The average score of the following two Executive Opinion Survey questions: "In your country, to what extent do graduate students from secondary education possess the skills needed by businesses?" and "In your country, to what extent do graduating students from university possess the skills needed by businesses?" In each case, the answer ranges from 1 (not at all) to 7 (to a great extent)
Digital skills among the active population	Response to the survey question "In your country, to what extent does the active population possess sufficient digital skills (e.g. computer skills, basic coding, digital reading)?" [1 = not all; 7 = to a great extent]
Ease of finding skilled employees	Response to the survey question "In your country, to what extent can companies find people with the skills required to fill their vacancies?" [1 = not at all; 7 = to a great extent]
School life expectancy	Total number of years of schooling (primary through tertiary) that a child of school entrance age can expect to receive
Critical thinking in teaching	Response to the survey question "In your country, how do you assess the style of teaching?" [1 = frontal, teacher based, and focused on memorizing; 7 = encourages creative and critical individual thinking]
Pupil-to-teacher ratio in primary education	The average number of pupils per teacher, based on headcounts of both pupils and teachers

Source: Schwab (2019)

COVID-19 data (deaths/million inhabitants) and the average age of the population were obtained from the Worldometer platform (https://www.worldometers.info/coronavirus/) (Worldometer, 2020. Retrieved October 27, 2020).

The Worldometer is managed by an international team of developers, researchers, and volunteers, offering global and up-to-date statistics, including statistics on the COVID-19 pandemic. Worldometer was voted one of the best free reference sites by the American Library Association (ALA), the largest and oldest library association in the world.

The two databases (GCR/WEF and Worldometer) generated the final database used for this research, observing a sample of 133 countries.

The quantitative method adopted involved regression analysis with model 1, corresponding to the structural model in Figure 1, PROCESS (Hayes, 2018), macro for the IBM SPSS Statistics® 20.0 software.

Analysis and discussion

The research hypothesis was tested using the simple moderation model (model 1), as suggested by Hayes (2018). The author argues that non-standardized coefficients are the preferred metric when reporting causal modeling results. Thus, PROCESS model 1 was estimated to verify the moderating action of education in the relationship between the average age of the population and COVID-19 deaths per million inhabitants.

The analysis of the direct effect, without moderation, showed a significant result (B = 7.313, CI [3.209 : 11.417], SE = 2,074, $p < 0.001$, $R^2 = 0.087$), corroborating data from the literature that indicate that the greater the age of those affected by COVID-19, the higher the incidence of death.

The analysis of the model with the inclusion of the Education variable showed significant moderating action (B = -0.3374, CI [-0.6671 : -0.0077], SE = 0.1667, $p < 0.045$, $R^2 = 0.1260$), supporting the hypothesis, with positive and significant effects of low levels of education on the average age of the population and number of COVID-19 deaths per million inhabitants. The variation in the value of the determination coefficient (R^2) was significant, indicating that the model with moderation has greater explanatory power than the model without moderation. Using the Johnson-Neyman technique (Figure 2, average education value, plus and minus one standard deviation), it appears that the positive effect of the interaction between average age and education occurs for situations of low education level, ceasing to be significant for higher values of education. Thus, high levels of education tend to mitigate the effect of the average age of the population on the number of deaths per million inhabitants, indicating that education,

regardless of the age, makes people more prepared to prevent the disease and offer greater capacity to face its spread.
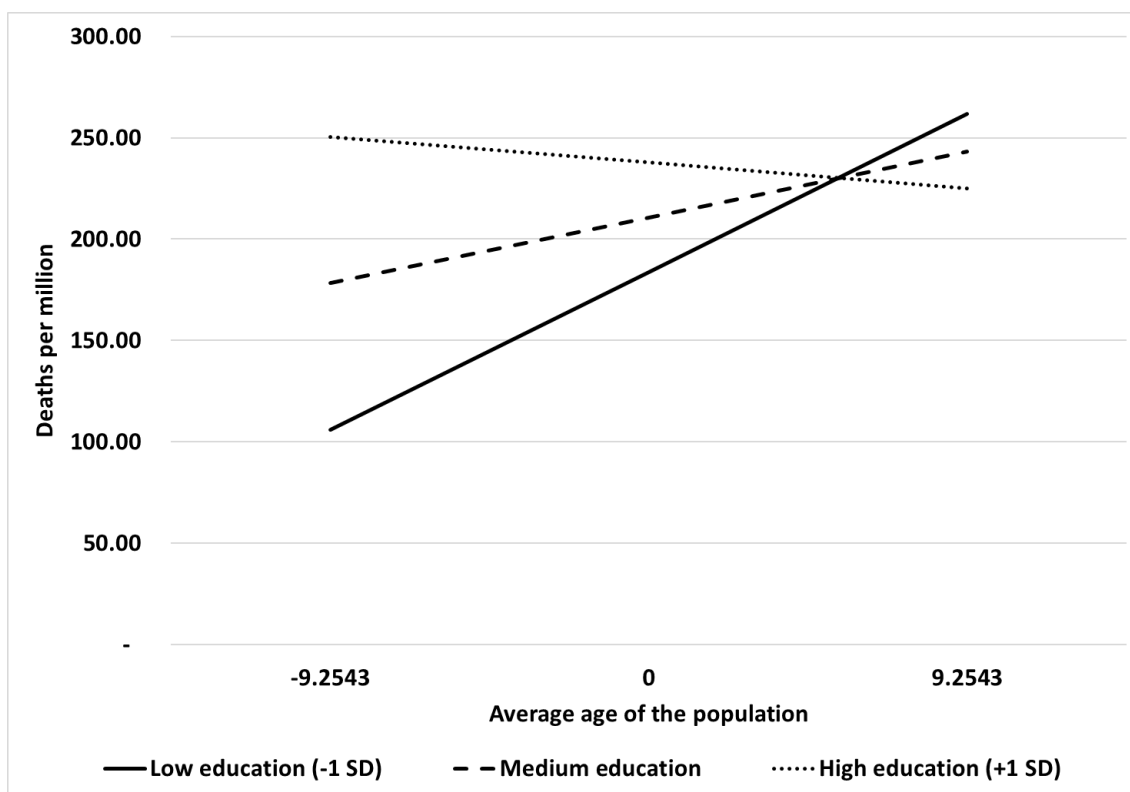

Figure 2 – Moderating effect of education on the relationship between the average age of the population and the number of COVID-19 deaths per million

Source: Elaborated by the authors

The statistical robustness of the moderation test was verified using the G*Power® 3.1.9.2 software, resulting in 0.9646 (post-hoc test) and an effect size of 0.1442. Despite a low value of determination coefficient (R^2) for the moderation model (0.1260), it is possible to say the model is reliable due to the statistical power found for the analysis performed (Hayes, 2018).

Conclusion

The scientific community has faced great challenges and dilemmas due to the COVID-19 pandemic, producing numerous research on this issue. The literature shows that age is considered to be one of the determining factors in the lethality of the disease, and

education is a variable that mitigates the spread and fatality of infectious diseases in general.

This research's objective was to verify whether the educational level affects the mortality rates observed in the population considering the average age. It contributes to the field by offering an analysis of the three variables concurrently, adding the educational level to the discussions about the relationship between average age and the COVID-19 mortality rate.

Through multivariate data analysis, the moderating effect of education on the relationship between the average age of the population and the number of deaths per million inhabitants was observed. There were positive and significant effects of low levels of education on this relationship, which means that when the population's education level is low, there is a higher incidence of deaths among the elderly.

However, it was found that high levels of education tend to mitigate the effect of age on the number of deaths. Thus, regardless of age, education makes people more aware of how to avoid the disease, effectively building capacity to face the pandemic.

In the short term, education, and information for the population on preventing and combatting the pandemic are essential, regardless of age and possible existing comorbidities. In strategic terms, the improvement and comprehensiveness of education must be part of the list of actions within the scope of public and private policies to face diseases and epidemics such as COVID-19.

This research reinforces the literature regarding the liberating role of education in raising awareness and preparing the population to make decisions related to health care and face the vicissitudes of everyday life.

References

Barcellos, S. H., Carvalho, L. S., & Turley, P. (2018). Education can reduce health differences related to genetic risk of obesity. *Proceedings of the National Academy of Sciences of the United States of America*, *115*(42), E9765–E9772. https://doi.org/10.1073/pnas.1802909115

Böckerman, P., & Maczulskij, T. (2016). The Education-health Nexus: Fact and fiction. *Social Science and Medicine*, *150*, 112–116.

https://doi.org/10.1016/j.socscimed.2015.12.036

Cutler, D. M., Lleras-Muney, A., & Vogl, T. (2012). *Socioeconomic Status and Health: Dimensions and Mechanisms* (NBER Working Paper Series No. 14333). *The Oxford Handbook of Health Economics*. Cambridge, MA. https://doi.org/10.1093/oxfordhb/9780199238828.013.0007

Davies, N. G., Klepac, P., Liu, Y., Prem, K., Jit, M., Pearson, C. A. B., … Eggo, R. M. (2020). Age-dependent effects in the transmission and control of COVID-19 epidemics. *Nature Medicine*, *26*(8), 1205–1211. https://doi.org/10.1038/s41591-020-0962-9

Diaz-Quijano, F. A., Martínez-Vega, R. A., Rodriguez-Morales, A. J., Rojas-Calero, R. A., Luna-González, M. L., & Díaz-Quijano, R. G. (2018). Association between the level of education and knowledge, attitudes and practices regarding dengue in the Caribbean region of Colombia. *BMC Public Health*, *18*(143), 1–10. https://doi.org/10.1186/s12889-018-5055-z

Dowd, J. B., Andriano, L., Brazel, D. M., Rotondi, V., Block, P., Ding, X., … Mills, M. C. (2020). Demographic science aids in understanding the spread and fatality rates of COVID-19. *Proceedings of the National Academy of Sciences of the United States of America*, *117*(18), 9696–9698. https://doi.org/10.1073/pnas.2004911117

Dudel, C., Riffe, T., Acosta, E., van Raalte, A., Strozza, C., & Myrskylä, M. (2020). Monitoring trends and differences in COVID-19 case-fatality rates using decomposition methods: Contributions of age structure and age-specific fatality. *PLOS ONE*, *15*(9), e0238904. https://doi.org/10.1101/2020.03.31.20048397

Esteve, A., Permanyer, I., Boertien, D., & Vaupel, J. W. (2020). National age and coresidence patterns shape COVID-19 vulnerability. *Proceedings of the National Academy of Sciences of the United States of America*, *117*(28), 16118–16120. https://doi.org/10.1073/pnas.2008764117

Guo, W., Li, M., Dong, Y., Zhou, H., Zhang, Z., Tian, C., … Hu, D. (2020). Diabetes is a risk factor for the progression and prognosis of COVID-19. *Diabetes/Metabolism Research and Reviews*, *36*(7), https://doi.org/10.1002/dmrr.3319. https://doi.org/10.1002/dmrr.3319

Hayes, A. F. (2018). *Introduction to mediation, moderation, and conditional process*

analysis : a regression-based approach. (T. D. Little, Ed.) (2nd ed.). New York, NY: The Guilford Press.

Lakhani, A. (2020). Which Melbourne Metropolitan Areas Are Vulnerable to COVID-19 Based on Age, Disability, and Access to Health Services? Using Spatial Analysis to Identify Service Gaps and Inform Delivery. *Journal of Pain and Symptom Management*, *60*(1), e41–e44. https://doi.org/10.1016/j.jpainsymman.2020.03.041

Levin, H., Belfield, C., Muennig, P., & Rouse, C. (2007). *The Costs and Benefits of an Excellent Education for America's Children*. New York, NY.

Martins, G., Boranga, J. A., Latorre, M. do R. D. de O., Pereira, H. A. dos S. L., & ABES, A. B. de E. S. e A. (2002). Impacto do saneamento básico na saúde da população de Itapetininga - SP, de 1980 a 1997. *Engenharia Sanitária Ambiental*, *4*, 161–188.

Mehta, P., McAuley, D. F., Brown, M., Sanchez, E., Tattersall, R. S., & Manson, J. J. (2020). COVID-19: consider cytokine storm syndromes and immunosuppression. *The Lancet*, *395*(10229), 1033–1034. https://doi.org/10.1016/S0140-6736(20)30628-0

Montez, J. K., Hummer, R. A., & Hayward, M. D. (2012). Educational Attainment and Adult Mortality in the United States: A Systematic Analysis of Functional Form. *Demography*, *49*(1), 315–336. https://doi.org/10.1007/s13524-011-0082-8

Nepomuceno, M. R., Acosta, E., Alburez-Gutierrez, D., Aburtod, J. M., Aburtod, J. M., Gagnon, A., … Turra, C. M. (2020). Besides population age structure, health and other demographic factors can contribute to understanding the COVID-19 burden. *Proceedings of the National Academy of Sciences of the United States of America*, *117*(25), 13881–13883. https://doi.org/10.1073/pnas.2008760117

Olshansky, S. J., Antonucci, T., Berkman, L., Binstock, R. H., Boersch-Supan, A., Cacioppo, J. T., … Rowe, J. (2012). Differences in life expectancy due to race and educational differences are widening, and many may not catch up. *Health Affairs*, *31*(8), 1803–1813. https://doi.org/10.1377/hlthaff.2011.0746

Onder, G., Rezza, G., & Brusaferro, S. (2020). Case-Fatality Rate and Characteristics of Patients Dying in Relation to COVID-19 in Italy. *JAMA - Journal of the American Medical Association*, *323*(18), 1775–1776. https://doi.org/10.1001/jama.2020.4683

Pioli, M., Pires, R. H., Ramos, S. B., Martins, C. H., Aparecido, L. E. de O., & Zaia, J. E. (2016). Influência de fatores de risco na mortalidade por doenças infecciosas e parasitárias. *Revista Saúde e Pesquisa*, *9*(3), 491–498. https://doi.org/10.17765/1983-1870.2016v9n3p491-498

Schoeni, R. F., Dow, W. H., Miller, W. D., & Pamuk, E. R. (2011). The economic value of improving the health of disadvantaged americans. *American Journal of Preventive Medicine*, *40*(1 SUPPL. 1), S67–S72. https://doi.org/10.1016/j.amepre.2010.09.032

Schwab, K. (2019). *The Global Competitiveness Report 2019*. *World Economic Forum*. Geneva: World Economic Forum. https://doi.org/ISBN-13: 978-92-95044-73-9

Shim, E., Tariq, A., Choi, W., Lee, Y., & Chowell, G. (2020). Transmission potential and severity of COVID-19 in South Korea. *International Journal of Infectious Diseases*, *93*, 339–344.

Sun, Z., Yang, B., Zhang, R., & Cheng, X. (2020). Influencing factors of understanding covid-19 risks and coping behaviors among the elderly population. *International Journal of Environmental Research and Public Health*, *17*(16), 1–16. https://doi.org/10.3390/ijerph17165889

Tantrakarnapa, K., Bhopdhornangkul, B., & Nakhaapakorn, K. (2020). Influencing factors of COVID-19 spreading: a case study of Thailand. *Journal of Public Health: From Theory to Practice*, *https://do*. https://doi.org/10.1007/s10389-020-01329-5

Usman, I. M., Ssempijja, F., Ssebuufu, R., Lemuel, A. M., Archibong, V. B., Ayikobua, E. T., … Kasozi, K. I. (2020). Community Drivers Affecting Adherence to WHO Guidelines Against COVID-19 Amongst Rural Ugandan Market Vendors. *Frontiers in Public Health*, *8*, Article 340. https://doi.org/10.3389/fpubh.2020.00340

Verity, R., Okell, L. C., Dorigatti, I., Winskill, P., Whittaker, C., Imai, N., … Ferguson, N. M. (2020). Estimates of the severity of coronavirus disease 2019: a model-based analysis. *The Lancet Infectious Diseases*, *20*(6), 669–677. https://doi.org/10.1016/S1473-3099(20)30243-7

Worldometer. (2020). Deaths from COVID-19 Virus Pandemic. Retrieved October 27, 2020, from https://www.worldometers.info/coronavirus/

Yang, J., Zheng, Y., Gou, X., Pu, K., Chen, Z., Guo, Q., … Zhou, Y. (2020). Prevalence of comorbidities and its effects in coronavirus disease 2019 patients: A systematic review and meta-analysis. *International Journal of Infectious Diseases*, *94*, 91–95. https://doi.org/10.1016/j.ijid.2020.03.017

Zimmerman, E. B., Woolf, S. H., Blackburn, S. M., Kimmel, A. D., Barnes, A. J., & Bono, R. S. (2018). The Case for Considering Education and Health. *Urban Education*, *53*(6), 744–773. https://doi.org/10.1177/0042085916682572