COVID-19 Mortality Rate Variable Construction for Country-level Analysis

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Abstract

The coronavirus disease 2019 (COVID-19) mortality rate has been widely discussed and is considered the primary variable of interest for existing country-level studies, using data from secondary sources (Di Gennaro et al., 2020; Hopman, Allegranzi, & Mehtar, 2020).

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The coronavirus disease 2019 (COVID-19) mortality rate has been widely discussed and is considered the primary variable of interest for existing country-level studies, using data from secondary sources (Di Gennaro et al., 2020; Hopman, Allegranzi, & Mehtar, 2020). A broad range of COVID-19-related literature has attempted to estimate associations between the COVID-19 mortality rate and various country-level factors (e.g., hospital beds and the population aged 65 or older) (Chaudhry, Dranitsaris, Mubashir, Bartoszko, & Riazi, 2020; Lawal, 2020; Liang, Tseng, Ho, & Wu, 2020). COVID-19 death counts per 100,000 population is a straightforward and commonly used mortality rate variable in statistical analyses. Although country-level variable is critical for understanding the overall mortality rate, various country-, area-, and patient-level characteristics can be used to provide additional clarity regarding the various dimensions of COVID-19 mortality rates. In this brief note, we discuss the use of alternative methods for exploring the COVID-19 mortality rate when estimating associations with country-level factors.

We conducted a brief narrative review of published empirical articles on the "mortality rate" of COVID-19. Then, we reviewed the "mortality rate" variables used in different country-level analysis. Finally, we explained three additional approaches to define the COVID-19 mortality rate variable.

COVID-19 mortality rate variable construction: In the section, we discuss a few potential approaches for the construction of a COVID-19 mortality rate variable. This discussion is intended to present potential techniques for integrating existing country-, area-, and patient-specific characteristics into these analyses to improve the overall understanding.

Country characteristics: Country-level characteristics, such as per capita health expenditures or hospital beds per 100,000 population, are important and commonly used variables when analyzing country-level factors

that affect the COVID-19 mortality rate. In most cases, each country is treated as an independent data point. Although this analysis technique is appropriate, it fails to distinguish various preexisting characteristics (e.g., income or development levels) that are likely to affect mortality levels. To understand how mortality rates vary according to income or other features, we can use country-level contextual characteristics (Sornette, Mearns, Schatz, Wu, & Darcet, 2020). For example, we can use the classifications provided by the World Bank income group, human development index, and the World Health Organization (WHO) region. The use of interaction dummies, such as the interaction between the World Bank-defined income group and the WHO-defined regional classification, would also allow the exploration of associations that exist among various income-grouped counties in different regions. Additionally, the mortality rate can be categorized ordinally to explore country-level characteristics. For example, five consecutive quintiles (e.g., 1 for 0%–20%, 2 for 21%–40%, 3 for 41%–60%, 4 for 61%–80%, and 5 for 81%–100%) could be used to indicate differences in mortality rates of affected countries. Countries could be analyzed for quintile-specific regression analyses.

Area characteristics: In many countries, the mortality rate is higher in urban areas than in rural areas (Dorn, Cooney, & Sabin, 2020). Using separate mortality rates for urban and rural areas, rather than overall country rates, would produce area-based insights. Area characteristics can be included as a binary dummy (e.g., 1 for urban and 0 for rural), and a country-area interaction dummy could also be examined. For example, a dummy variable that represents urban areas in high-income countries could be used to explore the factors associated with respective mortality rates in these areas. In a regression analysis, two different models examining urban and rural mortality rates, together with an overall (country-level or pooled data) mortality rate, would generate area-specific estimates, which could be used as robustness checks and the identification of urban-rural variabilities.

Patient characteristics: Similar to country- and area-level characteristics, general patient-level characteristics (e.g., income, education, sex) should be considered when estimating the relationships between the COVID-19 mortality rate and associated factors (Brandén et al., 2020). Lower-income individuals residing in the urban areas of high-income countries might be more vulnerable to COVID-19 than their rural counterparts. To examine these relationships, the use of patient characteristics would be necessary, although identifying the income groups associated with all deceased COVID-19 patients may be practically impossible to perform. However, preexisting area characteristics (e.g., postal code-based income group) can be used as an estimator. The use of area-based country data (like the panel data) could also be an option. If more localized data is unavailable, broad area-based (e.g., county) country-level data could also be applied.

Conclusion

The construction of the COVID-19 mortality rate is always researcher-dependent and depends solely on the objective of the study. However, this discussion highlights a few alternative approaches to the construction of possible COVID-19 mortality rate variables by considering country-, area-, and patient-level characteristics. However, we must remain cautious with regards to death reporting and data discrepancies(Ahamad, Tanin, Talukder, & Ahmed, 2020) to avoid the production of misrepresentative or biased results, which may have consequential implications on global COVID-19 response and mitigation strategies.

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