Abstract

Background: The COVID-19 death rate has varied by country. Although studies have suggested some biomedical risk factors including hypertension, social factors may not have been explored adequately yet to prepare for the next pandemic, which may include country-level public health status and health policies such as the role of the achievement of universal health coverage (UHC). In this study, world data were probed from an ecological perspective.

Methods: COVID-19 pandemic-related data were obtained from websites provided by WHO, UN, and academic societies. The outcome variable was defined as the annual COVID-19 deaths per 100,000 population in 2020 and 2021. The chronic disease mortality defined by adding mortalities due to cardiovascular diseases and neoplasms in 2019, the Socio-Demographic Index (SDI), a new metric for social development created by the Global Burden of Disease Study, and non-communicable disease (NCD) risk factors and social factors including the UHC service coverage index were independent variables. Countries with an elderly population (age≥65 years) of over 7% and between the middle and high SDI quintiles (divisions according to SDI) were included in the analyses. Statistical analyses were made including panel data analysis using a fixed-effects (FE) model and GEE.

Results: The COVID-19 mortality was significantly higher in 2021 than in 2020, particularly in high-middle SDI quintile countries. Panel data analysis using a fixed-effects (FE) model extracted factors correlated with a higher outcome mortality in the high-middle SDI quintile countries: the

tuberculosis prevalence, chronic disease mortality, cardiovascular disease mortality, and raised blood pressure prevalence. By analyzing three-quantile outcome level categories by the SDI-to-mortality negative slope coefficient levels, i.e., mild, medium, and steep, respectively, raised blood pressure prevalence had a significant positive correlation through categories, extracted by a FE model. On the other hand, the chronic disease mortality, diabetes prevalence, obesity prevalence, current smoking prevalence, and alcohol consumption per capita had a heterogeneous correlation between categories. With data from a systematic review, angiotensin converting enzyme (ACE) 1 ID/DD genotype frequency was correlated with a higher outcome mortality, i.e., within the steep category. By bivariable GEE model, when combined with the ACE1 ID/DD genotype frequency, the diabetes prevalence and the obesity prevalence were positively correlated within the steep category, supporting a mechanism of convergence between COVID-19 mortality and NCDs. The UHC service coverage index was consistently correlated with a lower COVID-19 mortality by FE and GEE, with a risk ratio of 0.57 per 1 SD increase (95% CI, 0.42-0.7) by FE.

Conclusion: Taken together, the disparity in the chronic disease burden was responsible for a higher impact of the pandemic in aging countries. ACE2-related mechanisms may be specifically involved in the convergence, possibly by impaired immune response. Therefore, accelerating achievement of UHC should also offer a key to next pandemic preparedness.