Review of: "The interaction of ethnicity and deprivation on COVID-19 mortality risk: a retrospective ecological study"

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The study on the UK ethnic diversity was appropriate and on time. The UK was one of the rich European countries highly impacted by the COVID-19 pandemic, and there were several reports of how the disease affects some ethnic groups more than the other, projecting the existing effect of health inequality in the country. In addition, this study is unique and novel because it examined the related age-adjusted COVID-19 mortality and disaggregated race and ethnicity and socioeconomic deprivation index in the United Kingdom. However, the reviewer observed a couple of things that would have improved the study and give more confidence to readers.

First, the result presented in Table 2 may be biased because of the problem of the small sample size within the disaggregated categorization of ethnicity across the index of multiple deprivations ($\boldsymbol{i}$ =1,2,3,4). Looking at the Tables 2 and 3, the study failed to report the ($\boldsymbol{n}$= group sample size), and as a result, the confidence intervals are said to be inflated/deflated for the most part. Also, the insignificant results in the table are suspected to be due to the poor representation of the within-group small sample sizes, which makes the result unstable and unreliable. Similarly, this problem was likely to be propagated in the spatial regression results in Table 3 that presents the marginal effects for the selected ethnicity profile. The lack of presentation of $\boldsymbol{n}$ reduces the readers' confidence (but only readers who are inquisitive and care about statistics).

Second, the spatial analysis based on the dis-aggregated ethnicity seems to end abruptly. Despite that the study reported a significant coefficient for the spatial lag of age-adjusted mortality, ($\boldsymbol{\phi}\hat{}$= 0.462, CI 0.355–0.569, $p < 0.001$), indicating positive spatial autocorrelation between the age-adjusted mortality in one $LAD_{\boldsymbol{i}}$ and age-adjusted mortality in another $LAD_{\boldsymbol{j}}$, the study failed to show how the evidence of $\boldsymbol{\phi}\hat{}$ was accounted for in the spatial autoregressive models. In addition to these identified flaws, the study did not declare which type of autoregressive model was applied which makes replication difficult. Interestingly, the study highlighted the possible effect of geography briefly as part of the theory for explaining health inequality in the UK but failed to completely account for this spatial effect in their spatial analysis. Hence, further analysis of "neighborhood effects" as projected in the "Introduction" using spatially varying

regression techniques such as the geographically weighted regression will show a more robust finding in addition to what was presented in the study. In such a scenario, categories of ethnicity will predict the outcome variable (i.e., age-adjusted COVID-19 mortality rate) , and we can see in which neighborhood each ethnic group will most likely predict COVID-19 mortality. This kind of recommended spatial analysis is best for location-based intervention rather than the generalized results from global regression such as those presented in this study.