**Article**

Social Determinants of Health and the COVID-19 Pandemic:
An Evidence-Based Approach to Health Equity

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**Review 1**
**Reviewer**: Dr Samuel Cai
**Institution:** University of Oxford

Overall, I think this is a well-written manuscript, which investigated the correlation between social vulnerability and COVID-19 outcomes at county level in NYC. I felt some parts of the discussion could be enhanced, though. For example, in the section of 'health burden on MV cohort', the authors quoted that being without health insurance is possibly one of the reasons why we saw higher COVID-19 incidence in MV cohort. This is perhaps not a strong argument. Comorbidity or underlying health status (of course may be in part associated with not having health insurance), age structures in the county, populations that work in key sectors such as healthcare/social care, and the general lifestyle patterns/attitudes towards the pandemic in the county will all collectively impact the incidence, so the reasons are multifactorial. The authors stated that lack of healthcare coverage for MV communities may be the reason, but this is also likely the case for HV communities, so how they can explain that?

I think at some points of the Discussion – the authors should at least mention some factors of the general living environment, for example, air quality, availability of public spaces and green spaces, and how the disparities of these factors may impact COVID-19 transmission and mortality etc….There are some large US studies already reported in this area. These living environments are not captured by the index.

**Review 2**

**Reviewer:** Prof Peter Goldblatt
**Institution:** University College London

This paper presents a very useful analysis of the correlation between the evolution of COVID-19 in the four counties of New York City (NYC) and levels of the social deprivation of each county. This time series analysis is particularly valuable in terms of the available literature on the role of social inequality in COVID-19 occurrence and mortality.

**Specific comments**

**Title**

This should specifically indicate that it is a study of the relationship between the evolution of the epidemic and social determinants in NYC

**Abstract**

The statement that "the impacts of social vulnerability and government intervention on COVID-19 outcomes are not well understood" is too great a generalisation. The United Nations and the World Health Organisation have both recognised and modelled the potential differential impacts of both the disease, health system responses and the containment measures taken by Governments to limit the spread of the disease:

> A UN framework for the immediate socio-economic response to COVID-19. New York: United Nations; 2020 https://unsdg.un.org/download/2114/31163
>
> Strengthening and adjusting public health measures throughout the COVID-19 transition phases: policy considerations for the WHO European Region, 24 April 2020 https://apps.who.int/iris/handle/10665/332473
>
> Factsheet October 2020. Vulnerable populations during COVID-19 response. Addressing vulnerability upfront in the WHO European Region. Copenhagen: WHO Regional Office for Europe; 2020 (https://www.euro.who.int/__data/assets/pdf_file/0007/466108/Factsheet-October-2020-vulnerable-populations-COVID-19.pdf).
> WHO manifesto for a healthy recovery from COVID-19. Prescriptions and actionables for a healthy and green recovery. Geneva: World Health Organization; 2020 (https://www.who.int/publications/i/item/who-manifesto-healthy-recovery-covid19
>
> Health inequity and the effects of COVID-19. Assessing, responding to and mitigating the socioeconomic impact on health to build a better future, Copenhagen: WHO Regional Office for Europe; 2020 https://apps.who.int/iris/handle/10665/338199

Other international organisations have identified the risks associated with specific social determinants (see bibliography at the end of my comments).
In the UK, both the Office for National Statistics and Public Health England have monitored inequalities in various aspects of the disease using small area deprivation based on the Index of Multiple Deprivation for around 30,000 areas each of around 1,500 people, as well as differences between ethnic groups:

> All ONS data related to health inequalities https://www.ons.gov.uk/peoplepopulationandcommunity/healthandsocialcare/healthinequalities/datalist

> Excess mortality in England: weekly reports
> https://www.gov.uk/government/statistics/excess-mortality-in-england-weekly-reports

Several reports and papers in England have attempted to bring this information together:

> Unequal pandemic, fairer recovery: The COVID-19 impact inquiry report
> https://www.health.org.uk/publications/reports/unequal-pandemic-fairer-recovery

> Build Back Fairer: The COVID-19 Marmot Review
> https://www.health.org.uk/publications/build-back-fairer-the-covid-19-marmot-review

> Health Profile for England: 2021
> https://www.gov.uk/government/publications/health-profile-for-england-2021

> Whitehead M, Taylor-Robinson D, Barr B Poverty, health, and covid-19
> BMJ 2021; 372 doi: https://doi.org/10.1136/bmj.n376 (Published 12 February 2021) Cite this as: BMJ 2021;372:n376

> Whitehead M, Taylor-Robinson D, Barr B. Covid-19: We are not "all in it together"—less privileged in society are suffering the brunt of the damage. BMJ Opinion 22 May 2020.
> blogs.bmj.com/bmj/2020/05/22/covid-19-we-are-not-all-in-it-together-less-privileged-in-society-are-suffering-the-brunt-of-the-damage/

**Introduction**

The reference to inequalities in the conditions of daily life "World Health Organization, n.d." should really be to the source document, the WHO global commission (CSDH) report, rather than the web summary page

> Closing the gap in a generation: health equity through action on the social determinants of health. Final Report of the Commission on Social Determinants of Health. Geneva: World Health Organization; 2008
> http://whqlibdoc.who.int/publications/2008/9789241563703_eng.pdf?ua=1

Checking this CSDH document would avoid the potentially misleading statement "The effects of SDOHs, in turn, are mediated by the allocation of power, resources, and money within society". As the CSDH report makes clear e.g. on page 26 "the inequitable distribution of power, money and resources- the structural drivers of those conditions of daily life". This is further made clear in the CSDH conceptual framework on page 43.

**Materials and Methods**

In the subsection "NYC as a Microcosm – and categorising counties by SVI", it is important to indicate the population size of each of the four counties. The results of the entire analysis are subject to the so-called "ecological fallacy":

> Robinson, W.S. (1950). "Ecological Correlations and the Behavior of Individuals". American Sociological Review. 15 (3): 351–357. doi:10.2307/2087176. JSTOR 2087176.

> Selvin, Hanan C. (1958). "Durkheim's Suicide and Problems of Empirical Research". American Journal of Sociology. 63 (6): 607–619. doi:10.1086/222356. S2CID 143488519

The larger the areas used, the greater the chance that the correlations do not reflect the individual characteristics chosen but some other characteristic of the area, as Robinson indicated. Related to this is the statistical issue of within and between area variation – the greater the within area variation in levels of vulnerability, the more noise this creates in assigning plausible causation to the between area variation.

In the subsection, "Time Period Stratification and Determination of Trends in Reported Data", the statement that "The number of daily deaths was subtracted from the number of daily hospitalisations on the same date to estimate daily recoveries" needs some clarification. There is a lag time between both hospitalisation and death and between hospitalisation and discharge (a proxy for full recovery". Both of these variables varied over the course of the pandemic as treatments improved and between areas and countries according to available hospital beds and staff. It is not clear how all of this variability in lag times.

In this context, you also need some evidence on the reliability of counts of cases over the course of the pandemic – how were they ascertained, did they miss any groups and were there therefore any numerator-denominator biases in calculating the rates used (hospitalisation rates, death rates and consequent recovery rates).

**Results**

The results for the "Recovered population evolution May 2020" in this section point to a weaker relationship than others. Need to say why this might be – is it to do with errors of estimating recovery times (as Indicated in the two paragraphs above) or is it a real weakening in the relationship between vulnerability and the likelihood of recovery?

**Limitations**

As indicated in my comments above, the two limitations should also be discussed in the relevant sections as they have a potentially major impact on the analyses presented.

**Conclusion: an action plan for critical healthcare and equity**

This section focuses mainly on healthcare whereas the introduction to the paper focuses on the more distal determinants of health. The conclusions therefore need to address this mismatch by including some inferences on what is needed to reduce population vulnerability both to infection and death over and above what can be delivered simply through healthcare - - the wider responsibilities of public services and public health in NYC.

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(https://www.ilo.org/wcmsp5/groups/public/---europe/---ro-geneva/---sro-budapest/documents/publication/wcms_746124.pdf

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**Review 3**

**Reviewer:** Dr Amanda Shriwise
**Institution:** World Health Organization; University of Bremen

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| **Does the title reflect the subject matter of the article?** | To some extent. While the title does draw attention, I think it also raises expectations in a way that is unhelpful. |
| **The article is clearly written** | Disagree. The article is not difficult to read, but the concepts it relies on are not always well defined and are not always employed clearly and correctly. |
| **The article is well structured** | Disagree. Again, the article is not necessarily poorly structured, but it is also not structured in a way that supports the overarching argument that it makes as well as one might hope. |
| **The article makes a strong contribution to the discussion in its field** | Disagree. I should start by saying that I am not an expert in quantitative methods and/or modeling, so it may be wise to seek a second opinion here. However, I am troubled by the lack of any controls in the modeling, as well as claims that city, state, and federal containment and mitigation measures seemed to have a positive impact when this was not really tested in the study. In my view, there are too many unknowns in the data and modeling here, and when combined with a research question that is simply too broad, this article appears to overreach and fails to make a strong substantive contribution to the field. |
| **The references are relevant and satisfactory** | Agree. The referencing is satisfactory, though I would have liked to see the authors draw from less US-centric work on social determinants of health (the standard acronym for which at WHO is simply 'SDH') and instead work to promote some coherence with European and global advances on this topic so as to enable a stronger contribution to the field as a whole. |
| **The article appropriately uses figures, tables, and appendices** | Disagree. While the figures and tables etc are well placed and reasonable in number, it is the modeling behind them that is problematic in my view, and therefore, I cannot fully 'Agree'. |
| **The contributor is confident about their evaluation** | Agree. While I am not an expert in quantitative methods and/or modeling, I am confident of the review submitted here. |
| **The subject matter of the article is suitable for an interdisciplinary audience** | Disagree. In my view, the piece is too full of jargon. I also think the authors could make a better contribution, particularly to an |

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| | interdisciplinary argument, by writing this piece more in the style of a viewpoint or extended commentary, rather than trying to make this argument through the use of quantitative modeling/testing, which neither the data nor methods do much to support. |
| **Recommendation** | Ask the authors to consider writing this article in the style of a viewpoint/commentary, bearing in mind the interdisciplinary audience. |
| **Additional comments** | Thank you for the opportunity to review this work. While I sympathize with the topic of this article, and while I am not an expert in quantitative methods or modeling, I find both the data and methods used to be problematic and that the article raises expectations that it simply cannot meet. My recommendation is to revisit the purpose of this article, including the research question underlying this study, in order to find a better match between the desired impact and methods/medium of writing and argument employed to achieve this end. My instinct is that this piece should instead be styled as a viewpoint/commentary - as already suggested by the title - rather than as a scientific test of sorts, but this is of course for the authors to decide. If the authors decide to stick to the quantitative testing model, my recommendation would be to get much more specific about the academic contribution of this piece, which is currently unclear. The article also claims that city, state, and federal interventions are evaluated, but I did not find this to be thoroughly explored in the testing models, and I would recommend revisiting the claims in this portion of the article in particular so as to get more specific and to leverage more substantive contributions. The topic is most worthy, and I do hope the authors are willing to pursue substantive revision to maximize their contribution amid the plethora of work on health equity and COVID-19 that is currently underway. |

**Second round of comments:**

- I would much prefer use of the acronym SDH instead of SDOH throughout the paper, as I believe this is a much more commonly used acronym

- P. 2 - I think the first and second paragraphs of sub-section 1.1 should be joined and that the reference to Figure 1 should come after the first sentence of what is now the second paragraph.

- P. 3 - In the first paragraph of section 1.2, I would recommend some clarification of the phrase 'Policy interventions have sought to increase accessibility to health care in the COVID-19 pandemic', as this is clearly not the case in the many instances where health services were delayed or stopped entirely in some instances.

- P. 3 - I think section 1.3 needs to be moved to section 2 on 'Materials and Methods', possible right after the first paragraph of what is now sub-section 2.1

- P. 14 - I think the last sentence in the opening paragraph to section 4 entitled 'Discussion' needs to clarify the distinction that seems to being made between the social vulnerability index and some sort of environmental vulnerability index; otherwise, this is a bit confusing as many of the public health and social measures implemented did affect these environmental factors (e.g., air quality), albeit through indirect mechanisms.

- P. 14 - If the authors could please read the second paragraph of sub-section 4.1 for changes between individuals and communities as the primary unit of analysis and clarify, that would be very helpful. I think it was 'individual social vulnerability indicators' in the second line that threw me off, but it would be good if they could please double check.

- P. 15 - I think there is reason to re-vist the first sentence of the second paragraph in sub-section 4.2. High SVI populations may not necessarily receive poorer COVID-19 treatment, though it may be more likely that they receive poorer COVID-19 treatment. Furthermore, I think mention of Medicaid needs to be brought in here, as presumably this is the kind of health coverage most used by High SVI populations.

- P. 15 - Building on the previous comment, I think bringing this is important to frame the discussion of health insurance in Queens County that follows, as, presumably, this Medium SVI group is just above the Medicaid qualification threshold but less likely to have access to employer-based health insurance. This could present a barrier and/or deterrent to accessing care; even if COVID-19 testing and treatment is free, this population may not trust that seeking care will come at no cost.

- P.P. 16-17 - I think Figure 11 should be retitled to 'Public health and social measures introduced in response to COVID-19 in New York City' and that this figure and accompanying text should be moved up, most likely to section 1 / the introduction to the paper.

- P. 18 - I think the first and second paragraphs of section 5 / the conclusion need to be merged into one. Otherwise, the first sentence leaves the reader wondering about the absence of SDH.

- P. 19 - I would like to ask that the authors consider mention not only of Critical Care Facilities, but also primary care facilities. Primary health care is a critical element of readiness in the face of health emergencies, both for the health system and population health. Furthermore, from a global, comparative view, critical care does not appear to be lacking much in the US; there may well be an equity/disparities issue that needs to be stressed here, and I do take this point, but I also think this discussion needs to be had in the context of the health system more broadly and should at least mention primary health care.