Reviewer's report

Title: The Impact of Social Distancing Measures on Antiviral Treatment Demand during a Severe Pandemic

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Reviewer: Nedialko Dimitrov

Reviewer's report:

Overall
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I recommend a major revision of this manuscript before it is accepted for publication. I find this paper to be well written and in line with what generally is published these days in the area of infectious disease modeling, especially of influenza. However, I find the paper lacking in a critical aspect: it does not do a sufficiently in-depth literature review to place the paper's results in context and highlight its contributions. As a reader, I am left unclear on what is new in the manuscript. Much of the discussion and conclusion is full of relatively weak statements that are otherwise well known, whose purpose seems to be to be mainly guard against criticism from reviewers. I understand the authors in writing such statements, but I'd like to see a stronger manuscript with clearly stated contributions and novel take-aways for the reader, placed in context of previous research.

More specific comments on individual sentences and paragraphs in the manuscript follow.

Specific comments
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- An example of a weak statement in the paper is the first sentence of the abstract: "In the case of a severe pandemic... it is likely that some of the population may..." There are three weakening insertions in one sentence here. I suggest exchanging this sentence and other similar statements throughout the paper with factual statements and citations. For example "ABC show (a study reference) that during the XYZ epidemic a fraction of the population willingly reduced their number of daily contacts."

- The results section of the abstract is a little too vague to be useful to the reader. For example "With short periods of social distancing (12 weeks or less)"-- this is good, because the authors gave specifics--"the effect is relatively small"--this is vague and not useful--"unless the proportion of people involved and the magnitude of the behaviour change is large"--also vague and not useful. I suggest altering all similarly vague statements throughout the paper with specifics on what the manuscript's model shows. Consider rewriting this, as an
example: "If social distancing measures last for 12 weeks or less, XYZ specific result with numbers"

- It is not clear from the abstract, or from the rest of the paper, what is novel about the results of the manuscript. The conclusions of the abstract state: "Our results demonstrate that the magnitude and duration of social distancing behaviours adopted by the population during a severe pandemic can have a significant impact on the need for antiviral drugs." What is new in this statement? Any modeler, or infectious disease expert knows that if extreme social distancing takes hold for a long period of time, the infection will be wiped out because of the decrease in the reproduction number. On the other hand, if the social distancing is weak, the reproduction number remains about the same, and the epidemic progresses as usual. What is new, in terms of specific numbers or insight, that is offered inside this manuscript?

- On Page 5, the definition of "differential transmissability" is unclear. Do the authors mean "there is no difference in transmissability between asymptomatic and symptomatic individuals?"

- On page 5, the phrase "The model ran for 12 months" is a little unclear. I presume the authors mean the model captured 12 months of the epidemic, as opposed to "the model used 12 months of super-computer time."

- On page 6, the sentence "transitions between compartments were the same..." and the entire description of the model parameterization... I suggest the authors construct an appendix with an explicit specification of the entire model, including all model parameters. This is critical for the reproducibility of the results. As the manuscript stands, if I were to give the manuscript to an advanced graduate student, they will not be able to reproduce the model because of lack of detail in the manuscript. I suggest putting this detail in an appendix because it is too tedious in the main body of the paper, but still a requirement for scientific integrity.

- The paper makes a number of model assumptions that refer possible observations of past influenza epidemics, but it is not clear will hold for future epidemics. For example, the pre-existing immunity assumption on Page 6. Why is it reasonable that for future epidemics we should assume a fraction of those 65 and older have immunity? In addition, why is it reasonable to assume seasonality will result in 2 waves? (also page 6). For seasonality, how is the influenza transmission reduced or increased according to the season in the model? Why is this particular parameterization of seasonality reasonable? The manuscript refers to details of the model, but there is no discussion on why these details are implemented in a reasonable way and should hold for future epidemics--so that the model results are insightful.

- In page 7, the sentence "We assume high vaccine coverage levels as might be expected for a severe" is missing a word.

- I am unclear on the meaning of "for ethical reasons, all individuals who present
for treatment with respiratory symptoms will be eligible..." Do the authors mean that there is no insurance coverage type consideration in the model? If that is the case, why is it "for ethical reasons?" And I am also unclear how priorities are taken into effect. So, an individual could be eligible for antivirals, but not receive them. When does that happen?

- I am unclear on the meaning of "We assume no variation in the magnitude of behavior change over each time period examined" occurring on Page 8.

- On page 9, the sentence "Clearly, increasing the duration of time that distancing occurs..." made me question why we are looking at antiviral demand? Why not look at simply number of infected individuals? Is the model's antiviral demand simply a group-weighted sum of the number of infected individuals? In other words, 30% of infecteds from group A seek antivirals and 40% of infecteds from group B seek antivirals? Ultimately, doesn’t social distancing simply reduce the effective reproductive number? Why not simply express that reduction, and that way we clearly now how much and for how long that reduction has to hold to wipe the epidemic? It is just not clear what the takeaways are for the reader on antivirals here.

- On page 10, the phrase "age-specific social distancing" made me ask the question... is the social distancing in the manuscript's model not age-specific? Is it across the board, for all age groups? Why does that make sense? Why would kids social distance themselves as much as adults? Also, what is the purpose of having the age compartments if not to do different social distancing on them? Is it just to have different contact rates from the Mossong study?

- The conclusions section is weak as stated before. I is unclear what is new. I suggest a clear literature review that compares and contrasts this manuscript's contributions with those of existing manuscripts, in addition to explicitly stating the main takeaways for the reader.

**Level of interest:** An article of limited interest

**Quality of written English:** Acceptable

**Statistical review:** No, the manuscript does not need to be seen by a statistician.

**Declaration of competing interests:**

I declare that I have no competing interests