Reviewer's report

**Title:** Dynamic modelling of costs and benefits of school closure during an influenza pandemic

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**Reviewer:** Shawn Brown

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The authors present in this manuscript a cost-effectiveness study of school closure as a mitigation strategy during a pandemic influenza over a range of reproduction rates using a deterministic stochastic dynamic model of transmission to capture the benefits of the mitigation. The authors find that school closure presents a fairly large impact from a societal perspective vs. the benefits that are gained from its use. A key finding is that targeting school closure amongst students that are of the age that could take care of themselves, due to the costs of closure being dominated by the productivity loss of parents needing to care for students not in school, could be a fairly cost-effective strategy for mitigating a pandemic, while closing kindergarten and primary schools are not. It is also noted that schools must be closed for quite a long period of time to have any appreciable impact on the overall pandemic. These results are in line with several studies that have been performed using dynamic models of impact of school closure, and the cost-effectiveness results are also in line with studies that have recently been published using similar methods.

Overall, the study presented is well defined and relevant to concerns with school closure during a pandemic. The methods used are appropriate, and I have no issues with the assumptions that were used for economic analysis (with the realization that any study of this nature will be influenced by the underlying assumptions). The authors have taken care to include important aspects of the costs and the assumptions are in line with what others have published on the same topic.

While I think this is a nice piece of work, there are several concerns that need to be addressed, however, before I can recommend this manuscript for publication:

**Major Compulsory Revisions**

1. The title of the work indicates (or at least reads) like the analysis performed would be a cost-benefit analysis, whereas the study is actually a cost-effectiveness analysis. While this is a minor point, I think the authors should reconsider the title to reflect this and better inform readers of what to expect from the manuscript.

2. The introduction talks of several modeling studies that have been done looking at transmission during a pandemic with school closure as a mitigating strategy. The authors also mention a few studies that have provided economic analysis of school closure. The reader is left with the impression, due to words like “novel”,
that there have been no attempts to combine these in the literature, which is not the case. Two papers in this journal at the time of submission have combined economic modeling with dynamic simulations:


These published works are much too close to the submitted work to not be discussed in much more detail in regards to the current work. Both of these works use dynamic models to estimate the benefits of school closure on a pandemic, and both provide similar costs models to the one presented here. The first is currently cited in the work, but is given no discussion, and the latter is not cited at all.

3. When comparing the epidemic curves that are produced by the dynamic model here, I am left some questions given the published work using agent-based models to study school closure. The authors note that there is little to no delay in the peak of the epidemic with school closure, which would seem to disagree with many of the published models that show quite significant delays in the peak given school closures of a similar length and triggering. (e.g. Lee et al. J Public Health Manag Pract 2009 Dec 23.). It is also stated that if school closures are opened prior to the peak, there is a rebound effect. This is shown in these other studies as well, but there is also rebound if the schools are opened past the peak as well. I think that it is worth a discussion on why this might be, as one of the strong arguments for school closure is to indeed delay the onset of the peak (as noted by the authors in the discussion) to allow time for preparation of other mitigations (e.g. vaccination). Also, some additional figures showing this in the supplementary section to support statements made about the shape of the epidemic curves under different school closure policies would be helpful (they were not present in the supplementary section that I have).

Minor Essential Revisions

1. The authors note that there may be uncertainty in the transmissibility of a future pandemic influenza, which led them to exploring the sensitivity of reproduction rate, and, similarly, there may be uncertainty in the case fatality. This was a very uncertain parameter during 2009 H1N1 and its potential sensitivity to the cost-effectiveness may be important. I encourage the authors to explore the sensitivity of this parameter further in order to produce a fuller picture.

2. A minor point: On page 7 of the PDF, the formatting of parenthesis in the equations is off.

Level of interest: An article of outstanding merit and interest in its field

Quality of written English: Acceptable
Statistical review: No, the manuscript does not need to be seen by a statistician.