Author’s response to reviews

Title: Estimating the costs of school closure for mitigating an influenza pandemic

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Author’s response to reviews: see over
1. The paper focuses on the (societal) costs associated with school mitigation during a potential influenza pandemic. As such this very narrow part of a preparedness plan might be interesting to evaluate. However, the current approach does not address any savings (and diminished pressure on the health care system) that might result from mitigation. The current ‘one-sided’ evaluation will thus look poor or inefficient when directly compared to active treatment such as vaccination or antiviral therapy, where the number of cases of influenza avoided is more straightforward to conceive. The ultimate goal, however, is similar. The paper would improve and be more balanced if this aspect would be added.

The immediate objective of the paper is to show what will be the cost of school closure in terms of absenteeism of working parents and evaluate absenteeism in monetary terms. School closure is being considered as one of the important NP mitigation strategies for pandemic influenza. Analysis/discussion on benefits of school closure and cost effectiveness of such strategy requires a detailed epidemiological model allied to the economic analysis. This is intended in a subsequent paper.

2. ‘School closure is likely to significantly exacerbate the pressures on the health system.’

The above sentence is the closing line of the abstract. It would appear that the costs of school closure fall outside the realm of health care and as for other pressures it is not clear what the authors infer. Also, it is not the net (incremental) costs the authors focus on. Instead they only draw inference on the investment (without taking into account return on investment). Back of the envelope calculation – provide Cost per case avoided.

Closing line of abstract has been changed to ‘School closure is likely to significantly exacerbate the pressures on the health system through staff absenteeism’. We wanted to describe how school closure might affect the health sector through staff absenteeism. As far as we are aware this is the first analysis of the proportion of health sector staffs that are women with dependant children and therefore are likely to be affected by school closure. We did not feel comfortable providing a back-of the envelope calculation of the reduction in demand for health care that might result from school closure (though it is clear that this must be large to negate the deleterious effect such a policy is likely to have on staffing levels). We prefer to provide a more detailed analysis in a subsequent publication (see comments above).

3. Methods section last line page 3: ‘We assume that these individuals would take absenteeism to care for these children’.

How about grand parents or other informal care givers? Taking care of grand children may also occur if the grand parents are not actual members of the same household.
As a result, the cost estimates presented seem too high.

See page 7-11, tables 2 and 3. We have now included a scenario in which informal care is utilised, and added a section on this to the discussion.

4. 1st paragraph page 6: This industry specific absenteeism was then evaluated in monetary values using both sector specific wage (from LFS) and average wage from DWP. These industry costs were aggregated to give an aggregate national estimate.

Wages may not accurately reflect societal costs due to losses in productivity. This should be elaborated on and preferably estimated as well.

According to the neoclassical economic model, wage rates equal the value of marginal revenue generated by an additional worker under full employment. The human capital method as adopted by this study conventionally uses wages to evaluate the loss of income from work days lost. The effective loss of work day/hour may be less than the reported loss. This is discussed on page 7, and we now use a scenario that accounts for the elasticity of productivity with respect to labour, using estimates from a Dutch study (see tables 2 and 3). In addition, we have included a scenario that allows for working at home.

**Minor Essential Revisions:**

5. Last line of the introduction is somewhat convoluted. Suggestion: This paper aims to estimate the economic cost of school closure to the United Kingdom. In addition those sectors likely to incur the greatest costs are identified.

We have modified the text accordingly.

6. Discussion page 8, 4th line from bottom: ‘That is, school closure, plus illness absenteeism, could reduce the workforce of the health sector by up to 50% at the peak of the epidemic.’

The absenteeism due to illness is new data not referenced or presented before. The readers would not be able to verify this statement.

This calculation is expanded on in the text to clarify where this estimate comes from.

**Discretionary Revisions:**

Have the authors considered estimating the costs associated with extra teaching efforts required to bring the children up to level? Or the cost associated with later entry into the labour force?

This would be difficult to estimate. We have not found a reliable way to estimate this, and have therefore omitted it from our analysis.
Also, the paper could be shortened further when truly focussing on the message of the losses in production and societal costs ensuing from school mitigation.

We have attempted to keep the paper as short as possible.

**Reviewer: Osman Mansoor**

**General**

This paper aims to inform one of the proposed policy options for responding to an influenza pandemic: suspension of school classes (which is a preferable term to school closure, as there are should be alternative methods for education to continue).

It is perhaps more accurate to use the term ‘suspension of school classes’, as some formal education would presumably continue, but other papers on this topic chooses school closure, so we have also adopted this term.

The study does not attempt to compare the cost of class suspension with the benefits in preventing disease transmission and the consequent impacts of that on the economy. Therefore, it is hard to interpret the economic assessment – which should be to help inform difficult policy choices, such as the issue of class suspension.

We acknowledge this point, but the immediate objective of the paper is to show estimate the cost of school closure. Analysis/discussion on the benefits of school closure and cost effectiveness of such strategy is intended in subsequent paper.

Obviously, extended class suspensions have considerable social as well as economic costs. The method leads to a point estimate, which might be better as range (using a range of assumptions). I am not an economist, but it strikes me that there may be some issues with using the average wage as the basis to calculate the economic cost of the parental absenteeism caused by class suspension. This is highlighted from one of the main losses due to health sector absenteeism, which would likely not affect overall economic output, especially in the context of a health service with no user-fees.

More generally, in the context of a pandemic there are likely be major changes in behaviour, including an increase in ‘work from home’, that would lead to very different impacts than their analysis suggests.

Furthermore, the analysis assumes that no alternative caregivers could be found for the children – this is especially unlikely to be true with the additional workforce ‘liberated’ by school closure. Obviously, part of the challenge of a policy of class suspension is the need to make alternative arrangements for children to limit physical contact (and continue education).

We have substantially revised the paper, to include a number of different scenarios, including informal care, etc. We think that the paper is greatly improved by this and thank both referees for their comments. We were not, however, able to find an estimate of the proportion of individuals who could
work at home, and how productive they might be while there, and caring for children (who may well be competing with their parents for the same computer to do school-work). We have, however, added a scenario that attempts to account for this, based on the proportion of homes that have broadband. This is rather speculative, and we have therefore drawn readers’ attention to this in the discussion on this. See page 7-11, and tables 2 and 3.

The assumption that children under 16-years-old and under would require the primary caregiver to stay home is questionable. Changing the age threshold to 10 or 12 years would substantially reduce the implications of class suspension. Older children are not only capable of staying home without parental care, they are also able to care for younger children.

The cut off age may have an effect on the overall productivity loss of caregivers. Presumably there are fewer working parents that would need to take leave for the younger ones (under 12 or under 9s). But the data set that we are basing our estimates (Labour Force Survey) only allows the use of age 16. In LFS Dependent children are defined as children aged under 16 and those aged 16 to 18 who are never-married and in full-time education. We wanted to get a national estimate for our estimation, and the LFS were useful and appropriate data base.

Furthermore, it is conceivable that reducing physical contact between older school could be more effectively undertaken without suspending classes. The latter notion is partly based on the idea that these children would likely maintain high contact rates between each other even if classes were suspended; and that they could be made to practise physical distancing that could be better reinforced in the school setting than during class suspension.

The possible effects of these epidemiological assumptions are beyond the scope of the current paper.

INTRODUCTION
The paper refers to six papers published on the epidemiological impact of class suspension, including one by one of the authors that suggest fairly limited impact. However, the paper does not make clear that there is still uncertainty about the potential impact of class suspension; but that it is clear that multiple non-pharmaceutical interventions would be needed. In other words, it cannot be considered on its own, and therefore there needs some justification on why its costs need to be considered independently.

References are clarified.

DISCUSSION
The value of class suspension is again mentioned here but with only three references showing its value. But my reading is that in all cases it has been shown to be at least of some value, especially if the kids can be kept home – as implied by the parental absenteeism.

References clarified (see above)
An interesting point that should be brought out here in relation to impact on health sector is that there is now clear consensus that class suspension must be applied very soon after the virus appears in a community in order to be effective. At this stage there should be very little strain on the health sector. By the time the health sector is stretched, there is unlikely to be any point in maintaining (or even more initiating) class suspension. At present the paper implies that health sector would be stretched during class suspension.

One of the purposes of the paper is to illustrate that the health service would be severely stretched due to class suspension. We have added a sentence to the penultimate paragraph to clarify this point “Note also, that if our estimates are broadly applicable, then the health service will be severely stretched throughout the period of school closure, and that even at the peak of the epidemic the majority of absenteeism in this sector is likely to result from school closure rather than staff illness”.

**TABLE 1.** Spurious accuracy of two decimal places; no adjustment for contribution to output; no range given uncertainties of assumptions – including capacity to work from home.

Decimal places are adjusted in table 1. In table 2 & 3 two decimal places are used because it reports only percentages. Tables 2 and 3 are expanded to include additional scenarios.

**TABLE 2:** The acronyms need to be explained. Figure 2 also, which would be best placed in the table.

Acronyms explained in table legend and in main text.