Impact of Changes to School Attendance

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28 April 2020

The Warwick approach uses a relatively simple SEIR-style age-structured model, matched to the early UK age-distribution of cases and then fitted to the temporal dynamics across 11 regions. There are a variety of ways in which the early matching can occur, and our results average across this uncertainty. A full description of the model formulation is being drafted (draft available on request).

Methods

We perform a number of analyses, simulating until Sept 2020:

- Firstly, we consider three basic scenarios for the basic level of social-distancing in the general population: continued lock-down at the current estimated rates; reduced lock-down (effectively 2/3 of the current compliance); minimal lock-down (effectively 1/3 of the current compliance). These three scenarios are shown on the top, middle and bottom graphs on each page.
- Secondly, we consider seven different scenarios for school children:
  1) Schools remain closed
  2) Additional vulnerable children, class sizes are ~13% or 100%
  3) Key years (Years 5,6,10,12) attend school, class sizes are ~25% or 100%
  4) Early years (ages 2-5) attend school, class sizes as normal.
  5) All primary children (Years 0-6) attend school, class sizes as normal.
  6) All secondary children (Years 7-12) attend school, class sizes as normal.
  7) Two weeks on, two weeks off; all children, class sizes ~50% or 100%
  7b) One week on, one week off; all children, class sizes ~50% or 100%
  8) Alternating morning and afternoons, class sizes ~50% or 100%
  9) All children attend school, class sizes as normal.
- Schools were assumed to restart on 7th May (end of the current lock-down period) and continue until 22nd July; we assumed that the main summer holidays would still take place.
- We then compare different measurable quantities (Deaths, Hospital admissions, ICU admissions) comparing all options (2-9) against option 1.
- To simplify the analysis, we consider the number of deaths and admissions that will occur due to new infections (ie we ignore the delays in the system); this provides a simple means of judging the increase in these quantities over the time that pupils are in school.
- Three different measures are shown in Table 1: the relative increase (or more correctly the decrease in the decline) in the growth rate over all age groups; the relative increase (in the growth rate over all children; and the relative increase in the number infected over the school term.

Results

There is considerable variability between parameter sets, due to the identifiability of key parameters (such as the relative transmission rate from asymptomatic infections). Results given show the average over this parameter uncertainty as well as the upper 95% confidence interval.

For any given scenario (2-9 compared to 1) we predict similar levels of relative increases in cases and admissions (both hospital and ICU) but slightly smaller increases in deaths; this is broadly consistent with the expected impact of age-structure.

Comparing across the entire time-scale (Feb-Sept 2020) the impact of even a full return to school (scenario 9) is minimal – leading to a <1% increase in cases, admissions and deaths assuming lock-down continues.

If we focus on just the period children are in school (May-July 2020), then the relative levels of change are higher – as there are fewer cases in the rest of the population. We predict that a full return to school (option 9) leads to a 11% increase in cases and admissions and a 7% increase in deaths – again assuming the lock-down continues. These results are shown in the Table and Figure 1.

Looking across all the different lockdown we see a broadly consistent pattern (Figure 2). A full return to school (9) is the worst, followed by all secondary school children (6). All other options have broadly the same minimal impact on the expected COVID-19 dynamics.

Conclusions

Re-opening schools generally leads to a small increase in cases and deaths. Keeping class sizes to a minimum (where practical) reduces the impact of re-opening schools still further.

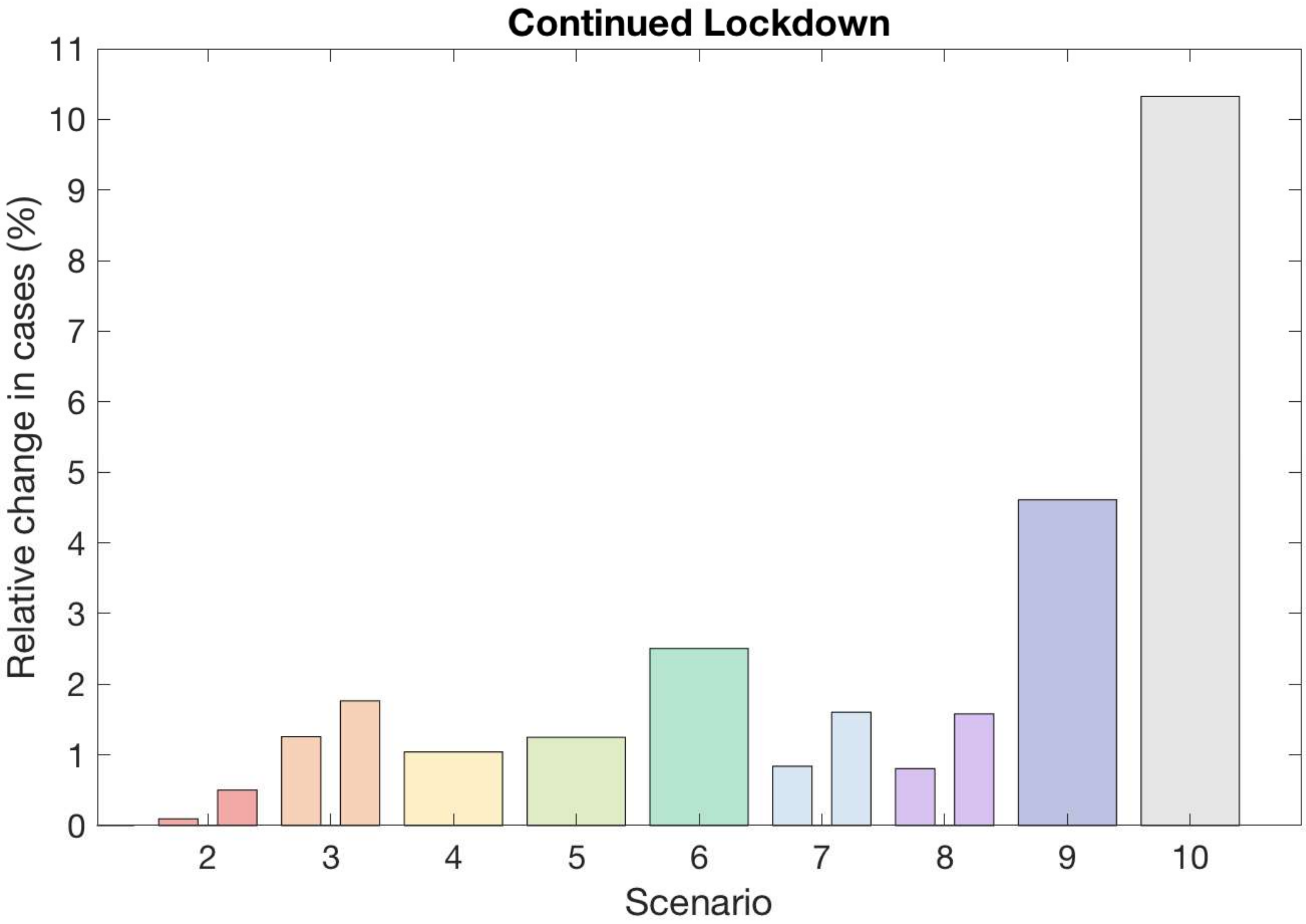
Of all the strategies considered, fully opening all schools (9), alternating half days (8) and fully opening secondary schools (6) have the greatest effects. It is questionable whether the model is sufficiently resolved (in terms of capturing social-distancing within schools) to differentiate between other options based on the epidemiology – and social / educational needs will probably drive the decision.

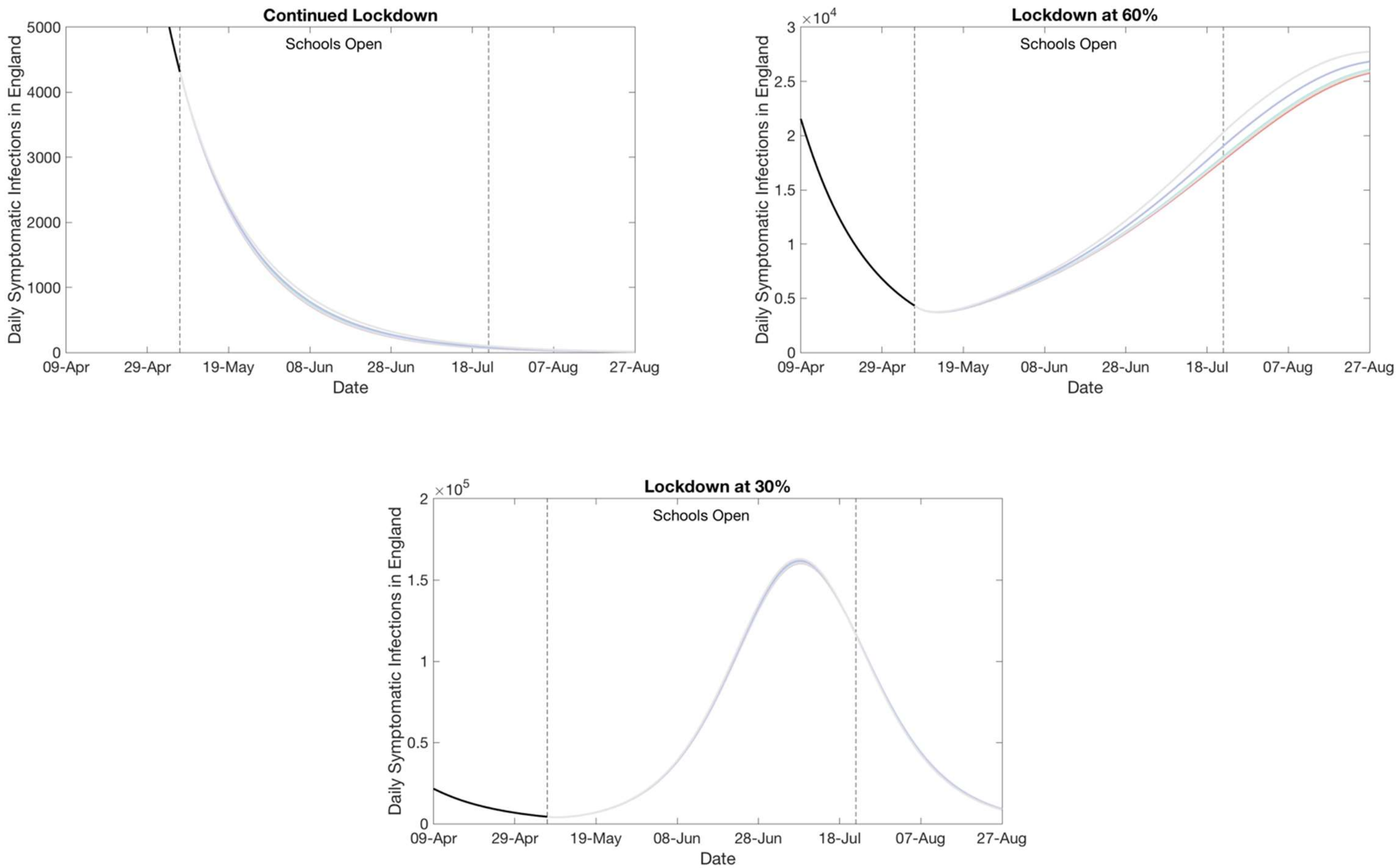
In general, we find that the impact of opening schools is a loss less than any changes to the population-wide policy of lockdowns.

Table 1. Results from the Warwick dynamic model looking at growth rates of infection (both population wide and in children) and the change in cases. This assumes children are in school 7th May to 22nd July, and that the lockdown continues for this period.

	1	Scenario 2	Scenario 3	Scenario 4	Scenario 5	Scenario 6	Scenario 7	Scenario 7b	Scenario 8	Scenario 9
	Stay Shut	More vulnerable children and key worker kids	Transition years 5/6/10/12, this side of summer holiday	Early year settings	All primary	All secondary	Half time A (Full class, 2 weeks on/two off – full attendance)	(Full class, 1 week on/1 off – full attendance)	Half time B – Half classes, alternating two weeks	Fully reopen
Relative change in growth rate	N/A	0.5% [0.1%] (1%)	1.6% [1.1%] (4%)	1.2% (2%)	1.2% (3%)	2.1% (5%)	1.6% [0.9%] (3%)	1.6% [0.8%] (3%)	4.7% [4.3%] (8%)	9.4% (16%)
Relative change in growth rate in children		2.6% [0.1%] (4%)	8.4% [5.2%] (16%)	6.2% (9%)	6.6% (12%)	11.0% (21%)	7.6% [2.3%] (14%)	7.5% [2.5%] (14%)	13.1% [11.1%] (21%)	25.8% (42%)
Relative change in cases over the period		0.6% [<0.1%] (1%)	2.1% [1.3%] (5%)	1.1% (2%)	1.4% (3%)	2.8% (7%)	1.9% [0.8%] (4%)	1.9% [0.8%] (4%)	4.6% [5.1%] (9%)	11.1% (20%)
Proportion of children going to school	2%	13%	18%	20%	42%	38%	50% / 100%	50% / 100%	50% / 100%	100%

Here the first value is the % relative change in the quantity assuming that class sizes will remain as normal; the term in [] assumes that class sizes will be reduced to a minimum based on the proportion of children in school; the final term is the upper 95% confidence interval on the predictions.


Continued Lockdown
Relative change in cases (%)
0
1
2
3
4
5
6
7
8
9
10
11
2
3
4
5
6
7
8
9
10
Scenario


Continued Lockdown
Schools Open
Daily Symptomatic Infections in England
5000
4000
3000
2000
1000
0
09-Apr
29-Apr
19-May
08-Jun
28-Jun
18-Jul
07-Aug
27-Aug
Date
Lockdown at 60%
×10^4
3
2.5
2
1.5
1
0.5
0
Schools Open
Daily Symptomatic Infections in England
09-Apr
29-Apr
19-May
08-Jun
28-Jun
18-Jul
07-Aug
27-Aug
Date
Lockdown at 30%
×10^5
2
1.5
1
0.5
0
Schools Open
Daily Symptomatic Infections in England
09-Apr
29-Apr
19-May
08-Jun
28-Jun
18-Jul
07-Aug
27-Aug
Date