# The impact of relaxing lockdown measures: 2

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**Summary**

- We investigated the impact of lifting some restrictions after a further 3 weeks, 6 weeks, or 12 weeks.
- We based what restrictions would be lifted on scenarios provided via SPI-M, and based our estimates of the impact of lifting these restrictions on a paper by Edwin van Leeuwen and Frank Sandmann of PHE.
- The "Max" scenario would substantially increase the burden of COVID-19. The "Moderate" scenario would increase cases as well, but to a much lower extent.
- In all cases, we predict that the peak ICU demand will already have been seen by the end of April, but the "Max" scenario leads to another peak which is almost as extreme, and much longer in duration.

**Aim**

To assess the potential impact of lifting restrictions on either 17th April, 8th May, or 19th June 2020.

**Methods**

We use the LSHTM age-structured stochastic transmission dynamic model. We used a county-level model (London boroughs are treated separately), and aggregated the data to the national level. Counties/boroughs, were seeded as before so that London boroughs were more likely to be seeded first and there was a roughly 30-35 day delay in peaks in an unmitigated epidemic. The seeding produced around 200 deaths per day in the United Kingdom on 27th March, which is roughly in line with current figures. Intensive social distancing was put in place to roughly capture those measures put in place on 20th March.

These interventions include:

1) Case-isolation, which reduces the transmission of clinical cases by 35%.
2) A reduction of work, school, and other contacts by 90%.

From this, we simulate the impact of lifting various restrictions.

The scenarios modelled are as follows (based on draft circulated on 26 March 2020):

- Options 1-3 would be maintaining current measures for a) three further weeks (Opt1), b) six further weeks (Opt2), and c) 'the longer term' **[assumed to be 12 weeks]**
- Option 8 is Option 7, followed by a reversion to measures outlined for Options 1-3

| **OPTION->** | **1-3** | **4: minor econ** | **5: minor social** | **6: moderate** | **7: max** |
|---|---|---|---|---|---|
| **Schools** | Closed, except for key workers | Closed, except for key workers | Closed, except for key workers | Closed, except for key workers | Open |
| **Bars and restaurants** | Closed, apart from take-out | Closed, apart from take out | Closed, apart from take out | Closed, apart from take out | Open |
| **Non-essential retail** | Closed | Some allowed to open | Closed | Open | Open |
| **Public spaces: libraries and playgrounds** | Some public spaces open, otherwise closed | Some public spaces open, otherwise closed | Parks, non commercial community spaces (eg libraries) opened | Parks, non commercial community spaces (eg libraries) opened | Open |
| **Gatherings > two people** | Banned | Banned | Up to 5 people | Up to 5 people | Allowed, distancing encouraged |
| **Stay at home guidance** | Stay at home, only 4 exceptions | Updated guidance with emphasis on 'should go to work if can't WFH' | May leave the house, including with non-house hold members, but observe distancing | If people cannot work from home, they should go to work. | Work at home where practical, but safe to return to work. Comms on self-isolation and handwashing |

We also modelled an Option 9, which is Option 6 followed by a reversion to measures outlined for Options 1-3.

When reverting to measures in options 1-3, we assumed they would be put in place for another 3 weeks (Option 1), 6 weeks (Option 2), or 12 weeks (Option 3).

**Impact on contact matrices**

We estimated the impact on contact matrices based on impacts predicted by van Leeuwen and Sandmann [1] on behalf of the PHE modelling team:

Table 3: Contact weights in polymod by scenario.

| Polymod | S123 | S4 | S5 | S6 | S7 |
|---|---|---|---|---|---|
| home | 0.800 | 0.900 | 0.900 | 0.950 | 1 |
| leisure | 0.094 | 0.165 | 0.402 | 0.496 | 1 |
| otherplace | 0.111 | 0.197 | 0.278 | 0.612 | 1 |
| school | 0.030 | 0.030 | 0.030 | 0.030 | 1 |
| transport | 0.147 | 0.417 | 0.583 | 0.800 | 1 |
| work | 0.328 | 0.500 | 0.500 | 0.800 | 1 |

For the purposes of this analysis, we assume that a policy of elderly shielding is in place, which further reduces the non-home contacts for over-70s by 50% compared to S123 in the table above. We assume that this policy remains fully in force regardless of what other restrictions are lifted. It is possible that elderly shielding, and shielding of high-risk adults more generally, has been more effective than the above table would imply, even with the further 50% reduction in non-home contacts that we have adopted as an assumption. This would further reduce the predicted demand for ICU beds as shown in the results below.

We adopted the additional assumption that interventions would have an impact upon "home" contacts (highlighted in red above), consistent with the results of a recent phone survey analysed by van Zandvoort, Jarvis et al [2]. We assumed a 20% reduction in home contacts under the base-case "lockdown" scenario (S123), but that this reduction would gradually decrease as more restrictions were lifted, which might signal to the public that it was appropriate to return to normal patterns of life.

The scenario above provides an estimate of the efficacy of recent intensive interventions (S123) on contact rates, but does not account for reductions in infectiousness owing to self-isolation and household isolation policies. We assumed that in the base case (S123), infectiousness of symptomatic individuals was reduced to 55% to account for self-isolation of symptomatic individuals, and infectiousness of asymptomatic and presymptomatic individuals was reduced to 80% of their normal values to account for household isolation. As with home contacts above, we assumed that the effective infectiousness of presymptomatic and asymptomatic individuals would increase as restrictions were lifted (i.e. to 90% under S4 and S5, to 95% under S6, and to 100% under S7).

Together, these assumptions resulted in an estimated basic reproduction number $R_0$ of 0.71 (**Fig. 1**), consistent with the analysis of van Zandvoort et al [2].

## Results

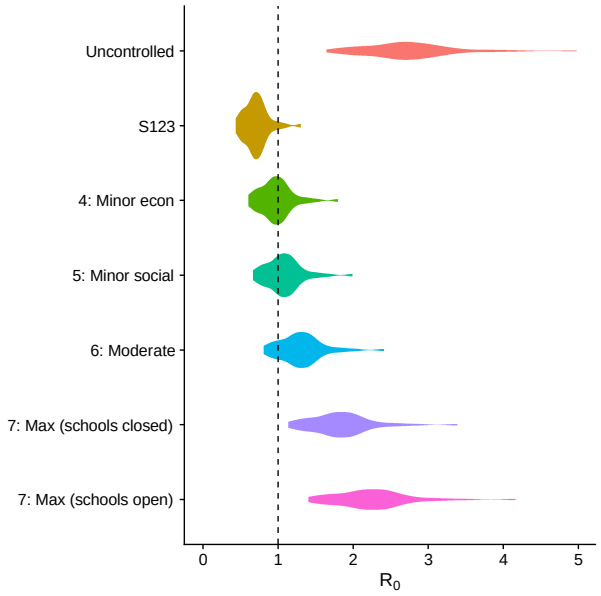


**Fig. 1.** Predicted impact on the basic reproduction number $R_0$ for each scenario.

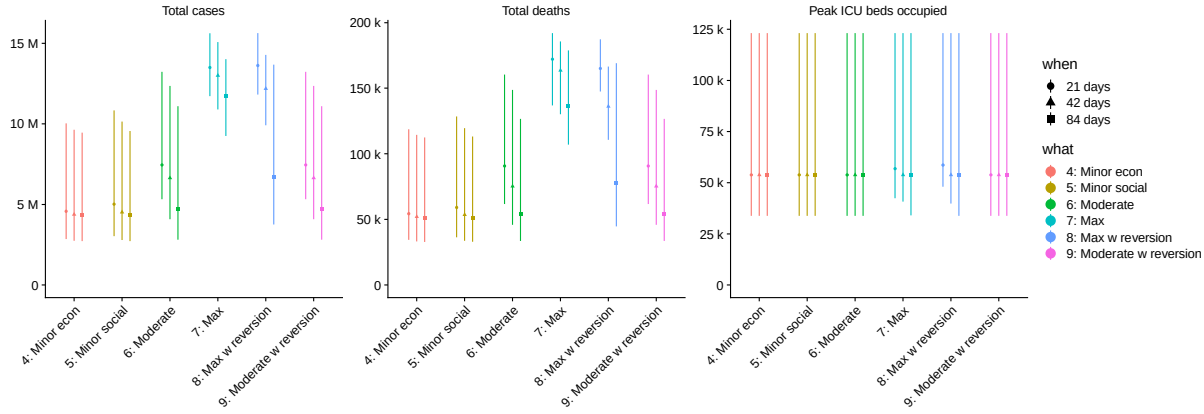


**Fig. 2.** Predicted impact of lifting restrictions on total cases (up to 31st Dec 2020), total deaths (up to 31st Dec 2020), and peak ICU beds occupied (up to 31st Dec 2020). Generally, longer periods of severe restrictions ("lockdowns") are preferable

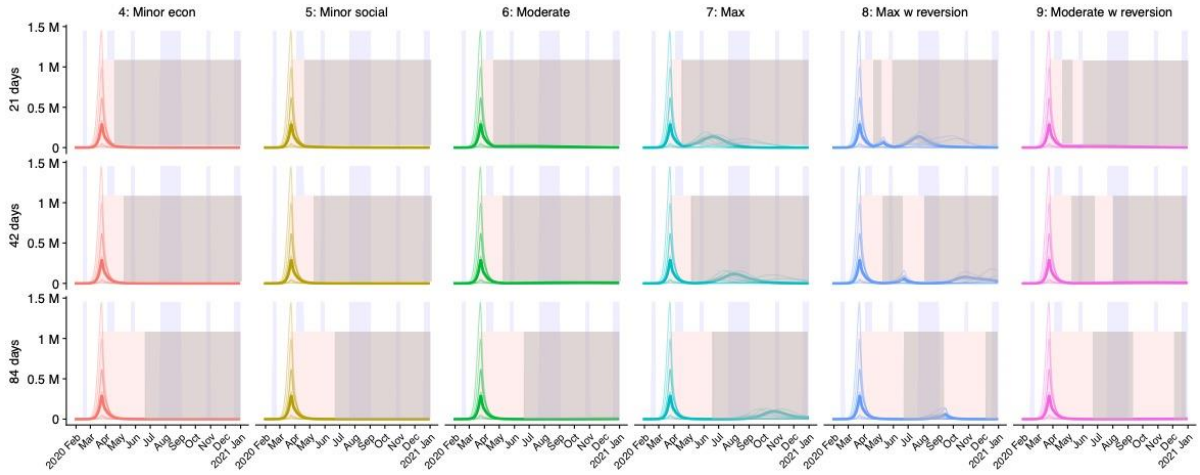


**Fig. 3.** Daily incidence of cases under each scenario. The option modelled is in columns, while the time after which lockdown is lifted is in rows. Pink shaded areas show “lockdown” interventions. Grey shaded areas show options for lifting restrictions. Blue shaded areas show normal school holiday times.

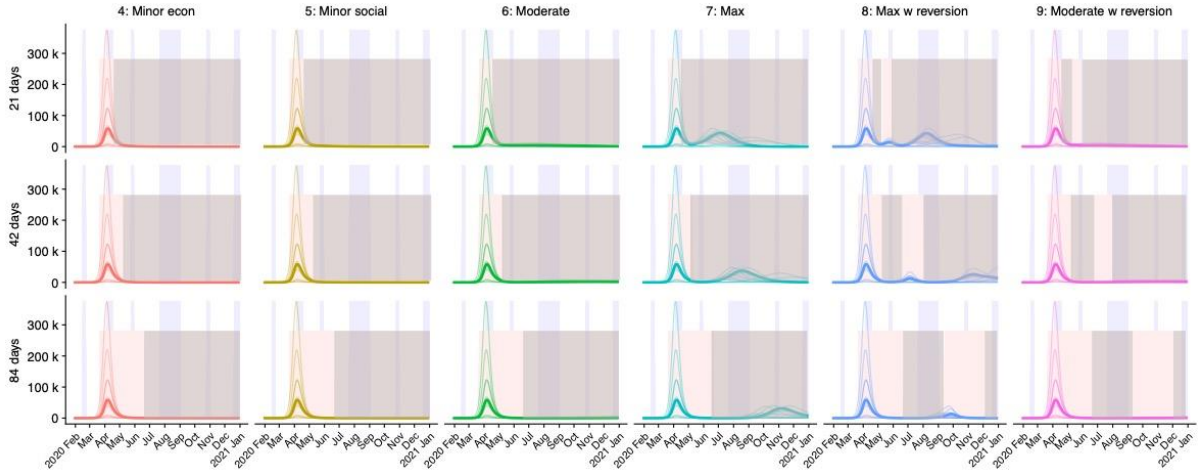


**Fig. 4.** ICU beds required under each scenario. The option modelled is in columns, while the time after which lockdown is lifted is in rows. Pink shaded areas show “lockdown” interventions. Grey shaded areas show options for lifting restrictions. Blue shaded areas show normal school holiday times.

## Tables – Summary of burdens under each scenario.

| | 4: minor econ 21 days | 4: minor econ 42 days | 4: minor econ 84 days | 5: minor social 21 days | 5: minor social 42 days | 5: minor social 84 days |
|---|---|---|---|---|---|---|
| Total cases | 12 M (8 M–15 M) | 11 M (6 M–14 M) | 6 M (2.7 M–14 M) | 15 M (12 M–17 M) | 15 M (11 M–17 M) | 11 M (6.4 M–15 M) |
| Total deaths | 170 k (120 k–220 k) | 160 k (88 k–210 k) | 79 k (33 k–190 k) | 230 k (180 k–270 k) | 220 k (160 k–250 k) | 160 k (94 k–200 k) |
| Cases in peak week | 2 M (1.2 M–3 M) | 1.5 M (980 k–3 M) | 1.3 M (820 k–3 M) | 2.4 M (1.6 M–3 M) | 2.5 M (1.7 M–3 M) | 1.6 M (880 k–3 M) |
| Deaths in peak week | 31 k (14 k–33 k) | 20 k (13 k–33 k) | 15 k (9.1 k–32 k) | 32 k (22 k–43 k) | 36 k (26 k–40 k) | 23 k (13 k–33 k) |
| Peak ICU beds occupied | 110 k (50 k–120 k) | 74 k (48 k–120 k) | 58 k (34 k–120 k) | 120 k (79 k–160 k) | 130 k (92 k–150 k) | 83 k (48 k–120 k) |
| Peak non-ICU beds occupied | 210 k (96 k–240 k) | 140 k (92 k–240 k) | 110 k (67 k–240 k) | 240 k (150 k–300 k) | 250 k (180 k–280 k) | 160 k (94 k–240 k) |
| Time to peak cases (weeks) | 8 (7–55) | 8 (7–8) | 7 (7–8) | 8 (7–54) | 8 (7–54) | 8 (7–54) |

| | 6: moderate 21 days | 6: moderate 42 days | 6: moderate 84 days | 7: max 21 days | 7: max 42 days | 7: max 84 days |
|---|---|---|---|---|---|---|
| Total cases | 17 M (15 M–21 M) | 18 M (15 M–21 M) | 16 M (12 M–18 M) | 16 M (15 M–18 M) | 17 M (15 M–19 M) | 16 M (13 M–18 M) |
| Total deaths | 260 k (220 k–310 k) | 260 k (210 k–310 k) | 230 k (190 k–270 k) | 210 k (200 k–250 k) | 230 k (210 k–260 k) | 220 k (190 k–250 k) |
| Cases in peak week | 2.6 M (1.9 M–3.1 M) | 2.7 M (1.9 M–3.1 M) | 2.8 M (1.8 M–3.2 M) | 1.5 M (1.2 M–3 M) | 1.5 M (1.2 M–3 M) | 1.4 M (1.1 M–3 M) |
| Deaths in peak week | 36 k (31 k–43 k) | 35 k (31 k–46 k) | 33 k (27 k–46 k) | 17 k (14 k–33 k) | 18 k (14 k–32 k) | 17 k (13 k–32 k) |
| Peak ICU beds occupied | 130 k (110 k–160 k) | 130 k (110 k–170 k) | 120 k (98 k–170 k) | 64 k (50 k–120 k) | 67 k (53 k–120 k) | 64 k (47 k–120 k) |
| Peak non-ICU beds occupied | 250 k (210 k–300 k) | 240 k (210 k–320 k) | 240 k (190 k–320 k) | 130 k (95 k–240 k) | 130 k (100 k–240 k) | 120 k (87 k–240 k) |
| Time to peak cases (weeks) | 55 (7–56) | 53 (7–53) | 8 (7–53) | 8 (7–21) | 8 (7–28) | 7 (7–8) |

| | 8: max w reversion 21 days | 8: max w reversion 42 days | 8: max w reversion 84 days | 9: moderate w reversion 21 days | 9: moderate w reversion 42 days | 9: moderate w reversion 84 days |
|---|---|---|---|---|---|---|
| Total cases | 16 M (15 M–18 M) | 17 M (15 M–19 M) | 14 M (12 M–17 M) | 17 M (15 M–21 M) | 18 M (15 M–21 M) | 16 M (12 M–18 M) |
| Total deaths | 220 k (200 k–240 k) | 230 k (200 k–260 k) | 210 k (170 k–230 k) | 260 k (220 k–310 k) | 260 k (210 k–310 k) | 230 k (190 k–270 k) |
| Cases in peak week | 1.4 M (1.2 M–3 M) | 1.7 M (1.3 M–3 M) | 1.7 M (1.4 M–3 M) | 2.6 M (1.9 M–3.1 M) | 2.7 M (1.9 M–3.1 M) | 2.8 M (1.8 M–3.2 M) |
| Deaths in peak week | 17 k (14 k–32 k) | 18 k (13 k–33 k) | 25 k (17 k–34 k) | 36 k (31 k–43 k) | 35 k (31 k–46 k) | 33 k (27 k–46 k) |
| Peak ICU beds occupied | 63 k (53 k–120 k) | 69 k (50 k–120 k) | 90 k (64 k–120 k) | 130 k (110 k–160 k) | 130 k (110 k–170 k) | 120 k (98 k–170 k) |
| Peak non-ICU beds occupied | 120 k (100 k–240 k) | 140 k (99 k–240 k) | 170 k (130 k–240 k) | 250 k (210 k–300 k) | 240 k (210 k–320 k) | 240 k (190 k–320 k) |
| Time to peak cases (weeks) | 8 (7–25) | 8 (7–38) | 8 (7–56) | 55 (7–56) | 53 (7–53) | 8 (7–53) |

**References**

[1] Estimates of impact of interventions based on time use. Edwin van Leeuwen, Frank Sandmann on behalf of the PHE modelling group. Circulated on March 30, 2020.

[2] Quantifying the impact of physical distance measures on contact patterns in the UK in response to COVID-19. Preprint. K van Zandvoort, CI Jarvis, A Gimma, K Prem, CMMID COVID-19 working group, GJ Rubin, WJ Edmunds.