

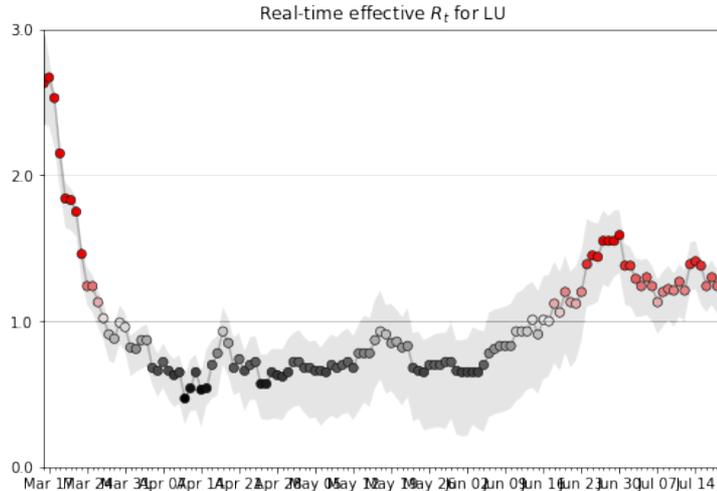
# Report: Controlling the second wave

Stefano Magni, Atte Aalto, Laurent Mombaerts, Françoise Kemp, Paul Wilmes, Alexander Skupin, Jorge Goncalves

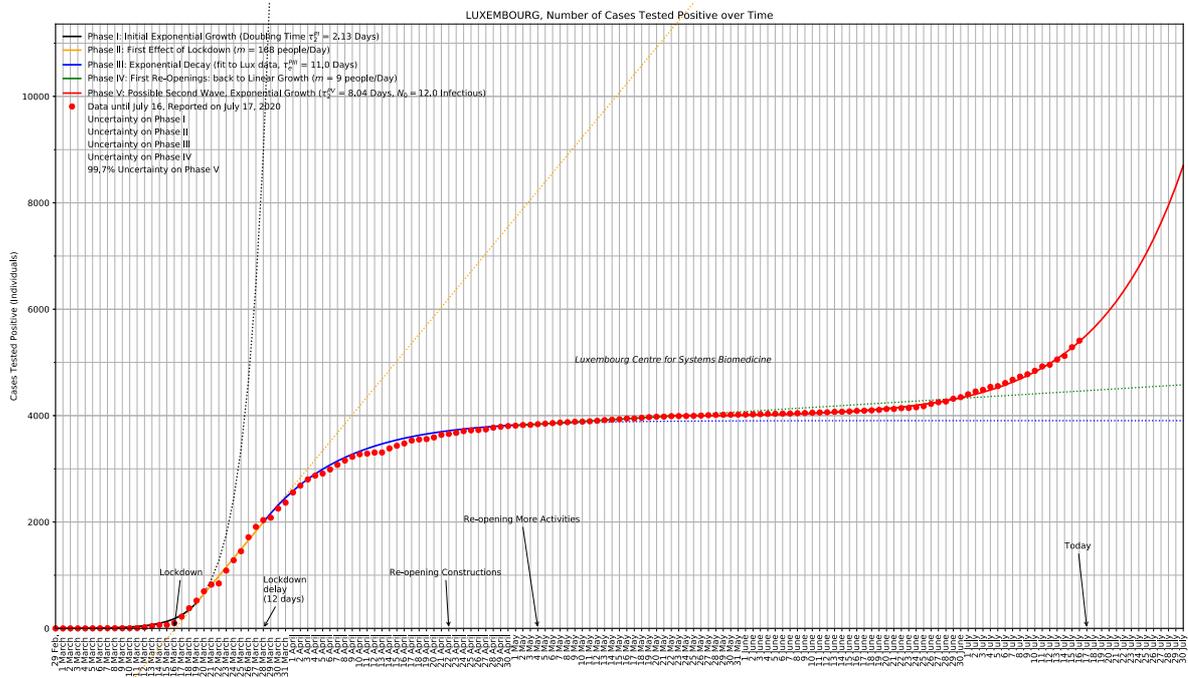
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## Analysis of the current situation

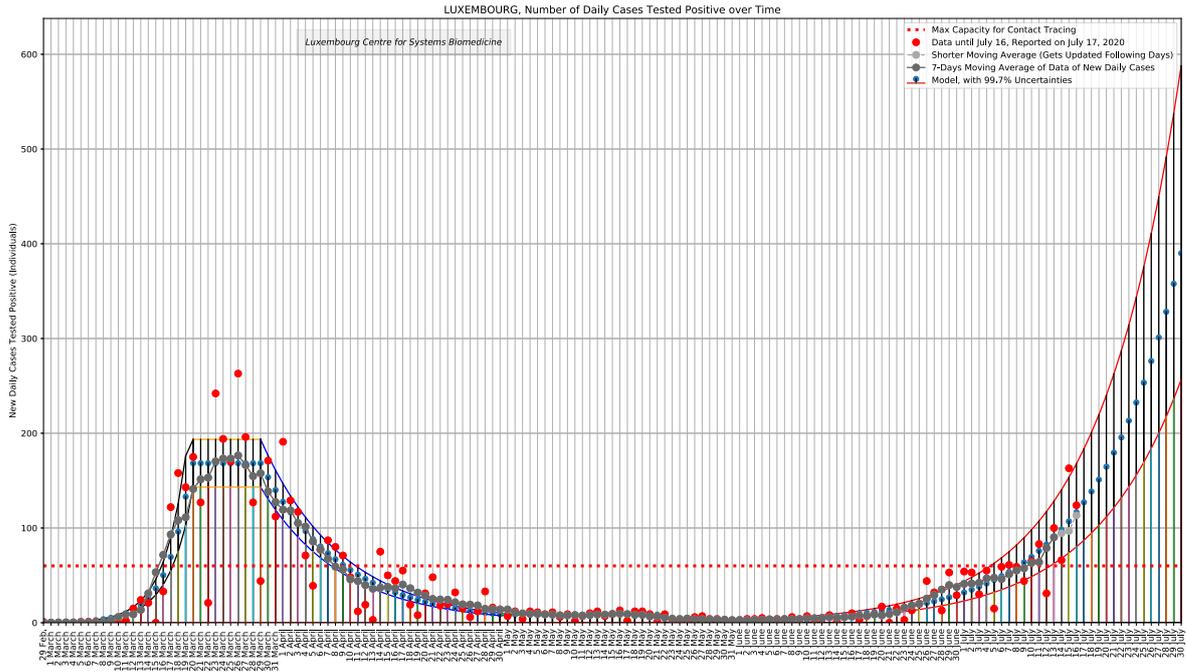
The situation in Luxembourg regarding the transmission of SARS-CoV-2 within the population and the resulting COVID-19 cases numbers remains dynamic. The effective reproduction number remains above 1 (Figure 1; 1.24 today based on data up to 18 July) which means that on average one infected individual will infect more than one other which in turn results in an increase in cases. Based on curve fitting of the most recent COVID-19 case numbers in Luxembourg, the total number of cases in Luxembourg may surpass the mark of 8,000 cases by 29 July if current trends persist (Figure 2). Based on these trends and with a currently estimated doubling time of 8 days, around 200 additional new daily positive cases might be expected by Tuesday or Wednesday of the coming week (21 or 22 July) and around 400 additional new daily positive cases might be expected by the end of July if the current exponential trend continues (Figures 3 & 4). These increases will lead to more hospital stays due to COVID-19 which have themselves also been steadily increasing since the beginning of July. Although the large-scale testing (LST) is contributing towards the detection of new positive cases, there has been a general trend for more positive tests in relation to the overall number of tests performed. By providing comprehensive snapshots of the population on a daily basis, the LST represents an important monitoring tool for COVID-19 cases in Luxembourg. Based on curve fitting of the most up-to-date numbers of positive cases detected through the LST (based on data up to 18 July), the currently estimated doubling time is 8.6 days (Figure 5). Based on curve fitting of the most up-to-date prevalence values derived from the LST, the currently estimated doubling time is 13.2 days albeit with a rather large degree of uncertainty (Figure 6). These most recent analyses underline the notion that, in the absence of any additional measures, the numbers of cases will continue to rise exponentially and that Luxembourg is witnessing a second wave in SARS-CoV-2 infections within its population. If the current dynamics persist, a shortfall in available intensive care unit (ICU) beds may be expected already by the end of August. Given the range of doubling times of 8 to 13.2 days from the presented analyses, it remains unclear whether the recent rise in cases is restricted to clusters (which evidence indicates) or whether broader community transmission of SARS-CoV-2 is occurring. Furthermore, the upper and lower bounds shown in Figures 5 and 6 provide a wide range of possible scenarii ranging from a relatively slow increase in new positive cases to a rapidly uncontrollable increase in cases. This wide range in uncertainty is due to the fact that despite an apparent exponential growth in LST numbers over the four weeks starting from 15 June, the trend over the past week is somewhat inconsistent. Here, additional information is vital to perform more accurate simulations. In addition, if clusters are detected, testing capacity should be rapidly mobilized to perform cluster testing around these



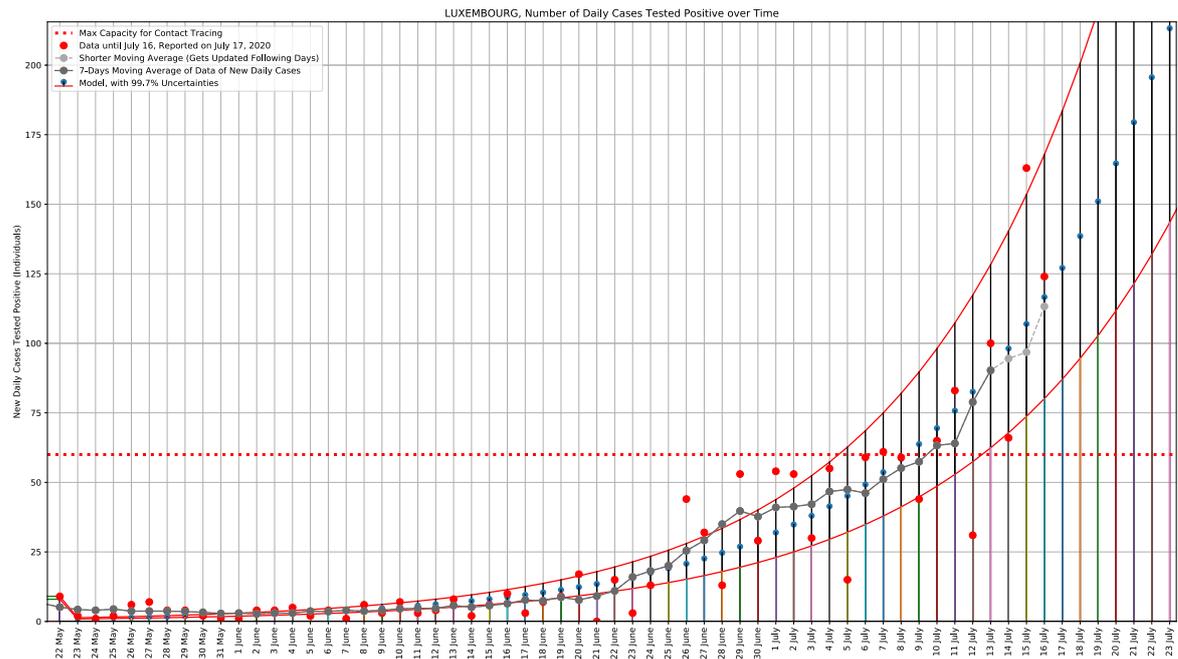
**Figure 1.** Evolution of the effective reproduction number in Luxembourg.



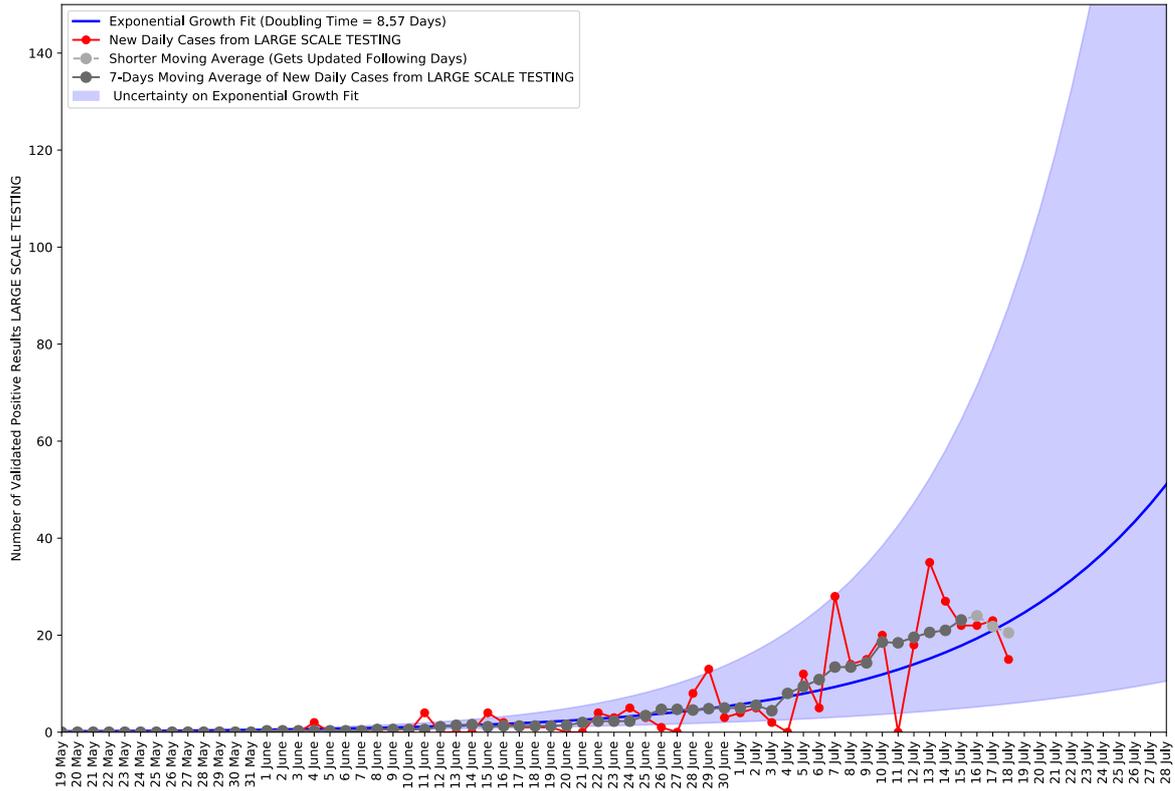
**Figure 2.** Official COVID-19 case numbers up to 17 July (red dots) were approximated with an adapted model for short-term forecasts. The optimistic scenario (blue) is based on a multi-exponential model that describes the number of cases well until the beginning of May (phase I). From the beginning of May, a linear assumption of an average of 6 cases per day was also adopted to better describe the data (phase II). From 14 June a further increase can be observed, which in turn shows the dynamics of a second wave (phase III).



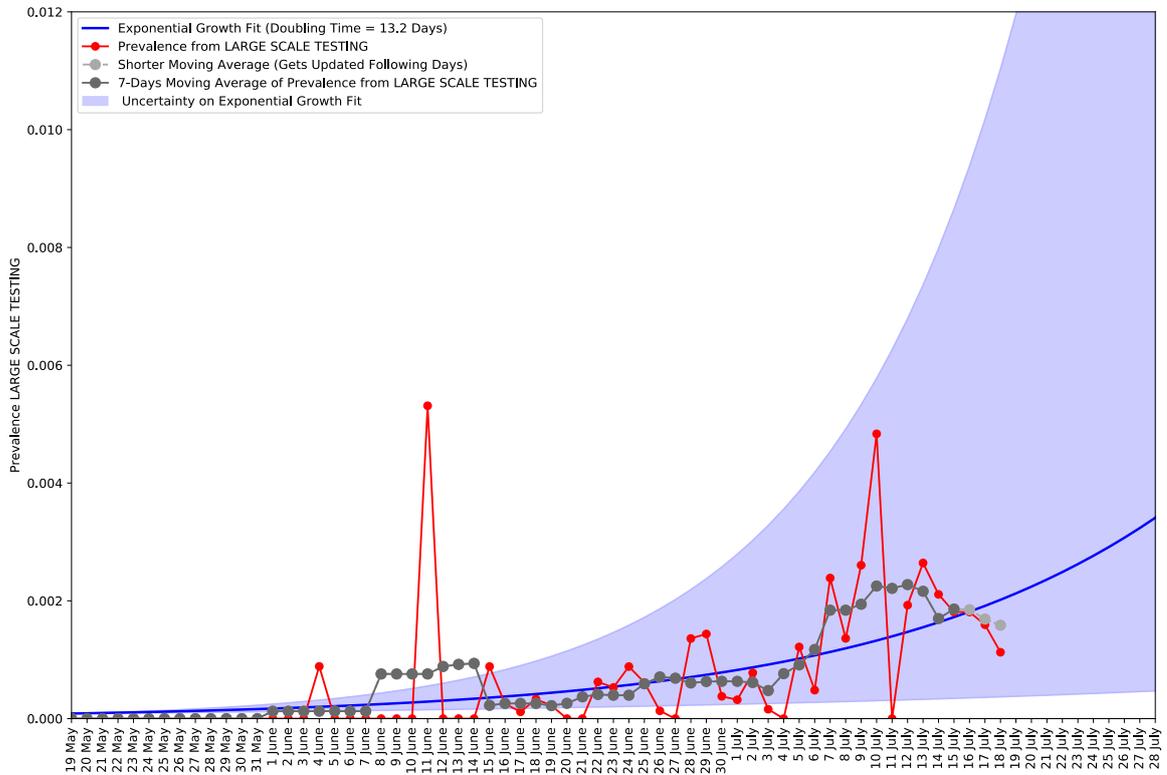
**Figure 3.** The daily COVID-19 case numbers up to 25 June (red dots) show the decay of the first wave in April, which is well described by the multi-exponential model with linear growth (blue). The 7-day mean shows a significant deviation from this trend for the past two weeks and indicates an exponential growth and, thus, a second wave.



**Figure 4.** Curve fitting of official daily new COVID-19 case numbers.



**Figure 5.** Curve fitting of daily COVID-19 case numbers that result from large-scale testing.



**Figure 6.** Curve fitting of COVID-19 daily prevalences derived from large-scale testing.

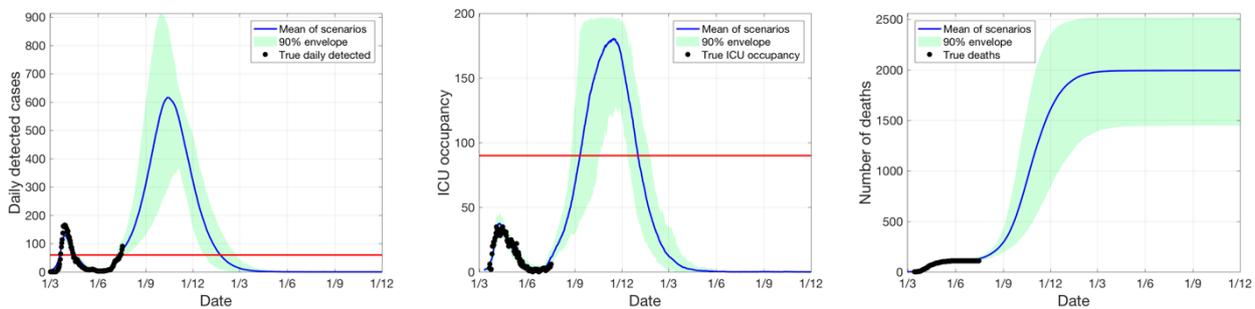


## Simulation of possible new measures

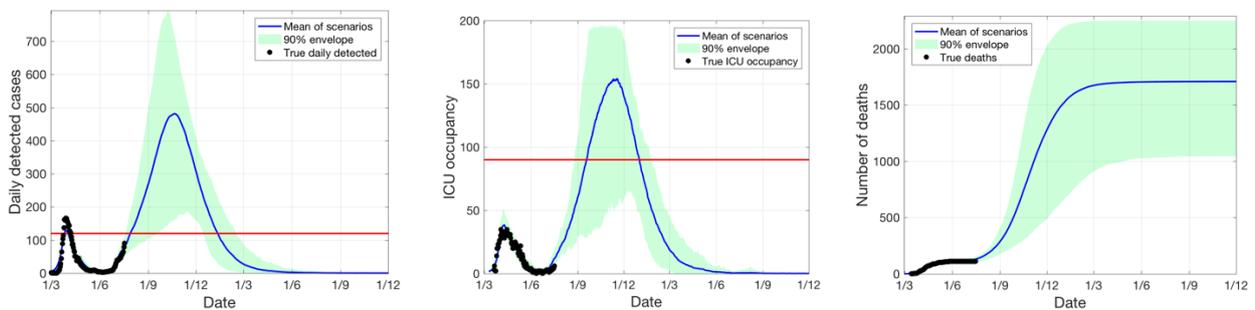
Below are several simulations that reflect the effect of different measures including manual contact tracing, limitations on private gatherings and encouragement of remote working on projected case numbers, ICU occupancy and expected numbers of deaths.

Please note that the impact of the holiday season is not taken into account. This is likely to have an impact on the numbers until the end of August, but there is a large uncertainty on when and how many people will be abroad. The only aspect included in the simulations is the construction sector that will be on collective leave in August. Another important aspect concerns essential information whether the majority of new positive cases result from clusters (which some preliminary evidence indicates) or whether wide-spread diffuse community transmission is occurring. With more up-to-date information, we intend to re-parameterize our models over the coming week to allow more accurate assessments of the impact of the highlighted measures.

- Current baseline<sup>1,2</sup>



- Manual contact tracing capacity<sup>3</sup> increased to 120 on 20 July, compared to baseline



- Private gatherings reduced by 80%<sup>4</sup> on 20 July, compared to baseline

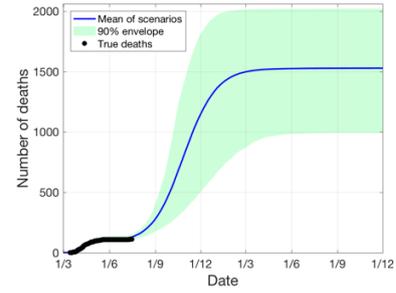
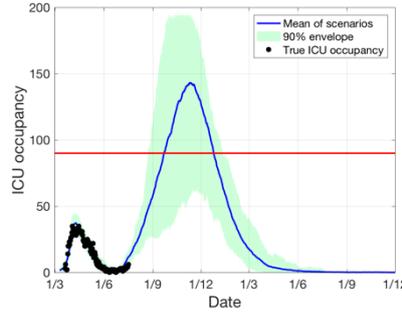
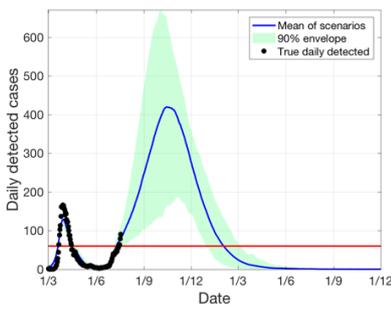
<sup>1</sup> Private gathering assumptions in the current baseline:

- 50% of population either invite or are invited as houseguests per week (since May 29)
  - In such house-parties, there are people from 2.5 households (on average) in addition to the hosting household
  - 75% of guests have their whole family with them
  - 80% of houseguest contacts are traced in the event someone being tested positive.
- 50% of population participate in outdoor gatherings per week (since May 29)
  - These gatherings have people from 10 households (on average)
  - 10% of contacts are traced in the event someone being tested positive.

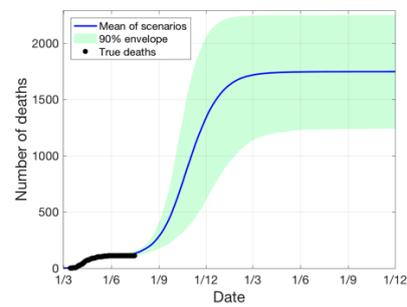
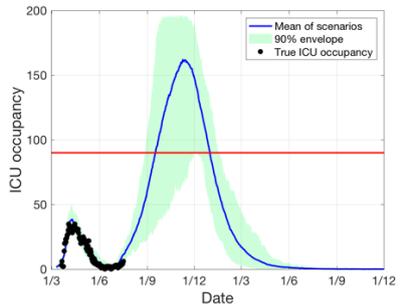
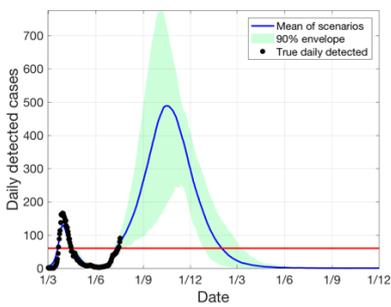
<sup>2</sup> In the current baseline, we assume that just before 1 July, 102,000 workers were still teleworking. On 1 July, two-thirds of them returned to office work.

<sup>3</sup> The current baseline assumes a maximum contact tracing capacity of 60 new positive cases per day (indicated by red line in the graph furthest to the left).

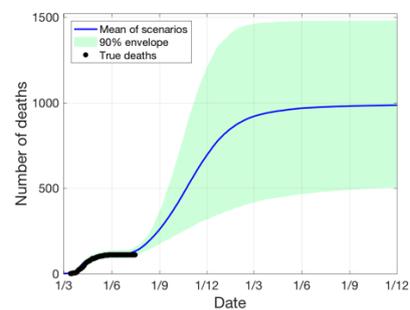
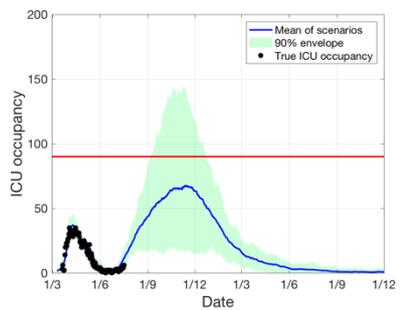
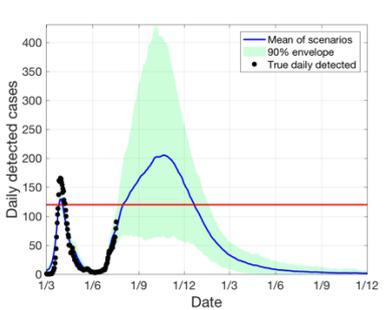
<sup>4</sup> The reduction in private gatherings means that the share of people attending such events per week would be reduced from 50% to 10% on 20 July.



- Encouraging teleworking<sup>5</sup> from 20 July, compared to baseline



- Manual contact tracing capacity increased to 120, private gatherings reduced by 80% as well as encouraging teleworking all from 20 July, compared to baseline



<sup>5</sup> Encouragement of teleworking is assumed to result in a reduction by half of those that went back to office work from 1 July onwards. This scenario is based on the assumption that on 1 July, two-thirds of these workers returned to office work. The scenario involves half of the people having returned to office work (34k) going back to teleworking on 20 July. They are from sectors in which teleworking is relatively easy.