SPI-M-O working group on scenario planning: Consensus view on Covid-19

Date: 25th March 2020.

1. A working group of SPI-M-O has agreed scenarios for government planning. These are to be put to SAGE at their meeting of 25th March. Two scenarios have been agreed, accounting for the policy measures put in place to date: a Reasonable Worst Case scenario, where measures do not control the epidemic, and an optimistic scenario, where control is achieved.

2. These are scenarios and not forecasts. It is not possible to meaningfully forecast the epidemic at this stage, as:

    - Its epidemiology is still uncertain, although our picture of it is improving.
    - It is not yet possible to assess how contact patterns have changed, will change over time and, crucially, the impact of that on transmission rates. It is not that case that, for example, a reduction of leisure activities of 80% would reduce transmission from leisure activities by 80%.
    - The impact of interventions will become apparent in around 3-4 weeks.

3. The fewer cases that happen as a result of the policies enacted, the larger subsequent waves are expected to be when policies are lifted. As we cannot predict how policies will change, the terms “Reasonable Worst Case” and “Optimistic Scenario” are only in relation to the number of deaths seen in a first wave.

4. Estimated numbers of deaths do not account for increased Covid-19 infection fatality rates that could occur if insufficient medical facilities are available, or additional deaths from other causes.

5. Modelling outputs from three groups were included in the development of these scenarios: Warwick, Exeter / Bristol and Imperial. Representatives from other groups were also present to compare the emerging findings of their models.

Models considered

6. Models considered different basic reproduction numbers and doubling times, as well as having different model structures. The Exeter / Bristol model used a lower reproduction number and doubling time, resulting in a longer, flatter epidemic. The results of Warwick’s

model and Imperial's model scenario with an R0 of 2.8 differed primarily because the former had a longer doubling time, and does not have full household structure.

7. It was agreed that the doubling time was the most important epidemiological factor in determining the severity of a mitigated reasonable worst case, and that it was prudent for worst case planning purposes to use the 3.3 days, per Imperial's model, as it was lower than the 4 days modelled by Warwick. The reproduction number was considered less important to this but that, while a reproduction number greater than 2.8 could not be ruled out, it was sufficiently far removed from what has been seen in other countries that it was appropriate to plan for 2.8 in the Reasonable Worst Case.

8. It was agreed that the models were giving comparable results and that differences were explainable by model structures and parameters used in the outputs presented. The results of Imperial's model with a doubling time of 3.3 days and reproduction number of 2.8 would be appropriate as a reasonable worst case.

Impact of policies

9. It is not possible to estimate the effect of policies enacted on contact rates, especially within households. The models are therefore assumption driven, and "poor" and "good" compliance are subjective measures.

10. Exeter / Warwick directly modelled changes in the reproduction numbers to 0.8, 1.2, 1.4 and 1.6.

11. Imperial's poor compliance scenario assumed:

    - School closure increases household contacts by 100% and social contacts outside the household by 50%
    - Social distancing reduces contacts outside the home and workplace by 66%.
    - 50% of households adhere to household quarantine and 70% of symptomatic cases adhere to case isolation, in each case reducing non-household contacts by 75%

12. Warwick's pessimistic scenario assumed:

    - School-age mixing was reduced to around 50% of its normal level, accounting for school closures but potentially greater mixing outside school
    - Workplace mixing was reduced to around 75% of its normal level

- Household mixing was increased to 125% of its normal level
- Other mixing reduced to 40% of its normal level

13. It was agreed that as Imperial's assumptions were more pessimistic, it was appropriate for planning purposes to use those modelling outputs, with R0 of 2.8 and doubling time of 3.3, as the reasonable worst case.

Comparison to other countries

14. It is very difficult to directly compare modelling results to what has been seen in other countries. It was agreed that control measures put in place in some other countries, possibly including Italy, have reduced the reproduction number to below 1, and that it was reasonable to assume that stringent measures with high compliance rates in the UK, as modelled here in the optimistic scenarios, would have a similar effect.

15. A modelling group with access to data from Italy believe that the results here are broadly in line with what was been occurred there. Other groups do not have access to this data and were therefore unable to comment.

Optimistic scenario

16. Imperial's good compliance scenario assumed:

- Social distancing reduces contacts outside the household or school/workplace by 90%, and reduces workplace contacts by 50%.
- Household contact rates are assumed to increased to 125% of its normal level.
- 75% of households adhere to household quarantine and 70% of symptomatic cases adhere to case isolation, in each case reducing non-household contacts by 75%.

17. Warwick's optimistic scenario assumed:

- School-age mixing was reduced to around 30% of its normal level accounting for school closures but potentially greater mixing outside school
- Workplace mixing was reduced to around 65% of its normal level
- Household mixing was increased to 125% of its normal level
- Other mixing reduced to 25% of its normal level

18. Imperial's and Warwick's models both gave around 10,000 deaths in the first wave of an optimistic scenario. Peaks times were slightly different as a result of different assumptions of the time lag between infections and deaths. For consistency, it was decided to use Imperial's good compliance scenario as an optimistic scenario for planning purposes.