SPI-M-O: Local interventions and spatial scales

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SIGNED OFF BY SPI-M CO-CHAIRS ON BEHALF OF SPI-M-O

Summary

1. This paper forms part of a response to a MHCLG commission on the effectiveness of local interventions, identification of the appropriate geographies and scales for interventions, and required levels of adherence. It also considers questions from NHS Test and Trace on the effectiveness of specific intervention measures.

2. This statement should be read in conjunction with the SPI-B paper "Areas of intervention ('local lockdown') measures to control outbreaks of COVID during the national release phase", tabled at SAGE 49 (29 July 2020).

General principles for local interventions

3. The impact of a behavioural and social intervention on transmission will fundamentally depend on four major factors:

    a. **Duration** of the intervention

    b. **Impact** of the intervention on contact rates

    c. **Area or size** of the intervention

    d. **Adherence** to the intervention

    These factors should not be considered independently; each will interact with the others in ways that are not necessarily simple or obvious. In addition, the relationship between adherence and the other three characteristics may differ across areas, different groups of the population, and at different points in the epidemic.

4. It is important to consider that local interventions will also have wider health, societal and economic impacts, as well as equity issues, and that these will similarly be affected by the four factors above. Decisions on local interventions will need to balance these wider impacts against risks of SARS-CoV-2 transmission.

5. The requirements for any intervention's implementation – scale, severity, size, duration – for a certain area will vary over time, as will levels of adherence to the measures in question. Interventions will need to flex and change accordingly.

Duration and impact of interventions

6. It is preferable from a purely epidemiological, COVID-control perspective to introduce measures early that have a large impact on contact rates, allowing these interventions to be in place for a shorter time period to reduce disease morbidity and mortality. This would have more of an effect on transmission than less stringent measures implemented for longer. However, a simple model presented to SPI-M-O implied that there is no simple 'rule of thumb' for the spatial scale and duration of control needed in a local hotspot.

7. There are also trade-offs between what is epidemiologically sensible when considering adherence to such measures; please refer to SPI-B's paper, "Areas of intervention ('local lockdown') measures to control outbreaks of COVID during the national release phase", as tabled at SAGE 49 (29 July 2020).

8. The more intense an intervention, the less time it may need to be in place, if all else is equal. Approximately two weeks is the minimum duration for any intervention; this would cover both one incubation period and two to three generation times for SARS-CoV-2.

Area or size covered by interventions

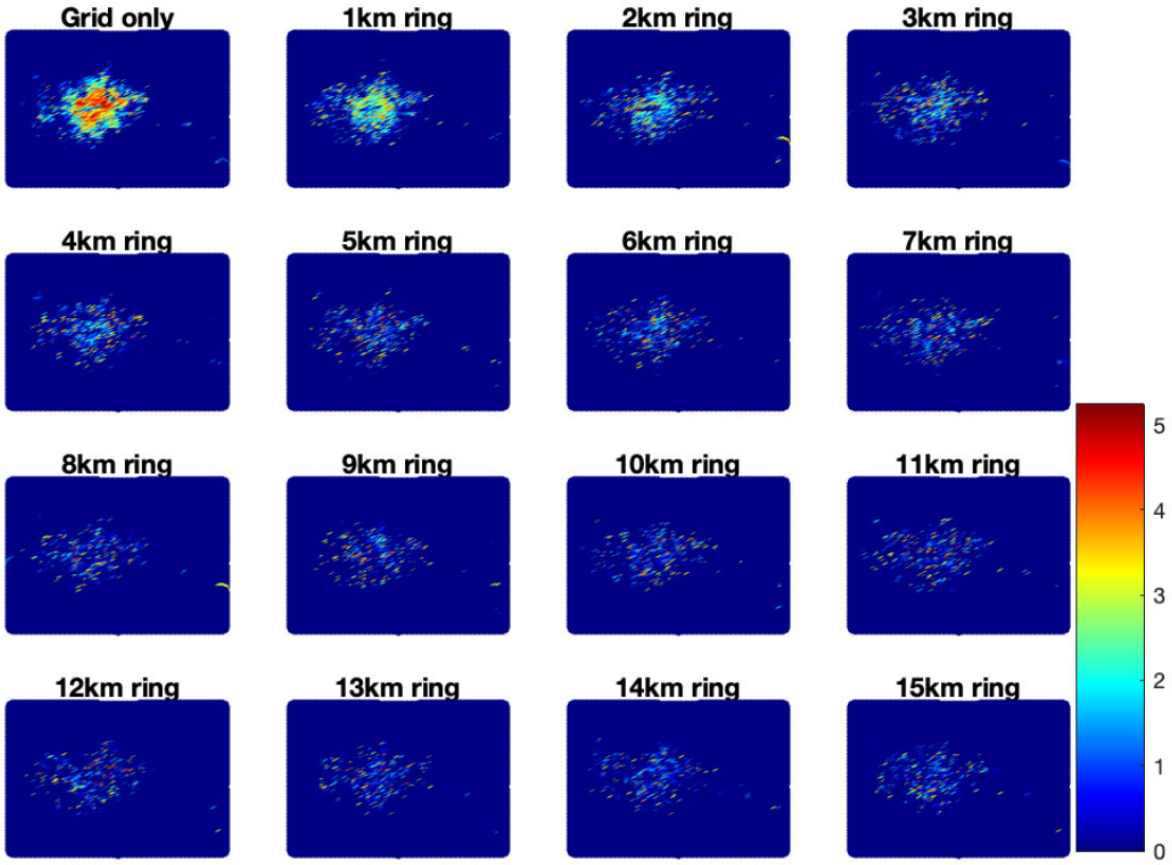
9. Lessons from livestock disease suggest that **local interventions should aim to target an area slightly wider than that of the known outbreak**. This relies on being able to identify both the hotspot and how far it extends, which is far from simple.

10. **"Neighbouring" or "wider" should not be simply interpreted as geographical or administrative but may also depend on local travel patterns and communities**, i.e. on the connectivity between places, and this may affect where appropriate boundaries for an area for intervention may lie. While local authorities (LAs) should be able to advise on this, a quantitative approach may also be possible, if granular movement data is available.

11. Depending on the resolution being considered, these "neighbouring" areas may not have enough tests for elevated incidence to have been identified. As a precaution, there would be a strong case for increased surveillance and testing in these areas, even if no other action is taken.

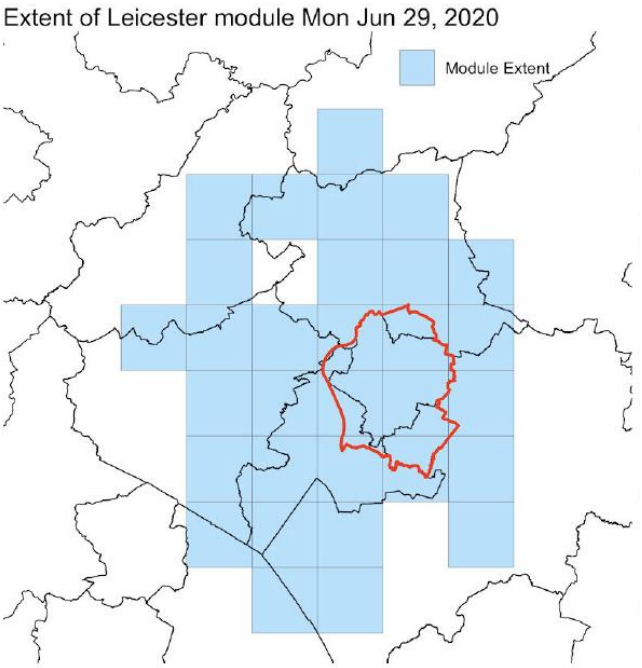
12. Analyses from Warwick shows there are diminishing returns from spreading the net progressively wider (Figure 1). This, unsurprisingly, depends greatly on population density and spatial demography of a region, as well as differential adherence. At the boundaries, there may be less buy-in and thus lower adherence to the intervention.

Figure 1: The average number of infections per grid (log scale) for London as the radius of lockdown implementation increases. As can be seen, anything larger than approximately a 5-6km ring in space leads to a less marked decrease in infections.



13. This is supported by analyses of Facebook movement data. LSHTM identified “communities of interaction” (areas with more movement within than between); these do not align with administrative boundaries (Figure 2) and were more local/fragmented during the nationwide lockdown. LSHTM and Imperial groups both found that movement patterns in Leicester did not change markedly when local measures were recently imposed.

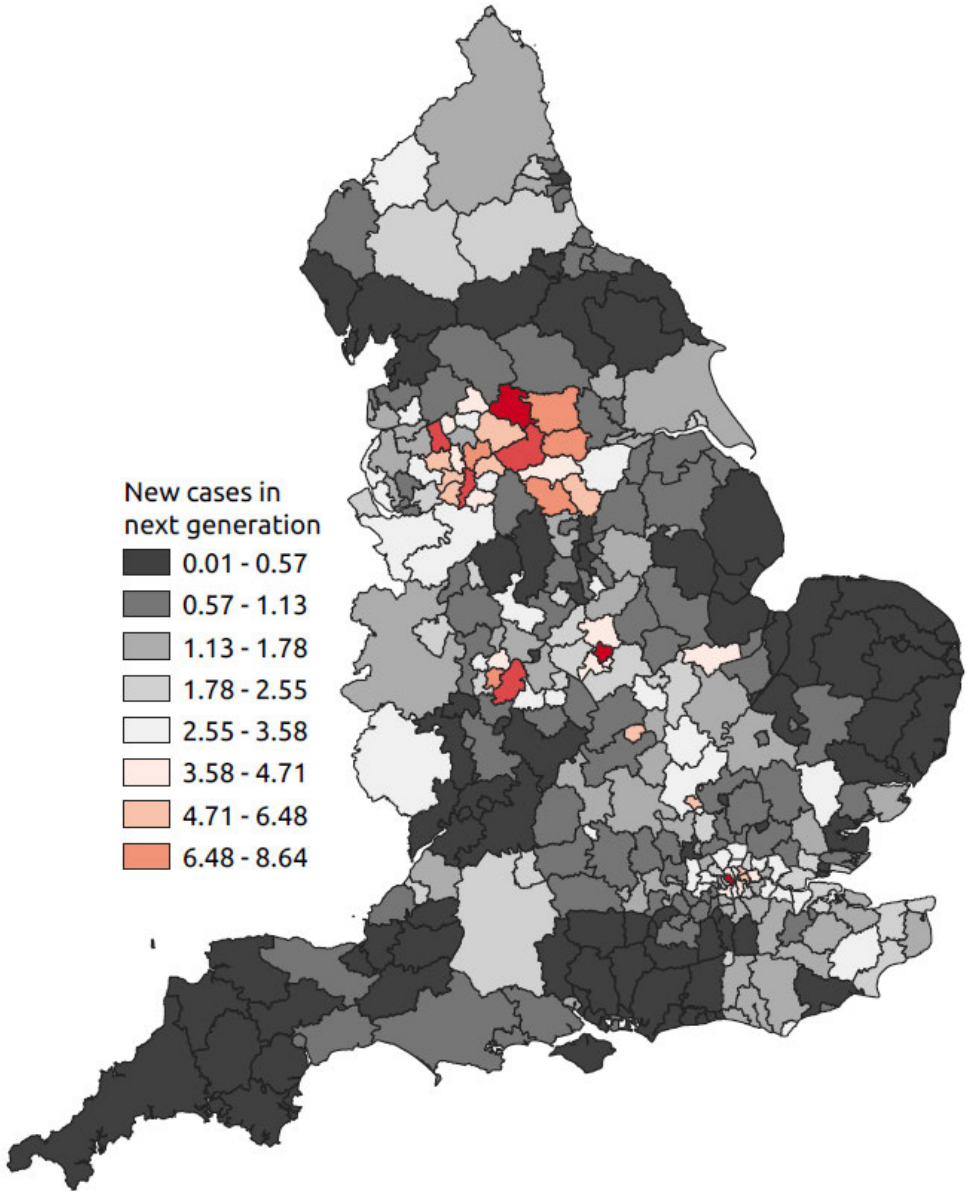
Figure 2: Map of Leicester local authority on 29 June 2020, where Facebook movement data show more movement within the blue tiled area (module extents) than between this area and those outside of it, compared to the 'local lockdown' area (red line) and local authority boundaries (black lines).



14. Similarly, Bristol/Exeter explored a hierarchy of "communities" or population partitions based on commuting patterns; implementation of these different partitions would depend on the scale of outbreak. The identification of these natural partitions would allow for spatial segmentation that minimised the disruption of commuting patterns, however current data on individual movement patterns between places would be required.

15. Lancaster noted that there is heterogeneity in national transmission risk between LAs, given transport patterns – please see the accompanying document "Lancaster risk report 20200730" for more information. If infected, some LAs pose a greater risk to transmission to the rest of the country than others; similarly, some LAs are more at risk. The modelling group can use these data to estimate future incidence at the LA level. This analysis could be developed further; for example, it currently includes pillar 1 testing data and so may be skewed by LAs with a significant healthcare presence appearing to have higher risk than other LAs. Again, current data on individual movement patterns would be required for this analysis.

Figure 3: Lower tier local authority map of England showing the specific expected new cases in the next generation of the disease, where darker colours represent fewer cases and red colours represent more cases.



16. Both the Bristol/Exeter and the Lancaster analyses use detailed commuting data from the 2011 Census, which may not be representative of current movement patterns. Other more recent travel/traffic volume data that are also used by Lancaster, are unavailable at a granular level. **To improve these analyses further, more timely daily data on travel between lower tier LAs is needed.**

Adherence

17. The SPI-B paper "Areas of intervention ('local lockdown') measures to control outbreaks of COVID during the national release phase", as tabled at SAGE 49 (29 July 2020), considers the factors affecting adherence to local interventions in more detail.

18. As SPI-B discussed, adherence to interventions and recommended behavioural changes are more likely if people have the capability, opportunity, and motivation to engage in co-design of interventions that lead to the recommended behaviours, and where measures are seen to be legitimate and proportionate. This links together with the above where size and duration of interventions are discussed.

19. Both incidence and R are currently lower than they were estimated to be in early to mid-March 2020. As a result, the adherence to any measures implemented to drive down viral transmission will be lower than was needed during the national lockdown from late March 2020 onwards.

20. **The choice of an area or community will likely affect adherence to any local interventions.** If modelling suggests a particular area may be suitable for restrictions this needs to be balanced with the public's response. As set out by SPI-B, factors such as community solidarity, need to be considered alongside the epidemiological factors when deciding on an area of intervention to maximise potential adherence. Adherence may also scale with the size of an intervention, as well as, for example the geometry, distance from the perceived focal point, or the initial rationale for intervention.

21. It is not clear that implementation of additional trade-off interventions will be successful in driving down transmission effectively, if adherence to existing recommended behaviours cannot be maintained or improved. It is likely people mix in an assortative way with others, based on the number and risk-level of social contacts, i.e. the virus will spread through those least concerned about it. Therefore, boosting adherence of any measures in these harder-to-reach groups is vital, and, without successful outreach, additional measures may not have the desired impact.

22. Outbreak investigations have their own biases which could lead to a disconnect; if contact tracing data is not fully representative of community transmission patterns in a given area, policy decisions may be made that is based on the behaviour of a relatively small number of individuals. Subsequent adherence may then be poor as the community may consider it an overreaction.

23. Ultimately, however, public understanding of what measures are brought in where and why are the key factor for adherence, and communication of these very complex messages needs careful handling.

Consideration of specific measures for NHS Test and Trace

24. NHS Test and Trace provided a list of potential measures for SPI-M-O to consider with regards to effectiveness of currently used and available control measures. **It is the view of SPI-M-O that more and better data from the current testing system is needed in order to be able to comment**; until more information on what settings people are being infected with SARS-CoV-2 in is available, modellers are unable to offer more than generic high levels principles as already produced. More information on the sorts of data needed can be found in SPI-M-O's consensus statement from SAGE 50.

Quarantine outside the home

25. Effectiveness of quarantine outside the home is likely dependent on the proportion of household transmission occurring before receipt of a positive test. Estimates (He et al. 2020) imply that approximately 45% of transmissibility happens before symptom onset; if individuals quarantine one day after symptom onset, approximately 60% of transmission events have already occurred, and if this is delayed until two days after symptom onset, approximately 75% of transmission events have happened. This may mean that transmission to other household members may have occurred already. Further research on quantitative estimates of the impact of quarantine outside the household is in expected.

26. It is possible that imported cases detected at airports may not have had the chance to infect their household members yet, so quarantine outside of the home could be of use for these groups.

27. Quarantine outside the home is likely to be possible for low incidence levels only, due to the cost and availability of spaces (e.g. hotel rooms) – with an isolation of period of 10 days, this capacity would need to be daily incidence x10. This may also differ between those asked to isolate (10 days) versus those quarantining on return from other countries (14 days).

28. For carers who need to enter quarantine outside of the home, there may also be psychological damage for both carer and recipient as a result of separation, particularly if dementia or learning disabilities leads to a lack of understanding and/or confusion. Any consideration would need to take this sort of situation into account.