

SPI-M-O: Statement on tiers in England and other measures in the Devolved Nations

Date: 11th November 2020

FINAL

Summary

1. The system of tiers in England had an impact on viral transmission during the period they were implemented. Tier 1 measures alone are not enough to prevent the epidemic from growing rapidly.
2. Results from two SPI-M-O modelling groups suggest a modest (approximately) 10% reduction in R when moving from tier 1 to tier 2. Under the right circumstances in some places, tier 2 could *theoretically* be enough to drive R below 1.
3. **There is a great deal of uncertainty about the effect of tiers, particularly tier 3.** The implementation of tier 3 restrictions differed across the country with many places having measures beyond the “baseline” tier 3. There are also many confounding factors that cannot be accounted for, including but not limited to: behavioural changes resulting from increases in prevalence irrespective of formal guidance, changing levels of population immunity, changes in local testing strategies and geographical distribution of different measures.
4. Tier 3 restrictions, taken as a whole, are associated with slowing growth rates. Estimates of the relative reduction in R from tier 1 to tier 3 range from around a quarter to a half. It is therefore unclear whether baseline tier 3 restrictions alone would be sufficient at a regional or national level to reduce R below 1. It is likely that some localities may need a “tier 4” to prevent the epidemic from growing. A “tier 4” that **guarantees** a reduction in prevalence would be required in most places, if the prevalence is to be reduced.
5. The implementation of firebreaks in Wales and Northern Ireland, and the introduction of local protection levels appear to have led to recent decreases in estimates of R.

England – Tier system

6. Tiers or local COVID-19 alert levels were implemented in England from 12th October. A three-tier system rationalised restrictions across the country, depending on levels of prevalence, test positivity rates (especially in the older or more at-risk age groups), as well as hospital admissions and occupancy, and other factors.

- Tier 1 (Medium) consists of the same restrictions as the national measures that came into force on 25th September, including the Rule of Six and the closure of hospitality venues at 10pm.
 - Tier 2 (High) aims to reduce household to household transmission by preventing mixing between households or support bubbles indoors. The Rule of Six continues to apply in all outdoor spaces.
 - Tier 3 (Very high) consists of a baseline package of prohibiting social mixing indoors and in private gardens, with the Rule of Six allowed in open public spaces. Closure of pubs and bars unless they operate as a restaurant, and advice to people not to travel in and out of these areas. Many places in tier 3 have restrictions that go beyond these baseline measures.
7. SPI-M-O has considered the impacts of these tiers on viral transmission across England since their introduction. This presents several challenges, the most important being that tiers are applied in circumstances related to the outcome (non-independence of treatment and effect) and are not independent of history, for example tier 3 may be applied where tier 2 has been unsuccessful in controlling the epidemic.

England – Impact of the Tiers

8. In March 2020, SPI-M-O estimated the unmitigated R in the community for SARS-CoV-2 was between 2.7 and 3.0¹. When mostly under tier 1 restrictions (with some places in tier 2 and 3), R in England was approximately 1.2 to 1.4² with significant heterogeneity across the country. This shows that mitigations through policy and behavioural changes not based on the tier system, i.e. “Covid-19 security”, combined with modest depletion of susceptible individuals in the population have dramatically reduced viral transmission. Tier 1 measures alone are not enough to prevent the epidemic from growing with a doubling time of one to two weeks.
9. Two temporal models have allowed for the relative impact of tier 2 and tier 3 restrictions to be compared with tier 1. The results for tier 2 are broadly consistent between these approaches, with **a modest (approximately) 10% reduction in R when moving from tier 1 to tier 2**. If R in a given area were slightly above 1, for example 1.1, and tier 2 restrictions were implemented, these could *theoretically* be *just* enough to push viral transmission from growth to decline although this has not been observed. This also

¹ SPI-M-O Consensus Statement 27th April 2020 (SAGE 29)

² SPI-M-O Consensus Statements 14th and 21st October 2020 (SAGE 62 and SAGE 63)

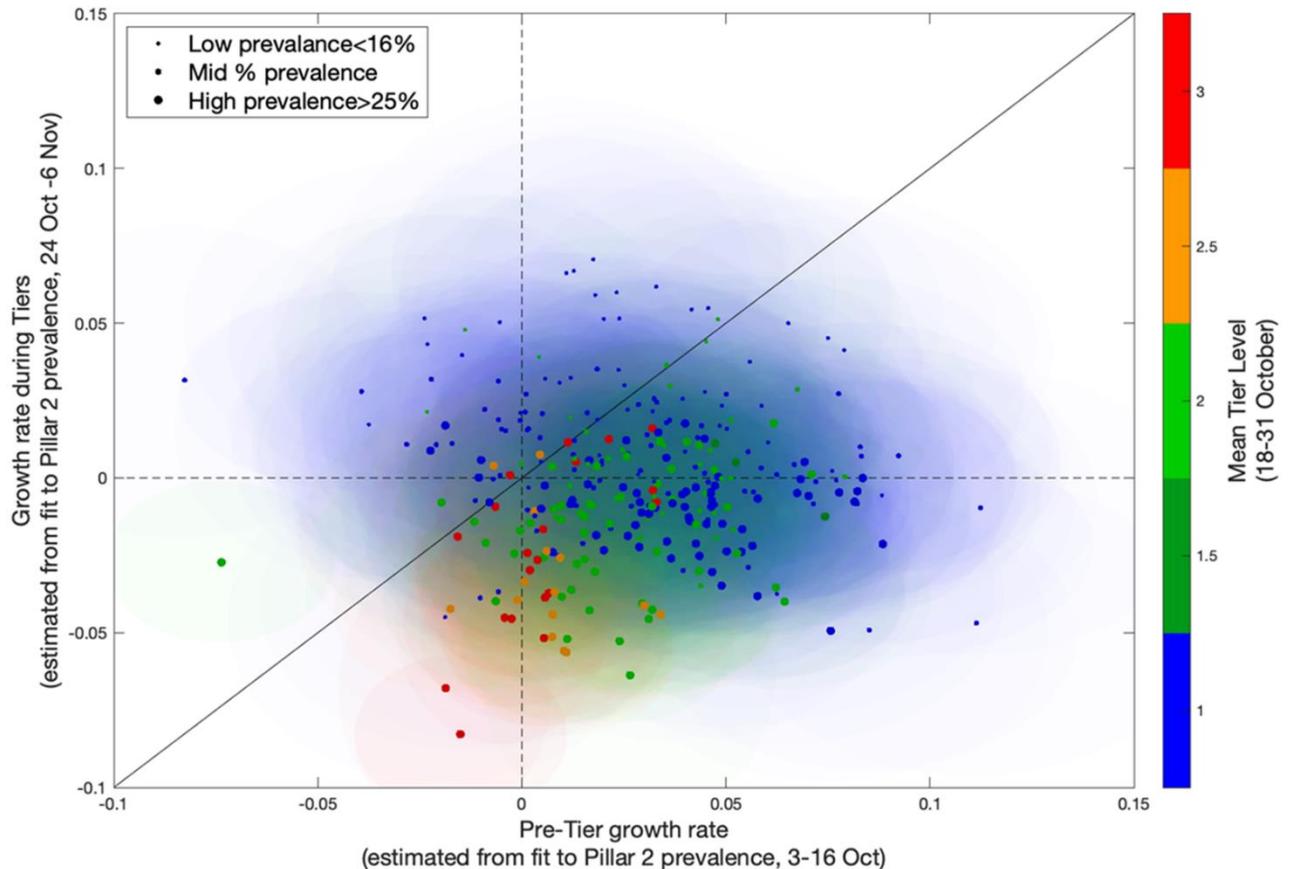
suggests that tier 2 is **not a reliable intervention for the maintenance, let alone the re-establishment, of any degree of control on transmission**. In a place where R is 1.1 or greater, the imposition of tier 2 measures is considered barely adequate to constrain epidemic growth and unlikely to turn epidemic growth rates negative.

10. There is evidence from two independent analyses that tier 3 restrictions have accompanied a reduction in transmission, particularly in the North West and North East & Yorkshire regions. The scale of that reduction, however, is harder to reconcile. It also needs to be considered that this slowing in growth will include the impact of informal behavioural responses that result from increases in prevalence. One group's estimate of the relative reduction in R between tier 1 and tier 3 corresponds to around 28%, whereas another uses two different models and estimates 36% and 47% reductions. One main difference between the models is that the second includes mobility *between* areas, suggesting that the effect of tier 3 may be diluted by contiguity with lower tiers.
11. SPI-M-O's consensus R estimates for England at the time just before tiers were implemented was $R=1.2-1.4$, with individual estimates for the NHS England regions slightly above or below. One analysis suggests that tier 3 as implemented would likely be sufficient to bring R below 1 in most, but not every area. The other analysis, however, would correspond to tier 3 being highly unlikely to reduce R below 1 in all locations. For this reason, it is unclear whether tier 3 restrictions alone would have been sufficient to reduce R below 1 at a regional or national level.
12. **There is a great deal of uncertainty about the effect of tiers, particularly tier 3.** Tier 3 restrictions differ across the country with many places having measures beyond the "baseline" tier 3. There are also many confounding factors that cannot be accounted for, including but not limited to: imposition of tier 2 and tier 3 is closely correlated to the epidemic and previous interventions; behavioural changes resulting from increases in prevalence irrespective of formal guidance; changing levels of population immunity; and changes in local testing strategies.
13. Consideration needs to be given to the spatial extent that local measures are applied to. People move between areas and so any local measure has "edge effects". Applying measures to larger areas, for example upper tier local authority (UTLA) rather than lower tier local authority (LTLA) or region rather than UTLA, reduces the importance of "edge effects" and may make measures more effective.
14. When considering transitions from national measures to a localised tiered approach or between tiers, **both prevalence and growth rate of the virus need to be considered**. Basing transitions on prevalence alone leads to a perverse outcome where growth rates

are highest in the lower prevalence areas and interventions sufficient to halt this growth do not take place until prevalence is very high. This has led to high prevalence across the whole country and, ultimately a second national intervention. For example, the North West and North East & Yorkshire regions initially had much higher prevalence than the rest of England, however, this is no longer the case as the rest of the country has steadily seen increasing infections in the absence of significant interventions; ONS estimate that at least 1 in 200 people are SARS-CoV-2 positive in every region of England, with an average of 1 in 90 for the country as a whole.

15. Figure 1 compares growth rates in English lower tier local authorities (LTLAs) before and after the introduction of the tiers system. Each LTLA is represented by one dot coloured according to which tiers were imposed (blue = tier 1, dark green = tier 1 then tier 2, light green = tier 2, orange tier 2 then tier 3, red = tier 3). The size of each dot represents prevalence. Position the x axis is growth rate before tiers were introduced. For all the dots to the right of the vertical line, prevalence was growing before tiers were introduced. Position on the y axis is growth rate under tiers (but before the implementation of national measures). LTLAs that are below the diagonal line had slower growth after the tiering system was brought in, whereas those above it saw increases in growth rates before and after 12th October.
16. From Figure 1 it can be seen that LTLAs in tiers two and three (green, orange, and red dots) generally had lower growth rates after tiers were introduced as they lie below the diagonal line. It can also be seen that LTLAs that spent time in tier 3 measures mostly had negative growth rates after the introduction of tiers (red and orange dots are mostly below the horizontal dashed line) and this is *not* the case for those in tier 2 measures. There are many green dots above the horizontal dashed line. These are LTLAs in which growth rates were positive after tier 2 measures were applied. Note that this figure is observational rather than analytical or explanatory and LTLAs differ in many ways related to both their tier and their growth rate.

Figure 1: Correlation plot showing the distribution of lower tier local authorities (LTLAs – dots) and their average tier (colour of dot – blue = tier 1, green = tier 2, red = tier 3) over time, by their growth rate before tiers were introduced (x axis); growth rate under tiers but before the implementation of national measures (y axis); and by prevalence (size of the dot, including shaded uncertainty bound).



17. Figure 1 also illustrates that **tier 2 and tier 3 measures were introduced to LTLAs where prevalence was high** (green, orange, and red dots are larger in size than blue ones). Estimating impact when interventions are applied in such a way is complicated and current methods do not fully account for the fact that stronger interventions were implemented in the areas at most need and may lead to biased estimates. SPI-M-O is working to minimise the impact of any such bias in its analysis.

18. There is substantial, quantifiable uncertainty around these estimates (represented by the large, pale cloud around each dot). The underlying testing data from which these growth rates are calculated is known to suffer multiple sources of variability and delay which are less easy to quantify. As an early summary of observed change after tiers were introduced, however, this figure a useful summary.

England – Impact of national measures and post-measures tiering strategy

19. One model estimated the number of cases that would be reported in different LTLAs on 2nd December for a number of different scenarios for R over the four-week period from 5th November. If R=0.8 for the duration, they estimate that 36% of LTLAs would have more

than 100 weekly cases per 100,000; this rises to 53% if $R=0.9$ rather than 0.8. Similarly, 75% would have over 50 cases per 100,000 with $R=0.8$ and 93% with $R=0.9$. It is very optimistic to think that the latest national restrictions in England would push R as low as 0.6 but doing so would lead to an estimate of only 30% of LTLAs with over 50 cases per 100,000 on 2nd December.

20. These estimates assume a uniform reproduction number across all LTLAs. In reality, transmission rates are likely to be different across the country. It is impossible, at this point, to predict precisely the outcome of the current measures.
21. It is almost certain that prevalence will remain high in some parts of the country at the end of these national restrictions. Any system of tiering that follows this period should:
 - Consider both prevalence and growth rate of the virus
 - Have a range of restrictions that have the potential to be more stringent than those in the current tier 3 for some areas to avoid the need for further national-level interventions.
 - Avoid any policy that leads, inexorably, to most parts of the country having high prevalence – interventions that prevent growth need to be introduced whilst prevalence is low if low prevalence is to be maintained.
22. Test and trace, including mass testing, is most effective when prevalence is low. Even the most effective test and trace system will have little impact when caseloads are high. Given that the impact of tiers will vary depending on the characteristics of different areas, a “tier 4” needs to be considered for those parts of the country where tier 3 is not able to shrink the epidemic. This is particularly important in the run up to the winter festive period if relaxation of measures is under consideration. Keeping incidence flat or decreasing between now and then is crucial.

Firebreaks in Wales and Northern Ireland and measures in Scotland

23. Both Wales and Northern Ireland have recently introduced short periods of restrictions termed “firebreaks”. Using either cases or hospital admissions gives an estimate that each have reduced R by 10-30%, in each instance bringing it below 1. The signal from deaths is not yet clear.
24. Scotland has also introduced local protection levels³ in their localised approach to managing the epidemic. The latest R estimate for Scotland now spans 1 (0.8-1.1).

³ <https://www.gov.scot/publications/coronavirus-covid-19-protection-levels/>

Annex: PHIA framework of language for discussing probabilities

