



Analysing variations in the response to the second wave through non-pharmaceutical interventions

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COVID-19 Actuaries Response Group – Learn. Share. Educate. Influence.

Summary

Over the last couple of months there have been different approaches adopted by the four nations within the UK to combat the second wave of COVID-19 infections. In this bulletin we explore whether the difference in approach enable us to demonstrate the relative effectiveness of restrictions.

We conclude that all restrictions, with the exception of Tier 1, have a material beneficial impact on rates but that duration and behaviour before and after restriction can alter effectiveness.

Introduction

In the first wave, the United Kingdom saw a close alignment of restrictions across the four nations, with minor variations adopted in the devolved administrations. However, in the second wave we have seen notable variations, including the tiering approaches adopted in England and Scotland. Both the timing and the duration of non-pharmaceutical interventions has varied, enabling us to identify corresponding differences in the outcomes in terms of infectivity levels and hospital admissions, and we judge that the main reason for these differences is the difference in interventions.

We use three sources of data to assess the effects. These are 1) the ONS weekly infectivity survey ([link](#)) 2) positive tests “cases” from those coming forward for testing, and 3) hospital admissions, the latter two being as reported on the UK Government dashboard, by now a familiar source of data on the key metrics being monitored ([link](#)). The data is assessed over the period since early October and for each country and region, a brief description of the non-pharmaceutical interventions is provided below:

- For England, the period covers both the tiered restrictions and subsequent national lockdown. We have chosen three regions, one for each Tier prevailing prior to the lockdown, noting that the tiering rules within England relate to the period prior to November 5th. We have chosen the South West as it was exclusively in Tier 1. Similarly, London was exclusively in Tier 2. The only area with substantial parts of it in Tier 3 for long enough to have an impact was the North West. These three therefore represent the best examples to attempt to discern the impact of each Tier.
- For Wales, the period covers the 17-day “firebreak”.
- For Northern Ireland, the period covers the more sustained period of tight restrictions.
- For Scotland, the period covers the use of the Scottish tiered restrictions. Unfortunately, neither the ONS nor hospital admissions data enable the varying effects of these to be identified, so we have not assessed the effectiveness of this policy.

We do not quantify the degree of rise or fall in terms of R or any other measure, and confine ourselves to more general observations as to the relative effectiveness of the level of restrictions between regions and countries.

Strengths and Weaknesses of Data Sources

ONS Infectivity Survey

This is a large and ongoing random sampling exercise of the community, which monitors current levels of infectivity together with newly acquired infections. As such it is a more current indication of community levels of infection than downstream measures, such as admissions and deaths, which inevitably introduce a lag, and make identification of the timing of any inflection points more difficult to ascertain.

Even with an extensive survey, once this is subdivided into more granular data (for our purposes, by English region), the numbers of positive occurrences do reduce to a level that means there is more uncertainty as to the outcome, particularly for more recent data. Again, this also makes ascertaining any peak in infectivity more difficult to pinpoint exactly, as smoothing of the data around a slowly turning point will typically result in a flattish curve for a period of days.

It should be noted that the ONS updates the curves shown each week, and not inconsiderable changes can emerge with the most recent data as a better view emerges. We therefore need to consider the most recent data in this light.

As infectivity is a function of infections acquired over the previous two weeks, it can be regarded as a proxy for the average of new infections over the recent period. We should thus expect any movement to be more gradual than we might see for new infections, which will be more responsive to a change in level of prevailing restrictions.

The data is available up to 28th November, which gives a sufficient period from the start of the English lockdown on the 5th November for any change to emerge.

Cases

This measure is widely used to understand changes in the levels of new infections being seen, particularly at local levels, where it is a key factor in determining the Tier level to adopt. It also has the advantage of being an “early warning” indicator of future hospital admissions.

However, it is influenced by the volume of testing, which does vary, and over time is increasing as more test availability comes on stream, and is used for different purposes (eg care home visits and universities). It is also unlikely to pick up many asymptomatic carriers, as the criteria for testing typically involves the presence of symptoms.

Hospital Admissions

Although this measure has the drawback of being a lagged indicator, as noted above, a major benefit is that it is indicative both of pressures that the healthcare system may be under, and also of the eventual mortality levels that will be seen. It also covers admissions from institutional settings, such as care homes, so provides a fuller picture than the ONS Infectivity Survey which is restricted to community settings.

However, the measure will not pick up a large increase in infectivity in younger lives, such as was seen in September, where few are likely to be hospitalised. (As COVID can cause long-term health implications for even young lives who don't need hospital treatment, the impact on the health of those affected should not be underestimated.)

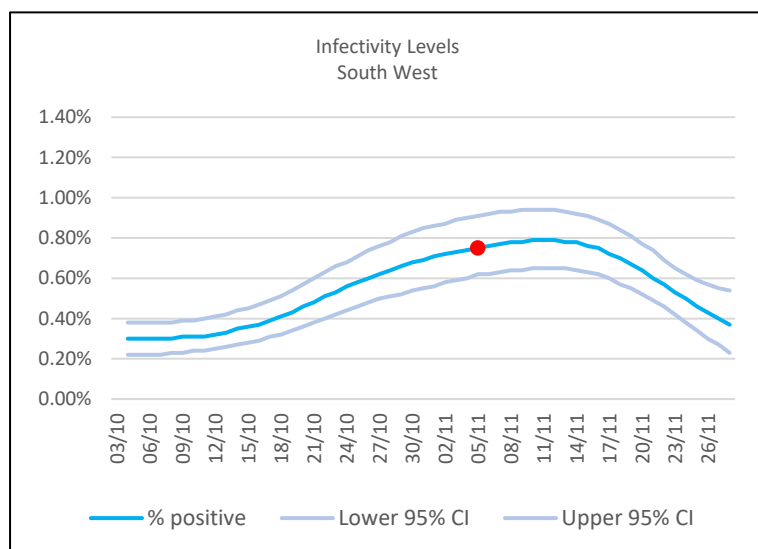
In addition, there is some blurring with those admitted for other reasons who test positive, and those who acquire the infection whilst in hospital, which are also included in the figures.

Data has been used up to 2nd December which, once the lag between infection and admission has been allowed for, gives a view to around 22nd November. (We have adjusted the graphs to allow for this lag.)

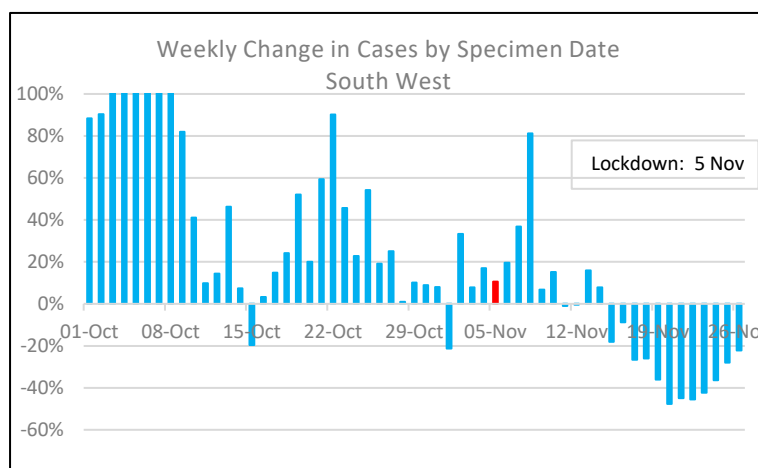
Whilst a rolling seven 7-day average is usually preferable to understand how a trend is emerging, it can over-smooth any inflection point in the data. Accordingly, we have used a 3-day rolling average, and compared with the equivalent figure of a week earlier. This is more volatile, but is more responsive to a step change in direction.

Analysis of case locations

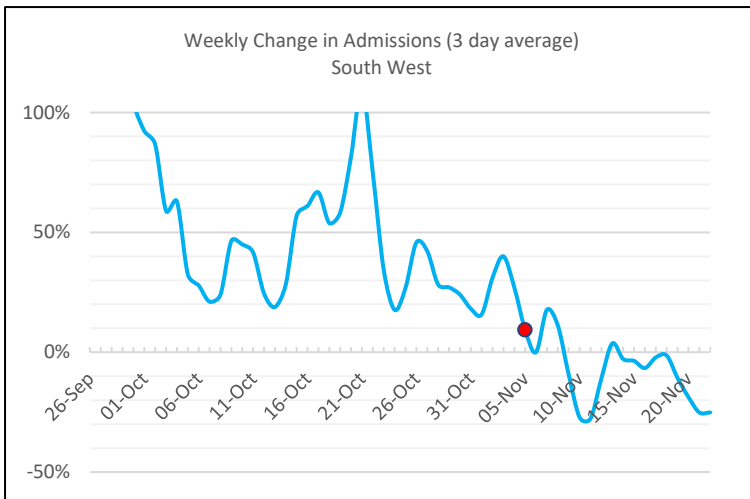
South West (Tier 1 to Lockdown)



We can see that Tier 1 measures were ineffectual at stopping the growth of the virus up to the start of the nationwide lockdown (the start of which is indicated by the red point). However, levels quickly stabilised after this and have since started to decline, with the rate of fall appearing to accelerate after a slower start. It must be remembered that the smoothing adopted by ONS will typically mean a lessening of growth prior to any peak, the absolute date of which cannot be determined accurately.



From the change in cases it is equally clear that, prior to nationwide lockdown, rates were generally increasing quite rapidly. However, around a week afterwards a very marked reduction begins to appear, which has continued for nearly two weeks.



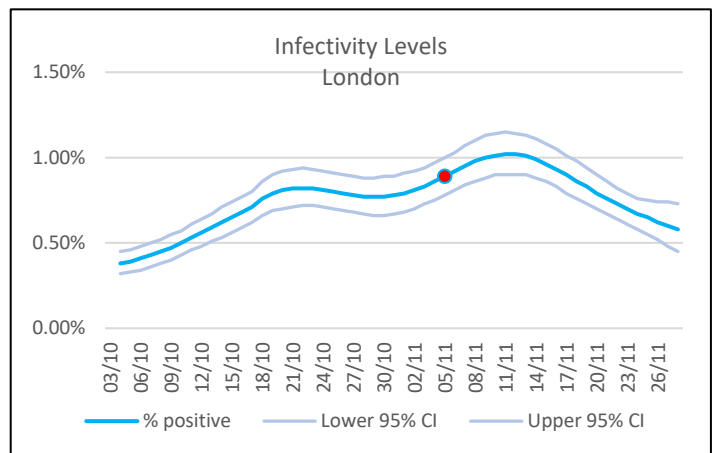
Finally, the admissions analysis shows increases of 20% to 30% per week through the second half of October, consistent with a rapidly rising infection level. However, following the nationwide lockdown we quickly see a step change to a falling pattern, with some weekly falls as high as 30%.

Conclusion: Tier 1 restrictions were inadequate to stop significant growth, whereas the move to national lockdown has quickly had the effect of reversing the trend, with the latest ONS data suggesting an accelerating decline.

London (Tier 2 to Lockdown)

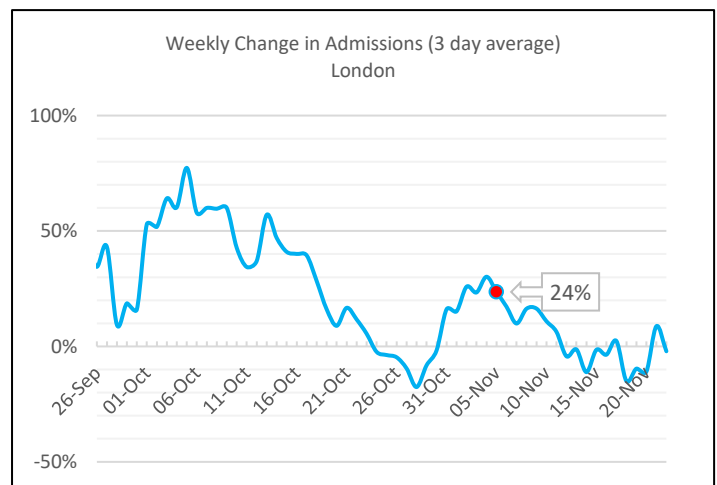
Our second example from England is London, which transitioned from Tier 2 prior to the national lockdown.

Tier 2 appeared to be broadly holding levels of infectivity stable prior to lockdown. However, immediately after the introduction of the national lockdown there was a noticeable increase in levels, which continued for around a week before the expected decline began to take effect. There is speculation that there was a nationwide burst of activity prior to the lockdown which generated a short period of increasing infections. Possibly this is more apparent in an area which was relatively flat beforehand.



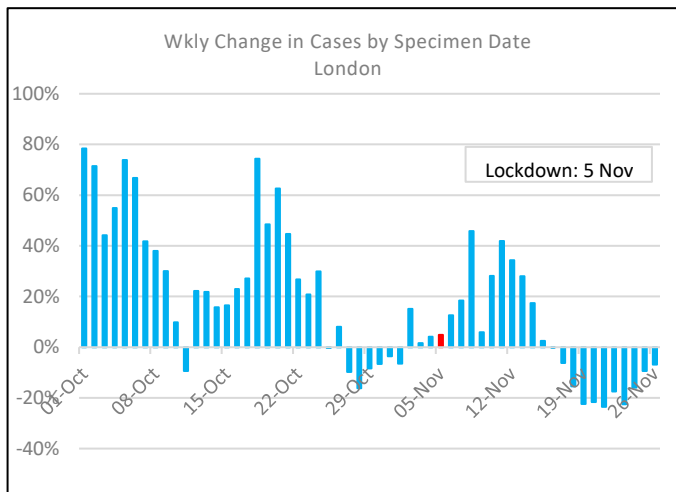
We can also see this pattern of an unexpected increase post lockdown in the cases, with some fairly substantial increases recorded. However, this has now been reversed, although the effect of the spike has been to dilute the overall effect of lockdown in terms of improvement over the lockdown period.

The admissions graph also picks up the fact that increases continued beyond lockdown for a week, although suggest that they started well before. There is no obvious reason for this,



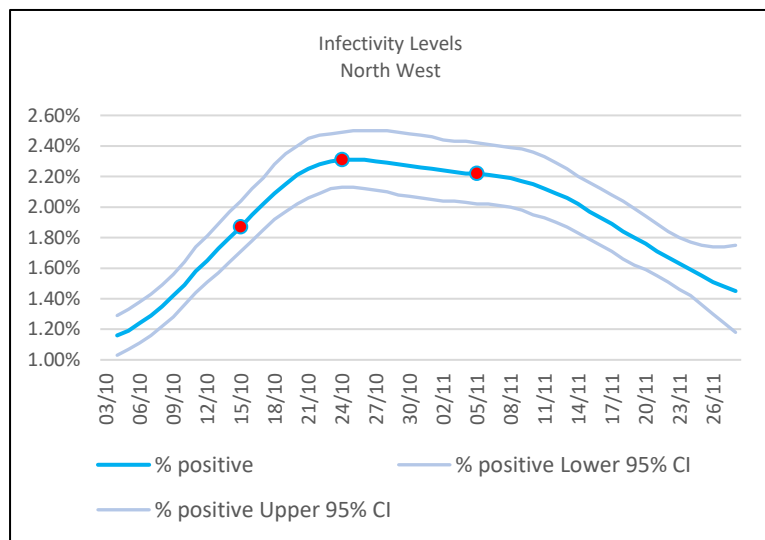
although the Imperial College REACT study ([link](#)) has picked up volatility around that period in a way that the ONS method may have smoothed.

Conclusion: Tier 2 measures appear to have stabilised cases and there is some evidence that it reduced levels of infectivity, particularly in those groups most prone to hospitalisation. However, national lockdown appears to have been slower than in other areas to result in a fall in infectivity.

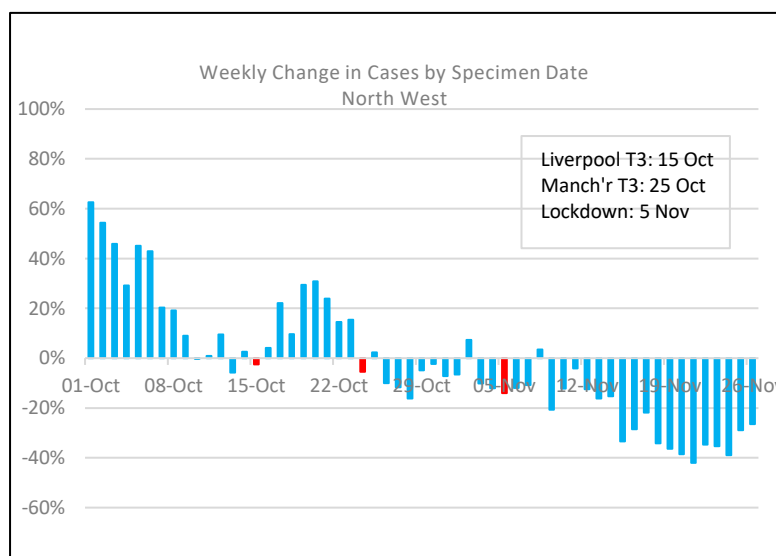


North West (Mainly Tier 3 to Lockdown)

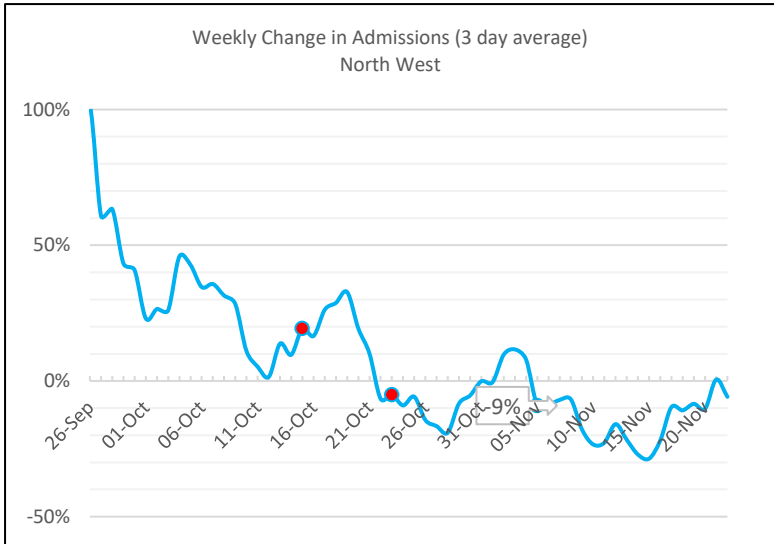
The North West region started the TIERING system with Liverpool in Tier 3 but the other major city, Manchester in Tier 2 for a further week. The overall picture is thus a blend of the effects of each tier.



Here we can see that there was a very slight lessening of the gradient after Liverpool entered Tier 3 (first red dot), but when Manchester followed (second red dot) infectivity levels peaked and started to decline albeit gradually. However, the introduction of the national lockdown (third red dot) has seen a further noticeable acceleration of the fall.



A similar pattern can be seen with cases. The rate of increase in the week following Liverpool entering Tier 3 was noticeably lower, and turned negative after Manchester followed. The rate of decrease has been much greater and consistent though the following lockdown.

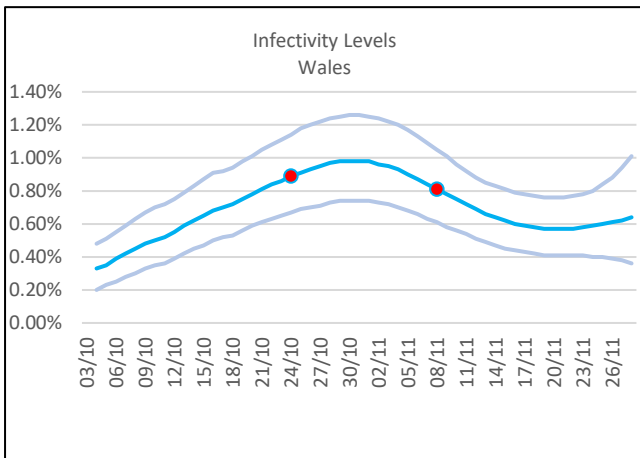


Likewise, in the admissions chart, growth was typically 20%-30% per week, but fell to around nil by the time Manchester entered Tier 3. However, this has been consistently negative since the national lockdown, with the falls of up to 25% per week.

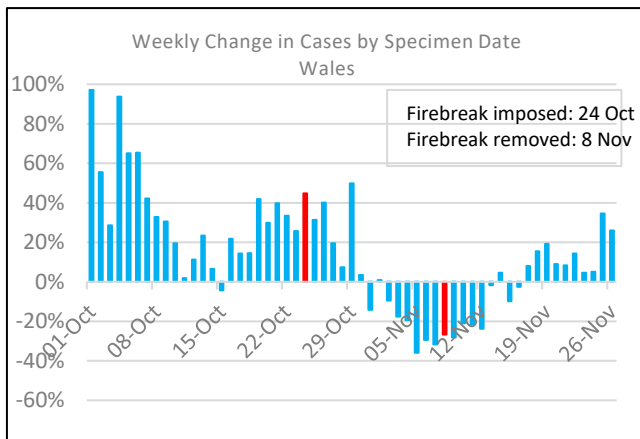
Conclusion: Tier 3 measures were effective in reversing the growth, and the national lockdown has resulted in a further decrease in rates.

Wales

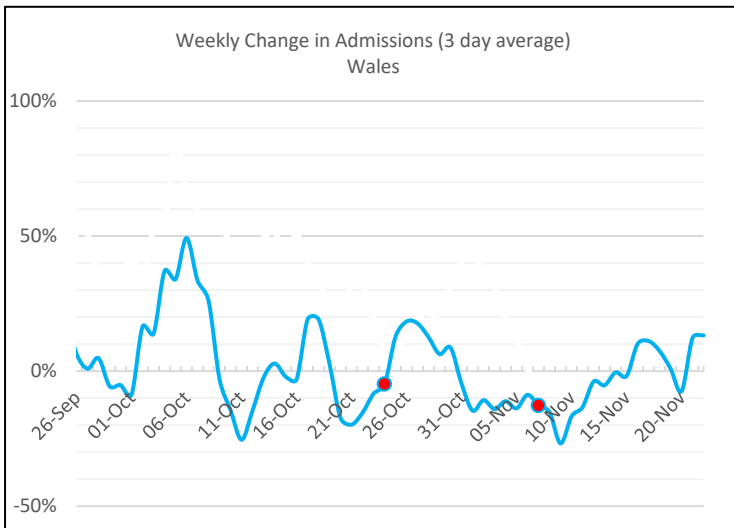
In contrast to England, Wales adopted a shorter duration approach dubbed a ‘firebreak’ adjacent to the October school half-term break (an approach SAGE was keen to be adopted more widely).



We can see from the ONS data that prior to the firebreak the local measures were ineffective in preventing prevalence increasing. Following the start of the firebreak (first red dot), it would appear that levels peaked a few days later and then started to decline at a similar rate to the increase. This decline has continued beyond the end of the firebreak (second red dot), although there are signs that in recent days this has reversed. This reversal has prompted the Welsh Government to impose further restrictions from 4th December.



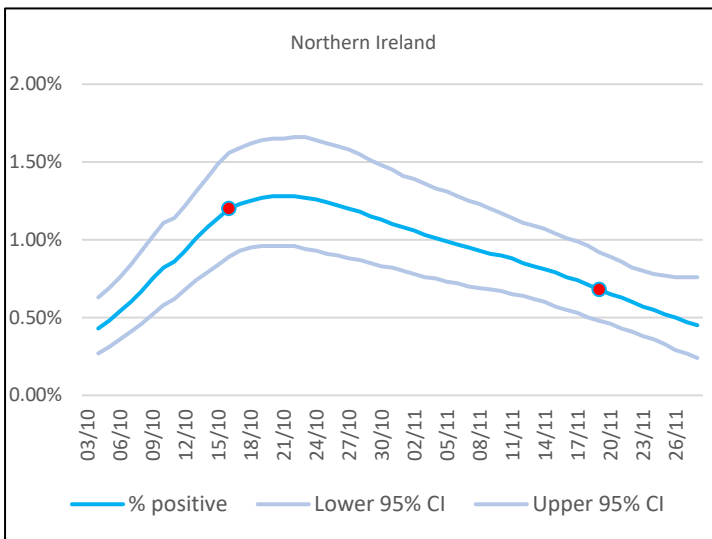
The effect of the firebreak is clear when looking at the rate of change of cases, with an obvious period of two weeks when cases were falling, albeit lagged by around 6 days. On either side of that, cases have been increasing, with the rate accelerating in recent days, suggesting a return to previous levels of growth.



This pattern is repeated in admissions data. Prior to the firebreak the data is quite volatile, which may be a function of the definition of an admission being vaguer than used elsewhere. However, a sustained period of falling admissions is observed. Though since the firebreak this has now been reversed, with recent days showing increases on the previous week.

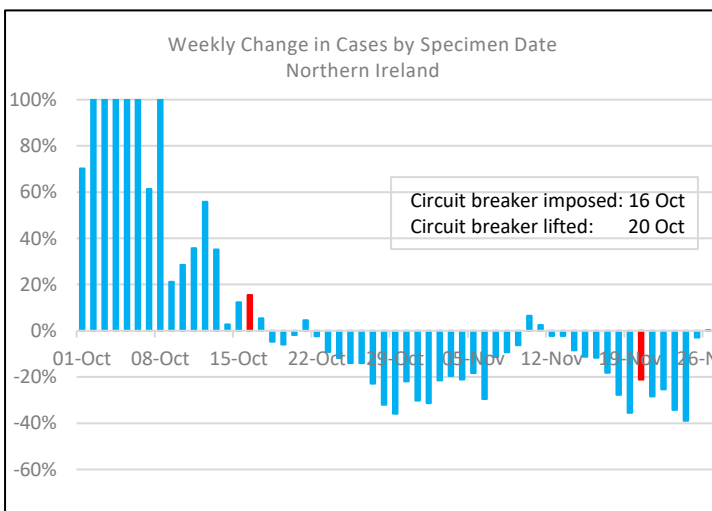
Conclusion: The firebreak was successful in turning around increasing infection levels, but the 17-day duration appears to have been inadequate in terms of avoiding a further tightening of restrictions.

Northern Ireland



The province initiated a circuit breaker (CB) on 16th October, which continued until a short respite on 20th November. The start of this period (red dot) coincided with an extended October school half-term break.

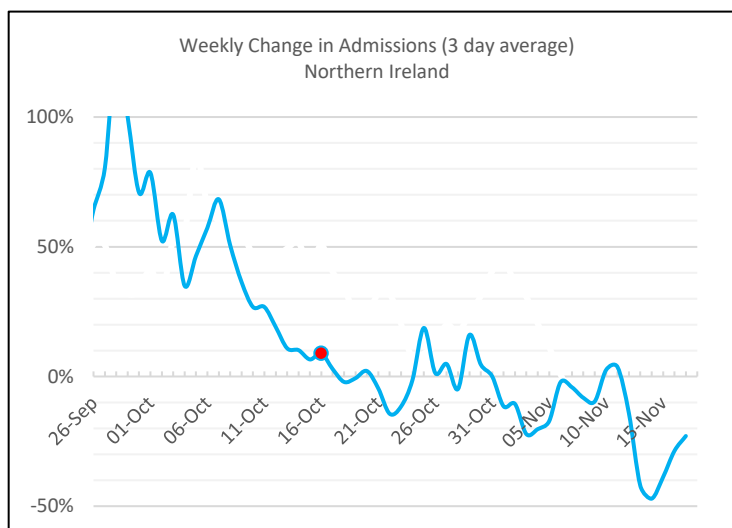
We can see that infectivity was increasing rapidly prior to the CB, but quickly peaked and turned downwards. The fall has been remarkably steady, particularly given schools returned on 2nd November, which might have been anticipated to slow results. The most recent estimate is around 35% of the peak rate modelled.



The cases data confirms this, although there appears to have been a marked slowing in the second week of November. This slowing might be a “schools effect” which has been lost in the ONS model, possibly through smoothing. Apart from that, November has seen sustained periods of falling cases.

Given typical lag times, any impact of the end of the CB is likely to be just beyond the observed period.

Admissions figures confirm this trend, although given lower volumes, there is more volatility. However, since the start of November we can see that they have been falling for the majority of the time. Unlike other regions, data is retrospectively updated, so we have removed the most recent week's data, but the last days shown must also be treated with some caution.



Conclusion: The CB has been effective in reducing infections over a sustained period.

Conclusions

The more stringent restrictions, whether it be lockdown in England, the firebreak in Wales or the longer Circuit Breaker in Northern Ireland have all been similarly effective in bringing down both cases and admissions at a reasonably rapid rate. Prior to the national lockdown in England, it is clear that regional tier restrictions had varying degrees of effectiveness; Tier 1 failed to stem the growth, Tier 3 appeared to be effective at initiating a modest decline, and in the middle, Tier 2 was broadly neutral.

The other main difference in the experience seen is predominately down to the duration of restrictions. In particular the shorter 17-day firebreak adopted by Wales appears to have been inadequate to prevent the need for a further round of restrictions within a relatively short period. That being said, taking action in and of itself was beneficial compared with no action.

With all these graphs, there may be debate around the precise timing of the effects, particularly the hospital admissions, where there is a longer lag. Notwithstanding that, the consistency of patterns seen suggests that the longer duration and more restrictive measures are demonstrably more effective at bringing infection rates down. This seems a logical conclusion given the virus spreads when we are closer together and interacting.

However, these non-pharmaceutical interventions bring with them disruption. From this analysis, it could be suggested that, if restrictions are required then to be the most effective we should try to discourage a surge in activity and contact prior to their imposition, possibly by reducing the period between announcement and implementation.

Finally, the last few days have seen a rise in admissions in England, which is not included in the above analysis. This increase, most notable in southern areas, will relate to infections acquired during the last week of lockdown. The reasons for this increase are not immediately obvious, but are obviously a cause for concern as we approach the Christmas period, and the announced loosening of restrictions over the festive period to permit travel and family contact.

10 December 2020