Policy Modelling - December 2020 and January 2021

What is new in this paper

The Covid-19 epidemic is growing in Wales with a deteriorating outlook (medium-high confidence).

It is difficult to accurately estimate Rt values as behaviours in the run up to Christmas may be changing (e.g. proportion of symptomatic people seeking tests). However, there is evidence from test positivity increase, growth rate and doubling times that we are in a period of exponential growth (high confidence).

From the current mobility and activity data it is unlikely the current policies underpinning alert level 3 restrictions will have the desired impact on the growth of the epidemic (medium confidence).

Changes in epidemic growth from the national implementation of alert level 3 restrictions on the 4 December have not yet been observed. Any beneficial impacts on NHS demand will not be observed for at least one or two weeks (medium confidence).

The current growth in the epidemic combined with Christmas mixing is likely to lead to a substantial increase in NHS demand and reduction in NHS and social care capacity in the New Year (high confidence).

The potential beneficial impacts of higher alert levels, with regard to prevented harm from COVID-19, will depend on the public's willingness, understanding, motivation and ability to adopt protective behaviours (e.g. not mixing between households).

To minimise health harms and reduce economic impacts, short, sharp interventions that satisfy alert level criteria rather than set dates are recommended (medium confidence).

The uncertainty that the Christmas mixing period gives to forecasting data makes the confidence intervals too wide for reliable estimation of future NHS demand. A risk-based approach should be adopted (high confidence).

The most efficient way to reduce harm from covid-19 and pressure on the NHS is to remove the Christmas relaxation policy and move to alert level 4 restrictions as soon as practically possible (high confidence).

1. Summary

This paper considers the current state of the epidemic in Wales and the modelled impacts of NPIs before and after Christmas. In doing so it estimates the impact of tiers or alert levels (herein, levels) on growth of the epidemic and impacts for NHS Wales, including deaths, hospitalisations and ICU occupancy over the winter period. The paper does not consider the additional non-COVID impacts of winter NHS pressures nor does it forecast staffing requirements or impacts of staff absences through quarantine or illness. The paper does not revisit previous modelling or TAG advice on non-pharmaceutical interventions that have been published[1,2,3].

The paper describes a deteriorating picture of the epidemic in Wales in the run-up to Christmas with increasing covid health harms and negative impacts on the NHS being accrued in the coming weeks. Given the uncertainty of impacts of current restrictions and very likely increase in cases in the coming weeks, immediate actions, equivalent to alert level 4, to suppress growth of the virus, is recommended.

The health benefits of restrictions are considerable in preventing deaths and hospital admissions, but the GVA costs are also substantial and may be greater. There are also indirect health harms and impacts on wellbeing that have not been costed which may be considerable. Efforts to monitor and mitigate socioeconomic harms should continue to be an integral part of the advice and the decision making process.

2. Current Situation (15 December)

The most recent estimate of the Reproduction number (Rt) for Wales from SAGE (9 December 2020) is predicted to be between 0.9 and 1.2 (SPI-M from 16 December is higher at 1.0 to 1.3). The estimate of Rt is shown as a range without a central estimate. Public Health Wales have also estimated Rt for Wales using data on the number of positive cases. Public Health Wales have also estimated Rt for Wales using data on the number of positive cases. As of 15 December 2020, Rt in Wales is estimated to be 1.56 (95 % confidence interval 1.54 – 1.58). And the all Wales doubling time estimated by PHW is 9.1 days.

Nation	Growth rate per day	R_t
Wales	-1% to +4%	0.9 – 1.2
England	-2% to 0%	0.8 – 1.0
Scotland	-5% to -2%	0.7 – 0.9
Northern Ireland	-3% to +1%	0.8 – 1.1
UK	-2% to 0%	0.9– 1.0

[1] https://gov.wales/technical-advisory-group-statement-regarding-non-pharmaceutical-interventions-pre-christmas-period
[2] https://gov.wales/technical-advisory-group-effectiveness-non-pharmaceutical-interventions-local-health-protection
[3] https://gov.wales/technical-advisory-group-fire-breaks

The ONS infection survey data shows that test positivity appears to have increased in the most recent week of data (29 November and 05 December), after falling from a peak at the end of October[4]. These data are helpful because they are the only estimates of infection covering asymptomatic as well as symptomatic cases, and they are not affected by other factors such as testing capacity or the number of people coming forward for testing.

The ONS results are for private households only – the 'community population' – and do not apply to those in hospitals, care homes or other institutional settings. For the week 29 November to 05 December, an average of 0.84% of the community population had COVID-19 (95% credible interval: 0.57% to 1.17%). This equates to approximately 1 person in every 120 (95% credible interval: 1 in 85 to 1 in 175), or 25,600 people during this time (95% credible interval: 17,300 to 35,600). The positivity rate appears to have increased in the most recent two weeks, after falling from a peak at the end of October (figure 1). It is important to stress the uncertainty around these figures. Since the survey picks up relatively few positive tests overall, the results can be sensitive to small changes in the number of these positive tests.

The Covid-19 epidemic is growing in Wales with a deteriorating outlook (medium-high confidence).

Changes in epidemic growth from the national implementation of level 3 restrictions on the 4 December have not yet been observed. Any beneficial impacts on NHS demand will not be observed for at least one or two weeks. (medium confidence)

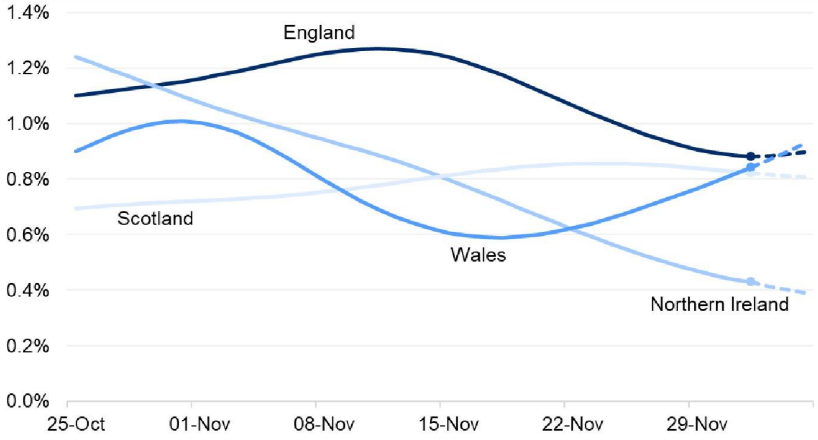


Figure 1. ONS Infection Study change in prevalence of covid-19 over time in four nations.

4 https://www.ons.gov.uk/peoplepopulationandcommunity/healthandsocialcare/conditionsanddiseases/bulletins/coronaviruscovid19infectionsurveypilot/previousReleases

Analysis of the weekly case estimates generated using PHW testing data alongside ONS case estimates shows an increase in both data sets[5]. PHW data reflects *new* cases detected (incidence) whereas ONS data is an estimate of all people testing positive (prevalence) that week. Interestingly the ratio of ONS prevalence to PHW seven day incident cases appear to have reduced over time, which may indicate a higher rate of case acquisition from TTP, although it may also be related to time lags and finding more cases outside of the community settings which aren't covered by the ONS study. This finding may chime with the relatively low rate of positive cases found in asymptomatic testing in towns and universities in Wales and other nations – possible evidence that a high proportion of positive cases are currently being identified.

Table 1. PHW testing data and ONS Infection Survey case estimates.

PHW dates	PHW cases	Cases per 100k	Testing episodes	Testing per 100K	Positive proportion	ONS dates	Cases per week	Lower CI	Upper CI	ONS/PHW Ratio cases per week
19-25 Oct	7394	234.5	45878	1455	16.1	17-23 Oct	26100	12600	47900	3.5
26-01 Nov	8661	274.7	43433	1377	19.9	25-31 Oct	27100	12200	50600	3.1
02-08 Nov	6501	206.2	42751	1355.9	15.2	31-6 Nov	35300	25500	46600	5.3
09-15 Nov	5379	170.6	40062	1270.6	13.4	8-14 Nov	18400	11700	26700	3.4
16-22 Nov	6063	192.3	48952	1552.6	12.4	15-21 Nov	16400	10500	23900	2.7
23-29 Nov	7302	231.6	54566	1730.7	13.4	22-28 Nov	18100	12100	25500	2.4
30-06 Nov	11298	358.3	67114	2128.7	16.8	29-5 Nov	25600	17300	35600	2.2

As illustrated by trends in the table above and figure below the number of tests per week have increased by 68% between 9-15 Nov and 30 Nov-6 Dec, and by 46% from 19-25 Oct to 30 Nov-6 Dec. This may indicate higher case ascertainment, but might equally represent changes in testing in response to COVID incidence. Cases are still increasing but some of the increase might be associated with increases in testing. This might go some way to explaining why deaths have not increased as quickly as cases, based on data of time lags from symptom onset to death (**Low confidence**). Death registrations may also be delayed when the system is under pressure.

Further analysis of TTP data may prove beneficial in order to better understand these trends to understand why more people are seeking tests in the run up to the Christmas period; but if people have to report symptoms to get tested then the data may not be reliable.

It is difficult to accurately estimate Rt values as behaviours in the run up to Christmas may be changing (e.g. proportion of symptomatic people seeking tests). However, there is evidence from test positivity increase, growth rate and doubling times that we are in a period of exponential growth (high confidence).

[5] https://public.tableau.com/profile/public.health.wales.health.protection#!/vizhome/RapidCOVID-19virology-Public/Headlinesummary

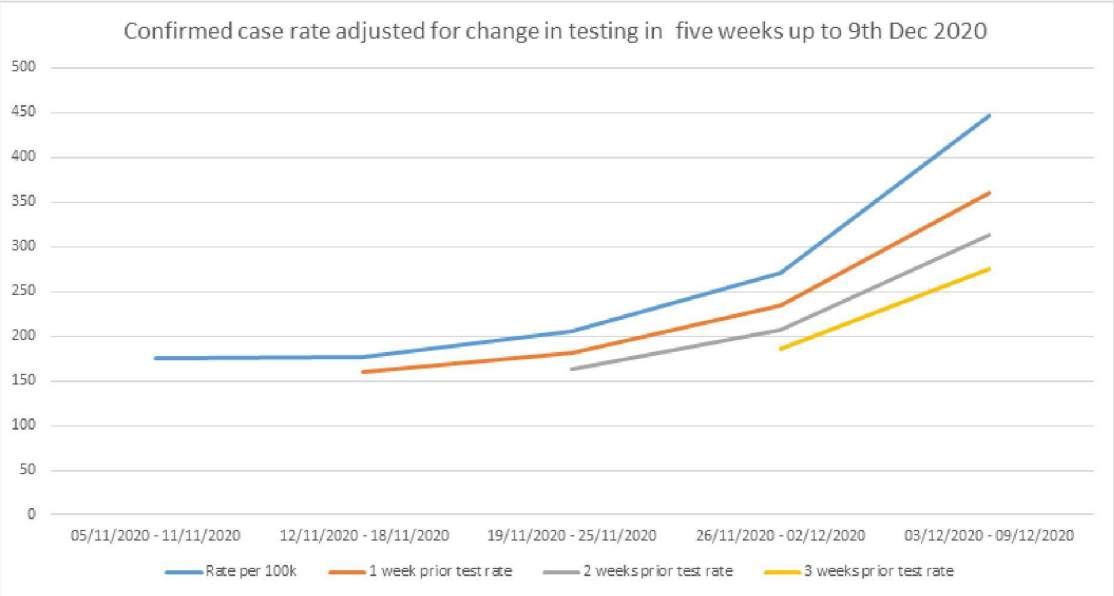
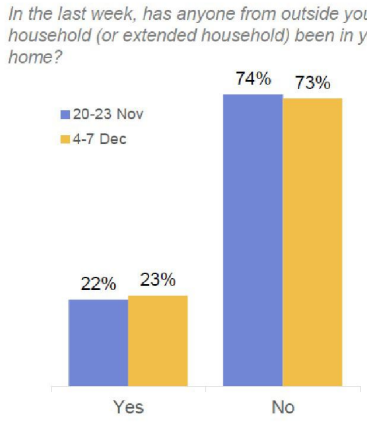


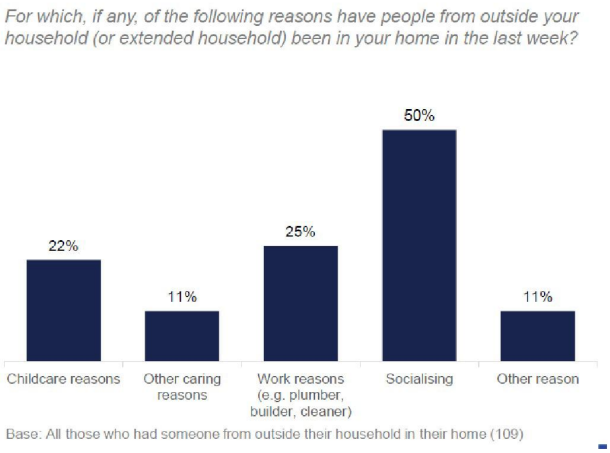
Figure 2. Confirmed case rate adjusted for availability of tests.

3. Recent trends in activity data

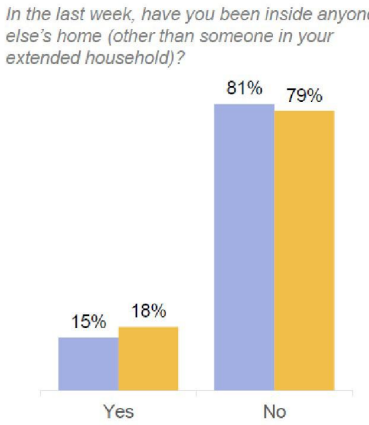
Data are available via Welsh Government commissioned survey research from Ipsos MORI. The most recent IPSOS MORI data[6] for the period 4-7 December for Wales shows further reductions in some categories from the last survey. There were reductions in people making essential trips only and avoiding non-essential travel compared to two weeks ago. It should be noted that this is self-reported adherence and will be affected by individuals understanding of the rules and the circumstances that apply to them. Questions were also introduced recently regarding going into other people's homes. A quarter (23%) reported allowing someone from outside their household/extended household into their home (similar to two weeks ago when first asked) – half of those gave the reason as socialising (also up from a third (32%) two weeks ago).

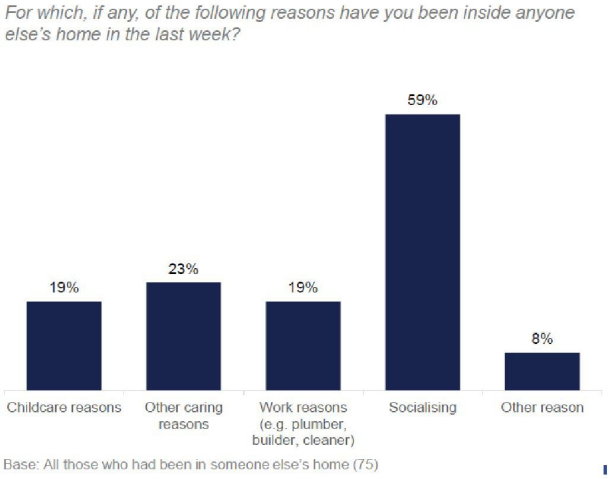
[6] https://gov.wales/survey-public-views-coronavirus-covid-19-4-7-december-2020





One in five (18%) also said they had been in someone else's home in the last week (similar to two weeks ago) with 59% of those saying these had been social visits (up from 44% two weeks ago). Note the relatively small sub-sample size relating to those mixing in their own/others' homes. Given this, the estimates should be interpreted with caution.



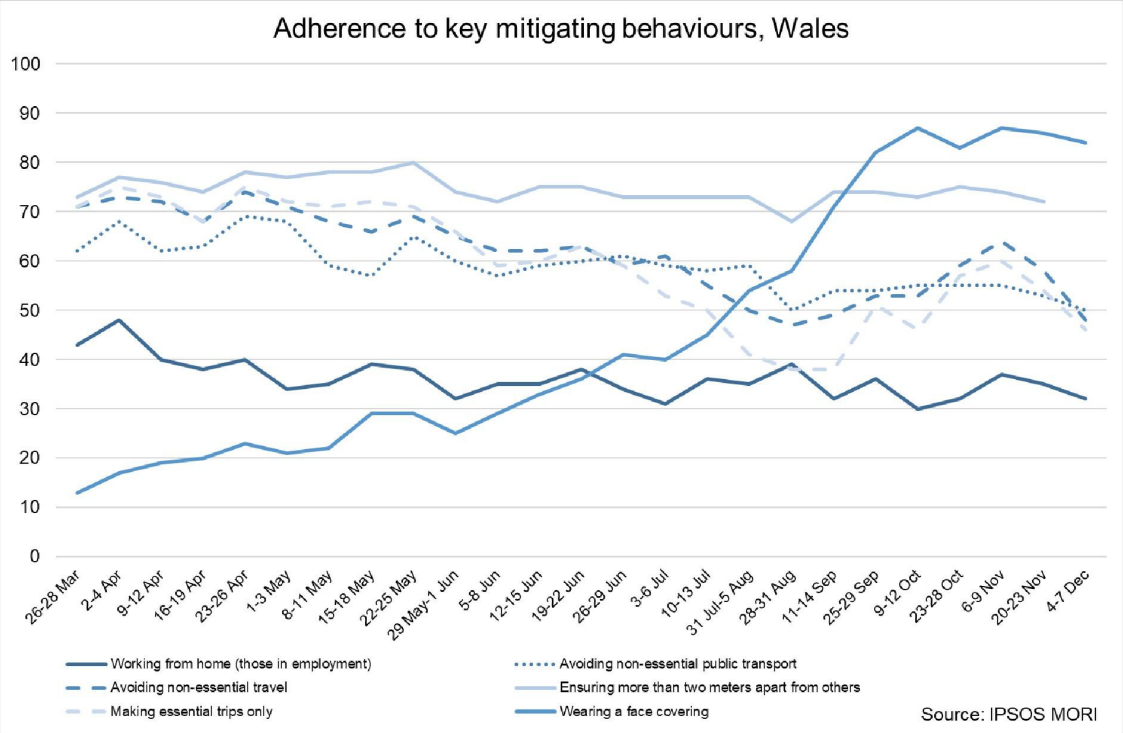


It is also useful to look at public understanding as a potential contributor to adherence, the above sources of data also providing information in relation to the current restrictions in Wales. For example, Ipsos MORI data show around three in four (75%) report being very or fairly confident with their understanding, although this reduces to half (53%) when respondents are asked about understanding among the wider population. Note these proportions are somewhat lower than when the same question was asked with reference to the recent firebreak (85% and 71%, respectively).

One in ten (9%) had experienced one or more COVID 19 symptoms in the last week, though only two in five (44%) of participants had requested a test. These results have been consistent since they were added to the survey two months ago. Again,

note the care needed in interpretation given the small sub-sample size of those reporting symptoms.

Data on a range of other mitigating behaviours included in the Ipsos MORI survey since the spring can be found below.



The latest results from the Public Engagement Survey on Health and Wellbeing during Coronavirus Measures[7] for the period 30 November – 6 December show that one in three (36%) say they understand the current restrictions in Wales 'very well'. A further half (50%) reported understanding the restrictions 'fairly well'. These results are reasonably similar to those presented above, recognising difference in survey methods and timing. The results also show that two in five (39%) report following coronavirus restrictions 'completely' and a further half (50%) reported majority compliance. The percentage reporting 'completely' is lower than the last survey (47%). One in three (35%) reported having people outside their household/permitted extended household come into their house, whilst one in five (21%) reported going into others people's houses.

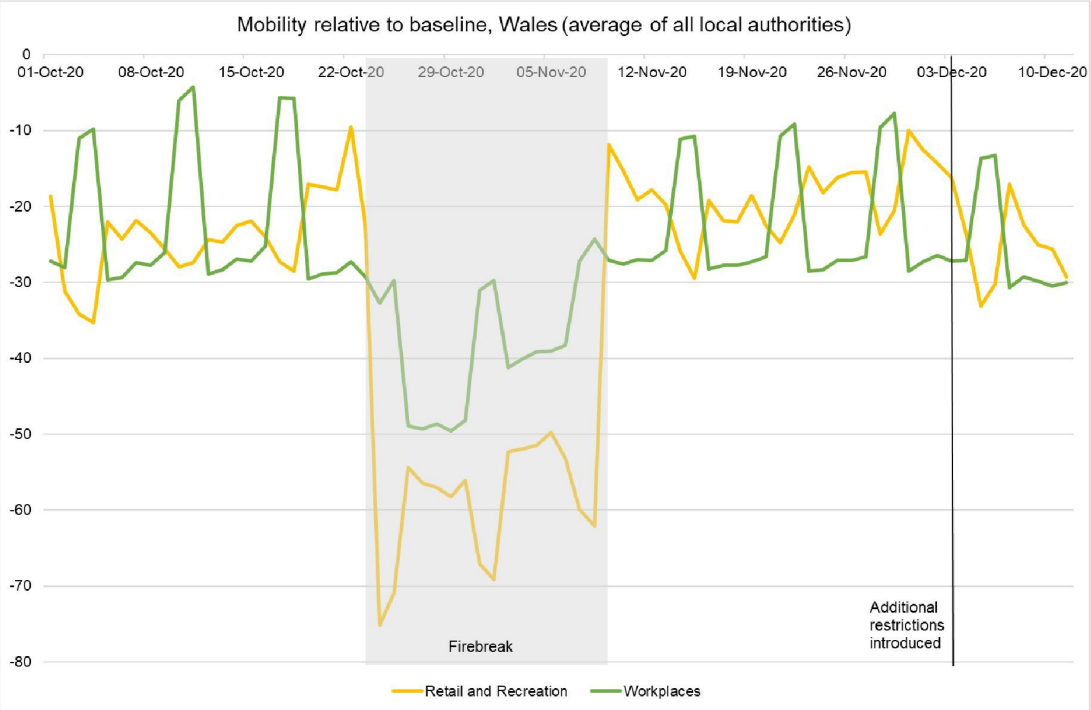
The potential beneficial impacts of higher alert levels, with regard to prevented harm from COVID-19, will depend of the public's willingness, understanding and ability to adopt protective behaviours (e.g. not mixing between households).

[7] https://phw.nhs.wales/news/results-of-latest-public-engagement-survey-from-public-health-wales2/

4. Mobility

Mobility data provides rapid insights into the movement of the population. Whilst the data does not demonstrate adherence, it is a useful measure of population wide response to changes in restrictions. For example in the first week of the firebreak mobility was at its lowest since May/June. The recent introduction of further restrictions on hospitality, the closure of entertainment venues and indoor tourist attractions has also resulted in reduced mobility – but not to the same extent as the firebreak. The percentage of Facebook users staying put (i.e staying at/close to home all day) was 27.3% in the week after those restrictions were introduced, up from 25.6% the week before – but below the 38.1% seen in the first week of the firebreak (or the 33.2% in the second week). Previously very large reductions in mobility have been followed by reductions in cases, as was the case with the first lockdown and the firebreak and to a lesser extent the local lockdowns. It is possible that smaller falls in mobility may not be followed reductions in cases. Other factors not measureable through the mobility data such as household mixing and other social distancing behaviours are not measureable through this data.

Following the introduction of the additional restrictions in hospitality, the closure of entertainment venues and indoor tourist attractions from the 4 December there has been a small reduction in mobility. It is most noticeable in the Google data for retail and recreation which covers places like restaurants, cafes, shopping centres, theme parks, museums, libraries, and movie theatres. It is not possible to determine which of the additional controls has had a greater effect. The reduction in workplaces could be due to establishments closing. The chart below shows the change in mobility for retail and recreation and workplaces by day.



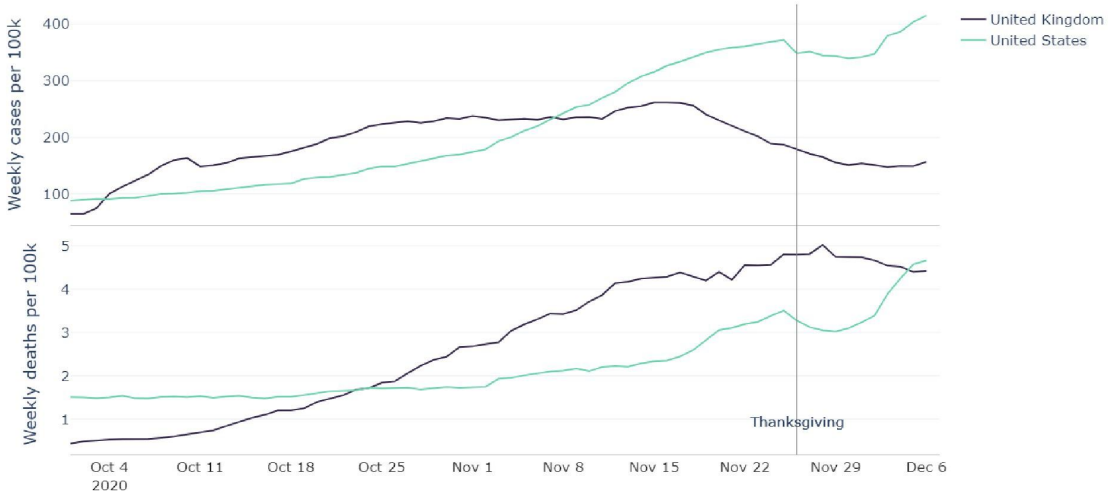
From the current mobility and activity data it is unclear if the current policies underpinning level 3 restrictions will have the desired impact on the growth of the epidemic (**medium confidence**).

5. Christmas relaxation

It is difficult to estimate the likely impact of mixing over the Christmas period of relaxation (23-27 December), however a central assumption of a 10% higher background Rt is made in the policy modelling below, alongside greater intergenerational mixing. Usually the SU model assumes an additional 10% reduced mixing in older people in the background assumptions.

SPI-M-O modelling groups continue to consider the impact of the festive period on transmission of SARS-CoV-2 and the impact of mass testing on secondary infections. Three modelling groups considered mixing during the holidays and suggest there could be changes in the age distribution of infections over a festive period, specifically a slight shift towards a higher proportion of cases in older and more vulnerable age groups. Preliminary analysis from one modelling group suggested that if additional mixing is restricted to three households meeting per day and to the five-day window of relaxations, the total number of days spent mixing may have more of an impact on subsequent prevalence than exclusivity of the bubbles. . Any reduction in the duration of mixing or the numbers who mix will reduce the risk of transmission (**high confidence**). Exclusivity of bubbles was also highlighted as an important factor in limiting risk (**high confidence**). There are important caveats to consider, including that households were assumed to have no symptomatic infectious cases, childcare bubbles were not included and person-to-person transmission only was considered (i.e. not transmission arising from other settings). In addition, this modelling did not account for the adoption of pre-isolation strategies, which would act to further reduce overall risk. Modelling from one SPI-M group indicated that children mix less over the festive period (likely due to Schools closing), whereas other age groups mix more, and especially the 16-25 year old age group.

Lessons learnt from winter celebrations elsewhere point towards a period of increased transmission following an increase in travel and household mixing. Reports suggest that both Thanksgiving in the U.S. (22 November) and Canada (21 October) led to periods of increased epidemic growth. The virus spreads through mixing. If Christmas leads to substantial mixing we see an increase in infection. (**high confidence**).

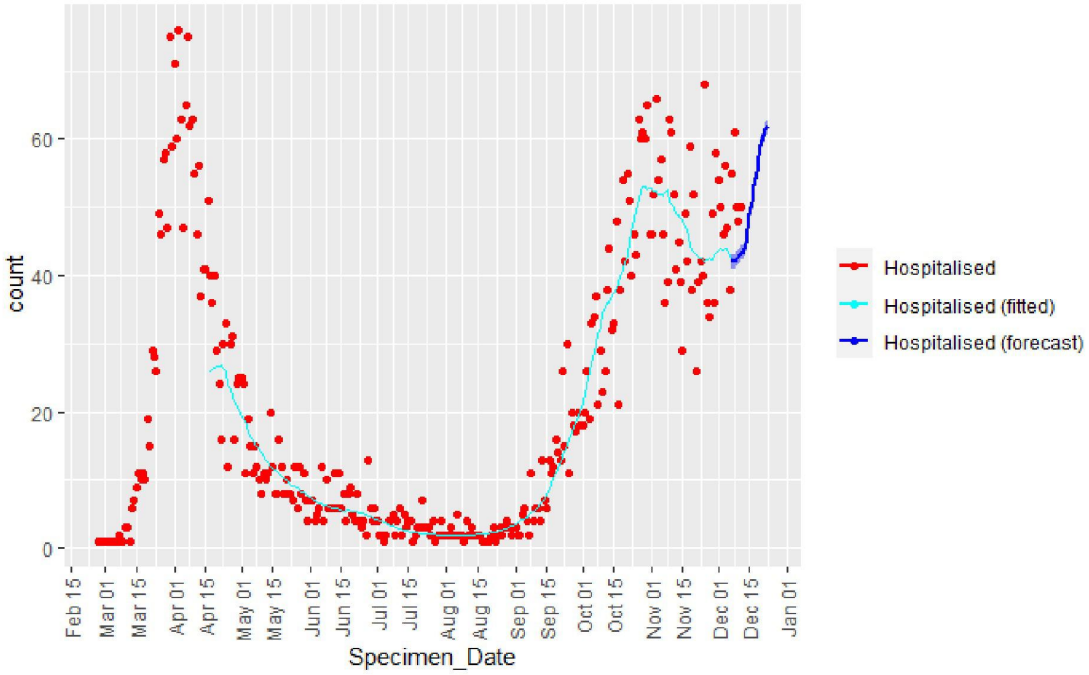


6. Short-term forecasts for hospital admissions

Public Health Wales has developed a short-term regression model to predict hospital admissions in the following 12 days from current daily case numbers.

A lagged log-linear multi-lag regression model was used to predict hospitalisations from non-hospitalised cases. Only confirmed community acquired hospitalisations were included defined as a positive test results being obtained no more than 2 days after admission. The predictor variables were the time lagged non-hospitalised case counts and the outcome variable was the hospitalisation count. Both counts were log-transformed and smoothed prior to model fitting. Time lags applied to the non-hospitalisation counts covered a window of 12 to 50 days (in 1 day increments, covering a total of 38 days). This window was identified as optimal based visual inspection of multiple model fits with lag windows ranging from 1 to 50 days. The lower limit of this window being the number of days we can forecast (the most recent two days of data were excluded due to incompleteness). The entire time series of non-hospitalised case counts were used to fit the model, except the first 50 days which could not be fitted. The model was then used to predict hospitalisation counts up to 12 days into the future (up to 23th Dec). The model covers all of Wales and all age groups.

The plots shows data for hospitalisation counts (red), the prediction made by the model (light blue) and the forecast with error margins (dark blue).



This model predicts a rise of daily hospital admissions of around 50%, from 40 (current) to 60 per day, by 23 December.

7. Modelling assumptions

The Swansea University model was used to consider the impacts of alert levels. The assumptions that informed the model are listed below. The model is age stratified so hospital admissions increase when there is more transmission in older people.

The background Rt value for Wales, as measured by the fit of the model on 1st December, is 1.3 – in reality this is likely to fluctuate. This assumes some long-term level of social distancing because the R0 for covid-19 is over 2.5, and there is still a large susceptible population. The background Rt is a national figure where regional variation, both higher and lower, exists. A full month has passed since the Firebreak ended on the 9 November. The numbers of cases, admissions and deaths since then are consistent with a return to pre-firebreak transmission rate, or slightly lower. Since then there has been an incremental increase in prevalence, but not an immediate rebound. If the firebreak had caused a rebound to a relatively higher Rt value, it would likely have been noticed by now in greater case and admission levels. The maintenance of consistent, or slightly lower Rt values, may have been assisted by peripheral impact of the Lockdown in England and bordering counties; however, it is difficult to assign causality, and uncertainty in current Rt remains.

We consider 3 intervention scenarios, with assumed approximate Rt values defined in comparison to the background Rt estimate in the post firebreak period of 1.3 on the 1st December. Rt levels are guided by experience of the analysis of Tier effects in England, and of the estimated large effect of the firebreak in Wales.

Alert Level two (medium risk) – modelled Rt 1.15 for period of level - some impact on growth of epidemic, not enough to bring the Rt value below 1. Includes additional controls to limit the spread of coronavirus. These may be complemented by more targeted local actions to manage specific incidents or outbreaks. (**low confidence**)

Alert level three (high risk) – modelled Rt 0.95 for period of level - -represents the strictest restrictions short of a firebreak or lockdown. This responds to higher or rising level of infections where local actions are no longer effective in containing the growth of the virus. (**low confidence**)

Alert level four (very high risk) – modelled Rt 0.85 for period of level - Restrictions at this level would be equivalent to the firebreak regulations or lockdown. These could either be deployed as a preventative firebreak or as a lockdown measure. (**high confidence**)

During the first firebreak schools were closed for the first week (half term), primary, years 7 and 8 returned in the second week with at home blended learning for older age groups during the second week (years 9-13 and FE). During the first firebreak, multiple analyses have shown that Rt may have dipped to a as low as 0.7 to 0.75 during the first week, making it one of the most effective measures in reducing transmission in the UK since the first lockdown.

For the purpose of this paper, health and NHS impacts are calculated to the end of February 2021 for consistency. It should be noted that the background scenario leads to fewer cumulative deaths, hospital and ICU admissions in this analysis (2,422, 7232, 986) compared the recent analysis (2,516, 8,569, 1,028) over the same period[8]. This is in part due to a shorter period of Christmas mixing assumed in this paper, in line with the UK wide announcement and the stochastic nature of the model[9]. It should also be noted that the background scenario is not fully unmitigated, as this would require a scenario with R0 ~ 2.5, and would result in a great deal more events due to the exponential nature of the epidemic process. (**high confidence**)

The continued measurement and analysis of the impacts of different levels will be important to guide future restrictions and relaxations of measures.

Finally, the models assume that the NPIs have the desired impact on restricting or reducing mixing and transmission of the virus between people. There are a great many variables that could influence transmission that are not accounted for in these models (e.g. public compliance with regulations, such as mixing between household in residential settings). In the future there may be an opportunity to include models for different levels of adherence to NPIs.

a. Modelling Scenarios

Pre-Christmas: 4th to 22 December

[8] https://gov.wales/sites/default/files/publications/2020-12/technical-advisory-group-statement-regarding-non-pharmaceutical-interventions-in-the-pre-christmas-period.pdf
[9] https://www.ispor.org/heor-resources/good-practices-for-outcomes-research/article/model-parameter-estimation-and-uncertainty-analysis

L1 = continue with transmission at post firebreak levels Rt 1.3
L2 = Level 2 intervention Rt 1.15
L3 = Level 3 intervention Rt 0.95
L4 = Level 4 intervention Rt 0.85

Post- Christmas: 28th Dec to 28 Feb

L1 = continue with transmission at post firebreak levels Rt1.3
Level 4 (Rt0.85) 2 weeks and Level 3 (Rt 0.95) 6 weeks
Level 4 (Rt0.85) 4 weeks and Level 3 (Rt 0.95) 4 weeks

8. Modelling Results

The Figures below show the modelled effects of 12 different pre-Christmas and post-Christmas policy scenarios. Each of the scenarios can be read from left to right, from the recent date of 4 December, to the start of the period of reduced restrictions 23 December, up until the end of the post-Christmas period of reduced restrictions 28 December. The results do not extend after the 28 February, conditions thereafter could significantly change the modelled outcomes (e.g. relaxation would increase transmission). The red section of the line indicates additional mixing during the Christmas period, estimated to result in a further 10% additional transmission.
For example, in the first 'No intervention' scenario, where the background Rt is assumed to be 1.3 (4 December), the cumulative number of COVID-19 patients requiring hospital and ICU beds is estimated to be 7,232 and 986 respectively, with 2,422 deaths.

Christmas mixing is likely to lead to a measurable increase in NHS demand and reduction in NHS and social care capacity in the New Year (high confidence).

In the fourth row 'Level 2' pre-Christmas intervention, which is estimated to reduce Rt down from the background Rt of 1.3, but only 1.15, the cumulative number of hospital and ICU beds is estimated to reduce to 6,066 and 827 respectively, with 2,034 deaths.

In the seventh row 'Level 3' pre-Christmas intervention, which is estimated to bring Rt down from the background Rt of 1.3, to below 1 (0.95), the number the cumulative number of hospital and ICU beds is estimated to reduce to 4,420 and 603 respectively, with 1,514 deaths.

The maximum number of reductions in the cumulative number of hospital and ICU beds would result from both pre and post-Christmas level 4 conditions and could prevent the loss of 1,400 deaths, 670 ICU beds and five thousand hospital admissions.

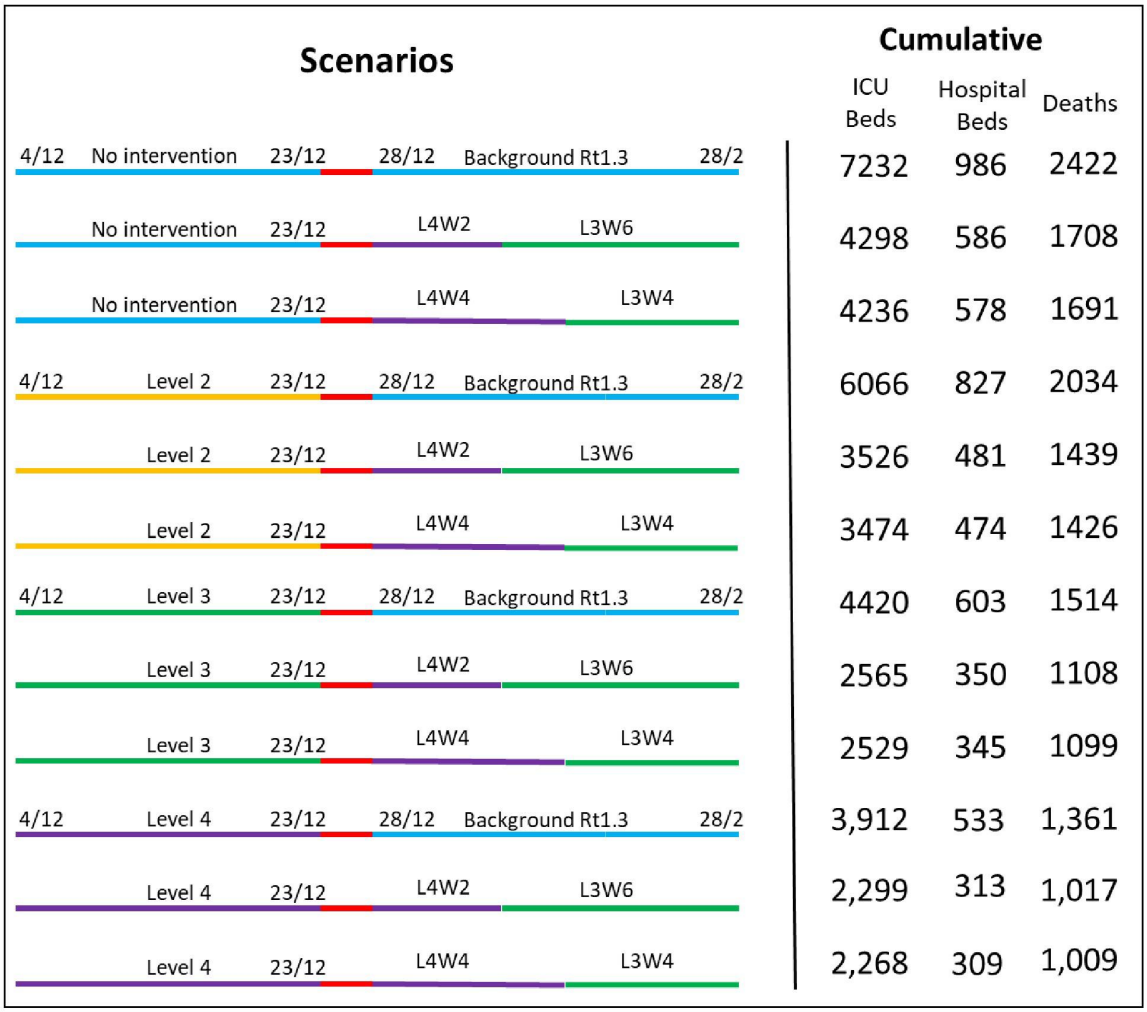


Figure 3. Modelling scenarios from 2 Dec 2020 to 28 Feb 2021, with cumulative hospital and ICU occupancy and deaths. Source: Swansea University Policy Model

9. Behavioural context of policy modelling

The analysis presented in the paper assumes there will be population adherence to the restrictions in place that underpin the modelled policy scenarios. However, as set out in the recently published Coronavirus control plan, the current picture with regard to behaviours is complex[10]. It is important to recognise many people have made great efforts to adhere to the restrictions in place throughout the course of the pandemic and continue to do so[11]. There are numerous potential explanations for non-adherence, such that simply looking at the actions of individuals when attempting to understand increasing rates of infection is not helpful or justified. Evidence from various sources suggests the majority of people continue to report practising key personal protective behaviours, including social distancing and hand hygiene. However, these data sources also provide evidence that indicates a degree

[10] https://gov.wales/coronavirus-control-plan-alert-levels-wales
[11] https://blogs.bmj.com/bmj/2020/10/26/the-concept-of-fatigue-in-tackling-covid-19/

of non-adherence elsewhere that needs to be considered, notably in terms of mixing with people not in the same extended household, alongside some misunderstanding of the risks of transmission associated with meeting others.

Public Health Wales data also provide a sense of people's plans for the festive period, with two in three (66%) reporting plans to have visitors to their home or visit other people's homes over the period 23-27 December and just under half (45%) intending to form a Christmas bubble. Around half (53%) reported changes being made to restrictions over Christmas being about right, while 31% would prefer tighter restrictions and 15% more relaxed restrictions. It should be noted, however, that in light of the continued growth in infections since these data were collected, alongside increasing public debate about the proposed arrangements[12], it is possible these proportions may have changed. With the increased likelihood of social mixing and rates of transmission, it will be as important as ever to mitigate the impact as far as possible[13].

10. Preliminary Health Economic analysis of scenarios

A preliminary economic analysis of scenarios was carried out. This included estimated costs of covid-19 hospital and ICU admissions, a conservative estimate of the cost of covid-19 deaths, estimates of quality-adjusted life years (QALYs) lost from Covid community cases, covid hospital admissions and deaths, and a very conservative (low end estimate) of the QALYs lost from long covid. The true costs and QALYs lost from COVID-19 are likely to be higher than these estimates as they do not include post-hospital rehab, the likely full implications of multi organ damage, productivity or informal care costs. The indirect opportunity costs for people whose NHS treatment is delayed because of treating COVID-19 patients is not included. There are likely to be lots of complex dynamic effects that are difficult to predict. Even for the costs and QALYs we have included, there is likely to be a large degree of uncertainty. The costs and QALYs are estimated for the population as a whole, however we know that direct covid harms are highly likely to be experienced more by people of low socioeconomic position, but that indirect harms are also likely to be unequally distributed as well.

The net cost savings plus value of QALYs gained was combined with estimates from Welsh Treasury of potential GVA loss from different types of restrictions. This gives an indication of net benefit associated with different scenarios – however this is likely to be a very incomplete and uncertain analysis but is presented here in case it should aid decision making despite this uncertainty.

Most of the scenarios have a negative net monetary benefit in this analysis – the GVA impacts are bigger than the value of health benefits. However there are other costs and benefits that are only partially accounted for. The estimate of "GVA" impacts is highly uncertain, but it is highly likely the GVA loss would be larger than

[12] https://www.bmj.com/content/371/bmj.m4847.full.print
[13] https://www.gov.uk/government/publications/emgspi-b-mitigating-risks-of-sars-cov-2-transmission-associated-with-household-social-interactions-26-november-2020

this. In addition to this GVA loss there will of course be the wide range of other socio-economic harms which are even harder to quantify.

Table E1. Cost savings and QALYs gained compared with Level 000001 where Rt stays at around 1.3. Results from 1st Dec - 28th Feb. All scenarios assume relaxing of restrictions from 23rd - 27th December. All figures reflect a range of assumptions and are therefore heavily rounded.

Scenario	Description	HC cost savings (m)	QALYs gained	Incremental net monetary benefit valuing QALYs at £60k (m)	Incremental net monetary benefit valuing QALYs at £30k (m)	"GVA" loss from 15 December (m)	Net value (m) with QALYs at £60k
L1_L1	Level 1 from Dec - Feb (Rt around 1.3)- **comparator**	£0	0	£0	£0	£0	£0
L1_L42wL36w	Level 1 until 22nd Dec, level 4 for 2 weeks from 28th Dec, then level 3 for 6 weeks	£30	6,000	£360	£200	-£500	-£140
L1_L44wL34w	Level 1 until 22nd Dec, level 4 for 4 weeks from 28th Dec, then level 3 for 4 weeks	£30	6,000	£370	£200	-£600	-£230
L2_L1	Level 2 until 22nd Dec, level 1 from 28th Dec	£10	3,000	£190	£100	-£60	£130
L2_L42wL36w	Level 2 until 22nd Dec, level 4 for 2 weeks from 28th Dec, then level 3 for 6 weeks	£40	8,000	£490	£260	-£550	-£60
L2_L44wL34w	Level 2 until 22nd Dec, level 4 for 4 weeks from 28th Dec, then level 3 for 4 weeks	£40	8,000	£500	£270	-£650	-£150
L3_L1	Level 3 until 22nd Dec, then level 1 from 28th Dec	£30	7,000	£440	£240	-£150	£290
L3_L42wL36w	Level 3 until 22nd Dec, level 4 for 2 weeks from 28th Dec, then level 3 for 6 weeks	£50	10,000	£650	£350	-£650	£0
L3_L44wL34w	Level 3 until 22nd Dec, level 4 for 4 weeks from 28th Dec, then level 3 for 4 weeks	£50	10,000	£660	£350	-£750	-£90
L4_L1	Level 4 until 22nd Dec, then level 1 from 28th Dec	£30	8,000	£520	£280	-£300	£220
L4_L42wL36w	Level 4 until 22nd Dec, level 4 for 2 weeks from 28th Dec, then level 3 for 6 weeks	£50	11,000	£700	£370	-£800	-£100
L4_L44wL34w	Level 4 until 22nd Dec, level 4 for 4 weeks from 28th Dec, then level 3 for 4 weeks	£50	11,000	£700	£380	-£900	-£200

11. Conclusions

As modelled previously, and now observed, we are currently in a period of sustained epidemic growth. This is due to relaxation of restrictions following the first firebreak and more population mixing. The scenarios within this paper consider the potential impacts of a pre and post-Christmas levels to control growth of the epidemic. As discussed previously earlier intervention prior to a period of exponential growth (e.g. firebreak) has greater impacts in the short term than interventions after epidemic growth has been observed. Short-term forecasts indicate a likely 50% increase in daily hospitalisations by 23rd December, based on current case trends.

This policy modelling analysis is helpful as it illustrates the potential benefits in terms of reduction in deaths, NHS occupancy and ICU bed for levels 2, 3 and 4 scenarios in the pre and post-Christmas period. Unlike the previous pre-Christmas analysis, this paper only considers one background Rt (1.3). As shown in the earlier paper, an increase in background Rt of 0.1 can have significant effects on all outcomes. Even so, this analysis shows that if realised, the impact of level 3 or level 4 restrictions in the pre-Christmas period could prevent the loss of significant numbers of lives from COVID infection.

Reduction in epidemic growth from levels 2, 3 or 4 in the pre-Christmas period could reduce the maximum occupancy level of both hospital and ICU beds. Levels 3 and 4 could reduce hospital demand sooner than level 2.

The two post-Christmas scenarios of either two or four weeks in level 4, followed by either 6 or 4 weeks level 3, respectively, yielded strikingly similar results, though it should be noted that the assumed Rt was similar in both cases. Both scenarios could

result in similar reductions in deaths and hospital admissions. A further scenario in between Rt = 0.95 and 1.15 could be instructive to investigate. As described earlier there is greater confidence in the Level 4 reduction in Rt as this has been observed in the firebreak, until further data is collected on the Level 3 restrictions in Wales it would not be advisable to use the modelling to set dates for transitioning from Level 4 to Level 3.

Given the significant changes in population mixing and behaviours in the pre and post-Christmas period (e.g. return of university students) alongside new and existing restrictions (e.g. blended learning, hospitality and Christmas event closures) there is a high degree of uncertainty in the outcomes of the models. The observed data trends may be quite different from those that have been modelled. In particular, the public response to restrictions is difficult to predict, both overall and in the likely heterogeneity between people and places. Additionally, the recent identification of a variant SARS-CoV-2 may change the transmission dynamics. However, to date the models have provided a very clear and reliable indication of the epidemic's behaviour in Wales. Evidence from other winter celebrations (e.g. Thanksgiving) suggests that a period of household mixing could increase growth of the epidemic. Polling data also suggest a considerable number of families in Wales will meet with other households to celebrate Christmas.

While the immediate post firebreak Rt value is fairly well defined, the impacts, if any, from very recent restrictions on the growth of the epidemic are not yet clear. From past NPIs, changes in growth rates were observed after 10 days, one clear generation period. Hence, at present, all model scenarios track the observed data reasonably well and we cannot yet distinguish between them. Wales could realistically be on any of the 4 main trajectories. If the restrictions currently in place impact on Rt this could be revealed in the trends in the data observed from the week commencing 14 December.

This tracking can be used not only to identify the more likely scenarios, but also inform how different measures could have an impact in the post Christmas period. This tracking is especially important to determine whether level 3 restrictions are sufficient to reduce Rt below 1. If this is revealed not to be the case, then the small differences in the model scenarios between level 3 and 4 would be amplified, with level 3 scenarios having a reduced impact.

The closure of schools for a period of blended learning could have positive impacts on Rt if people do not mix between households in the run up to Christmas. Also, if behaviours change and more symptomatic people take tests and isolate for 10 days on symptoms, this could have a significant impact on the epidemic in Wales. From Ipsos data fewer than half of those displaying one of the three recognised symptoms seek a test. Many people who test positive have no symptoms at the time of testing.

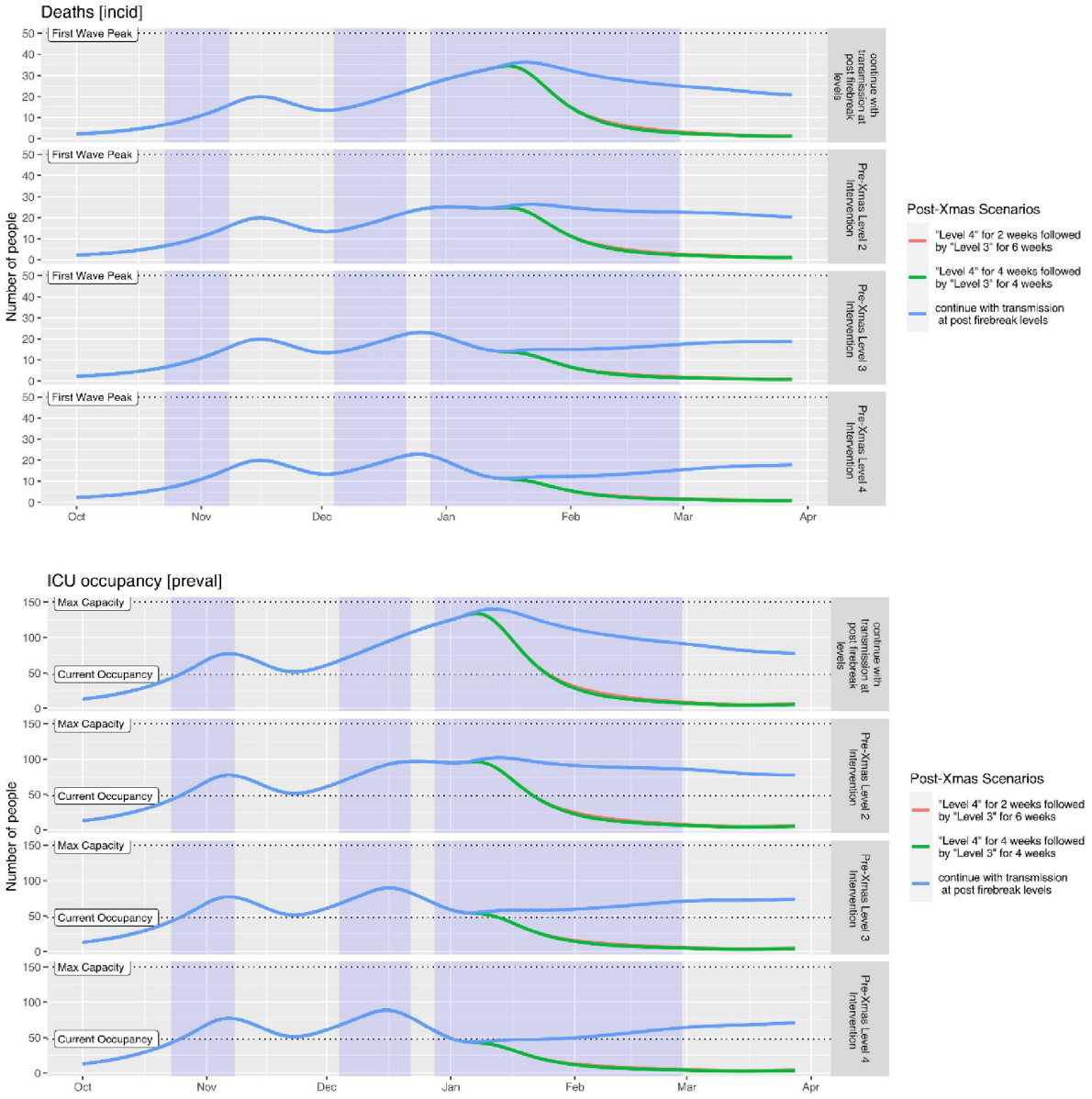
A 10 day period of pre-isolation before meeting older family member would be one way of reducing risk of transmission between households.

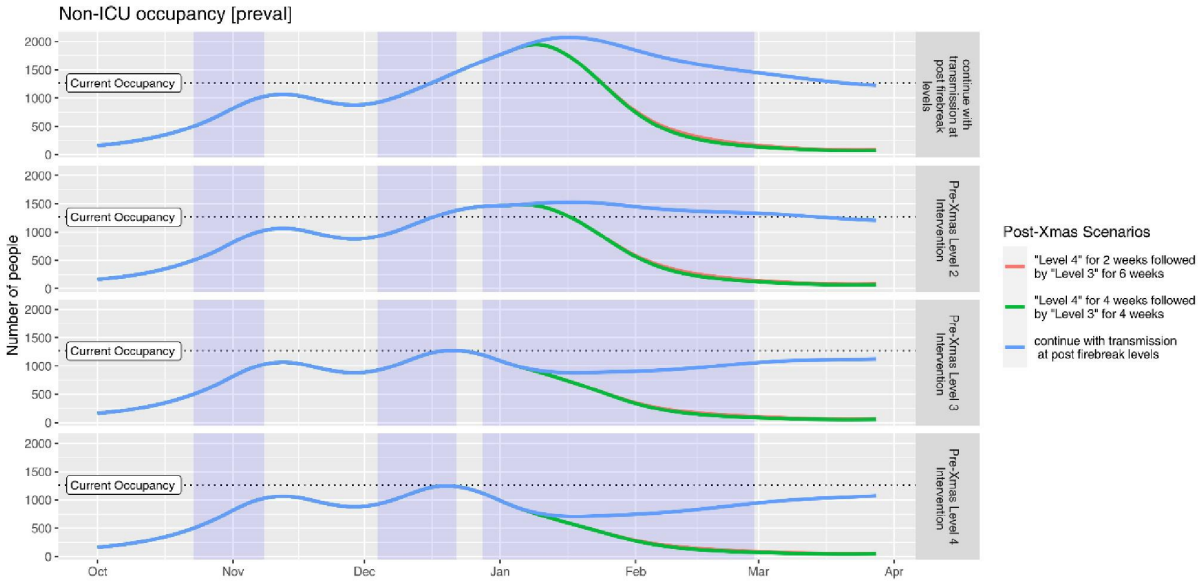
Immediate level 4 type restrictions in the pre and post Christmas period would likely lower the epidemic's growth and associated health impacts. Alongside more risk communication about 'not mixing' additional measures that could be considered include greater working from home, avoidance of mixing in Christmas sales, stay local advice. In all scenarios there is an expected period of epidemic growth post-firebreak that is reflected in the data. Given this background level of transmission will inevitably require restrictions then it should be considered at what level of prevalence is COVID-19 to be controlled? It is expected in the model scenarios that the later, or less effective measures will all result in a sustained period during which hospital occupancy is above current levels.

The current growth in the epidemic combined with Christmas mixing is likely to lead to a substantial increase in NHS demand and reduction in NHS and social care capacity in the New Year (high confidence).

The preliminary health economic analysis suggests that long periods of level 4 may cause considerable socioeconomic harm which counterweights the health benefits. This suggests that any move to level 4 should be kept under review, for instance weekly, and considered in the context of socioeconomic harms as well as indicators of covid transmission and related harm. However, the assumed benefits of level 3 would have to be confirmed (by monitoring the pre-Christmas period), and there would need to be considerable confidence that the Rt value could be maintained below 1. As we build up a better picture of the harms associated with covid-19, an assessment of the balance of costs and benefits may change. In particular, more evidence around the prevalence and typical syndrome for long covid may change the estimated magnitude of benefits from preventing virus transmission.

APPPENDIX. COMPARISON OF MODELLED SCENARIOS AND IMPACT ON TRENDS IN DEATHS, ICU OCCUPANCY AND NON-ICU OCCUPANCY.




Non-ICU occupancy [preval]
Number of people
2000
1500
1000
500
0
Current Occupancy
continue with transmission at post firebreak levels
Pre-Xmas Level 2 Intervention
Pre-Xmas Level 3 Intervention
Pre-Xmas Level 4 Intervention
Oct
Nov
Dec
Jan
Feb
Mar
Apr
Post-Xmas Scenarios
"Level 4" for 2 weeks followed by "Level 3" for 6 weeks
"Level 4" for 4 weeks followed by "Level 3" for 4 weeks
continue with transmission at post firebreak levels