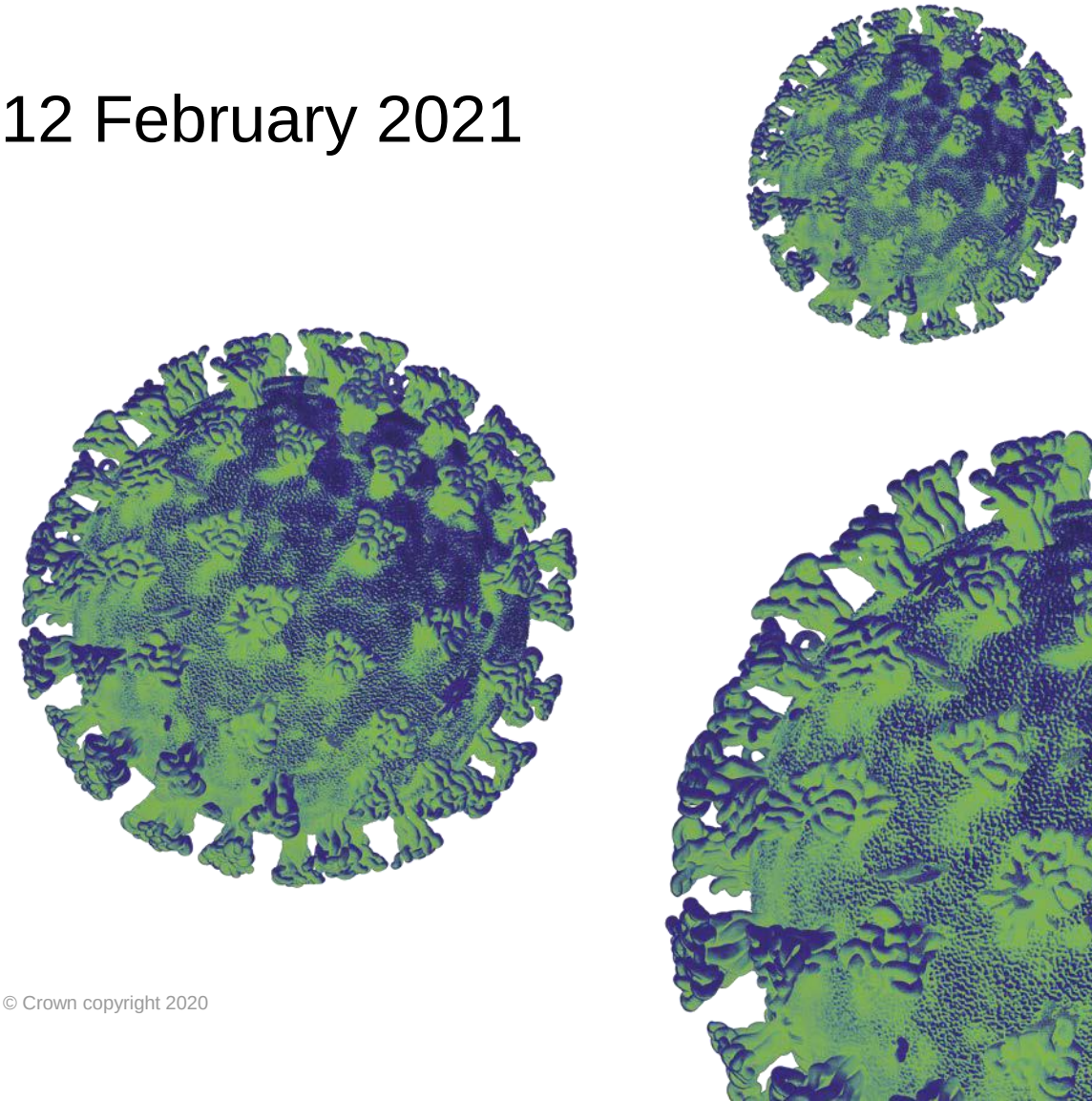
Llywodraeth Cymru
Welsh Government

Technical Advisory Group

Policy modelling update

12 February 2021



Policy modelling update 12th February 2021

Welsh Government COVID-19 TAG Policy Modelling Subgroup

1. Summary

- This paper explores the results of policy modelling carried out by Swansea University to understand possible futures around the coronavirus pandemic in Wales. It suggests a new reasonable worst case (RWC) and most likely scenario (MLS). The modelling results suggest a third and fourth wave of the pandemic is likely if mixing increases. This is consistent with modelling from SAGE and SPI-M.
- Overall the modelled scenarios suggest that a gradual approach to schools returning to face-to-face learning should be achievable without producing a resurgence of the virus, if other restrictions are maintained.
- Opportunities to release other restrictions on top of schools reopening face-to-face learning may be limited if the new variant increases transmission more substantially, for instance if the increase in Rt is around 0.6 compared to previous 'wild type' variants.
- Key uncertainties are around the impact of schools on transmission, the level of adherence to social distancing and other precautions, the impact of vaccines on transmission, and the impact of new variants.
- As vaccine roll out continues, the horizon looks more positive in terms of expecting lower numbers of COVID-19 deaths than have been observed in November 2020 – January 2021.
- The direct economic consequences of COVID-19 continue to be significant in terms of healthcare costs and lost QALYs, particularly if Wales continues to see a substantial number of COVID-19 deaths.
- Continued surveillance of infections in schools, effectiveness of vaccines, and impact and spread of variants is crucial in helping to understand what trajectory Wales is following in terms of the pandemic and in fine-tuning future policy formulations to deal with the pandemic while reducing other health, educational and socioeconomic harms and inequalities.

2. Objective

The objective of this paper is to examine scenarios for COVID-19 in Wales from February-June 2021 which include different assumptions around the impact of new variants, impacts of vaccinations, and different levels of restrictions (including scenarios for different levels of face-to-face learning in schools) as well as individuals' ability to continue to follow restrictions and to continue to adopt protective behaviours (labelled in this paper as 'adherence'). It also suggests a new Reasonable Worst Case and Most Likely Scenario.

3. Background

Wales went into level 4 restrictions on 20th December 2020 following the identification of the new Variant of Concern 202012/01, increasing rates of confirmed COVID case rates, and pressure on the NHS.[1] Over 20% of the population of Wales have now received one dose of a vaccine, including over 86% of over 80 year olds. This is expected to lead to a reduction in hospitalisations and deaths in vaccinated groups, if transmission does not increase above the level it has been previously.

So far during 2021, schools across Wales have been providing remote learning to pupils, except for vulnerable children and the children of critical workers. There is good evidence that the impacts on children of not attending school are significant in terms of education as well as physical and mental health, and Welsh Ministers have indicated that they intend for schools to be the first to re-open following the lockdown.[2]

Current case rates are likely to drop below 100 confirmed cases per 100k (7 day rolling) this week, and positivity has also fallen below 9% after peaking at over 25%. However, ONS prevalence is still above 1% although may have started to fall slightly after plateauing at around 1.4% for around a month. ONS antibody prevalence was 11.2% in January 2021, indicating that a high proportion of people have had the virus – the true proportion since the pandemic began may be 20-30% of the population, which means there may be substantial levels of natural immunity.

4. Evidence Summary

Current evidence from SAGE and SPI-M and ECDC suggests that the new variant VOC 2020/12/01 (B117 or Kent variant) may have increased transmission with a relative Rt advantage of 0.4 to 0.7.[3] This may be seen particularly when Rt is above 1, which means that Wales might see more rapid acceleration in cases as restrictions are released. Analysis by Public Health Wales suggested that it took longer for the Rt of the new variant to move below 1 in January 2021 than for previous wild type variants. There is also concern about other new variants which have E484K mutations, and around the South African variant.

A recent SPI-M consensus statement around schools reopening suggests that schools may add from 10% to 50% to the Rt number when opened fully, with most models suggesting transmission and susceptibility is lower in teenagers than adults, and lower in younger children than in

[1] Written Statement: Alert level four restrictions
[2] Technical Advisory Group: considerations for changing the operation of schools to allow more face-to-face learning, 5 February 2021 ; Minister for Education, Open letter to headteachers, 5 February 2021 .
[3] https://www.ecdc.europa.eu/en/publications-data/covid-19-risk-assessment-spread-new-sars-cov-2-variants-eueea

teenagers.[4] However primary schools returning to face to face teaching means that parents may also be more likely to return to work or have more contacts.

Recent SPI-M papers have suggested there is a very real threat of a third wave of COVID-19 even with the vaccination programme being relatively successful, particularly in terms of hospital admissions where more than a quarter are in younger age groups. If vaccine uptake is less than 100%, and the vaccine is less than 100% effective, and the R0 for new variants is around 4, then a loosening of restrictions could lead to a rapid acceleration of virus transmission and an increase in pressure on the NHS. However, it may be that seasonality of the virus and outdoor mixing will add to the factors that favour lower transmission as we move towards the Summer.

The modelling in this paper aims to look at the impact of different scenarios for a return to face-to-face learning in schools between February and June 2021, including comparing a 'slow step up' to a full return to classrooms with a 'fast step up', when combined with other uncertainties, particularly around the efficacy of the vaccine, the impact of new variants on the transmissibility of the virus, the levels of adherence to restrictions and to reducing close contacts in general, and the wider restrictions in place for Wales during the period. The modelling attempts to estimate the likely impacts of these different scenarios and underlying assumptions for cases, hospitalisations, ICU occupancy and deaths in Wales. The data outputs shown in this paper currently run until end of June / beginning of July.

5. Updated modelling scenarios from Swansea University

Swansea University produced a range of modelled scenarios (576 in total) for the time period up to end of June 2021. The SU model is based on the dynamic transmission model COVID-UK, prepared and published by Davies et al at the Centre for Mathematical Modelling of Infectious Disease (CMMID, London School of Hygiene and Tropical Medicine). Full details of the model are available in https://github.com/cmmid/covid-uk.

Briefly, the COVID-UK model structure is:

- Stochastic, tracking up to 66.4 million people at the UK level over time steps of 6 hours, hence the output is probabilistic and a distribution of outcomes can be obtained from a fixed set of parameters.
- Age-structured into 16 age bands, with demographics provided at the local authority level.
- There are 6 Disease states: Susceptible (S), and after successful transmission Exposed (E) but not infectious. After a latent period approximately 50% of infectious individuals are asymptomatic (Is), while the rest enter a pre-clinical, but infectious state (Ip) followed by a

[4] SPI-M-O, Statement on relaxation of NPIs and the re-opening of schoolsg, 27 January 2021, and reaffirmed in SPI-M-O, Consensus Statement, 10 February 2021 ; see also https://cmmid.github.io/topics/covid19/reports/comix/Comix%20Weekly%20Report%2043b-%20Effect%20of%20school%20opening.pdf

clinical symptomatic infectious state (Ic) followed by isolation and recovery (R). The waiting times in each state are gamma distributed.

- Age-specific hospitalisation rates, fatality rates, and duration of hospital stay, estimated from the early stages of the pandemic are used to monitor the impact of the epidemic and health service capacity.
- A detailed description of the transmission between individuals based on measured social mixing patterns provided by the POLYMOD study. Contact matrices are provided for home, school, work and community, all stratified by age band.
- The force of infection at time t for an individual is then given by the product of the susceptibility to infection upon contact and the number of contacts per day (all age specific).
- Scenarios are explored by scheduling changes to the number of contacts expected in each age group, and how this varies over time, for example when schools open/close, when lockdown measures dramatically decrease contacts, and when relaxation gradually increases the contact rate.
- Following modifications to allow for flexible initial conditions and flexible scheduling of combinations of interventions over long time periods, the version of the model being used is available on Swansea University's code repository (https://github.com/sa2c/covid-uk).

The key considerations which vary between the different scenarios which have been modelled are as follows.

Level of restrictions in place across Wales

The Welsh Government has set out four alert levels for public response to threat levels, that require measures designed to control the spread of the virus and protect people's health.[5] Wales has been in Level 4 restrictions since 20 December 2020. The scenarios modelled in this paper assume one of the four scenarios for the level of restrictions that would be in place across Wales during this period:

- Level 4 until the end of February, then Level 3 until the end of June
- Level 4 until the end of February, then Level 2 until the end of June
- Level 4 until the end of March, then Level 3 until the end of June
- Level 4 until the end of March, then Level 2 until the end of June

This assumption is set out above each scenario.

Effectiveness of vaccines

The scenarios modelled in this paper all set out a range of possibilities for how effective vaccine is against clinical events and transmission: either 60%, 75%, or 90% effective. This is represented in

[5] Coronavirus Control Plan: Alert levels in Wales (14 December 2020).

each figure by a band representing the lower, central, and upper estimates for cases, hospitalisations, ICU occupancy and deaths in each model.

Levels of 'adherence'

Each of the scenarios modelled in this paper is presented twice, side-by-side. The 'adherence' levels in these scenarios are modelled on the assumption of both:

- 'Good adherence' (where 'adherence' is at a level equivalent to what was seen during the autumn firebreak in Wales)
  'Low adherence' (where 'adherence' is at a level equivalent to what was seen during December 2020 in Wales)

In this analysis, low or good adherence is in reference to individual's numbers of contacts, which may change as a result of motivation to comply, but also depending on ability to comply, for instance if workplaces require them to return to working on-site. So it is not only about adherence with the rules, but also how many contacts people are having which may still be within the rules. We know that so far in the pandemic, adherence has been high and there has been a huge collective effort to reduce contacts, take precautions (such as meeting outside, wearing face covering, handwashing, etc) and control the virus. In these scenarios, good adherence is similar to the reduction in contacts seen in the October 2020 firebreak, while poor adherence is more like the number of contacts seen in December 2020.

Operation of schools

Two kinds of scenarios for the operation of schools are modelled in the scenarios presented in this paper: 'fixed' scenarios and 'step up' scenarios. Figures presenting each of these scenarios for each of the levels of wider restrictions and both 'good adherence' and 'low adherence' are presented in the paper.

The 'fixed' schools scenarios are on the basis of:

- Attendance of 10% of children on site in schools throughout (described for brevity as "closed", as this would represent no substantive additional face-to-face learning during the period, compared to current levels of attendance by vulnerable children and children of critical workers); or
  Attendance of either 20%, 30%, 50%, 75%, or 100% of school children on site in schools and further education throughout the period from 22 February to the end of July.

There are also two 'step up' scenarios for the operation of schools presented, which represent a phased return to face-to-face learning for all pupils over the period. In these 'step up' scenarios,

changes are implemented after holidays or in the middle of a half term, as they might be if linked to a 3 week review period.

- The ‘slow step up’ scenarios are modelled on the basis of attendance of: 10% before 22 February, 20% from 22 February, 30% from 15 March, 50% from 11 April, 75% from 5 May, 100% from 7 June;
- The ‘fast step up’ scenarios are modelled on the basis of attendance of: 10% before 22 February, 20% from 22 February, 50% from 15 March, and 100% from 11 April.

Impact of Variants

Three levels of impact of new variants have been included; old variant, where the virus behaves as it did up until around November 2020, NV_0.4 where the new variant initially adds around 0.4 to the Rt number (but this will change over time based on transmission dynamics) and NV_0.6 where the new variant adds around 0.6 to the initial Rt number. Current analysis from England suggests that the new variant may add around 0.4 to 0.7 to the Rt number, but this would be if the new variant was 100% of cases, and the background R0 in Wales may be slightly lower than in England because Wales has more people in rural areas, so 0.6 is felt to be a sensible high value to use in the modelling.

6. Results Summary

These scenarios suggest that gradual unlocking of restrictions, combined with a gradual ‘step up’ of children being in school face to face, should be achievable without another wave of cases, hospitalisations and deaths in this period, as long as ‘adherence with restrictions’ remains high. If ‘adherence’ is very good and the new variant effect not at the higher end of current estimates for its transmissibility, then many of the schools scenarios look like they should not produce a large resurgence of cases, hospitalisations, or deaths.

Welsh Government and PHW can track the variant spread, and overall trajectory, over the coming weeks to understand better which assumptions are more likely, and to inform further modelling scenarios.

If adherence with restrictions wanes, then there may be a resurgence of the virus around May-June time, especially if the new variant adds around an initial 0.6 to the Rt number. Given that the peaks in hospital cases and deaths for those scenarios with the least optimistic assumptions come at least 2 months after moving to Level 3, this would in a real-world scenario allow some opportunity to re-impose more stringent restrictions at an early stage if data indicated that cases were following such a trajectory. As such it indicates the importance of carefully monitoring key indicators and reacting swiftly if needed.

The results show the predicted effect of a gradual uncoupling of cases from admissions and deaths that should be seen as a result of vaccine roll out. The model results seem to show the expected gradient where ratio of admissions: cases falls somewhat and deaths: cases falls even more, which is what we would expect with the vaccine, as 25% of COVID admissions are in under

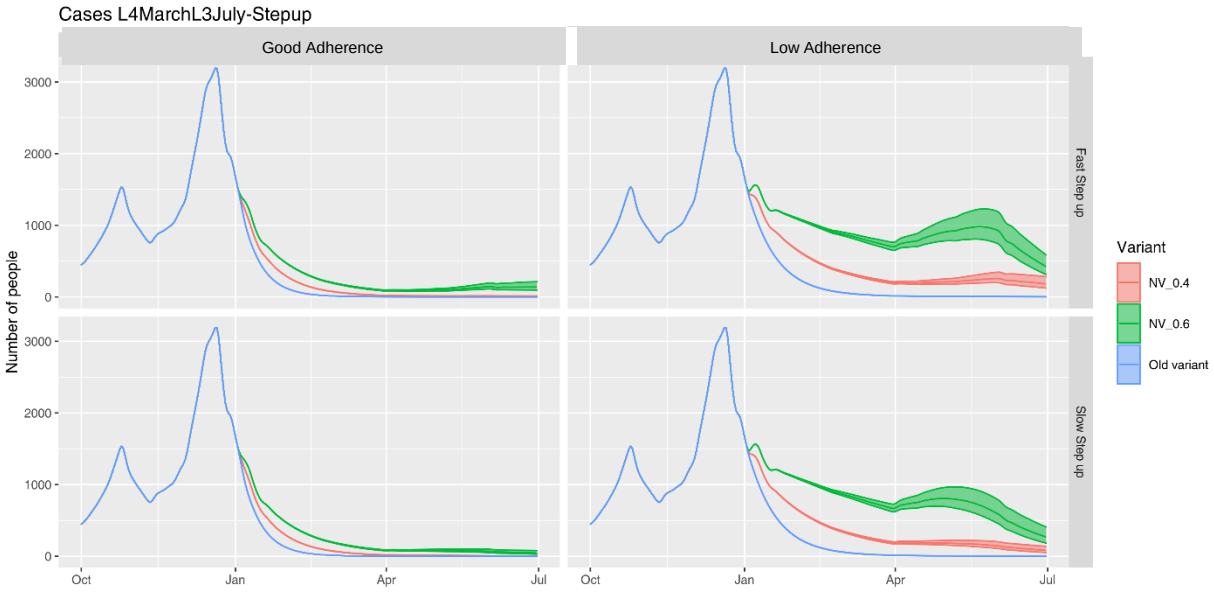
60 year olds while around 6% of COVID deaths are in under 60s – but vaccines are not 100% effective so not all at risk groups are protected even with full coverage. The modelled ratio of deaths to cases in May 2021 is around one quarter of the ratio in January 2021. However some people aged under 60 in who are in hospital will have had the vaccine, and vaccination of health care workers should help to reduce cases in these groups and pressure on the system due to staff being on sick leave with the virus.

The results of these scenarios may reinforce the need to be cautious with loosening restrictions and monitor outcomes over time if a further wave of cases, hospitalisations and deaths is to be avoided.

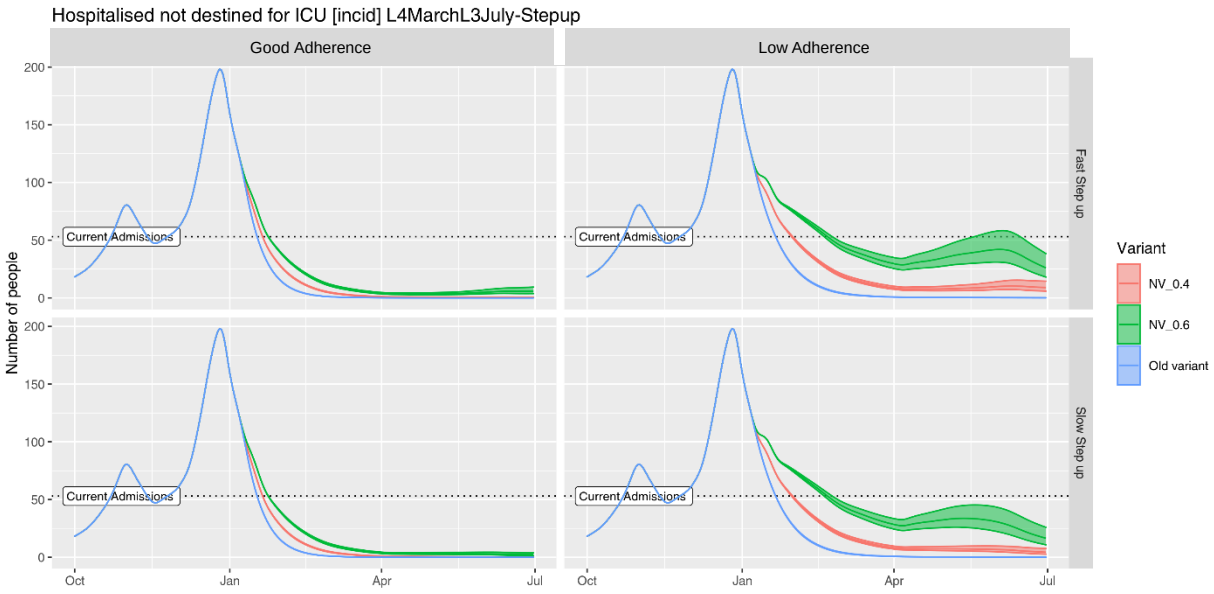
Although the central scenario shown in the first set of figures below assumes that Level 4 restrictions are in place across Wales until the end of March, with Level 3 restrictions in place until the end of June, it is to be hoped that in such a scenario, cases may have come down to such a point that other restrictions may be released before the end of June. Figure 1 shows results of a set of central scenarios with Level 4 until end of March, and Level 3 thereafter.

Figure 1. Trend in outcomes for Level 4 restrictions until end of March then Level 3 until end of June, with good/low adherence, varying effects of new variants (coloured curves), fast vs slow step up, and different vaccine efficacy (areas around trend lines).

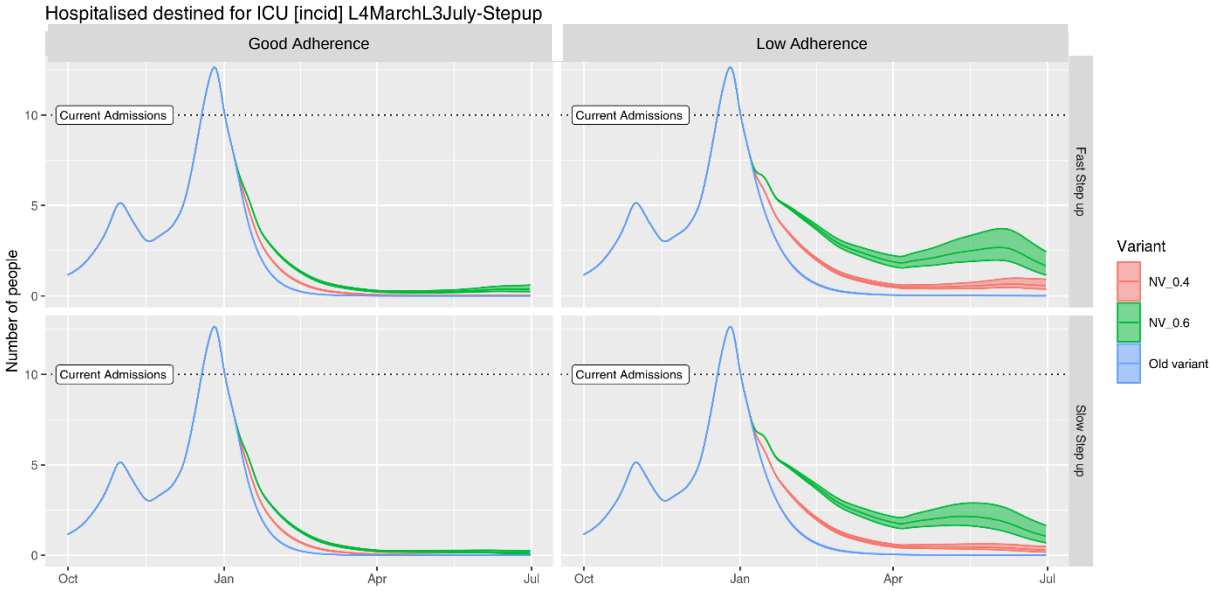
1A. Daily cases.



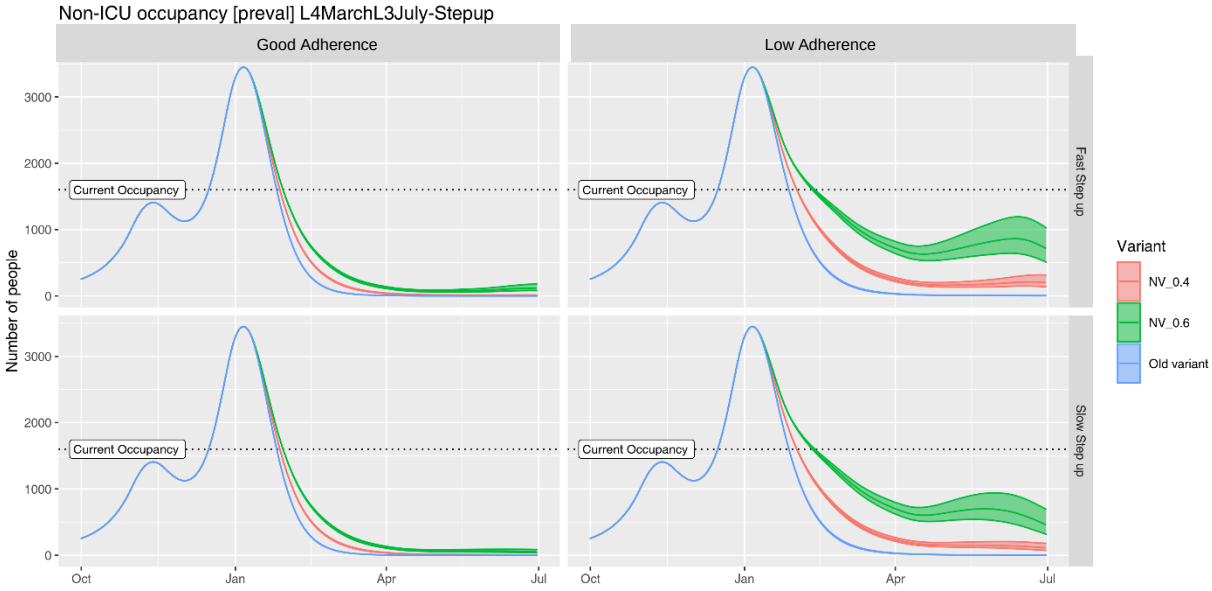
1B. Hospital admissions not destined for ICU (COVID positive cases).



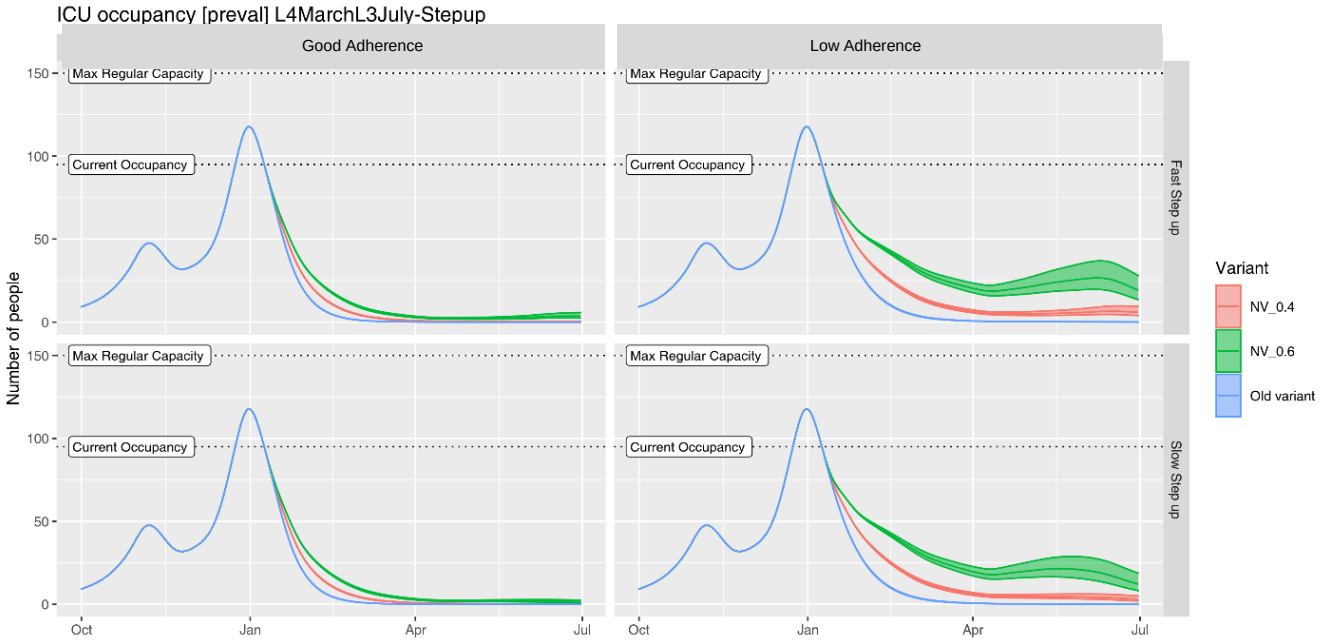
1C. Hospital ICU admissions (COVID positive cases).



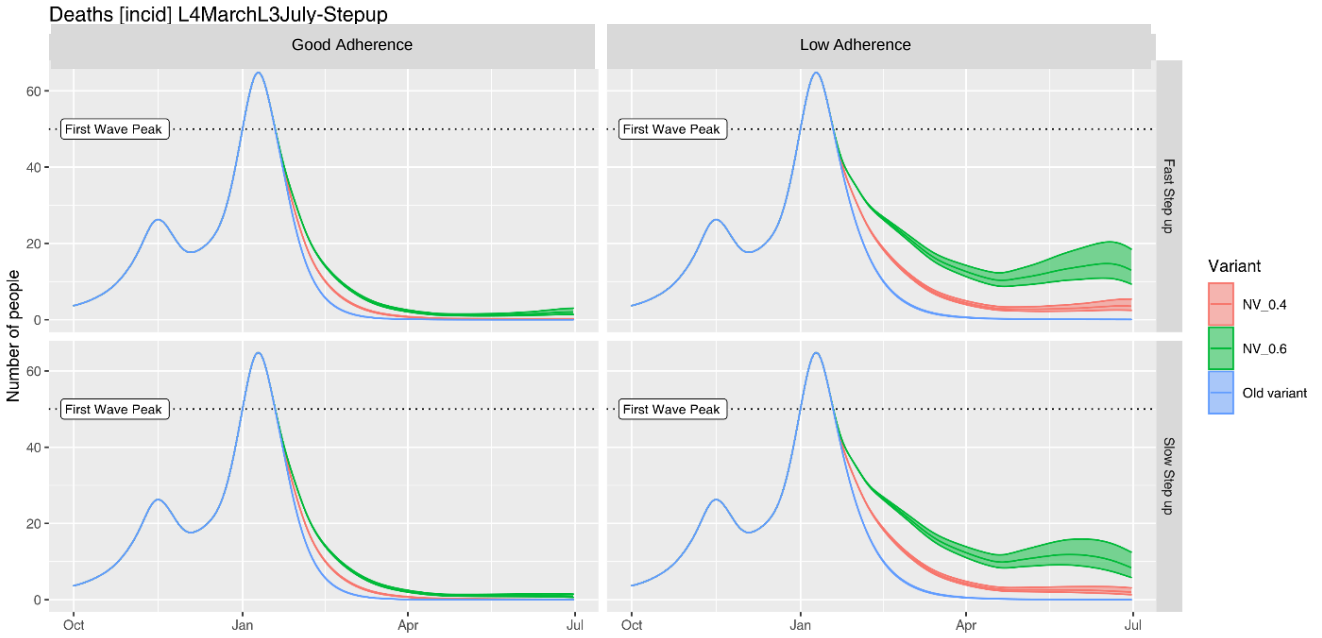
1D. Hospital non-ICU occupancy (COVID positive cases).



1E. Hospital ICU occupancy (COVID positive cases)



1F. Deaths.



Impact of fixed schools scenarios and impact of early release of restrictions

Figure 2 shows the impact of different levels of schools returning from the start on top of Level 4 restrictions until the end of March and Level 3 afterwards. It suggests that the main predictors of the size of a potential resurgence in cases are the level of “adherence” as well as the impact of any new variants. Schools make a marginal difference on top of these factors.

Figure 3 shows a scenario of what may happen if restrictions were loosened quite early – in this scenario Level 4 ends at the end of February and Wales moves to Level 2. It is seen that a combination of low ‘adherence’ plus a greater impact of a new variant may produce a third wave where cases are greater than the second COVID wave seen in January, however deaths are slightly lower than January as vaccines will prevent a proportion of deaths.

Figure 2. Cases with Level 4 until end of March, Level 3 until end of June shown with different levels of young people being in school or further education as well as good/low adherence, different vaccine efficacy, and different levels of impact for new variants.

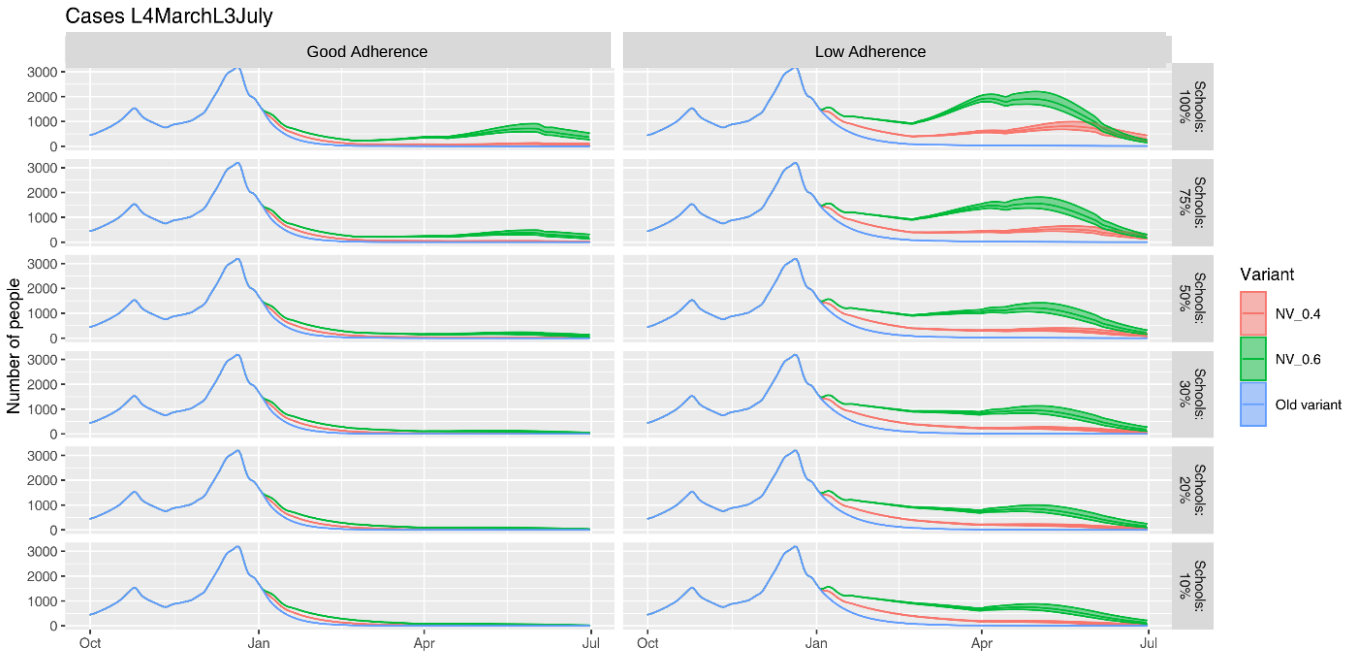
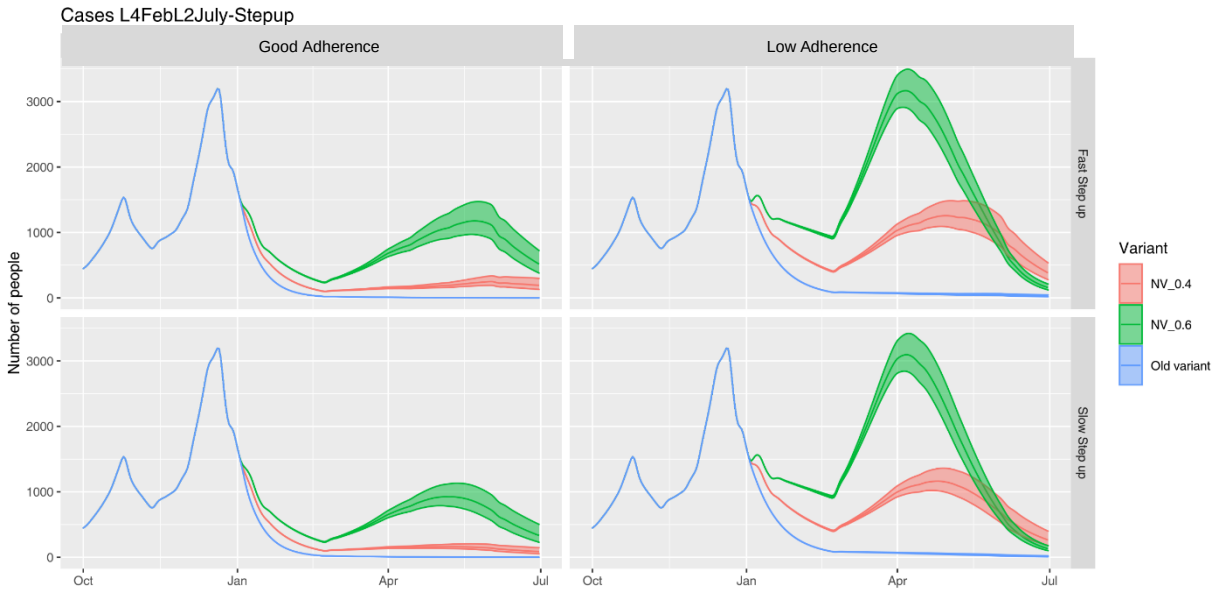


Figure 3. Trend in outcomes for Level 4 restrictions until end of February then Level 2 until end of June, with good / low adherence, fast / slow step up of schools, differential impact of new variant, with vaccine efficacy shown as area for each coloured trend line.

3A. Daily cases.



3B. Daily Deaths.

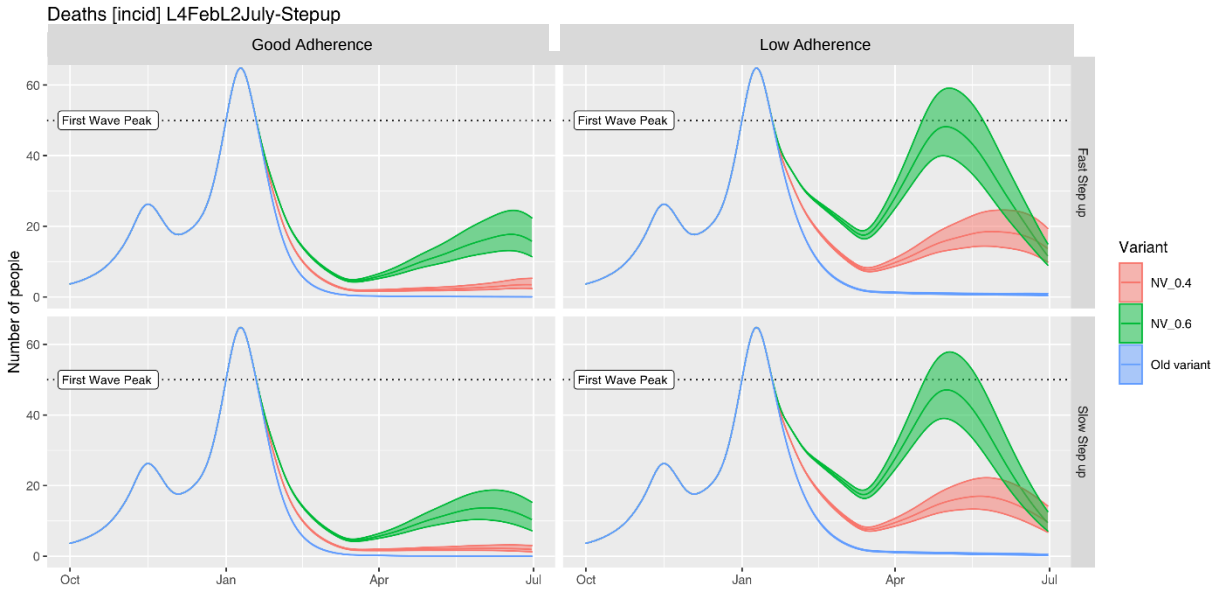


Table 1a, 1b and 2a and 2b show cumulative cases and deaths from 22nd February to 30th June for different scenarios. It is clear that the impact of new variants, vaccine efficacy and 'adherence' are great, but all but the most pessimistic scenarios do not see as many deaths as have happened in recent months.

Tables 1a and 1b: Numbers of cases and deaths in a scenario with Level 4 restrictions until the end of March, then Level 3 restrictions until the end of June, 'good adherence', with varying 'fixed' levels of schools attendance, vaccine efficacy, and effects of the new variant on R (no increase, an increase of 0.4 and an increase of 0.6). Modelled results from 22nd February to 30th June

Cases

	vaccine efficacy = 0.6			vaccine efficacy = 0.75			vaccine efficacy = 0.9		
	Old variant	NV_0.4	NV_0.6	Old variant	NV_0.4	NV_0.6	Old variant	NV_0.4	NV_0.6
Schools: 10%	285	2,647	11,902	273	2,431	10,310	263	2,272	9,222
Schools: 20%	300	2,966	14,123	287	2,703	12,092	277	2,511	10,716
Schools: 30%	317	3,366	16,984	303	3,040	14,380	292	2,806	12,624
Schools: 50%	360	4,532	25,386	342	4,007	21,104	328	3,639	18,218
Schools: 75%	434	7,237	42,955	410	6,206	35,401	391	5,498	30,225
Schools: 100%	549	12,800	69,695	513	10,683	57,866	485	9,241	49,539

Deaths

	vaccine efficacy = 0.6			vaccine efficacy = 0.75			vaccine efficacy = 0.9		
	Old variant	NV_0.4	NV_0.6	Old variant	NV_0.4	NV_0.6	Old variant	NV_0.4	NV_0.6
Schools: 10%	35	128	337	34	119	298	32	112	270
Schools: 20%	35	132	364	34	123	319	33	115	286
Schools: 30%	36	138	398	34	127	345	33	118	306
Schools: 50%	36	152	494	35	138	418	33	127	363
Schools: 75%	37	181	689	35	161	567	34	145	480
Schools: 100%	39	236	996	37	203	806	35	178	670

Tables 2a and 2b: Numbers of cases and deaths in a scenario with Level 4 restrictions until the end of March, then Level 3 restrictions until the end of June, *'low adherence'*, with varying 'fixed' levels of schools attendance, vaccine efficacy, and effects of the new variant on R (no increase, an increase of 0.4 and an increase of 0.6). Modelled results from 22nd February to 30th June.

Cases

	vaccine efficacy = 0.6			vaccine efficacy = 0.75			vaccine efficacy = 0.9		
	Old varian t	NV_0.4	NV_0.6	Old variant	NV_0.4	NV_0.6	Old variant	NV_0.4	NV_0.6
Schools: 10%	1,872	25,423	91,449	1,751	21,855	78,126	1,658	19,410	68,736
Schools: 20%	2,011	29,099	101,612	1,874	24,845	86,900	1,770	21,936	76,450
Schools: 30%	2,174	33,469	112,498	2,017	28,406	96,414	1,898	24,944	84,884
Schools: 50%	2,590	44,666	135,852	2,379	37,599	117,276	2,221	32,738	103,663
Schools: 75%	3,377	63,873	165,889	3,049	53,658	145,094	2,811	46,522	129,398
Schools: 100%	4,695	88,628	194,161	4,149	74,899	172,143	3,762	65,105	155,150

Deaths

	vaccine efficacy = 0.6			vaccine efficacy = 0.75			vaccine efficacy = 0.9		
	Old variant	NV_0.4	NV_0.6	Old variant	NV_0.4	NV_0.6	Old variant	NV_0.4	NV_0.6
Schools: 10%	111	624	1,869	104	542	1,566	98	482	1,345
Schools: 20%	112	671	2,017	105	578	1,683	100	510	1,440
Schools: 30%	115	726	2,177	107	620	1,811	101	544	1,543
Schools: 50%	120	865	2,529	111	728	2,096	105	628	1,777
Schools: 75%	130	1,104	3,008	119	913	2,491	111	775	2,106
Schools: 100%	145	1,421	3,496	131	1,163	2,903	120	976	2,454

7. New Reasonable Worst Case (RWC) and Most Likely Scenario (MLS)

The most recent reasonable worst case (E1) and MLS were signed off by the Minister for Health and Social Services in November 2020. The spread of the new variants and the vaccine rollout has meant that these scenarios are now out of date. Since then, Swansea University have run a number of updated models which take into account a more transmissible variant, the vaccine rollout, and also considers different levels of restrictions and school openings as described above.

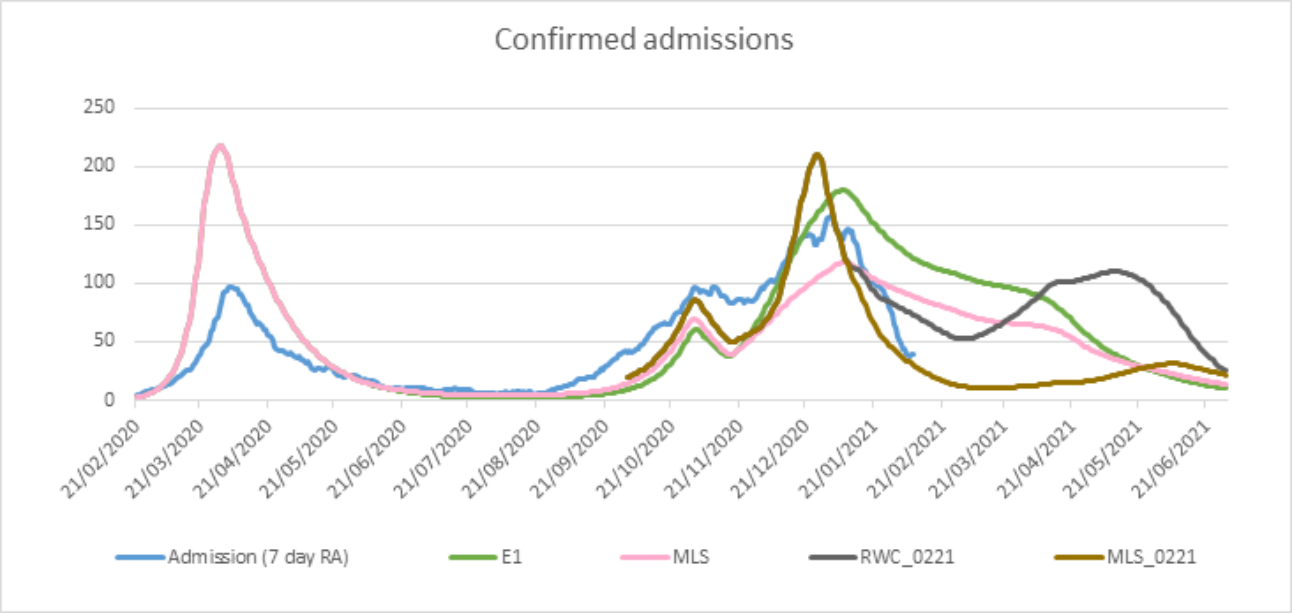
For the new reasonable worst case (RWC), we consider the scenario where schools are fully open (100%), the vaccine efficacy is 60% (low efficacy), the new variant adds 0.6 to the R number (highly transmissible), and adherence to restrictions is low (low adherence).

For the new most likely scenario (MLS), we consider the scenario where schools are fully open (100%), the vaccine efficacy is 75% (medium efficacy), the new variant adds 0.6 to the R number (highly transmissible), and adherence to restrictions is good (good adherence).

Under these 2 scenarios, between 22nd February 2021 and 30th June 2021, the total number of cases and deaths are estimated to be:

	Cases	Deaths
Proposed RWC	194,161	3,496
Proposed MLS	57,866	806

The following chart show the previous RWC(E1) and previous MLS, along with the new proposed MLS (MLS_0221) and RWC (RWC_0221), compared to the actuals:



Under the new most likely scenario (MLS_0221), schools are able to fully open without too much of an impact, but if the RWC were observed, there would be another peak in April/May, lower than the December peak but higher than the peak observed in March 2020 for COVID-19 hospital admissions.

Next steps for the Reasonable Worst Case and Most Likely Scenario

Next steps may include sharing these scenarios with colleagues in LHBs and other organisations, and signing off scenarios to be used as a new Reasonable Worst Case and Most Likely Scenario.

8. Economic Analysis

Costs and QALYs were attached to the outcomes in the Swansea University model. Table shows an example of results for Level 4 until end of March, Level 3 until end of June, for a range of school scenarios, combined with vaccine efficacy and additive effect of new variants. In these modelled scenarios, the direct net monetary losses vary from around £17million in a scenario of old variant, good adherence, high vaccine efficacy, with few children in schools, to £1.7billion in a scenario of new variant, low adherence, low vaccine efficacy with all children in schools. The main contributor to net monetary losses is the value of COVID deaths with the QALYs lost from each death valued at around £440,000.

Table 3. Results of economic analysis. Cumulative COVID-related QALYs lost and healthcare costs incurred from February 22nd – June 30th 2021, under different scenarios, with Level 4 until end of March, Level 3 thereafter.

	Vaccine efficacy = 0.6			Vaccine efficacy = 0.75			Vaccine efficacy = 0.9		
	New Variant adds 0.4	New Variant adds 0.6	Old variant	New Variant adds 0.4	New Variant adds 0.6	Old variant	New Variant adds 0.4	New Variant adds 0.6	Old variant
QALYs lost									
Schools 100%, Good adherence	1,919	8,361	288	1,642	6,786	273	1,441	5,659	260
Schools 50%, Good adherence	1,173	3,997	268	1,063	3,375	256	978	2,930	246
Schools 10%, Good adherence	973	2,636	260	904	2,331	249	849	2,105	240
Schools 100%, Low adherence	11,750	28,522	1,124	9,655	23,856	1,017	8,137	20,318	934
Schools 50%, Low adherence	7,002	20,558	912	5,887	17,109	847	5,086	14,569	795
Schools 10%, Low adherence	4,942	15,047	832	4,288	12,627	781	3,810	10,869	739
Healthcare costs (£1000s)									
Schools 100%, Good adherence	4,720	25,660	302	3,722	19,714	271	3,034	15,583	245
Schools 50%, Good adherence	2,087	10,182	243	1,763	7,988	221	1,527	6,493	204
Schools 10%, Good adherence	1,447	5,482	218	1,272	4,527	201	1,137	3,854	186
Schools 100%, Low adherence	34,350	81,515	2,033	26,859	66,173	1,711	21,573	54,648	1,475
Schools 50%, Low adherence	18,329	57,629	1,346	14,474	46,021	1,181	11,807	37,637	1,054
Schools 10%, Low adherence	11,371	40,131	1,102	9,259	32,027	986	7,779	26,308	894
Net monetary loss (£1000s)									
Schools 100%, Good adherence	119,849	527,304	17,595	102,227	426,871	16,656	89,494	355,125	15,873
Schools 50%, Good adherence	72,490	250,023	16,333	65,542	210,473	15,594	60,237	182,321	14,962
Schools 10%, Good adherence	59,841	163,662	15,804	55,517	144,382	15,138	52,055	130,148	14,562
Schools 100%, Low adherence	739,363	1,792,844	69,493	606,170	1,497,521	62,708	509,816	1,273,723	57,513
Schools 50%, Low adherence	438,450	1,291,083	56,059	367,706	1,072,570	51,992	316,958	911,759	48,731
Schools 10%, Low adherence	307,880	942,977	51,004	266,551	789,626	47,856	236,405	678,428	45,263

Appendix. Economic analysis - Current assumptions

COVID community cases

1. COVID community cases cause a 0.000889 QALY loss, equivalent to asthma for 7 days.[6]
2. COVID community cases – currently no assumption about healthcare or productivity costs – there are costs of testing and contact tracing which could be attached to community cases.

COVID deaths

1. COVID deaths result in a QALY loss of 7.24 QALYs per death, based on data from SAIL that estimated mean years of life lost of 9.97 when compared with age and sex specific life tables, multiplied by average health-related quality of life utility index for people aged 75 and over in the UK (0.726[7]). This may be a high estimate as it includes age but does not directly factor in co-morbidities in terms of mortality risk.
2. COVID deaths results in an excess healthcare cost of £232.[8] This is likely a low estimate.
3. COVID deaths – no estimate currently for productivity loss.
4. COVID deaths – no estimate for any spillover effects (e.g. lost wellbeing in family and friends).
5. COVID deaths – no estimate currently for private costs e.g. funerals etc.

COVID hospital admissions

6. COVID hospital admissions – QALYs lost - assume 0.01126 QALYs lost per admission - assumes 0.274 HRQoL loss for 15 days based on Adronis et al – people in hospital for pneumonia. [9]
7. COVID hospital admissions – cost per admission of £7,085 – data from NHS Wales Finance Delivery Unit
8. COVID hospital admissions – no current estimate of productivity or informal care costs.
9. COVID hospital admissions – no current estimate of opportunity cost of displaced care.

COVID ICU admissions

1. COVID ICU admissions – QALYs lost - assumes 1.402 HRQoL loss for 9 days from Adronis et al (Note this means that the QALYs for this health state are 'worse than death').
2. COVID ICU admissions – cost per admission of £22,198 (NHS Wales FDU).

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[6] Sullivan PW, Slejko JF, Sculpher MJ, Ghushchyan V. Catalogue of EQ-5D scores for the United Kingdom. Medical Decision Making. 2011 Nov;31(6):800-4.
[7] Janssen B., Szende A. (2014) Population Norms for the EQ-5D. In: Szende A., Janssen B., Cabases J. (eds) Self-Reported Population Health: An International Perspective based on EQ-5D. Springer, Dordrecht.
[8] Lee, T. and Stoye, G., 2019. Variation in end-of-life hospital spending in England: Evidence from linked survey and administrative data.
[9] https://researchonline.lshtm.ac.uk/id/eprint/4647598/1/Is%20the%20Venner-PneuX%20endotracheal%20tube_GREEN%20AAM.pdf

Long COVID

1. Long COVID cases – morbidity - We used 0.3 QALYs lost for six months (0.15 QALYs lost) which is the equivalent of moderate fibromyalgia for six months, but also may be similar to other syndromes that are similar to long COVID. We had clinical input into using fibromyalgia as a similar syndrome but in reality long COVID may be several distinct syndromes. This was initially applied to 2.3% of COVID cases based on data from the ZOE symptom checker app which indicated 2.3% of people had symptoms for 12 weeks or more.[10] More recently we used 10% of COVID cases as ONS data suggests that 10% of people in the ONS COVID Infection Survey report symptoms for 12 weeks or more.[11]. However in the longer term we want to model the decay rate of symptoms over time in more detail.
2. Long COVID cases – mortality – we do not currently assume any mortality impact of long covid.
3. Long COVID cases – costs – we do not currently assume any cost impact of long COVID cases (except in sensitivity analysis), but it is likely that the NHS costs and productivity losses may be significant, so adding an estimate of these is a priority.

[10] https://covid.joinzoe.com/post/long-covid

[11] https://www.ons.gov.uk/peoplepopulationandcommunity/healthandsocialcare/healthandlifeexpectancies/adhocs/12788updatedestimatesoftheprevalenceoflongcovidsymptoms