

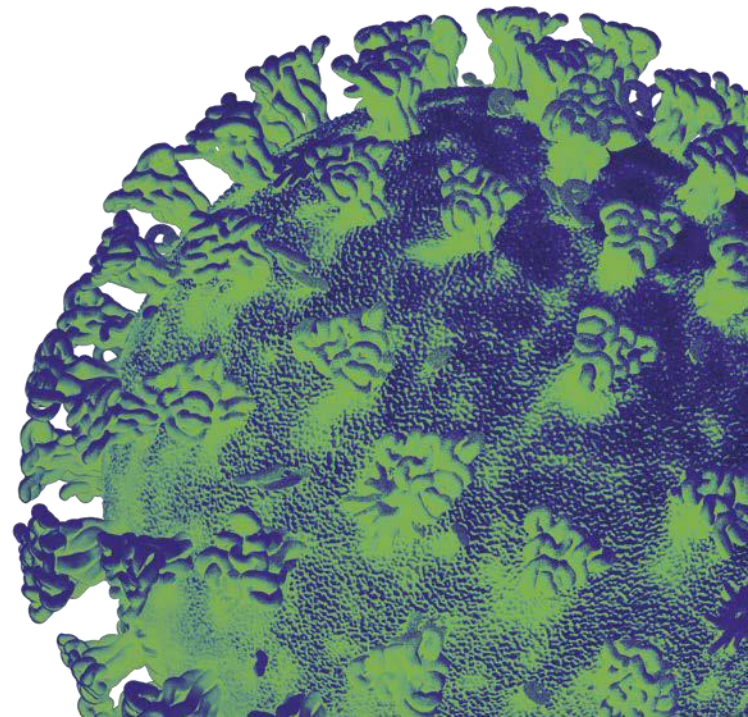
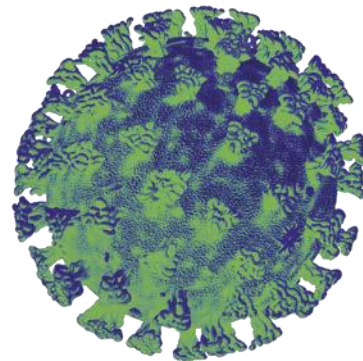
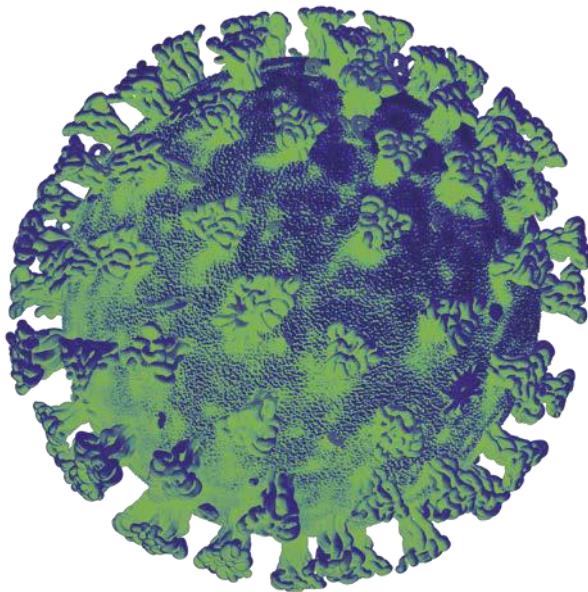


Llywodraeth Cymru
Welsh Government

Y Grŵp Cyngor Technegol

Diweddariad modelu polisi

24 Medi 2021



Diweddariad modelu polisi Medi 2021

Is-grŵp Modelu Polisi Grŵp Cyngor Technegol COVID-19 Llywodraeth Cymru

1. Crynodeb

- Mae'r papur hwn yn un o gyfres o bapurau sy'n archwilio canlyniadau ymarfer modelu polisi a gynhelir gan Brifysgol Abertawe a grwpiau eraill i ddeall sefyllfaoedd posibl yn y dyfodol mewn perthynas â phandemig y coronafeirws yng Nghymru. Mae holl gyhoeddiadau'r Gell Cyngor Technegol i'w gweld ar wefan Llywodraeth Cymru.
- Drwy gydol mis Mehefin i ganol mis Gorffennaf 2021, gwelwyd cynnydd mewn achosion a phositifedd profion yng Nghymru. Mae'r cynnydd hwn wedi bod ar ei uchaf ymhlith pobl ifanc nad ydynt wedi cael eu brechu eto, ac sydd â mwy o gysylltiadau cymdeithasol yn gyffredinol.
- Yn dilyn cwmp bach mewn achosion COVID-19 a phositifedd profion yn ail hanner mis Gorffennaf, parhaodd yr achosion i godi eto i dros 550 o achosion fesul 100,000 a phositifedd profion o 19% ar 6 Medi 2021. Yn dilyn hyn, arafu wnaeth yr achosion tan 14 Medi, ond mae'r dyddiau diwethaf yn dangos efallai ein bod yn gweld arwydd o gynnydd pellach mewn achosion.
- Mae modelau epidemiolegol Prifysgol Abertawe wedi llunio amcangyfrifon o heintiadau a chanlyniadau iechyd sy'n uniongyrchol gysylltiedig â COVID tan ddiwedd mis Mawrth 2022.
- Yn gyffredinol, mae'r senarios wedi'u modelu yn awgrymu ei bod yn debygol y bydd yr achosion, derbyniadau i'r ysbyty a marwolaethau yn parhau i gynyddu tan ddiwedd Medi/Hydref 2021, er nad yw'n glir pryd yn union y bydd y trobwynt. Gall achosion o COVID-19 gyrraedd brig tebyg i'r hyn a welwyd mewn tonnau blaenorol, gyda rhai senarios lle byddai'r lefelau yn uwch. Mae'r brig o ran derbyniadau i'r ysbyty a marwolaethau oherwydd COVID-19 yn debygol o daro ychydig wythnosau ar ôl yr achosion o COVID-19 ond ar lefel ddyddiol is na thonnau blaenorol.
- Mae'r modelau presennol yn awgrymu brig posibl yn nifer y cleifion yn yr ysbyty ond mae hyn yn sensitif iawn i ragdybiaethau ynghylch hyd arhosiad. Gan fod hyd arhosiad wedi bod yn fyrrach yn gyffredinol yn y drydedd don nag mewn tonnau blaenorol, mae'n debygol y bydd y brig yn is, o fwch sylweddol, na'r hyn a ragfyneir gan y modelau presennol. Mae'r modelau presennol yn rhagfyneir y gallai nifer y gwelyau sy'n cael eu defnyddio gan gleifion sy'n profi'n bositif am COVID-19 gyrraedd tua 1,900, a fyddai'n rhagori ar frig mis Ionawr. Fodd bynnag, pe gwelid hyd arhosiad byrrach, gallai hyn fod yn llawer is – gyda hyd at 750 o welyau yn cael eu defnyddio. Mae hyd arhosiad yn amrywio gan ddibynnu ar ddifrifoldeb y clefyd yn ogystal â ffactorau eraill fel oedi wrth drosglwyddo gofal.
- Ar hyn o bryd, gellir olrhain y nifer dyddiol a welir o ran achosion o COVID-19,

derbyniadau i'r ysbyty, a'r gwelyau unedau gofal dwys sy'n cael eu defnyddio uwchlaw trywydd presennol senario fwyaf tebygol mis Mehefin 2021. Fodd bynnag, mae nifer y marwolaethau a welir ychydig yn is nag a ragfyneir gan y modelau, ac mae'n parhau'n isel mewn termau absoliwt.

- Yn y drydedd don hon, a chyda thystiolaeth sy'n dod i'r amlwg bod imiwnedd yn gwanhau, rydym yn dal i fod mewn ras rhwng brechlynnau a'r amrywiolyn Delta. Efallai fod pobl wedi cymysgu llai wedi i'r ysgolion gau dros yr haf, ond bu'r cymysgu cynyddol yn sgil llacio cyfyngiadau yn rym gwrthwynebol arall. Yn sgil dychwelyd i'r ysgol yn ddiweddar, mae lefel y trosglwyddiadau mewn plant a phobl ifanc yn debygol o barhau'n uchel, felly mae angen i unrhyw ymateb polisi ystyried y cydbwysedd o ran niwed i blant.
- Efallai fod trosglwyddiadau wedi cynyddu yn dilyn y newidiadau i reolau hunanynysu Profi Olrhain Diogelu. Awgrymodd modelu blaenorol y gallai'r newidiadau arwain at gynnydd o tua 0.2 yn yr Rt, o dan werthoedd R a welwyd yn ddiweddar.
- Mae brechlynnau'n gorfod gweithio'n fwy caled mewn byd lle y mae cyffredinrwydd y feirws yn uchel – gallai brechlynnau fod yn llai effeithiol wrth i rym heintio gynyddu.
- Nid yw'r senarios wedi'u modelu presennol yn cynnwys effaith drifft antigenig pellach; felly maent yn debygol o fod yn gadarn dros y misoedd nesaf, ond efallai y bydd angen gwaith modelu pellach dros y misoedd sydd i ddod.
- Mae modelu COVID-19 Academi'r Gwyddorau Meddygol¹ wedi'i gynnwys yn y papur hwn, wedi'i ddosrannu yn ôl maint poblogaeth Cymru.
- Mae senarios modelu Mapio SPI-M o Brifysgol Warwick ac Imperial hefyd wedi'u cynnwys i'w cymharu â modelau Prifysgol Abertawe.
- Mae rhagor o waith ar y gweill mewn perthynas â senario fwyaf tebygol a senario waethaf sy'n rhesymol ei thybied newydd sy'n ystyried deinameg trosglwyddiadau sy'n newid yn gyflym.
- Mae rhagor o waith ar y gweill sy'n edrych ar senarios lle y bydd effeithiolrwydd brechlynnau yn gwanhau a chyhoeddir hyn yn y papur nesaf.
- Mae rhagor o waith ar y gweill hefyd i gynnwys effaith trydydd brechiad / y brechiad atgyfnerthu a brechiadau ar gyfer plant 12-15 oed.
- Mae rhagor o waith ar y gweill i edrych ar senarios ar gyfer firysau anadlol eraill fel y ffliw a'r feirws syncytiol anadlol (RSV) ar gyfer gaeaf 2021/22 a gyhoeddir gan TAC ym mis Medi 2021.
- Mae'r model yn cael ei ddiweddarau'n rheolaidd ar hyn o bryd i adlewyrchu unrhyw arwyddion mewn patrymau o gynnydd/gostyngiad o ran trosglwyddiadau.

¹ [Preparing for the future: Looking ahead to winter 2021-22 and beyond](#), a gyhoeddwyd ar 15 Gorffennaf 2021

2. Objective

The objective of this paper is to examine scenarios for COVID-19 in Wales from September 2021 to March 2022, which include different assumptions around the impact of new variants, impacts of vaccine efficacies and individuals' ability to continue to follow restrictions and to continue to adopt protective behaviours (labelled in this paper as "adherence").

The paper also compares the scenarios from different modelling groups including Swansea University, Warwick/Juniper, Imperial and Academy of Medical Sciences (AMS).

This paper focuses mainly on direct COVID-19 related harms. As the ratio of cases to hospital admissions and deaths falls, the social harms of COVID-19 are reduced, and policy makers need to continue to weigh up these against non-COVID-19 harms.

3. Background

Wales implemented Level 4 restrictions on 20 December 2020 following the identification of the new Variant of Concern 202012/01 (B.1.1.7, now known as Alpha), increasing rates of confirmed COVID-19 case rates, and pressure on the NHS.² Over 90% of the population of Wales aged over 16 have now received at least one dose of a vaccine. Vaccination is now open for all those aged 12 year olds and over.

The case rate as of 16 September 2021 for Wales is 527 confirmed cases per 100k (7 day rolling sum), positivity is around 15%, and case rate and positivity are currently increasing again after increasing through June, then falling briefly in late July and in the 2nd week of September. In addition, prevalence is 1.62% (as measured by the ONS COVID Infection Survey in the week to 11 September 2021) and antibody prevalence was 91.2% of adults in the week beginning 23 August 2021 (as measured by the COVID Infection Survey),³ indicating that a high proportion of people have antibodies present either following natural infection or vaccination. However, this percentage has fallen slightly over the past few weeks indicating evidence of waning of COVID-19 antibodies in the population of Wales. However, the credible intervals for the past few weeks overlap so caution should be taken in interpreting decreases.

4. Evidence Summary

The latest information about the COVID-19 situation in Wales can be found on the Welsh Government website.⁴

² [Written Statement: Alert level four restrictions](#)

³ [Coronavirus \(COVID-19\) latest insights - Office for National Statistics \(ons.gov.uk\)](#)

⁴ [Technical advisory Cell: summary of advice 2 April 2021](#)

5. Updated modelling scenarios from Swansea University

Swansea University produced a range of modelled scenarios for the time period up to end of March 2022. The methods have been described previously.⁵ The box below describes the current model run on 1 September 2021.

Model Run 01/09/21 'Standard'
Standard refers to the default scenario without waning immunity taken into account.

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.⁶ The move to alert level 0 took place in Wales on 7 August 2021.⁷

In the "standard" Swansea University model, the levels of restrictions are assumed to be eased according to the following schedule in 2021:

Opening Schedule	
12 April	School Return plus level 3.5
03 May	Alert level 3
17 May	Alert level 2
7 June	Alert level 1.5
19 July	Alert level 1
07 Aug	Alert level 0

For Alert Level 0 this set of modelling scenarios is not the same as Alert Level 0 in the previous paper,⁸ which was a complete easing of restrictions whereas Wales has retained a set of baseline measures – so we are actually more similar to Alert level

⁵ <https://gov.wales/sites/default/files/publications/2021-03/technical-advisory-cell-modelling-update-12-february-2021.pdf>

⁶ [Coronavirus Control Plan: Alert levels in Wales](#) (14 December 2020).

⁷ [Wales moves to alert level zero | GOV.WALES](#)

⁸ [technical-advisory-group-policy-modelling-update-12-july-2021.pdf \(llyw.cymru\)](#)

0.5 in the previous paper.

The Swansea University roadmap modelling scenario has therefore changed since the previous ‘slowed 2’ scenario (included in [previous modelling update](#), 12 July 2021). A date for the complete removal of restrictions in Wales hadn’t been confirmed at the time the previous models were run. Since then, the Welsh Government announced their easing of restrictions and move to a lower Alert level was due to take place on 7 August 2021. This ‘standard’ scenario takes this date into account in its assumptions as well as some changes in transmission that might have occurred due to other reasons such as TTP self isolation rules changing. The most recent published contact survey (COMIX) data⁹ for Wales still shows lower mixing than pre-COVID-19 but contacts may have increased in recent weeks, while Google mobility data suggests a lot of mobility in Wales is similar to pre-pandemic, except for workplace and public transport, which may indicate a proportion of people continuing to work from home.

Effectiveness of vaccines

A range of vaccine efficacy levels was chosen to reflect general ‘low’, ‘medium’ and ‘high’ efficacy scenarios based on current knowledge. The model was run before the announcement of booster vaccines and of vaccines (one dose) for 12-15 year olds.

Vaccine Efficacy (3 scenarios representing uncertainty in each variant ribbon plot)			
Scenario	Test positive	Hospital / ICU	Death
Low	70%	91%	95%
Mid	80%	96%	98%
High	90%	98%	99%

⁹ [Comix Report Survey Week 76 \(cmmid.github.io\)](#)

Uptake of vaccines in the model was assumed as follows;

Vaccine Uptake (maximum at end of roll out)	
75+ years	97%
70-74 years	96.5%
60-69 years	94.5%
50-59 years	91%
40-49 years	85%
30-39 years	77.5%
18-29 years	76.5%
16-17 years	70%
12-15 years	0%

Clinically vulnerable population = 14%, Clinically vulnerable uptake = 97%

Levels of ‘adherence’

Each of the scenarios modelled in this paper is presented with differing ‘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. 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 low adherence is more like the number of contacts seen in December 2020. In future papers, we are looking no longer including this idea of ‘adherence’ as it has less meaning as restrictions are released.

Impact of Variants

Current analysis from England suggests that the Delta variant is 40-80% more transmissible than the previously dominant Alpha variant. On the charts below, 'low delta' and 'high delta' are the lower and higher estimates respectfully of the new dominant Delta variant. These represent scenarios where Delta (or the mixture of circulating variants) is 30% and 80% more transmissible than Alpha respectfully. For the first time, a central Delta scenario ('mid delta') is also included in the analysis. This scenario represents a situation where the Delta variant is assumed to be 55% more transmissible than the Alpha variant.

In addition some other variant assumptions were modelled. This is partly to provide a comparison to historic patterns, but also to model the periods of transition when two variants were present before a dominant variant emerged. Historic variants are not shown in all charts for clarity as we have cut down to the most relevant scenarios.

Variant Assumptions	
Blue	Original
Red	Delta = Alpha + 55% (Mid Estimate)
Green	Alpha = Original + 40% (Alpha)
Purple	Delta = Alpha + 30% (low estimate)
Orange	Delta = Alpha + 80% (high estimate)

6. Swansea University Modelling Scenarios

All Swansea University model scenarios estimated an increase in cases from August 2021 with peaks likely late September to mid-October and likely peaks in hospitalisations and deaths in October 2021. The medium term forecasts produced by SPI-M on 8 September 2021 also suggest there is the potential for another large wave of hospitalisations.

If the Delta variant effect is initially 30% more transmissible than Alpha variant (named low delta scenarios), then there are estimated to be peaks of between around 2,600 and 3,300 COVID-19 cases per day. If Delta is 80% more transmissible (named high delta scenarios), there are estimated to be peaks of

between around 3,000 and 3,400 COVID-19 cases per day. In reality, we may see the peak number of COVID-19 (symptomatic) cases falling somewhere between the low Delta and high Delta scenarios. A further scenario is provided ('mid delta') where delta is estimated to be 55% more transmissible than Alpha. For this scenario, there are estimated to be peaks of between around 2,900 and 3,400 COVID-19 cases per day. Shortly after 7th August 2021, the cases (and subsequently the hospital admissions and deaths) begin to increase. The peaks for all scenarios are remarkably similar but this may suggest an artificially high level of certainty; this effect is driven by the models reaching a point of a small number of susceptible people, too few to sustain transmission in the model.

For each Swansea University model scenario, there are different levels of vaccine effectiveness which have an impact on the overall trend in cases, hospital admissions and deaths. These scenarios suggest that the transmissibility of the Delta Variant of Concern (VOC) and vaccine effectiveness assumptions have a great impact on the number of cases, hospitalisations and deaths, with a smaller but important contribution from adherence to restrictions; however adherence is less of a useful concept now that few restrictions remain – it is more like a proxy measure of contacts and strengths of contacts compared with pre-pandemic.

Figures 1, 2 and 3 compare actuals with model-estimated cases, hospital admissions and deaths under different scenarios of transmission (low Delta: 30% increased transmission relative to Alpha, mid Delta: 55% increased transmission relative to Alpha, high Delta: 80% increased transmission), adherence (low, good) and vaccine effectiveness (low, mid and high). In addition to the Swansea University (SU) models, the Academy of Medical Sciences (AMS) models are also included for comparison. The number of daily COVID-19 deaths estimated by the AMS models falls neatly between the SU models. However, the AMS models are a lot more pessimistic in terms of daily hospital admissions estimated.

These figures illustrate the uncertainty around the size and timing of the third COVID-19 wave, with the peak in daily cases ranging from well below the second wave peak in December 2020 to more than twice the height of the second wave's peak under different scenarios. The uncertainty in model estimates are driven by the uncertainty in effectiveness of vaccines on the Delta variant, increased transmissibility of the Delta variant and adherence levels.

The SU models estimate a peak followed by a fall in cases as we see acquired population immunity effects. This would represent the first decline in cases in the absence of substantial NPIs, though ongoing TTP efforts continue to contribute significantly (as well as vaccination). There is some evidence of this in some parts of North West England such as Bolton and Blackburn, but within Wales, it does not look like any local authority areas are showing clear acquired immunity type effects yet.

Figure 1. Modelled Swansea University (SU) COVID-19 cases from 1 December 2020 to 30 March 2022; under different scenarios of Delta increased transmission, different levels of adherence, and different levels of vaccine effectiveness. Sources: SU model. Actuals from PHW.

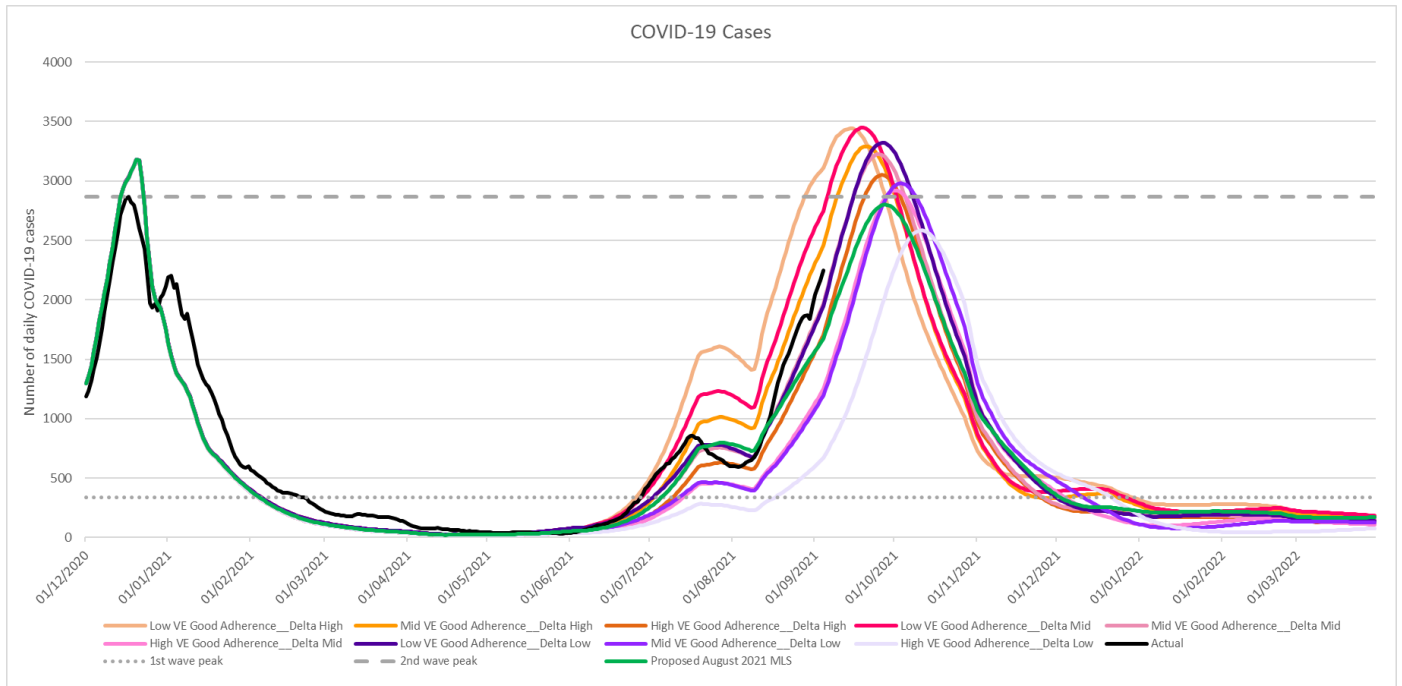


Figure 2: COVID-19 hospital admissions from 1 December 2020 to 30 March 2022; under different scenarios of Delta increased transmission, different levels of adherence and different levels of vaccine effectiveness. Sources: SU model, AMS model. Actuals from PHW.

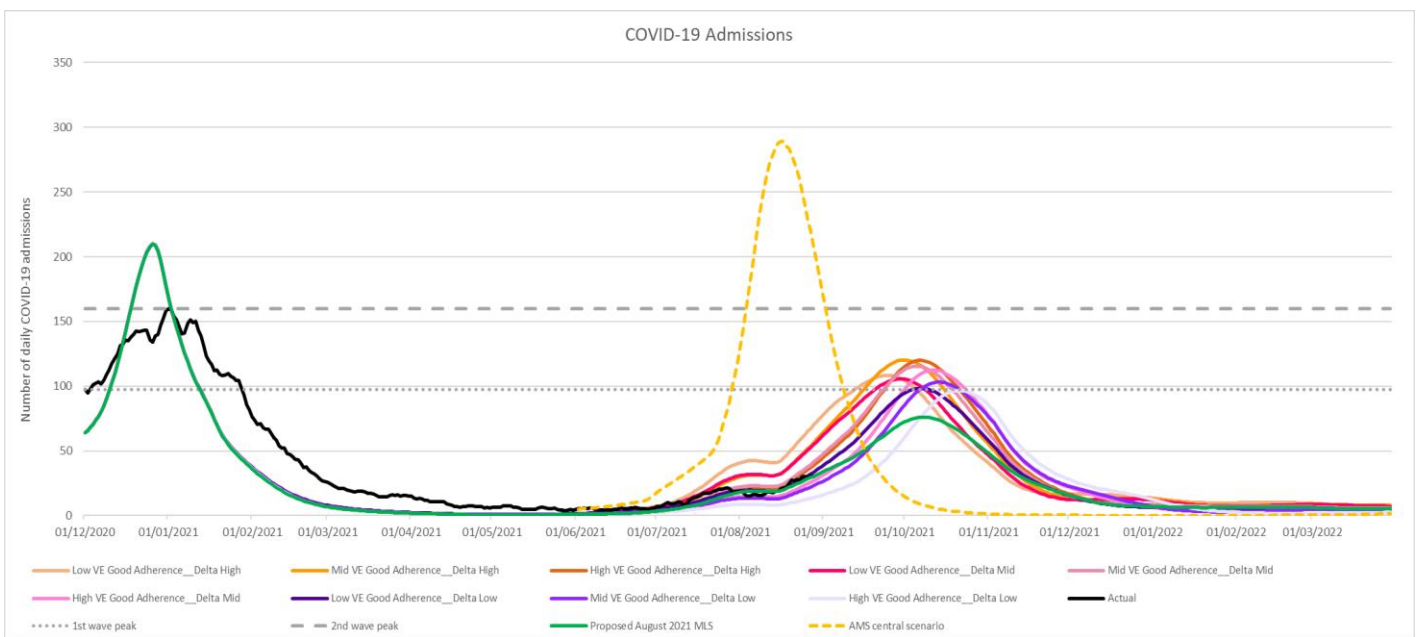


Figure 3: COVID-19 deaths from 1 December 2020 to 30 March 2022; under different scenarios of Delta increased transmission, different levels of adherence and different levels of vaccine effectiveness. Sources: SU model, AMS model, Actuals from PHW.

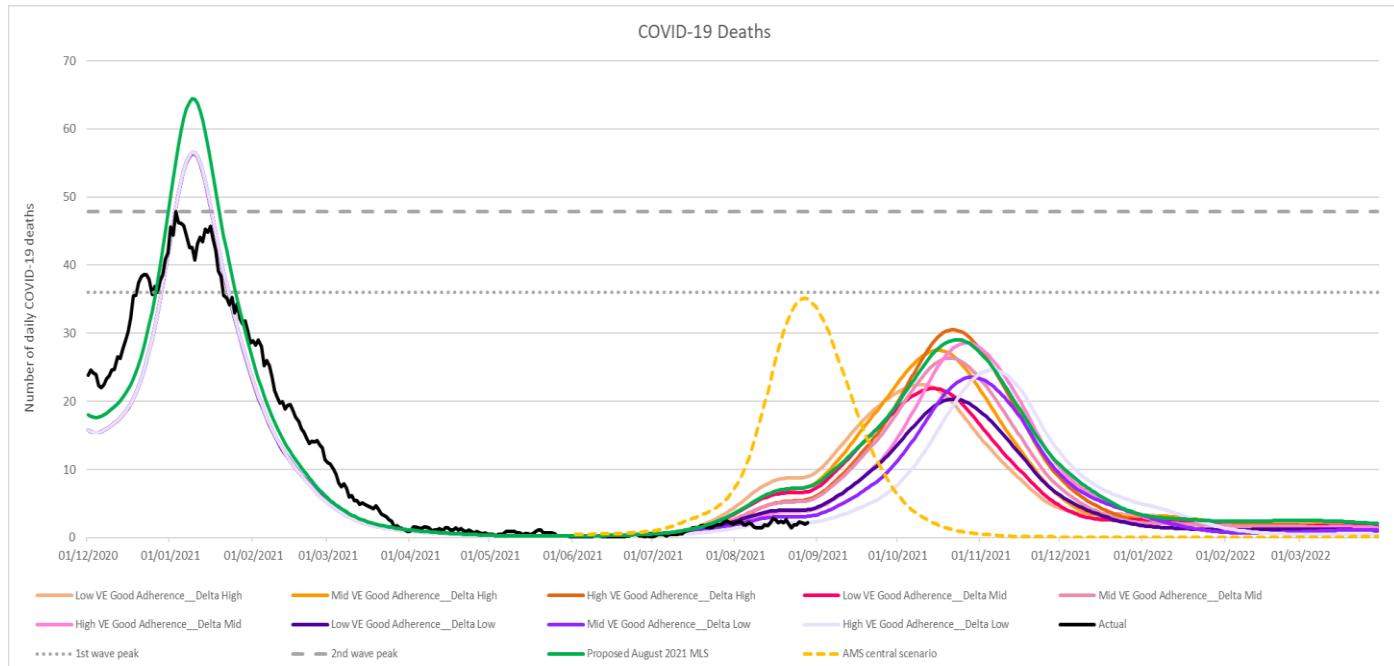


Table 1A shows the total symptomatic cases (in future labelled as “cases”), deaths, admissions and ICU admissions between 1 September 2021 and 30 November 2021 estimated for each scenario. For all scenarios, the number of cases and deaths reduce as vaccine efficacy increases or adherence to restrictions improves.

Table 1B shows the daily peaks of COVID-19 cases, deaths, admissions and ICU admissions between 1 September 2021 and 30 November 2021 estimated for each scenario. For all scenarios, the maximum number of cases and deaths reduce as vaccine efficacy increases or adherence to restrictions improves.

So far the models are tracking quite close for cases and admissions but ICU admissions might be higher than the peaks and totals indicated for these scenarios and deaths might be lower than the peaks and totals for these scenarios.

The total hospital occupancy scenarios are very sensitive to length of stay in the model. If length of stay is shorter in the third wave, then occupancy may peak at closer to 750 for general ward and 820 including critical care. This is closer to the current SPI-M Medium Term Projections. Length of stay depends on severity of disease as well as other factors like delayed transfers of care. The next iteration of scenarios are fitted to more recent length of stay data.

Table 1A: Totals (between 1 September 2021 and 30 November 2021)

Scenario	Cases	Deaths	Admissions	ICU Admissions
Low VE Gd Adh High Delta	161,800	1,370	5,900	360
Low VE Gd Adh Low Delta	172,600	1,190	5,600	340
Low VE Gd_Adh Mid Delta	167,300	1,330	5,900	360
Low VE Low Adh High Delta	140,100	1,300	5,400	330
Low VE Low Adh Low Delta	154,400	1,200	5,300	330
Low VE Low Adh Mid Delta	146,000	1,270	5,400	330
Mid VE Gd Adh High Delta	159,800	1,640	6,600	360
Mid VE Gd Adh Low Delta	158,500	1,300	5,800	310
Mid VE Gd_Adh Mid Delta	163,200	1,540	6,500	350
Mid VE Low Adh High Delta	141,200	1,600	6,200	330
Mid VE Low Adh Low Delta	151,400	1,390	5,900	310
Mid VE Low Adh Mid Delta	146,200	1,550	6,200	330
High VE Gd Adh High Delta	153,600	1,750	6,600	370
High VE Gd Adh Low Delta	136,800	1,240	5,200	290
High VE Gd_Adh Mid Delta	151,600	1,580	6,200	340
High VE Low Adh High Delta	139,700	1,790	6,400	360
High VE Low Adh Low Delta	139,700	1,420	5,600	310
High VE Low Adh Mid Delta	143,000	1,680	6,300	350
AMS central		660	2,200	

Cases and admissions are rounded to the nearest 100. Deaths and ICU admissions are rounded to the nearest 10.

Table 1B: Daily peaks (between 1 September 2021 and 30 November 2021)

Scenario	Cases	Deaths	Admissions	Bed Occupancy*	ICU Bed Occupancy
Low VE Gd Adh High Delta	3,400	20	110	2,100	70
Low VE Gd Adh Low Delta	3,300	20	100	1,900	60
Low VE Gd_Adh Mid Delta	3,400	20	110	2,100	60
Low VE Low Adh High Delta	3,000	20	100	1,900	60
Low VE Low Adh Low Delta	3,000	20	90	1,800	60
Low VE Low Adh Mid Delta	3,000	20	100	1,900	60
Mid VE Gd Adh High Delta	3,300	30	120	2,300	60
Mid VE Gd Adh Low Delta	3,000	20	100	2,000	50
Mid VE Gd_Adh Mid Delta	3,200	30	120	2,200	60
Mid VE Low Adh High Delta	2,900	30	110	2,200	60
Mid VE Low Adh Low Delta	2,900	20	100	2,000	50
Mid VE Low Adh Mid Delta	2,900	20	110	2,100	60
High VE Gd Adh High Delta	3,100	30	120	2,300	70
High VE Gd Adh Low Delta	2,600	20	100	1,900	50
High VE Gd_Adh Mid Delta	2,900	30	110	2,200	60
High VE Low Adh High Delta	2,800	30	110	2,200	60
High VE Low Adh Low Delta	2,600	30	100	1,900	50
High VE Low Adh Mid Delta	2,800	30	110	2,100	60
AMS central		-	30	170	-

* This total bed occupancy (apart from AMS scenario) is assuming historical lengths of stay – it is likely to be a lot lower, at roughly 40% of what is shown here, with current observed lengths of stay.

Cases, admissions, and bed occupancy are rounded to the nearest 100. Deaths and ICU bed occupancy are rounded to the nearest 10.

Interpretation – new Reasonable Worst Case (RWC) and Most Likely Scenario (MLS)

Within Wales, the reasonable worst case scenario (RWC) and most likely scenario (MLS) are used for planning for the NHS and others. It makes sense to update the RWC and MLS over time as our understanding changes. Because the current Swansea scenarios are all very similar, we have opted to not adopt a new RWC as none of them are particularly pessimistic in relation to other scenarios. More work is underway around modelling a waning vaccine effectiveness scenario which may be a new RWC. However, the inclusion of boosters and vaccines in 12-15s may produce a more optimistic scenarios.

We plan to share the current scenarios with NHS and other colleagues for planning purposes but more work is underway to have a new MLS and potential new RWC that reflect these changing dynamics.

7. Academy of Medical Sciences Modelling Scenarios

The Academy of Medical Sciences (AMS) have recently published a winter planning report, “COVID-19: Preparing for the future”. The paper explores the health and social care challenges we may be facing over the coming winter and beyond. It includes a range of modelled scenarios for winter 2021/22 for COVID-19, influenza and respiratory syncytial virus (RSV). In this paper, we use the underlying data for the UK COVID-19 central scenarios in the AMS models and apportion them to the population of Wales.¹⁰ We are grateful to Professor Azra Ghani (Imperial College London) and colleagues for sharing these data with us.

The central-case scenarios incorporate current estimates for key epidemiological parameters. Two central scenarios are shown reflecting uncertainty in the impact of Step 4 of the English roadmap out of lockdown that occurred on 19 July 2021. The ‘central’ scenario assumes an increase of R_t reflects an increase in contact patterns. The ‘central delayed’ scenario assumes that the increase in contact patterns from Step 4 is counteracted by the school summer holidays such that the impact on transmission occurs from early September 2021 when schools reopen.

¹⁰ The [ONS 2020 mid-year estimates](#) are used to obtain the population estimates for Wales and the UK.

Assumptions underlying the AMS COVID-19 modelling

Scenarios were generated under three sets of assumptions as described in the table below. All scenarios assume best estimates for vaccine effectiveness (from recent Public Health England (PHE) data) against the Delta variant and high vaccine uptake (95% uptake). R_t is assumed to increase from 19 July to 4, 4.75, 5.5 to reflect the uncertainty in impact of Step 4 of the relaxation of measures, as described in the roadmap out of lockdown.

Scenario	Best case	Central case	Worst case
Immunity	3-year natural immunity; 5-year vaccine	1-year natural immunity, 3-year vaccine	1-year natural immunity, 1-year vaccine
Vaccine impact on transmission	Best PHE estimates against Delta	Best PHE estimates against Delta	Best PHE estimates against Delta
Immune escape for Delta compared to Alpha	None	10%	40%
New variants	None	None	September and December

8. Warwick Scenarios (SPI-M Roadmap) – SAGE 92

[University of Warwick: Road map scenarios and sensitivity – Step 4, 9 June 2021 - GOV.UK \(www.gov.uk\)](#)

These scenarios have been published in a previous paper but are included here for context.¹¹

The Warwick/Juniper model has been developed in Warwick over the past year and matched to a variety of epidemiological data. The scenarios included here do not take into account the Delta variant.

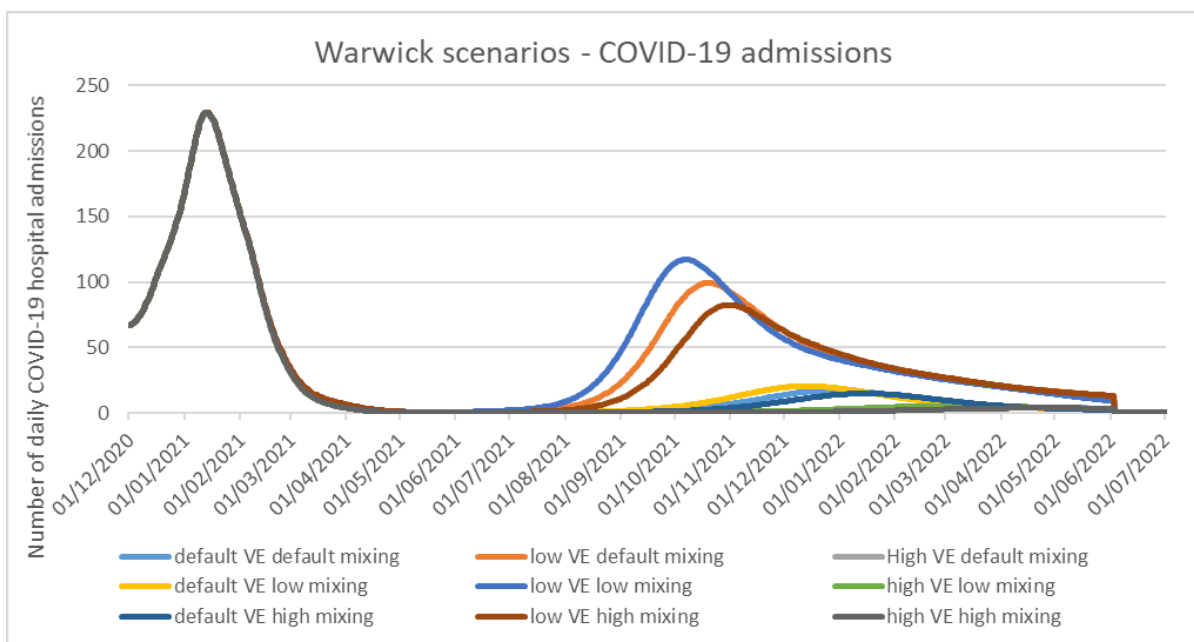
The model operates and is fitted to data from the seven NHS regions in England and the three devolved nations. The results of this model have been presented to SPI-M and SAGE on a number of occasions, and the model has been used to examine short-term and medium-term projections as well as reasonable worst-case scenarios. More recently, the model has been extended to include vaccination, initially to investigate priority ordering and subsequently increased in complexity to include two-dose schedules and multiple actions of vaccine protection. In generating these predictions, for any possible variants that may evade the vaccine protection provided by the presently available vaccines has not been accounted for. These

¹¹ [Technical Advisory Group: policy modelling update 12 July 2021 | GOV.WALES](#)

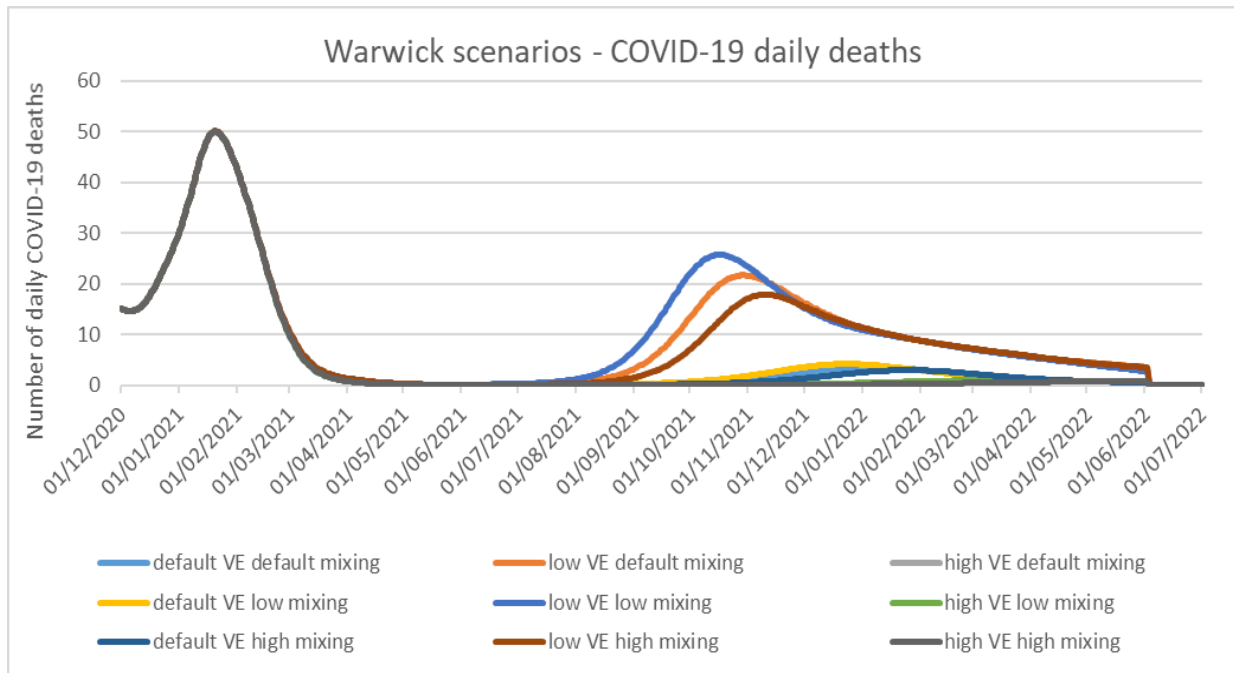
could either arise through natural mutation from currently circulating variants within the UK or could be imported into the UK.¹²

The assumptions on restrictions in Wales were as follows: Stepping down of NPIs across 26th April, 3rd May, 17th May, and 7th June to the lowest levels seen during the pandemic in 2020. Further reductions to half these levels on 19th July. Gradual return to pre-COVID-19 mixing over subsequent 6 months.

There is no specific parameter for levels of adherence for the Warwick/Juniper model. However, levels of mixing are specified by the level of restrictions in place, and the models have 'expected/low/high mixing'.



¹² Warwick roadmap paper: "Model Projections for Road Map: Devolved Administrations"



9. Imperial Scenarios (SPI-M Roadmap) – SAGE 92

[Imperial College London: Evaluating the roadmap out of lockdown – modelling Step 4 of the roadmap in the context of B.1.617.2 \(Delta\), 9 June 2021 - GOV.UK \(www.gov.uk\)](https://www.gov.uk/government/news/imperial-college-london-evaluating-the-roadmap-out-of-lockdown-modelling-step-4-of-the-roadmap-in-the-context-of-b.1.617.2-delta)

These have been published in a previous paper in this series but are included here for context.

The Imperial modelling focussed on “Step 3” of the plan due to take place not before 17th May 2021. It also considered the impact of further relaxation of measures from “Step 4”, occurring not before 21 June 2021.¹³

The restrictions in Wales were assumed to be as follows:

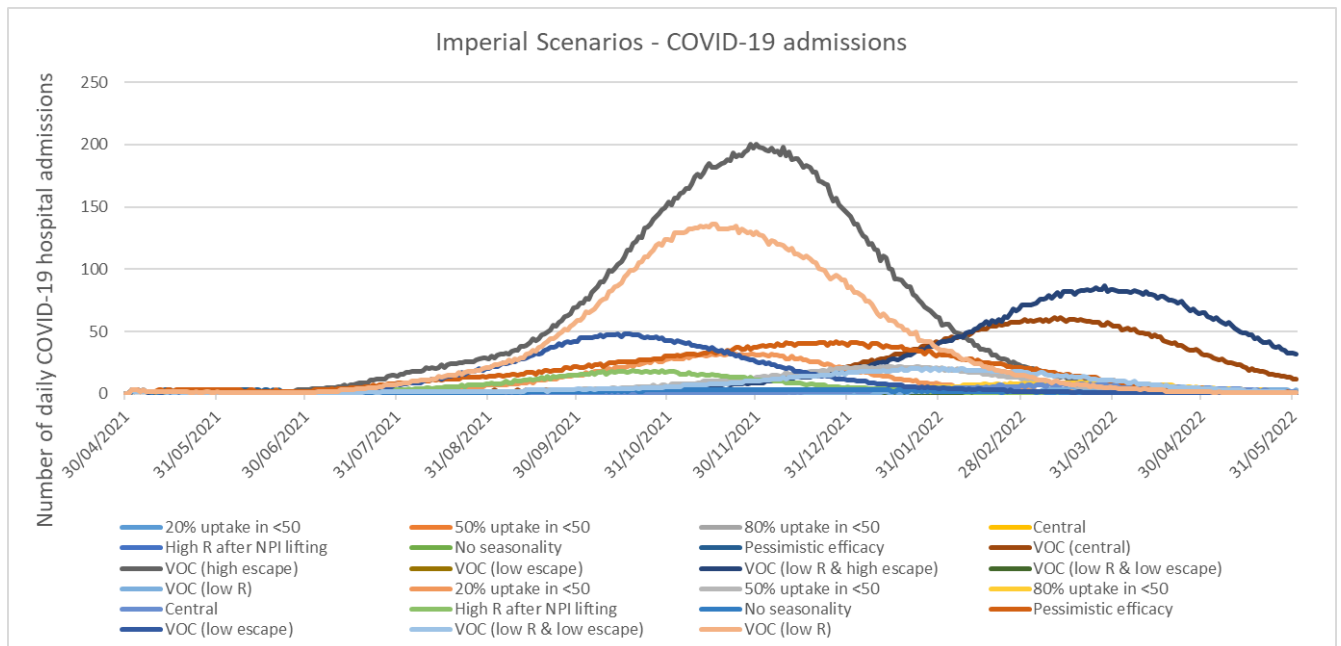
	Step 3 (17 May)	Step 4 (7 June)	Step 5 (28 June)	Full lift (19 July)
Wales	Schools open	Schools open	Schools open	Schools open
Average R	2.1 (1.7 – 2.5)	2.3 (1.9 – 2.8)	2.5 (2.0 – 3.1)	Central: 3.5 (2.8 – 4.3)
(95% probability interval)	Schools closed	Schools closed	Schools closed	Higher R after full lift: 4.5 (3.8 – 5.3)
	1.8 (1.4 – 2.2)	2.0 (1.6 – 2.5)	2.2 (1.7 – 2.8)	Schools closed
				Central: 3.2 (2.5 – 4.0)
				Higher R after full lift: 4.2 (3.5 – 5.0)

¹³ Imperial College London: “Evaluating the Roadmap out of Lockdown : Step 3” dated 5th May 2021

The following variant of concern (VOC) assumptions are assumed:

VOC characteristics	Central	Optimistic
Timing and rate of introduction	15 importations a day, increasing 10-fold at Step 3.	As central
Transmissibility relative to B1.1.7	As transmissible as B1.1.7.	20% less transmissible than B1.1.7
Cross-immunity from natural infection	Infection with VOC is fully (100%) protective against B1.1.7^. Infection with B1.1.7 or earlier variants gives 55% protection against infection/mild disease and 70% protection against hospitalisation with VOC (similar to assumed efficacy of one dose of Pfizer).	As central

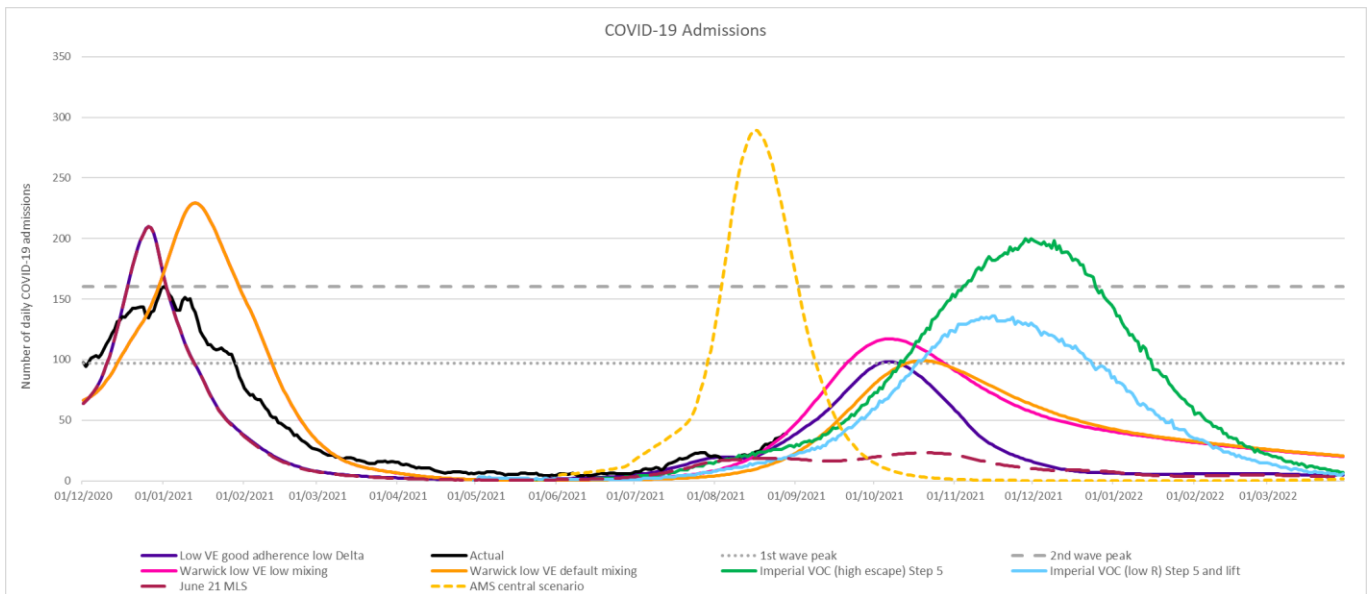
There is no specific parameter for levels of adherence for the Imperial model. However, levels of mixing are specified by the level of restrictions in place.



10. Results Summary – Triangulating Swansea University, AMS model scenarios, and SPI-M Roadmap scenarios

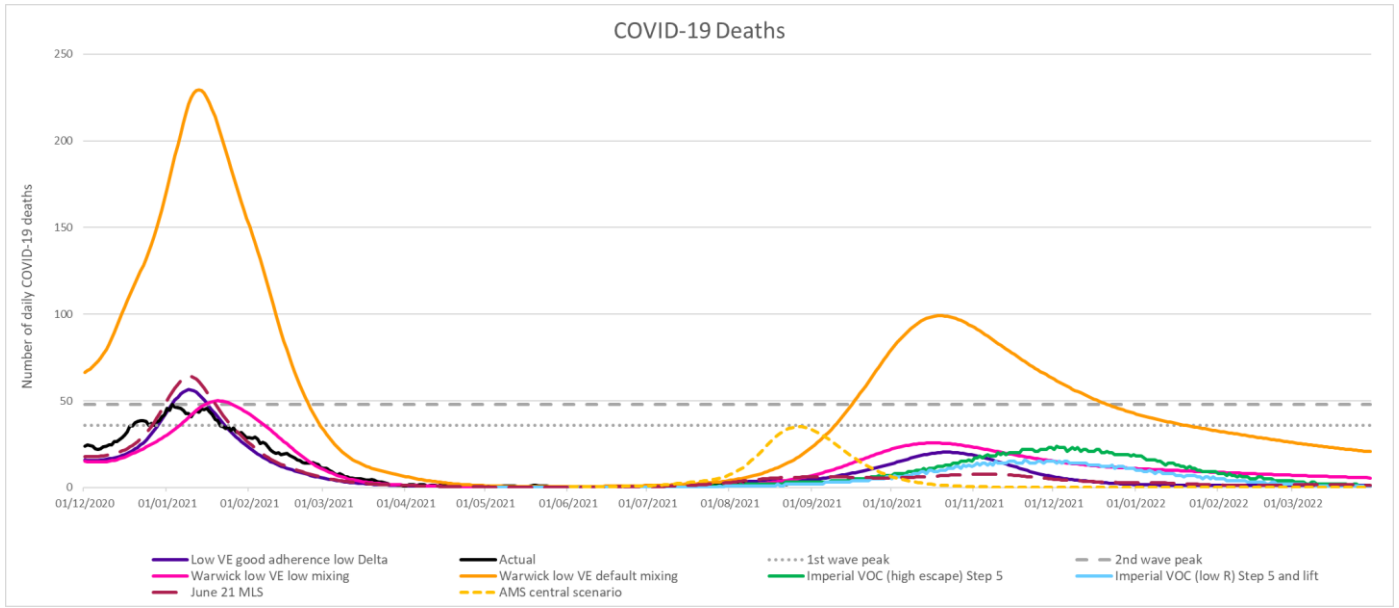
The most recent SPI-M consensus statement¹⁴ suggests the UK may be entering a period of growth due to increased mixing as restrictions are relaxed. The SPI-M roadmap modelling and medium term projections (currently included in the COVID Situation Report (CSR) for Wales¹⁵) suggest there is the potential for another large wave of hospitalisations, but are currently looking more positive week on week for Wales which may indicate an inflection point in the pandemic.

The charts that follow show that the timing and size of peaks vary between models, with some being higher than the January peak and some being lower, indicating uncertainty around behaviours, the effectiveness of vaccines, and how Delta variant behaves in times of high prevalence.



¹⁴ [S1376 SPI-M-O Consensus Statement.pdf \(publishing.service.gov.uk\)](https://publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/101326/S1376_SPI-M-O_Consensus_Statement.pdf)

¹⁵ [COVID-19 situational reports | GOV.WALES](https://gov.wales/covid-19-situational-reports)



Appendix 1. Charts showing all Swansea University Modelling scenarios

Note: on these charts the ribbon bands show a range from high, mid, low vaccine effectiveness. The black dots represent the actuals up to 1 September 2021. The red dots are incomplete data, where more cases may be added after the date. Note that the variants shown on this are 'what if' scenarios so 'Alpha' is 'what if' Alpha was still the dominant variant. It does not mean we will see a resurgence in Alpha now, as Delta is now the dominant variant.

