

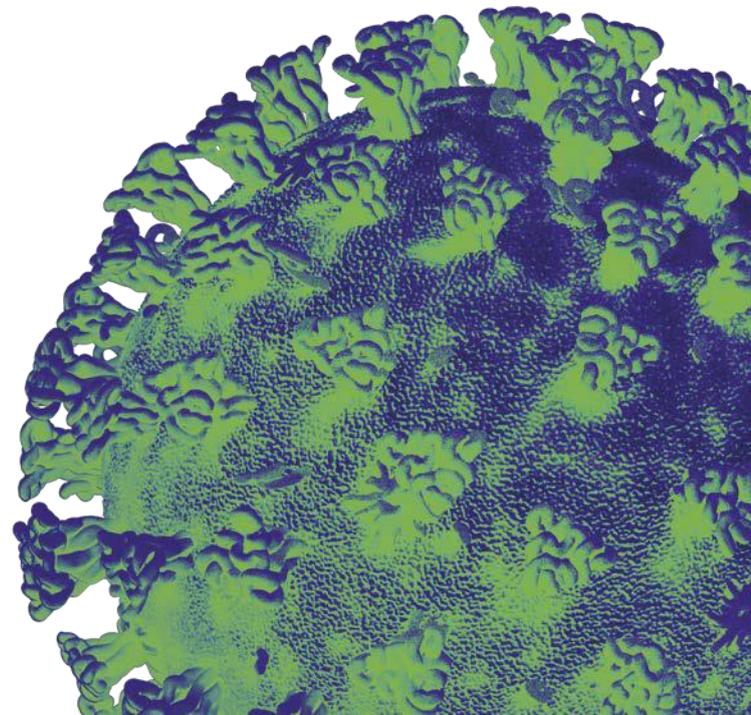
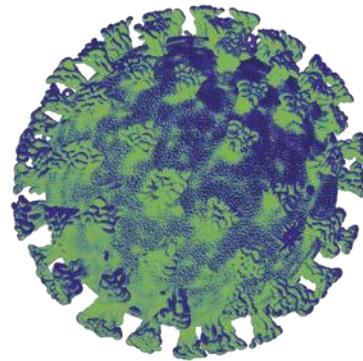
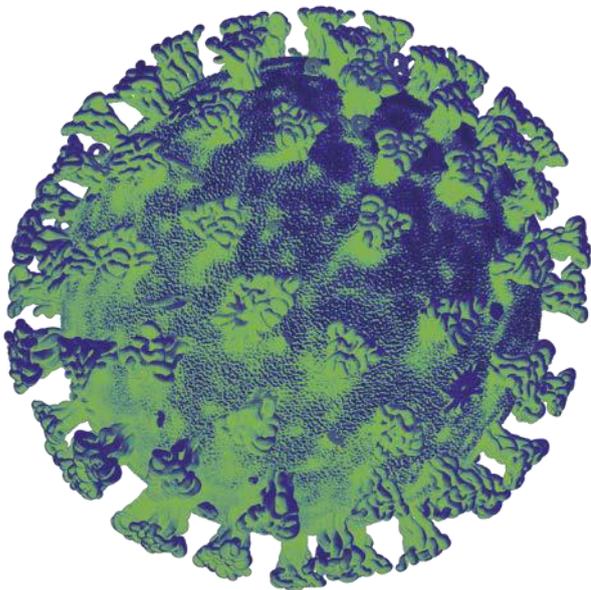


Llywodraeth Cymru
Welsh Government

Technical Advisory Group

Policy modelling update

11 January 2022



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Welsh Government COVID-19 TAG Policy Modelling Subgroup

- This is the latest in a series of papers on modelling the pandemic in Wales. This paper includes scenarios from Swansea University that were produced on 22 December 2021, and further scenarios that were produced on 5 January 2022.
- The 22 December 2021 scenarios took into account accelerated booster rollout that was not in the 17 December 2021 scenarios – assuming 45,000 booster doses per day. The 17 December 2021 scenarios also featured high and low severity assumptions where high severity had a case hospitalisation ratio of 2.5%, low severity had 1%.
- The 22 December 2021 and 5 January 2022 scenarios were focused around the ‘low’ severity assumption as more evidence had emerged of decreased intrinsic average severity being observed for Omicron compared with Delta, making the ‘high’ scenarios less likely. The basic reproduction number (R0) for the 22 December 2021 and 5 January 2022 scenarios was increased from 5.1 to 6.5 to reflect the rapid growth that had been observed. The low severity assumption was also updated to include a higher proportion of asymptomatic cases.
- Omicron became the dominant variant (accounting for more than 50% of cases) in Wales by the end of December with rising numbers of cases of Omicron in Wales throughout December 2021. This led to debate on whether measures needed to be taken to bring the spread of COVID-19 under control. At this point there was a lot of uncertainty about the level of pressure that could be seen in the NHS from an Omicron wave, as well as pressure from a lot of the population being infected at the same time.
- The decision to move to Alert level 2 in Wales was made prior to the production of the scenarios included in this paper. This paper looks at modelling scenarios based on different sets of population protections being applied for set periods of time. In particular, the scenarios consider a move on 26 December 2021 to Alert Level 2 for two or four weeks.¹ In the event, Wales moved to introduce Alert Level 2 – type restrictions on 26 December. An unmitigated scenario where no population protections are introduced is also included. The models assumed there was a reduction in the number of contacts on average in the week before Christmas; however this may not be the case based on COMIX data.
- There is data emerging that suggests the intrinsic severity of Omicron is lower than the previous dominant Delta variant, with Omicron 60-80% less likely to

¹ Alert levels are set out in the [coronavirus control plan](#) for Wales.

lead to hospitalisation and death. However, because there has been an unprecedented number of COVID-19 cases with the Omicron variant, there is still concern about pressure on the NHS, from community acquired cases, as well as hospital-acquired cases, and patients incidentally testing positive on admission.

- There is also concern about the sustainability of health, social care, and other essential public services with such high prevalence and rates of sickness absence, as well as isolation for contacts of cases. Data on staff absence in Wales has some limitations but so far, data up to 3 January 2022 suggest that sickness absence and self-isolation in NHS staff has not yet been as high in the Omicron wave as it has reached in the winter 2020/21 wave but has increased at the end of December 2021.
- The high prevalence has put pressure on the Test, Trace Protect (TTP) system which means confirmed case data is potentially distorted where testing demand has outstripped capacity, and the impact of TTP may be reduced when contact tracing is not able to keep up with the volume of cases. Also the change to asking people not to have a PCR test following a positive LFD test will affect the COVID-19 case data.²
- This paper assumes a 25% increase in asymptomatic infections compared with Delta. The Delta variant in Wales had produced a case-hospitalisation ratio (CHR) of around 2%³. Here, the 'low severity' scenarios have a CHR of 1%. Hospital cases may be inflated due to people being admitted for other reasons who test positive, or nosocomial infections.
- Early studies from [England](#)⁴ and [Scotland](#)⁵ suggest a reduction in the chance of needing hospital treatment for Omicron when compared to Delta cases. The Imperial analysis looking at data from England found a reduction in the range 20-25% when using any attendance at hospital as the endpoint, and 40-45% when using hospitalisation lasting 1 day or longer.
- The analysis from [Scotland](#)⁶ also found a 50-80% reduction in the number of hospitalisations with Omicron when compared with the expected rate for Delta.
- A paper from [South Africa](#)⁷ found a reduction of around 80% in the risk of being hospitalised for S gene target failure (a proxy for Omicron) compared with S gene positive (likely to be mostly Delta).
- All of these analyses are subject to some biases in terms of timings and being able to accurately measure reinfections, and UK data is limited as the majority

² COVID-19 case data in Wales reported here: [Rapid COVID-19 virology - Public | Tableau Public](#)

³ [Technical Advisory Group: policy modelling update 30 November | GOV.WALES. See the Annex for a time series of the CHR in Wales from early November to early December 2021.](#)

⁴ <https://www.imperial.ac.uk/mrc-global-infectious-disease-analysis/covid-19/report-50-severity-omicron/>

⁵ <https://www.research.ed.ac.uk/en/publications/severity-of-omicron-variant-of-concern-and-vaccine-effectiveness->

⁶ <https://www.research.ed.ac.uk/en/publications/severity-of-omicron-variant-of-concern-and-vaccine-effectiveness->

⁷ Wolter et al. Early assessment of the clinical severity of the SARS-CoV-2 Omicron variant in South Africa [link](#)

of cases have been in young people so far and there were small numbers of hospitalisations included in the analysis.

- These reductions in severity are positive news but must be balanced against the much larger risk of infection with Omicron, due to the reduction in protection provided by both vaccination (including boosters) and natural infection. Some of the most pessimistic scenarios around Omicron can be ruled out but it could still cause a significant wave of hospital admissions and other harms, and a lot of people being absent due to sickness at the same time.
- Each scenario was run for varying levels of vaccine effectiveness, from 60% to 80% vaccine effectiveness against infections – this was calibrated to the Delta variant and updated with decreased effectiveness for Omicron.
- In light of Omicron, the booster vaccination programme was ramped up in mid-December. All eligible adults in Wales were offered and encouraged to receive a booster vaccination by the end of the year.⁸ Booster vaccinations up to 8 December 2021 were included in the 22 December 2021 and the 5 January 2022 modelling⁹ with an assumption of 45,000 vaccines being administered per day in Wales after this date.
- Swansea University produced an additional low severity scenario on 5 January 2022, updated to fit the initial Omicron Rt rise more closely.
- The scenarios suggest a peak of up to around 12,000 – 19,000 daily cases between 1 December 2021 and 30 March 2022 depending on levels of protective measures and how effective these restrictions are. However the peak may be less sharp, and more drawn out, dependent on the mixing behaviour over the Christmas period and the subsequent weeks. COMIX data suggests slightly increased contacts in Wales up to the end of December, albeit with a lot of uncertainty.¹⁰
- Schools returning may be associated with increased mixing or adults returning to the workplace so the data may change in the next week – there may be an increase in transmission which would be observed in the ONS covid infection survey and other metrics such as waste water.
- There are some signs that some areas like London may have seen a peak of cases in younger age groups, but cases are transitioning into older age groups who may be at higher risk of severe outcomes.
- With a large proportion of the population being infected, or reinfected, in the Omicron wave, consideration of long covid and other sequelae of COVID-19 is important because even if the risk is reduced, this may cause a significant

⁸ [First Minister outlines ambitious aim to offer all eligible adults a booster appointment by end of year | GOV.WALES](#)

⁹ Previous COVID-19 modelling (dated 17 December 2021) assumed booster vaccinations were administered at a rate of 20,000 per day. The paper detailing this modelling is published here: [Technical Advisory Group: policy modelling update 17 December 2021 | GOV.WALES](#)

¹⁰ <https://cmmid.github.io/topics/covid19/reports/comix/Comix%20Weekly%20Report%2092.pdf>

future burden of disease. Understanding how many Omicron cases still have symptoms at four weeks may give an early indication of this burden.

- Understanding more about the balance of economic and social harms as well as direct COVID harms, and indirect health harms caused by COVID and by staff being absent is important in providing context for these epidemiological models and helping to fine-tune policies to balance these different harms.
- Ideally we would have more models that include results for Wales as current models produced for SPI-M-O are England only. This would enable us to triangulate results from different models.

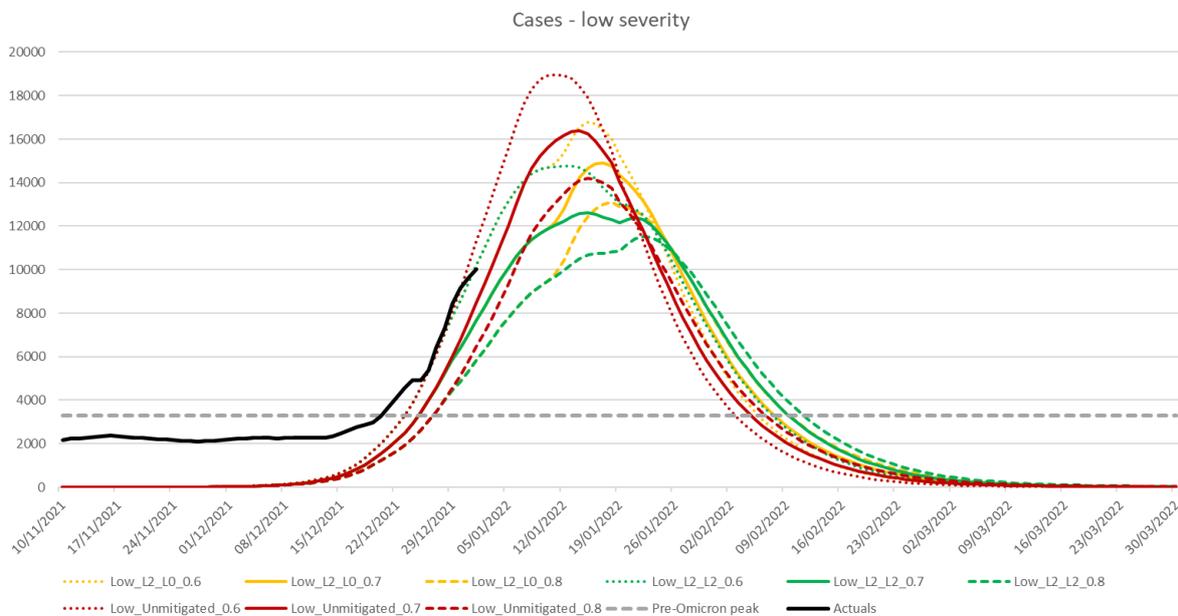
Modelling Scenarios

- The following scenarios were produced to assist with planning. They are not intended to predict what will happen but provide scenarios of what could happen. They are intended to be short-term scenarios with the aim of updating them regularly as the picture changes in light of new data, information, assumptions or variants. These scenarios are still uncertain but we are currently (6 January 2022) seeing a rapid increase in hospital admissions that is following other parts of the UK. However a proportion of hospital cases are nosocomial and some are likely to be incidental COVID-19 positives in individuals admitted for other reasons.
- **Note that the model scenarios shown here are for Omicron wave only; the cases start from zero and go back to around zero. In reality this is unlikely and it is likely we will see some level of continued prevalence of COVID-19 – either Omicron, Delta, or another variant.**
- All scenarios estimate that the peak number of COVID-19 cases will far exceed previous peaks regardless of which, if any, population protections were implemented in the 4 weeks following Christmas. There are a maximum 12,000 to 19,000 estimated daily symptomatic cases. This will continue to put pressure on the system in terms of high prevalence and sickness absence.
- However, the scenarios suggest how hospital admissions can be controlled/reduced to an extent by bringing in coronavirus control plan measures. The impact of the measures on admissions will also depend on the case hospitalisation ratio (CHR).
- With the low severity of Omicron, it may be possible to keep hospitalisations and bed occupancy at lower or similar levels to previous peaks observed in Wales. However, this may be counteracted by an increase in incidental cases and nosocomial cases.
- Model scenarios suggest that if alert level measures were applied for two weeks only from 26 December 2021, there may be some benefit, but if

introducing the protections for four weeks, alert level 2 could have a significant impact.

- The following charts show the scenarios from 22 December 2021 models for COVID-19 cases, hospital admissions, and hospital bed occupancy. Hospital occupancy may be the most appropriate metric in terms of total pressure on the NHS; this may vary if we see shorter length of stay with Omicron than with other variants. The models include Omicron infections only, while the actuals include all COVID-19 variants. Data is emerging which suggests Omicron is less likely to lead to critical care demand and less likely to cause death than Delta, with a potential similar reduction in severity as for hospital admissions. So far, although there has been an increase in hospital cases in London, any increase in critical care demand has been very modest.

Figure 1: Estimated daily COVID-19 cases in Wales due to the Omicron variant under various coronavirus control plan measures – low severity

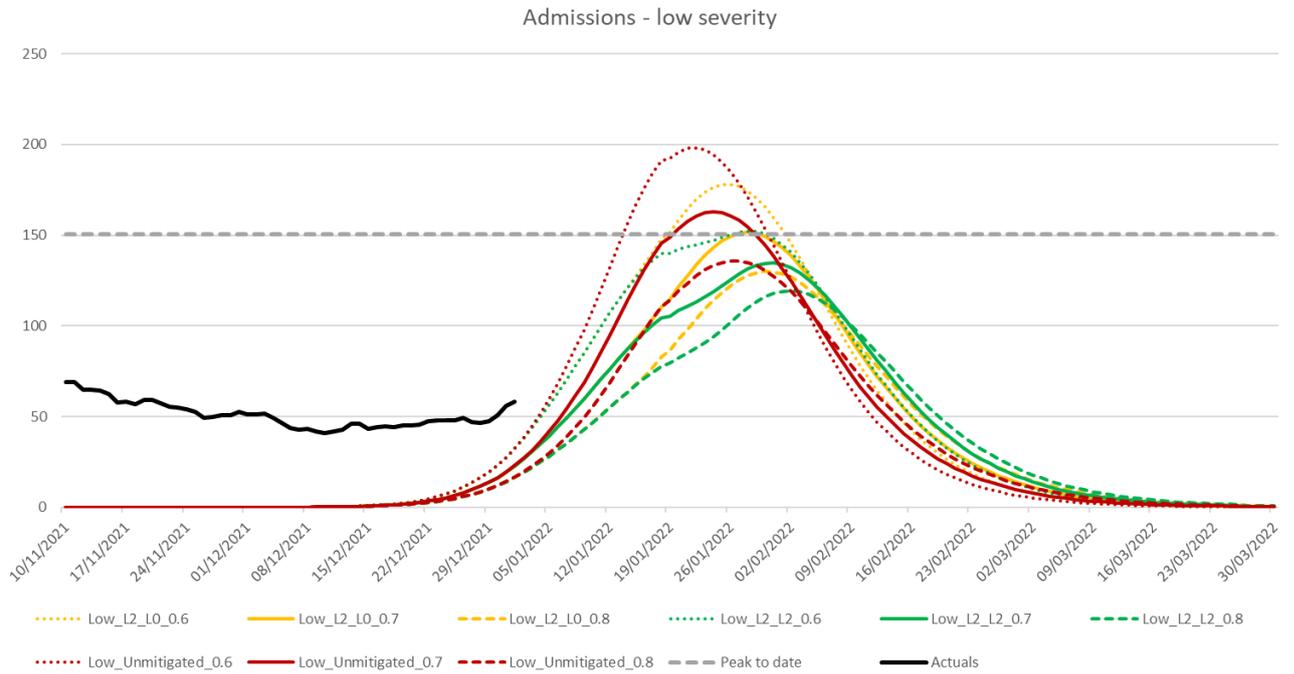


Sources: Swansea University modelling; PHW

L2_L0 means Alert Level 2 in Wales for 2 weeks (from 26 December 2021) followed by Alert Level 0 for the subsequent 2 weeks. L2_L2 means Alert Level 2 in Wales for four weeks

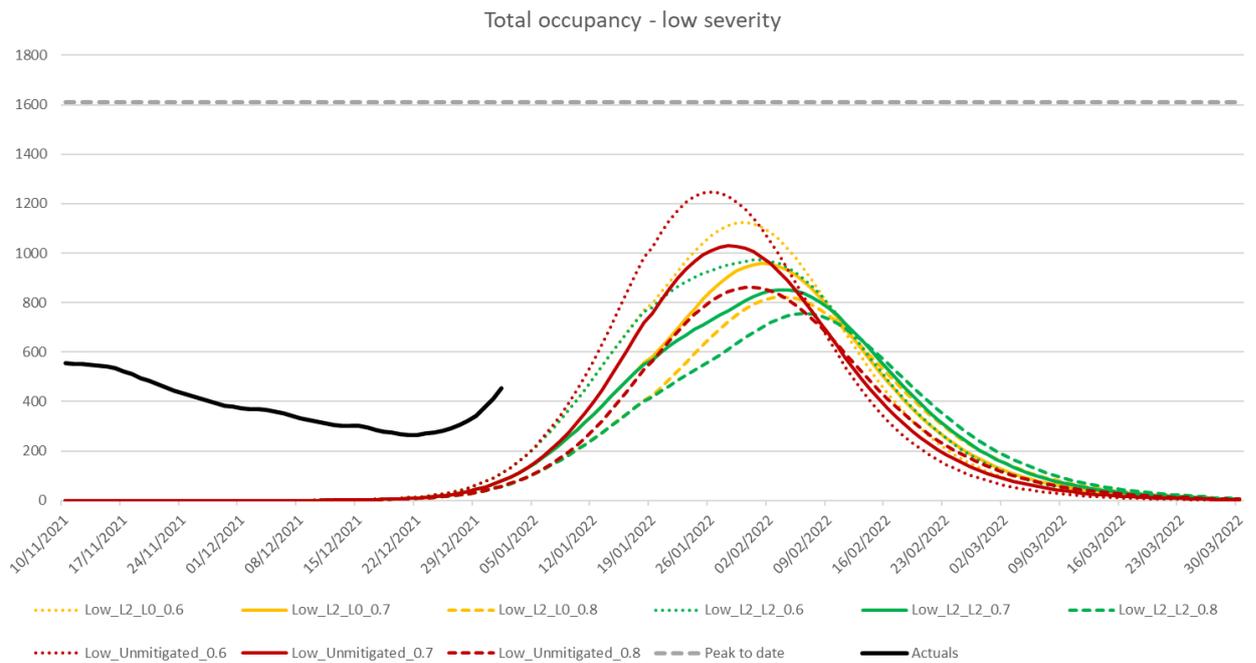
Models only include Omicron cases, actuals are all COVID-19 cases.

Figure 2: Estimated daily confirmed COVID-19 admissions in Wales due to the Omicron variant under various coronavirus control plan measures – low severity



Sources: Swansea University modelling; PHW
 L2_L0 means Alert Level 2 in Wales for 2 weeks (from 26 December 2021) followed by Alert Level 0 for the subsequent 2 weeks. L2_L2 means Alert Level 2 in Wales for four weeks
 Models only include Omicron admissions, actuals are all COVID-19 admissions.

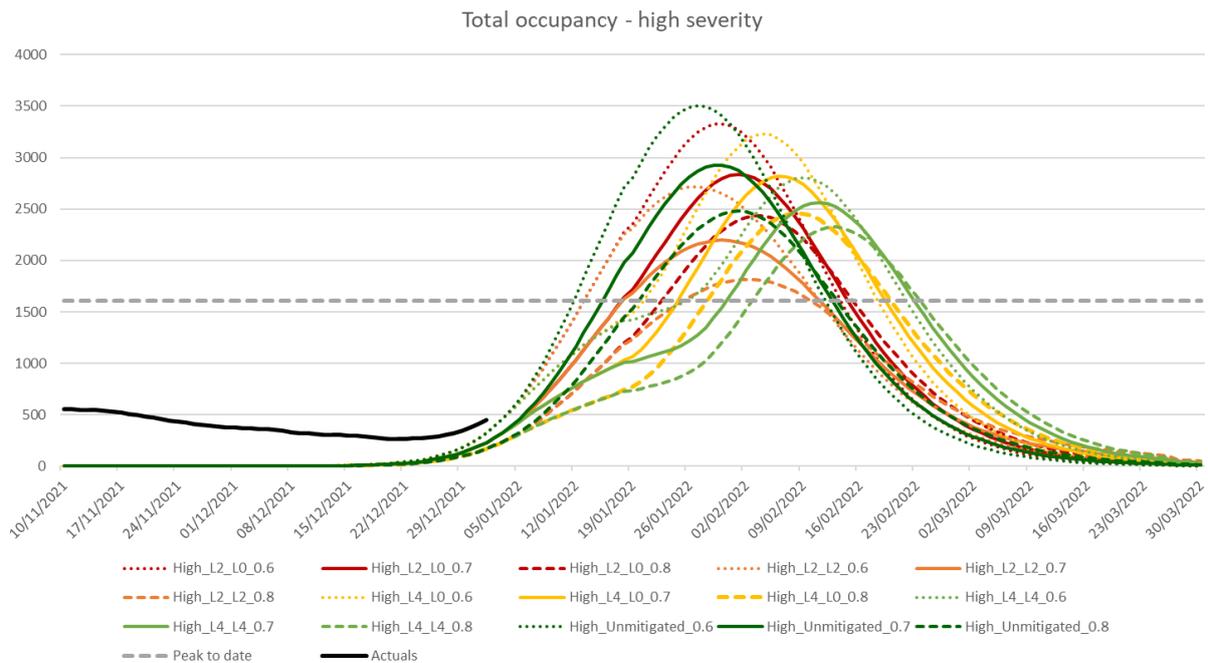
Figure 3: Estimated daily total COVID-19 hospital bed occupancy in Wales due to the Omicron variant under various coronavirus control plan measures – low severity



Sources: Swansea University modelling; StatsWales

L2_L0 means Alert Level 2 in wales for 2 weeks (from 26 December 2021) followed by Alert Level 0 for the subsequent 2 weeks. L2_L2 means Alert Level 2 in Wales for four weeks
Models only includes hospital beds occupied by patients with the Omicron variant, actuals are all hospital beds occupied by patients with any COVID-19 variant.

Figure 4b: Estimated daily total COVID-19 hospital bed occupancy in Wales due to the Omicron variant under various coronavirus control plan measures – high severity



Sources: Swansea University modelling; StatsWales

L2_L0 means Alert Level 2 in wales for 2 weeks (from 26 December 2021) followed by Alert Level 0 for the subsequent 2 weeks. L2_L2 means Alert Level 2 in Wales for four weeks
Models only includes hospital beds occupied by patients with the Omicron variant, actuals are all hospital beds occupied by patients with any COVID-19 variant.

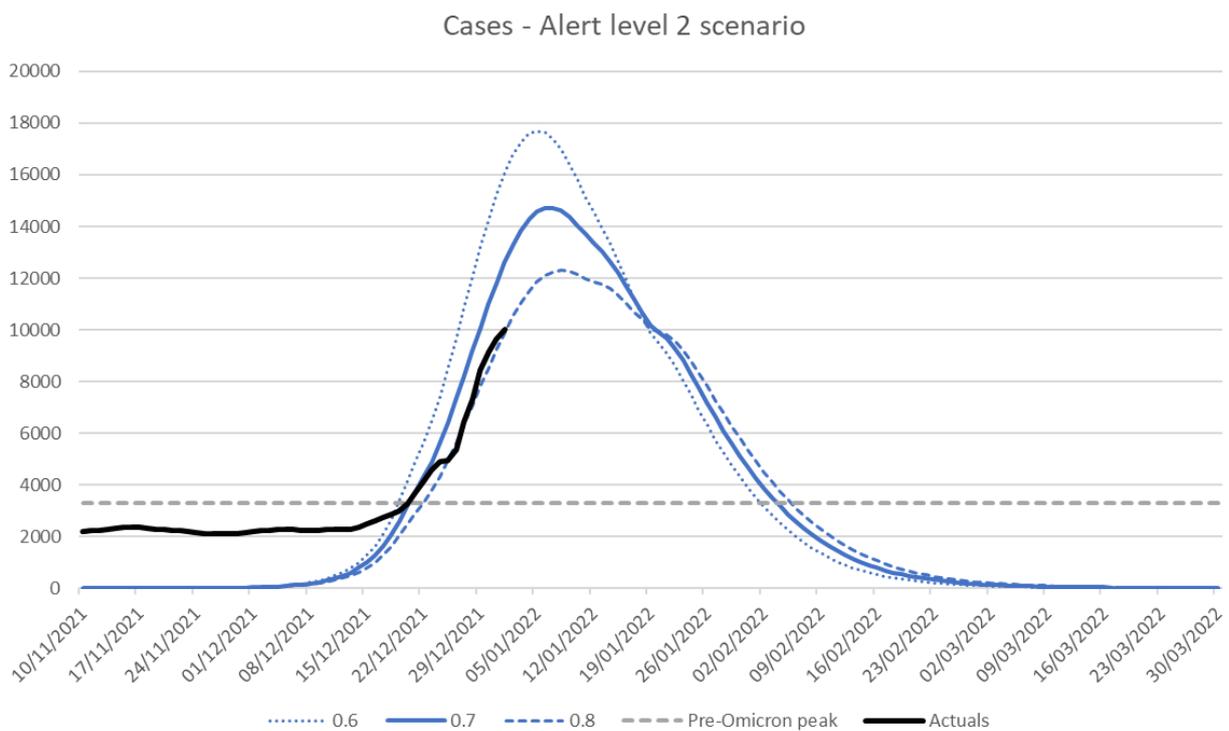
- An additional model scenario was provided on 5 January 2022, with the same assumptions as the low_L2_L2¹¹ severity scenarios above, and fitted to the initial rise in the Rt of Omicron.
- Under this scenario, cases are closely tracking the 80% vaccine effectiveness (VE) assumption ('high vaccine effectiveness'), with current daily cases estimated at just over 10,000 and a peak of around 12,000 in mid-January.
- Daily admissions are estimated to peak between 120 and 180 in mid-January, and start to decline sharply from early February. Under the mid and high vaccine effectiveness assumptions, peak daily admissions stays below the

¹¹ This refers to a scenario where Alert Level 2 is introduced for four weeks in Wales on 26 December 2021 before returning to Alert Level zero again.

peak seen before Omicron, but is exceeded under the low vaccine effectiveness assumption.

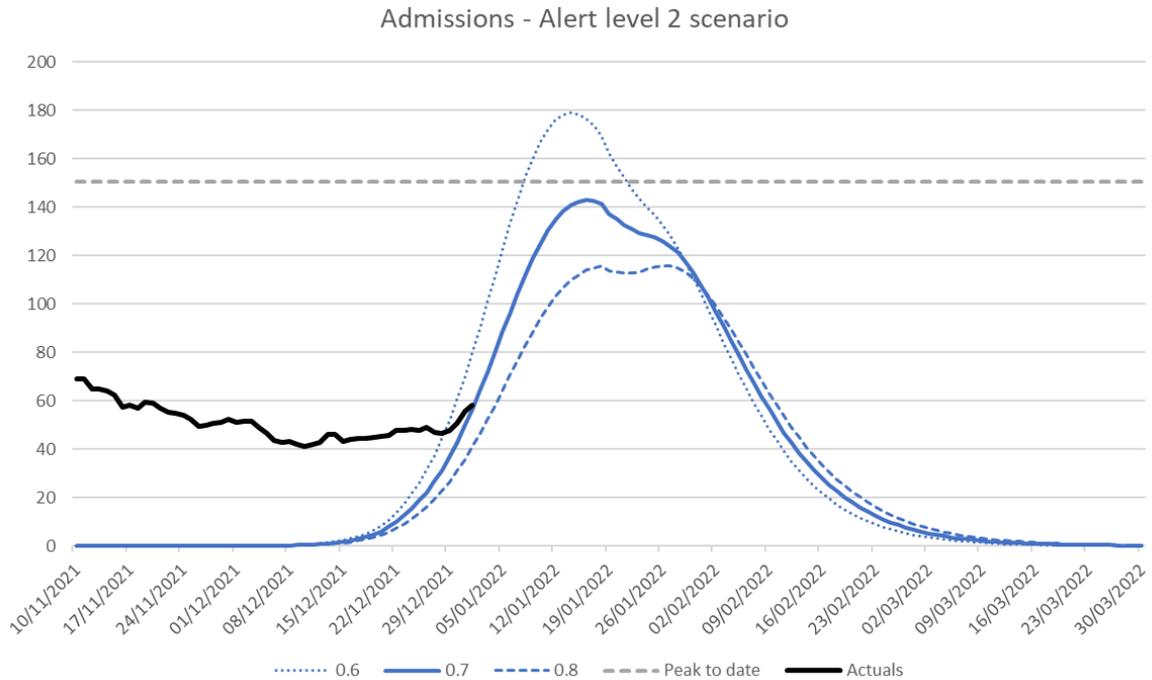
- Actual occupancy data is currently approximately around a week ahead of this scenario, but under all VE assumptions, the peak is estimated to remain below what was seen previously.
- The following charts show the updated 5 January 2022 scenario for COVID-19 cases, hospital admissions, and hospital bed occupancy, at various vaccine effectiveness estimates.
- In reality, we may not see such a rapid increase and fall in cases if people continue to change their behaviour and reduce their contacts; we may see a longer tail of cases than these scenarios predict and we are likely to see a longer period of continued COVID-19 cases, either Omicron or another variant.

Figure 4: Estimated daily COVID-19 cases in Wales due to the Omicron variant under Alert Level 2 – low severity



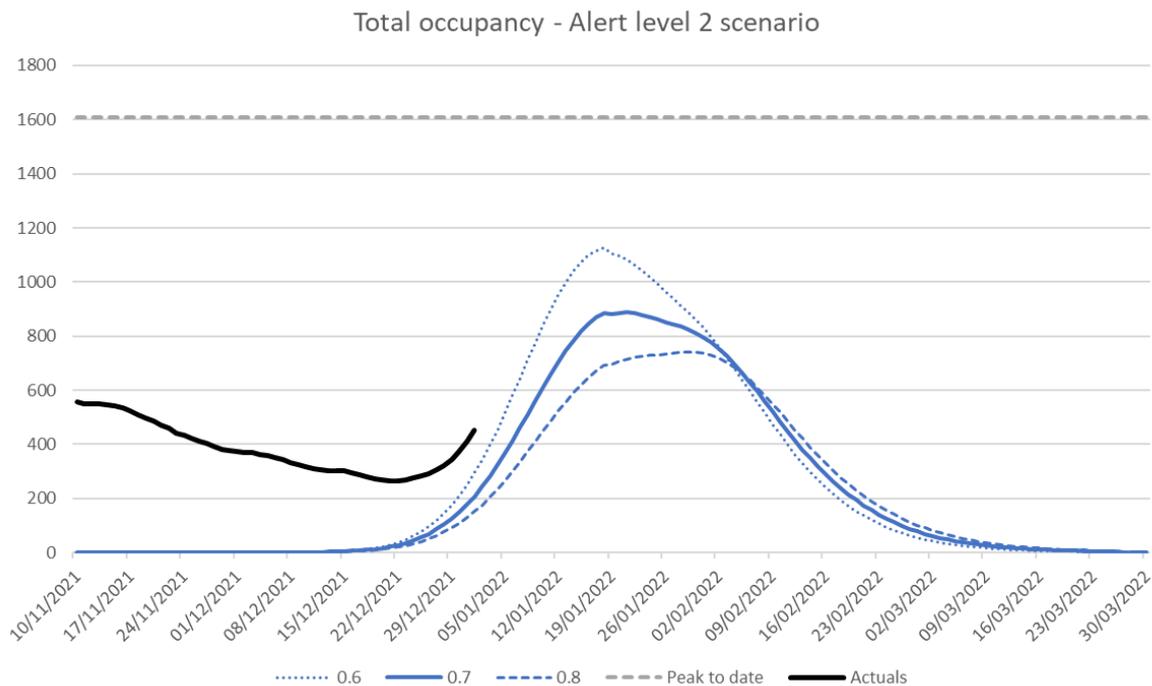
Sources: Swansea University modelling; PHW
Models only include Omicron cases, actuals are all COVID-19 cases.

Figure 5: Estimated daily COVID-19 admissions in Wales due to the Omicron variant under Alert Level 2 – low severity.



Sources: Swansea University Modelling; PHW
 Models only include Omicron admissions, actuals are all COVID-19 admissions.

Figure 6: Estimated daily total COVID-19 hospital bed occupancy in Wales due to the Omicron variant under Alert Level 2 – low severity.

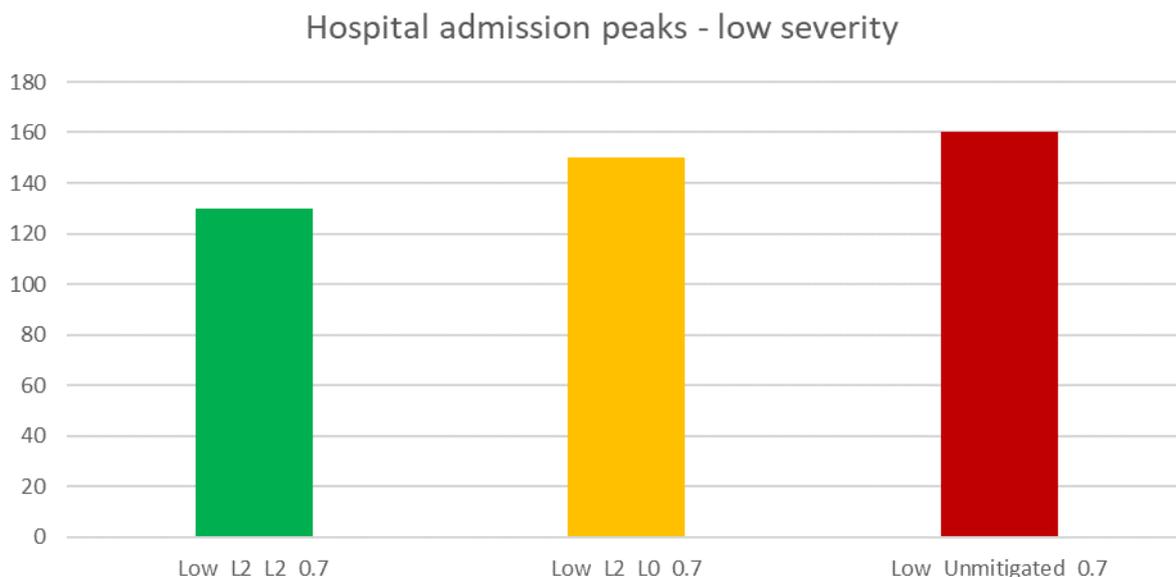


Sources: Swansea University modelling; StatsWales
 Models only includes hospital beds occupied by patients with the Omicron variant, actuals are all hospital beds occupied by patients with any COVID-19 variant.

Daily peaks (Between 1 December 2021 and 30 March 2022)

- The number of COVID-19 hospital admissions estimated per day is a key metric for planning to ensure the NHS in Wales can meet demand. In Wales, a maximum of 187 confirmed COVID-19 patients were admitted in one day (on 29 December 2020).
- There are significant differences in the maximum numbers of confirmed COVID-19 admissions per day under the low and high disease severity assumptions. Under the high severity assumption, the peaks all exceed 200 admissions per day. Under the low severity 22 December 2021 scenarios included in this paper, all scenarios where a protection (Alert Level) is introduced lead to peaks of below 200 in Wales (for lower vaccine efficacy assumptions), or below 160 for mid vaccine efficacy assumptions (70% vaccine efficacy assumptions).
- The charts below all show the estimated peaks of each of the 22 December scenarios with 70% vaccine effectiveness (mid VE) against infections. For further charts and for the tables of (rounded) totals and peaks for all scenarios at each vaccine effectiveness between 1 December 2021 and 30 March 2022, see the [Annex](#).

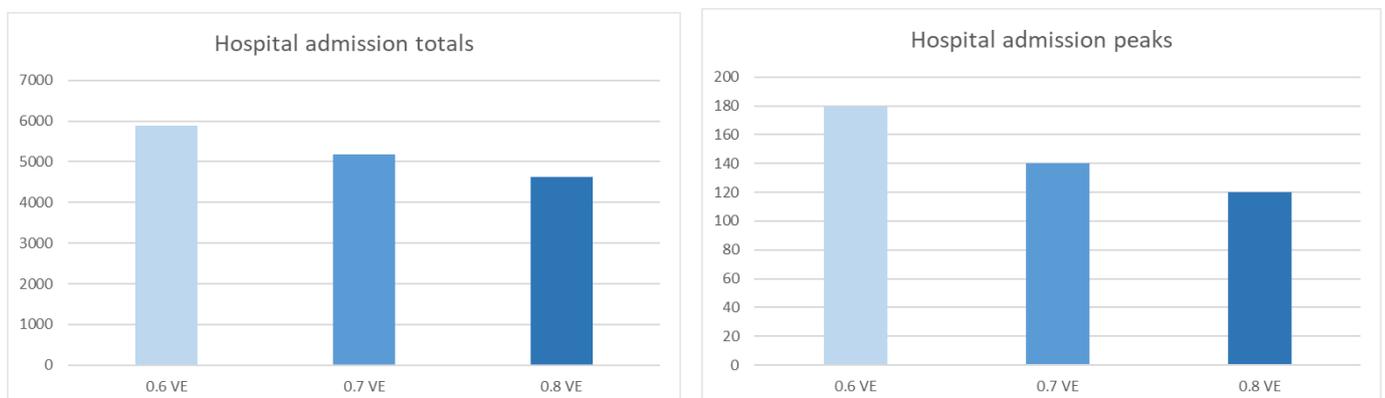
Figure 7: The estimated peak number of confirmed COVID-19 hospital admissions per day between 1 December 2021 and 30 March 2022, Wales



Source: Swansea University modelling

- Assuming a central vaccine effectiveness of 70%, there is an estimated range of between 5,000 and 5,100 COVID-19 admissions, with a daily peak of between 130 and 160 admissions, over the period between 1 December 2021 and 30 March 2022, depending on what protections are implemented.
- In reality there may be more hospital cases than this because of nosocomial (healthcare-acquired) cases as there has been a several fold increase in the susceptible population with Omicron variant, and there may be more incidental findings on admission. The peak occupancy depends on length of stay which may be affected by patient flow through the hospital, which may be delayed due to high levels of staff sickness absence.
- These scenarios estimate that entering alert level 2 for two weeks or four weeks will produce a similar total number of COVID-19 admissions between 1 December and 30 March 2022, and in addition is estimated to produce a similar total number of COVID-19 admissions as remaining in alert level 0 (no mitigations) over the same period. However, the model estimates that introducing protections does help to reduce the daily peak number of hospital admissions which would help to reduce pressure on the NHS.
- Protective measures are most effective (in terms of reducing peak hospitalisations per day) when implemented for a minimum of 4 weeks. However, introducing protections for at least 2 weeks does have an impact on reducing the daily peak number of hospital admissions, making the total admissions more manageable.
- In the scenario updated on 5 January 2022, with the low severity assumptions fitted to the initial rise in the Omicron Rt, the estimated total number of COVID-19 admissions over the same period ranges between 4,600 and 5,900. The daily peak ranges between 120 and 180, as detailed in the charts below.

Figure 9: The estimated total and peak number of confirmed COVID-19 hospital admissions per day between 1 December 2021 and 30 March 2022, 5 January 2022 scenarios, Wales



Source: Swansea University modelling.

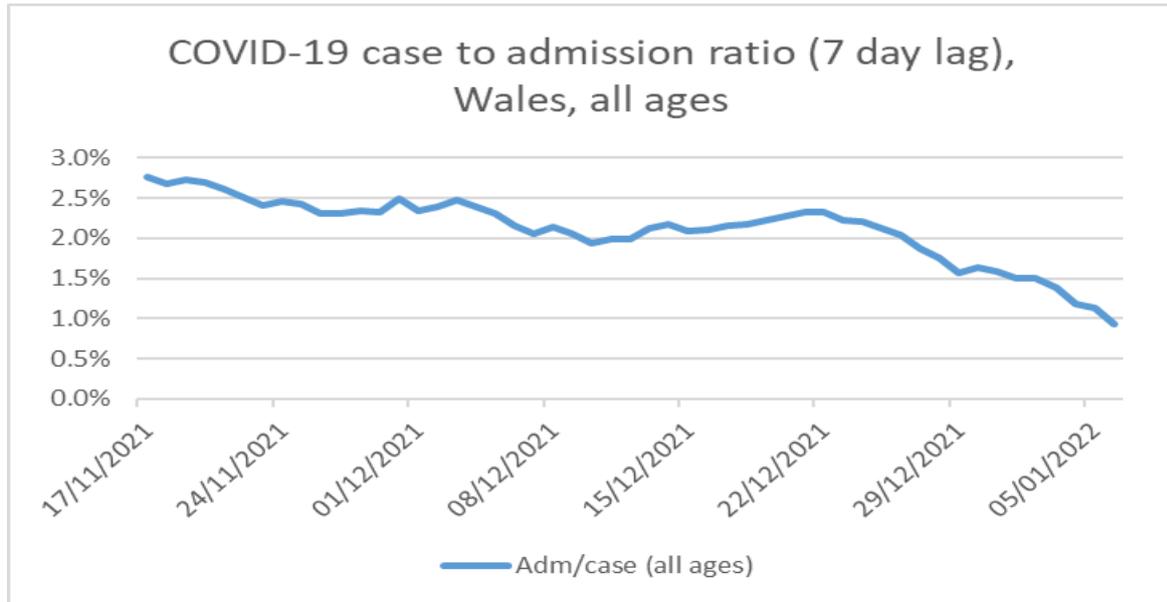
Annex

Further model assumptions

- To calibrate the Swansea University epidemiological models to the Omicron variant, the following updates were made on 22 December 2021:
- An R_0 of 6.5 was assumed. This was based on the doubling time of three days observed by mid-December. An additional seeding in late November was added to generate the date where the majority of cases were Omicron.
- To take account of the possibility of increased reinfection rates due to immune evasion which may occur due to the Omicron variant, an immune evasion parameter of 50% is set. This is accomplished by setting a starting condition where 50% of those who have had previous exposure to COVID-19 and/or a vaccination retain their immunity.
- The case to hospitalisation ratios (CHR) was set at 1%, below the recent Delta wave CHR. The ICU parameter was un-calibrated and set at an additional protection of 20%. The death parameter was also un-calibrated and assumed an additional 10% reduction in COVID-19 ICU hospitalisations which later died. The low severity assumption has 25% more asymptomatic infections compared with Delta.
- Scenarios are available for vaccine effectiveness against infection between 60% and 80%, which have a 85-95% vaccine effectiveness assumption against severe events. This is line with most recent vaccine effectiveness estimates from UKHSA for Omicron.
- Schools were assumed to remain open and contacts were assumed to be slightly higher than previous waves.

Case to Hospitalisation ratio, Wales

- Looking at the most recent data for the CHR from mid-November 2021 to the start of January 2022, the CHR shows a fall over time. With the Omicron variant, we may see fewer community cases lead to hospital admissions, but at the same time there may be an opposing force of an increase in nosocomial cases and incidental covid positives on admission, both of which still involve a lot of additional care in terms of clinical management, PPE and infection prevention and control.



Source: PHW ICNet

Daily peaks and cumulative totals of COVID-19 cases, Wales

- The following tables show the total and peak estimated COVID-19 cases, hospitalisations and hospital bed occupancy that may occur between 1 December 2021 and 30 March 2022 due to the Omicron variant. Separate tables are used to separate the scenarios run in December to the one run in January.

Totals (Between 1 December 2021 and 30 March 2022) – 22 December 2021 models

Low severity	Infections	Cases	Hospital admissions
Low_L2_L0_0.6	1,849,700	517,680	5,770
Low_L2_L0_0.7	1,730,800	472,870	5,070
Low_L2_L0_0.8	1,625,640	432,680	4,490
Low_L2_L2_0.6	1,835,420	511,950	5,640
Low_L2_L2_0.7	1,719,830	468,500	4,970
Low_L2_L2_0.8	1,617,510	429,460	4,420
Low_Unmitigated_0.6	1,856,680	521,280	5,870
Low_Unmitigated_0.7	1,734,310	475,100	5,120
Low_Unmitigated_0.8	1,626,490	433,920	4,520

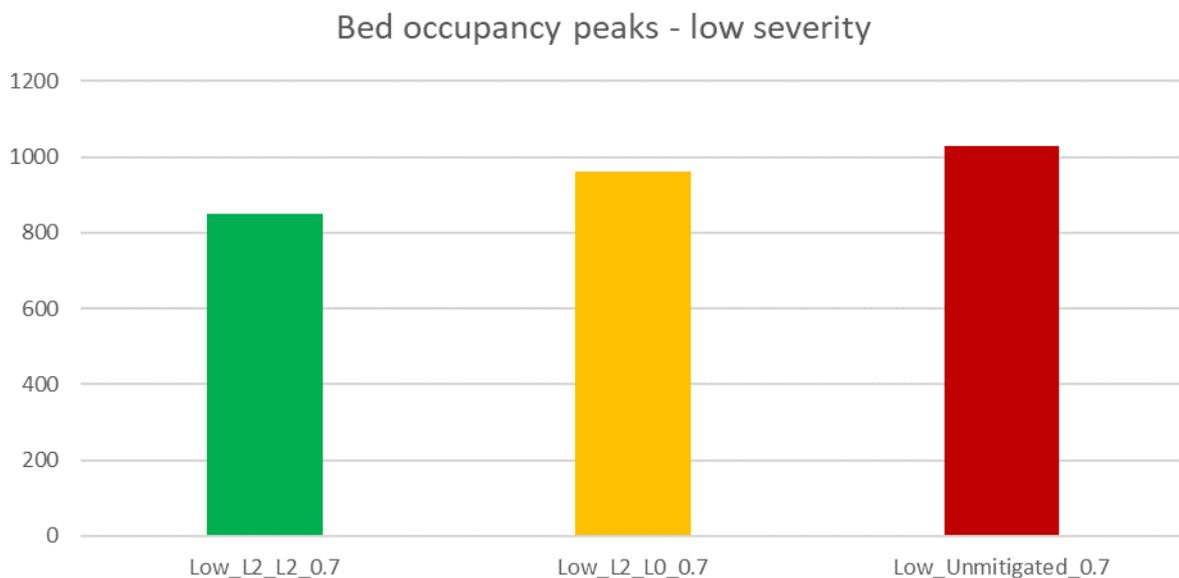
Totals (Between 1 December 2021 and 30 March 2022) – 5 January 2022 models

	Infections	Cases	Hospital admissions
0.6 VE	1,852,620	520,860	5,880
0.7 VE	1,736,740	477,070	5,180
0.8 VE	1,634,950	438,020	4,620

Daily peaks (Between 1 December 2021 and 30 March 2022) – 22 December 2021 models

Low severity	Infections	Cases	Hospital admissions	Total bed occupancy
Low_L2_L0_0.6	74,020	16,780	180	1,120
Low_L2_L0_0.7	66,190	14,890	150	960
Low_L2_L0_0.8	57,370	13,120	130	820
Low_L2_L2_0.6	60,950	14,770	150	970
Low_L2_L2_0.7	54,550	12,610	130	850
Low_L2_L2_0.8	50,290	11,530	120	750
Low_Unmitigated_0.6	72,930	18,980	200	1,250
Low_Unmitigated_0.7	68,130	16,380	160	1,030
Low_Unmitigated_0.8	61,130	14,190	140	860

Figure 9: The estimated peak number of total COVID-19 hospital beds occupied per day between 1 December 2021 and 30 March 2022, Wales

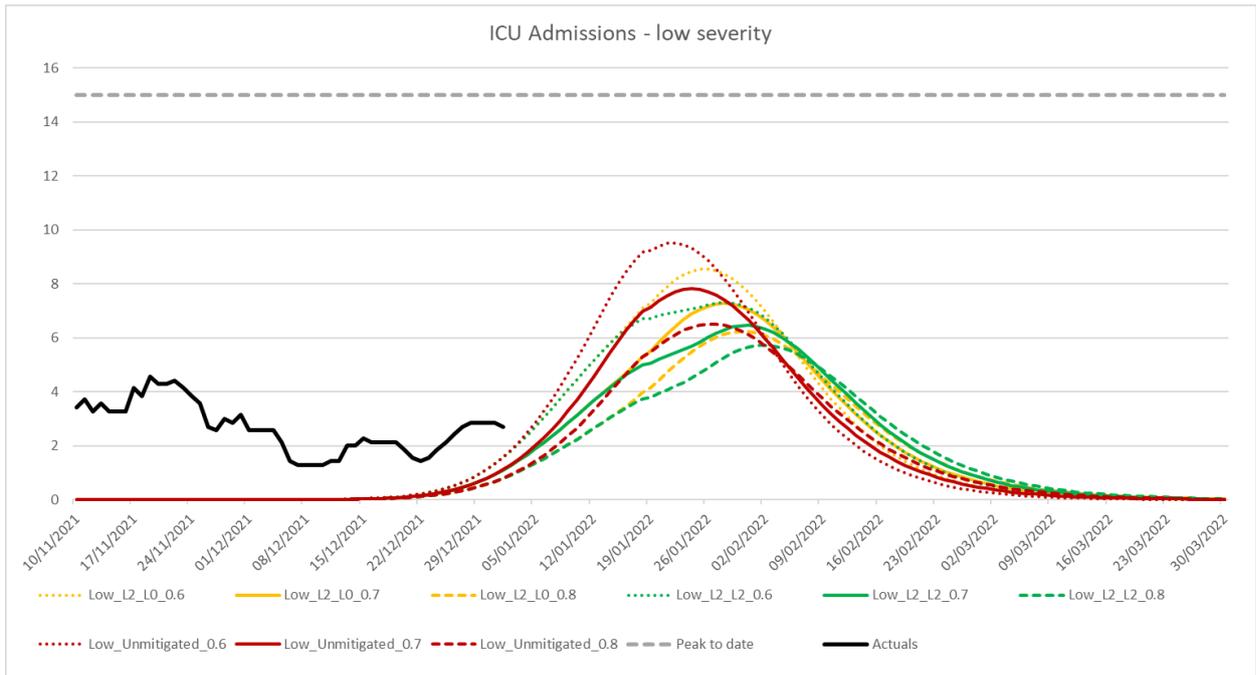


Source: Swansea University modelling (model run: 22 December 2021)

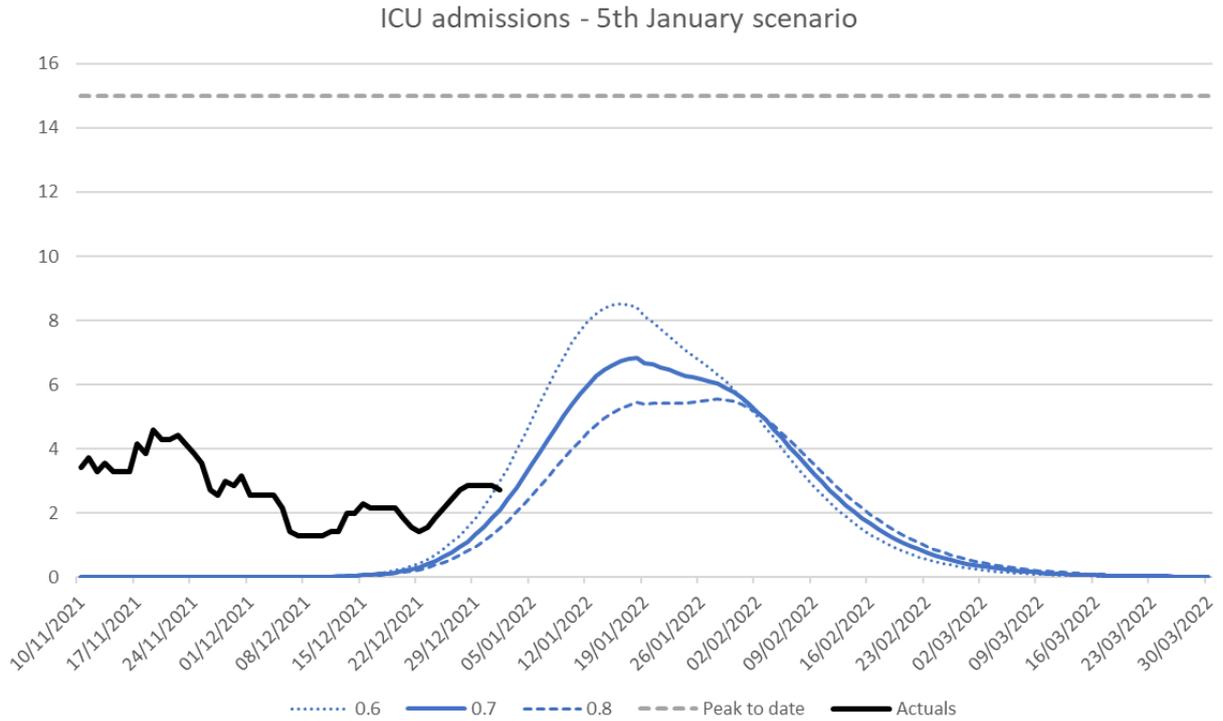
Daily peaks (Between 1 December 2021 and 30 March 2022) – 5 January model

	Infections	Cases	Hospital admissions	Total bed occupancy
0.6 VE	64,870	17,700	180	1,130
0.7 VE	54,880	14,730	140	890
0.8 VE	49,640	12,290	120	740

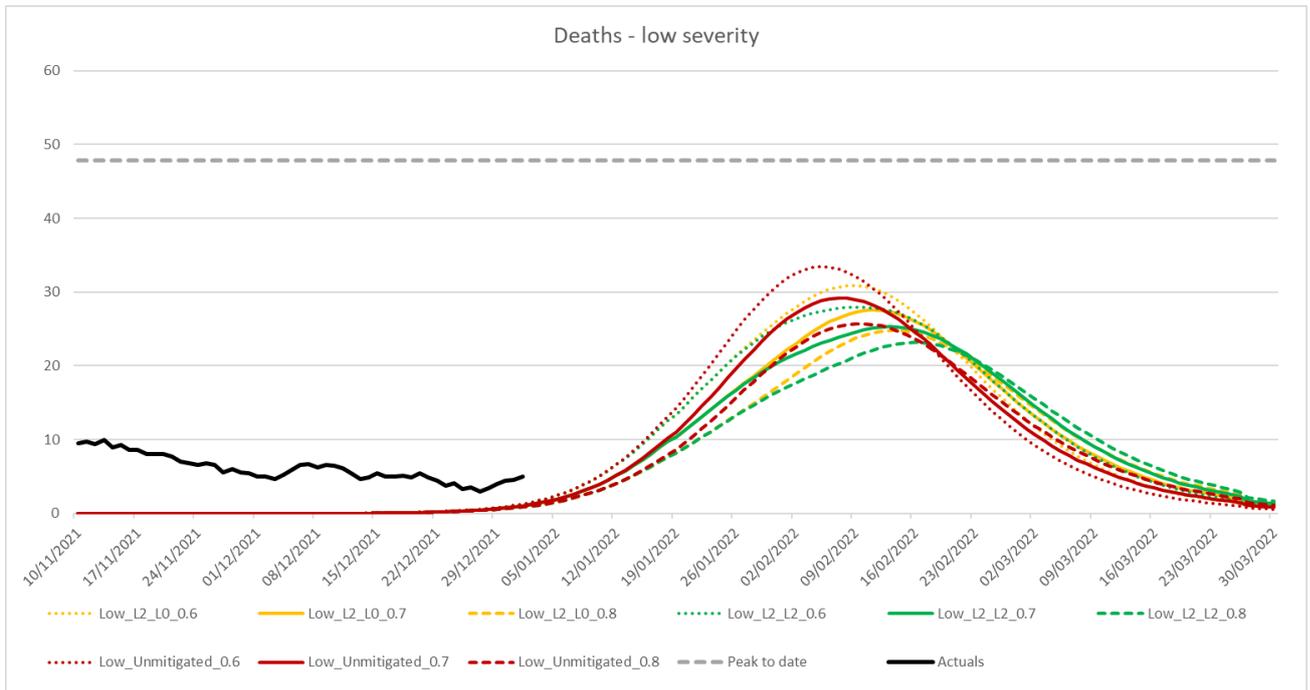
ICU admissions and deaths



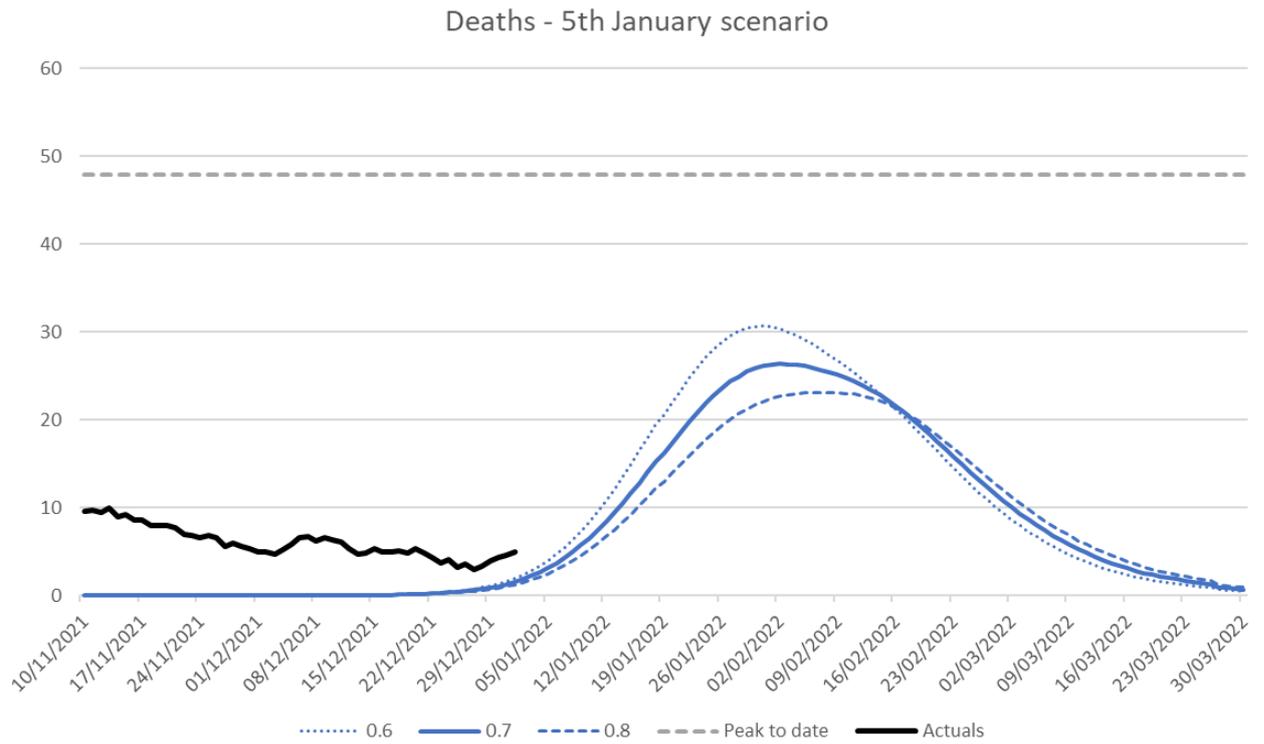
Source: Swansea University modelling (model run: 22 December 2021); StatsWales L2_L0 means Alert Level 2 in wales for 2 weeks (from 26 December 2021) followed by Alert Level 0 for the subsequent 2 weeks. L2_L2 means Alert Level 2 in Wales for four weeks. Models only include Omicron ICU admissions, actuals are all COVID-19 ICU admissions.



Source: Swansea University modelling (model run: 5 January 2022); StatsWales Models only include Omicron ICU admissions, actuals are all COVID-19 ICU admissions.



Source: Swansea University modelling (model run: 22 December 2021); PHW L2_L0 means Alert Level 2 in Wales for 2 weeks (from 26 December 2021) followed by Alert Level 0 for the subsequent 2 weeks. L2_L2 means Alert Level 2 in Wales for four weeks. Models only include Omicron deaths, actuals are all COVID-19 deaths.



Source: Swansea University modelling (model run: 5 January 2022); PHW Models only include Omicron deaths, actuals are all COVID-19 deaths.

The updated 5 January 2022 Scenarios produced by Swansea University compared with actuals

