

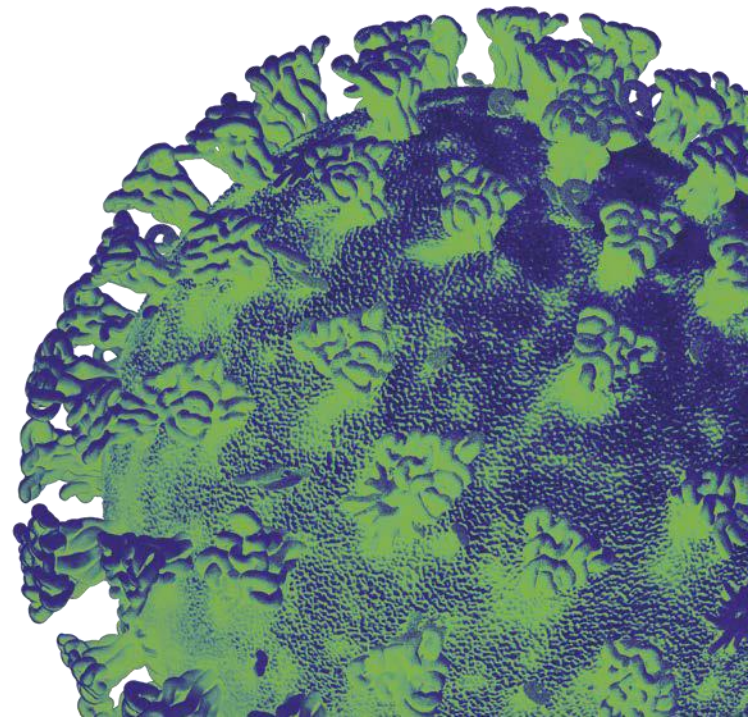
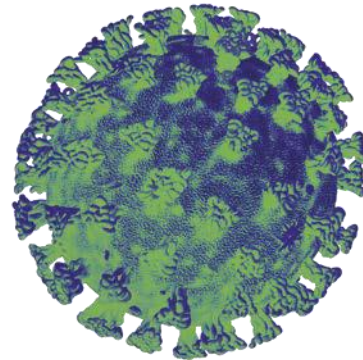
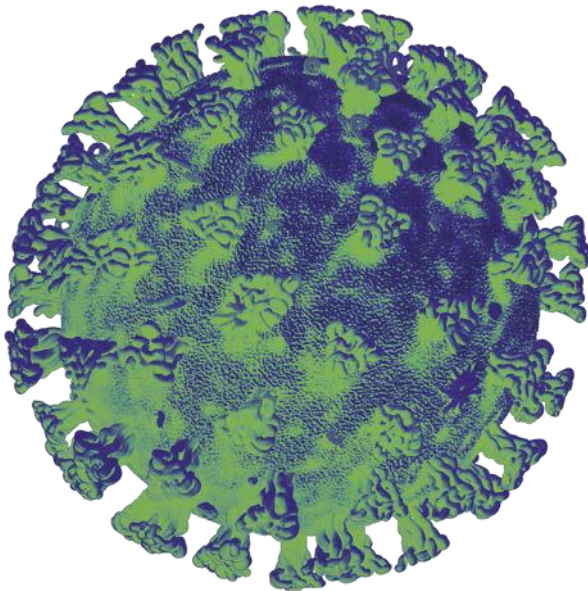


Llywodraeth Cymru
Welsh Government

Science Evidence Advice

Winter Modelling 2022-2023

Update: December 2022



Science Evidence Advice: Winter Modelling Paper Update, December 2022

Detailed scenarios including COVID-19 and winter viruses; including Intensive Care Unit (ICU) admissions, ambulance conveyances, cases for each virus and mortality.

Summary

- This paper provides additional scenarios for COVID-19, influenza and respiratory syncytial virus (RSV) models for the 2022/23 winter period.
- The scenarios are aimed at assisting with future planning for the NHS in Wales.
- Five COVID-19 scenarios are produced for the COVID-19 scenarios (an Optimistic scenario (lower bound and upper bound), Most Likely Scenario, Reasonable Worst Case and COVID Urgent scenario).
- As of end of November 2022, the lower bound optimistic scenario looks like the most likely scenario for COVID-19 admissions and deaths for the next two months. For COVID-19 occupancy the most likely is the optimistic upper bound scenario. These are most similar to the most recent medium term projections from Swansea University.
- Four influenza scenarios are produced, two at normal levels with a March or December peak and two at high levels, also with a March or December peak.
- Two new RSV/bronchiolitis scenarios are produced, one adjusted to remove those infected during the early peak in the summer/autumn months. These reflect the winter wave of RSV that has occurred since the last paper was produced.
- Actual numbers of COVID-19 admissions and occupancy compared to previously published scenarios are included. This is part of the continued monitoring of the COVID-19 impact on the NHS in Wales.

Background

This paper follows on from the previous winter modelling paper published in October 2022¹ and aims to provide some further scenarios to aid with winter planning. These additional scenarios include outcomes such as admission to hospital via ambulance, Intensive Care Unit (ICU) admissions, COVID-19 infections and mortality estimates. Also included are the actual number of hospital admissions and bed occupancy compared to scenarios published previously.

The scenarios included in this paper provide a forward look on what pressures the NHS Wales could expect to see over the coming months. There is however a large amount of uncertainty as we cannot say for certain what will happen. Pressures could occur due to several situations such as a new variant of COVID-19 that can evade vaccines that have been distributed. Similarly for influenza (flu) there could be a strain of flu that circulates that is not a good match for this year's flu vaccine. However, early signs have shown that the flu vaccine is a good match (provides good protection) for the current strain of flu circulating in Wales.

¹ [Science Evidence Advice: Winter modelling 2022 to 2023 | GOV.WALES](#)

COVID-19

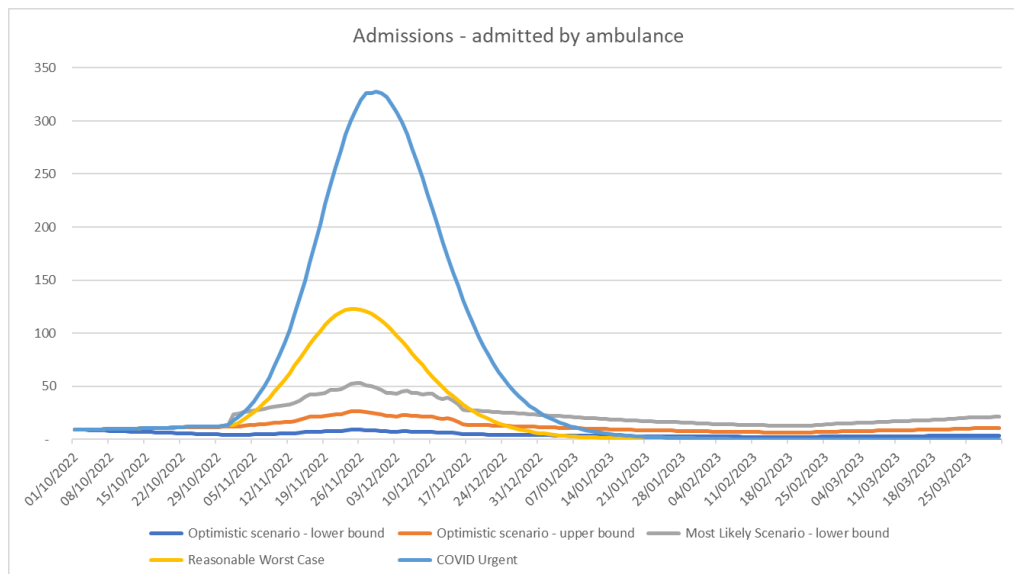
COVID-19 continues to circulate globally and the most recent ONS COVID Infection Survey data up to 1 November 2022 estimates that 1 in 40 people had the virus in Wales. There is still debate about how seasonal COVID-19 is, and it has not yet settled into an annual seasonal pattern, for example there was a rise in cases in July 2022. There is still some uncertainty as to how much the seasonal pattern is related to behaviours in winter, such as spending more time indoors. The virus may be more likely to peak during the colder months as places are less ventilated, allowing COVID-19 to spread more easily. As per the Welsh Government public health guidance² places where ventilation is poor will mean that stale air is not removed and fresh air is not introduced, giving coronavirus the opportunity to build up.

All of the scenarios included in this COVID-19 section show a peak in late November to early December 2022. Due to the unpredictable nature surrounding the spread of COVID-19 and the possibility of new variants emerging there is great uncertainty as to when a peak could occur. It is therefore advised that caution is taken when interpreting these scenarios in relation to specific dates. The peaks may occur before or after these dates. It's also important to note that these figures are for all of Wales and areas of Wales could see cases peaking at slightly different periods of time, depending how the virus spreads across the country.

Ambulance Conveyances

Admissions by ambulance were estimated using the percentage of admissions that arrived by ambulance for the financial year 2021-2022.

Figure 1: Scenarios for the number of COVID-19 patients conveyed by ambulance, in Wales, October 2022 to March 2023



² [Public health guidance for the general public | GOV.WALES](https://gov.wales/public-health-guidance-for-the-general-public)

Figure 1 shows that in the most likely scenario we could see a peak of around 50 COVID-19 admissions per day in Wales being conveyed by ambulance, compared to 120 in a reasonable worst-case scenario. The scenarios suggest there would be a small rise before a plateau in the number of admissions in the optimistic and most likely scenarios. This is compared to a steep rise, followed by a significant fall, in ambulance admissions in the reasonable worst-case and COVID urgent scenarios. The data includes people being treated primarily for conditions other than COVID so this may affect the reliability of these scenarios. This is the first time ambulance conveyances have been estimated and these estimates will be refined and improved over time.

Intensive Care Unit (ICU) admissions

ICU admissions were estimated using a ratio of ICU admissions to total admissions, using the current ratio where available otherwise using the previous year's figures as an estimate for the future. This was based on ICNet data from Public Health Wales.

Figure 2: Scenarios for the number of COVID-19 ICU admissions, in Wales, October 2022 to March 2023

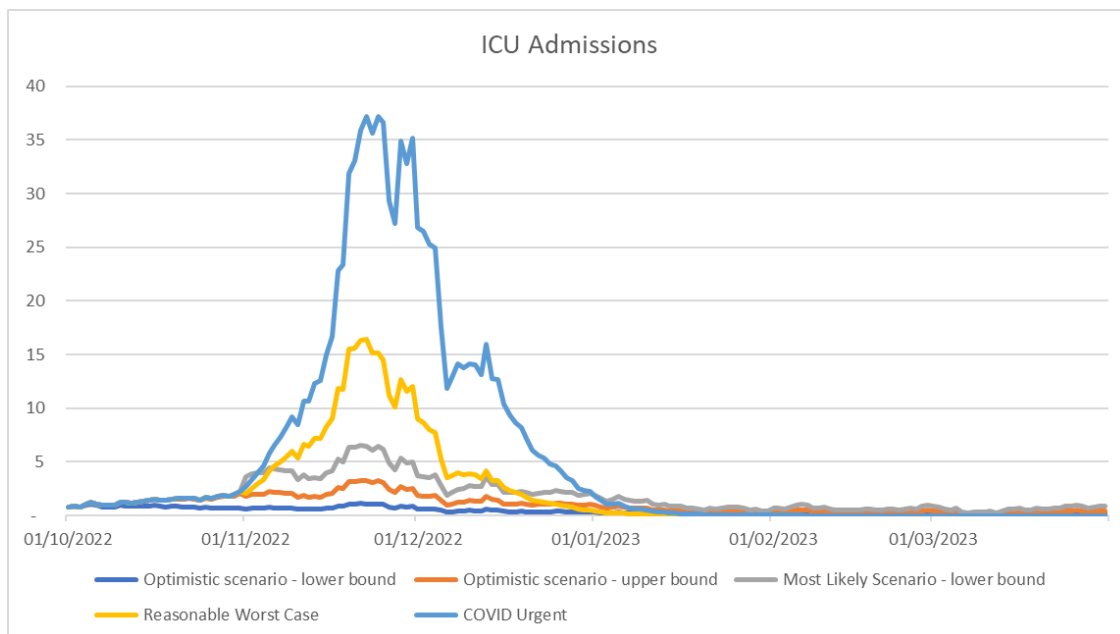
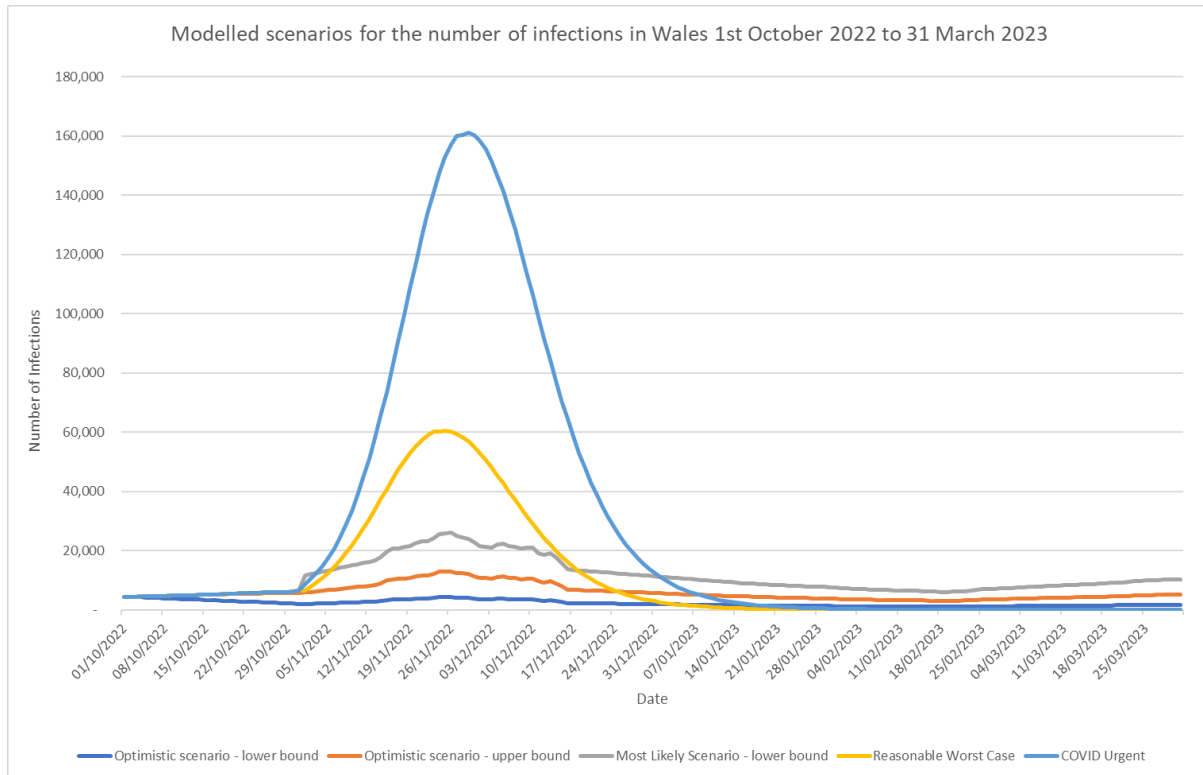


Figure 2 outlines that the number of COVID-19 ICU admissions is expected to peak at around 16 per day in the reasonable worst-case scenario. For the most likely scenario, the model suggests there would be a peak of seven admissions per day. With all the scenarios presented in figure 2 the peaks are not followed by a sustained fall but rather rise again slightly at several points before the downward curve continues to low levels. This could be due to the proportion of hospital admissions in previous years (data the scenarios are based upon), and we may not see this shape of curve this year.

Infections

Infections were calculated by taking an average ratio of admissions to infections using PHW data for February to July 2022.

Figure 3: Scenarios for the number of COVID-19 infections, in Wales, October 2022 to March 2023



As presented in figure 3, the most likely scenario suggests there could be a fairly sustained number of COVID-19 infections in Wales over the winter period, with a peak of around 26,000 infections per day.

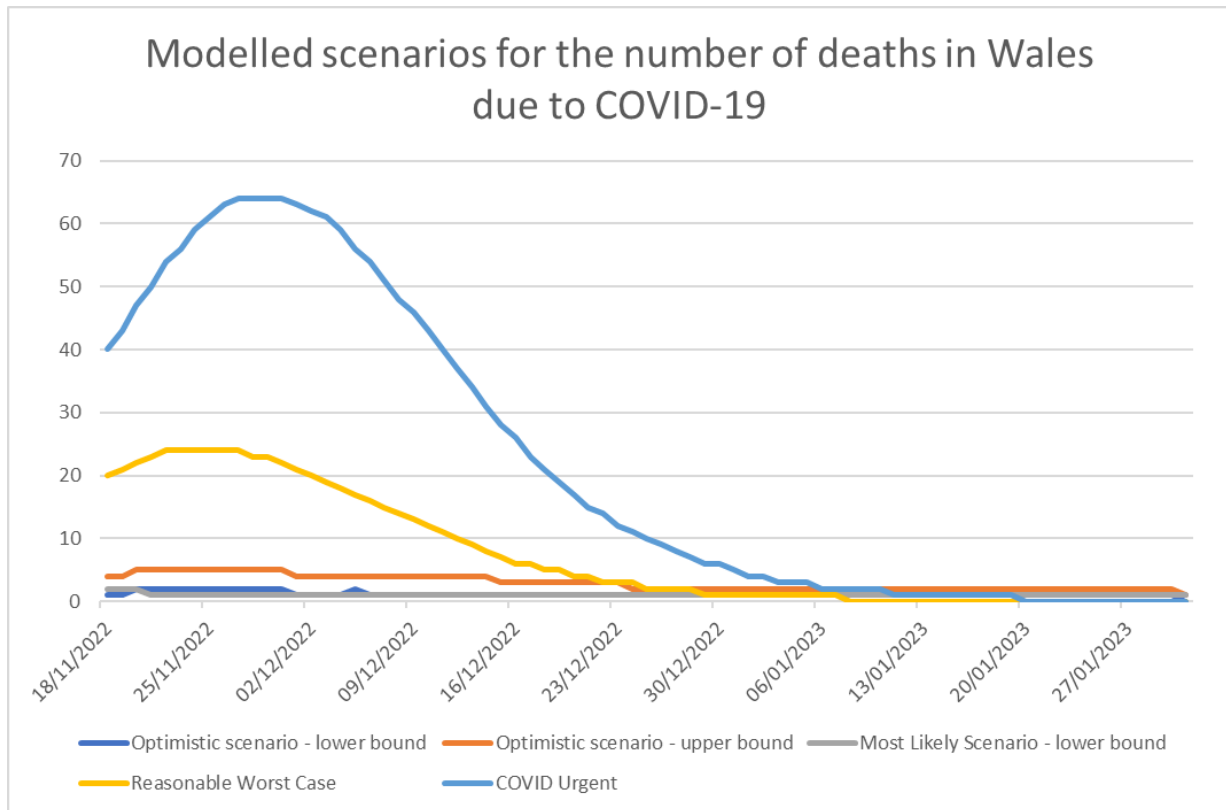
Deaths

The number of deaths due to COVID-19 were estimated using the number of deaths occurring between January 2022 and June 2022³ and the estimated number of infections.⁴ The post-January 2022 period was chosen as most of the population had received at least one dose of the COVID-19 vaccination.

³ [Monthly mortality analysis, England and Wales - Office for National Statistics \(ons.gov.uk\)](https://ons.gov.uk)

⁴ [Coronavirus \(COVID-19\) Infection Survey: Wales - Office for National Statistics](https://ons.gov.uk)

**Figure 4: Scenarios for the number of deaths in Wales due to COVID-19
October 2022 to March 2023**

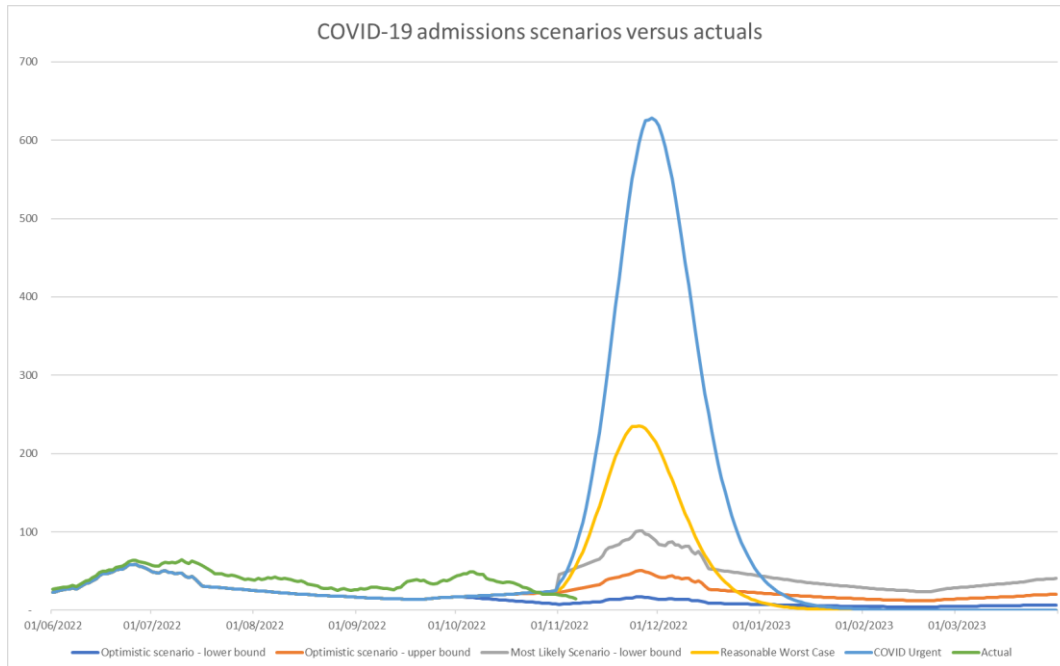


The number of deaths in figure 4 include all deaths, not just those occurring in hospital. Figure 4 shows that in the most likely scenario it is expected that deaths could reach 10 deaths per day due to COVID-19 in Wales. However, in a COVID urgent scenario numbers could reach a peak of between 64 deaths per day; this is more than double the reasonable worst-case scenario which peaks at 24 deaths per day.

COVID-19 actual data compared to previously modelled scenarios

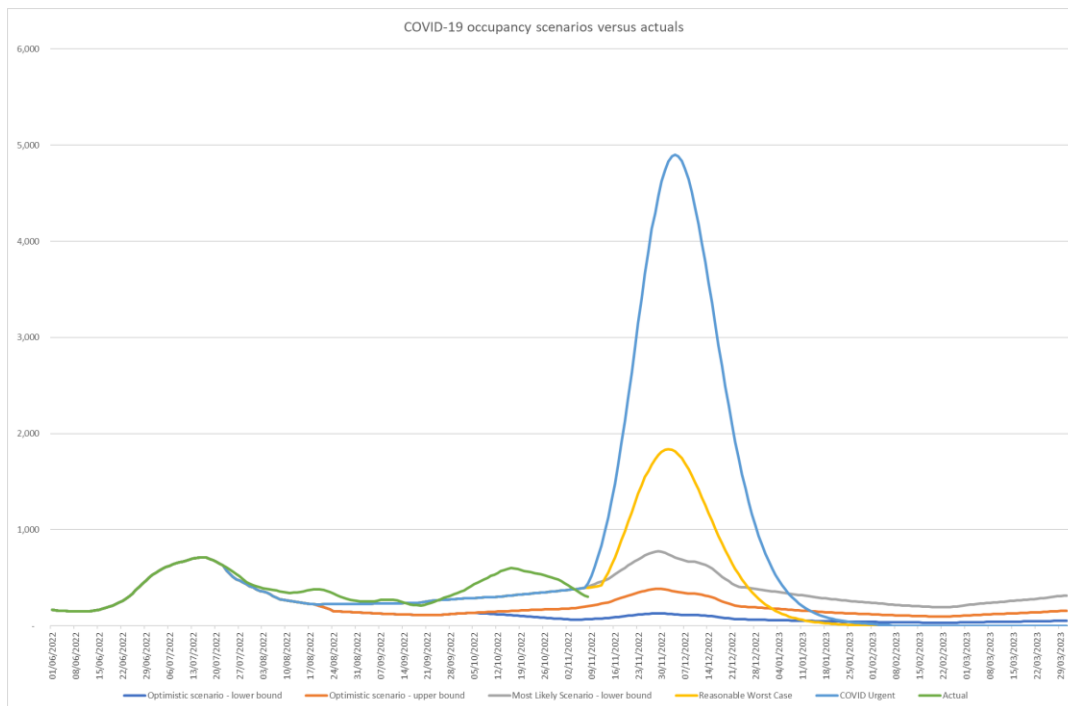
Since the publication of the first winter modelling 2022/23 paper, the scenarios included in the paper for COVID-19 admissions and occupancy have been compared against actual data as we progress through the year towards the winter period.

Figure 5: Number of COVID-19 admissions scenarios compared to actual number of admissions June 2022 to March 2023 (actuals data to 6 November 2022)



In data up to 6 November 2022, there has been a slight increase in cases compared to the scenarios which is similar to the slightly later increase in the optimistic scenario. We cannot be certain that admissions will continue to follow the optimistic scenario with a slightly early timeline but we will continue to monitor admissions closely.

Figure 6: COVID-19 occupancy scenarios compared to actual number of admissions June 2022 to March 2023 (actuals data to 8 November 2022)



Occupancy numbers have also seen numbers above the scenarios but track just below the peak on the most likely scenario, albeit slightly earlier. As with admissions, caution is needed when interpreting these scenarios.

Influenza (flu) and Pneumonia

The number of people with flu and pneumonia increases over the colder months. Not all pneumonia is related to flu but it generally peaks at a similar time. Although cases did rise in winter 2020/21 and 2021/22 compared to the summer months, numbers were much lower than the winters before. This was likely due to the interventions used to reduce the spread of COVID-19 such as lockdowns and the use of face coverings. As these measures are no longer in place, we could see a rise back to pre-pandemic cases of flu and pneumonia.

Influenza (flu) Cases

Flu cases have been estimated using data from England's 2017 to 2018 flu season, using data from the Flusurvey. This survey includes people with influenza-like-illness (ILI). As with COVID-19 we cannot be certain about the timing of when the number of flu cases would rise, however figure 5 gives an indication for a December and March peak, either of which would be feasible using data from previous years.

Figure 7: Modelled scenarios for the number of influenza (flu) cases in Wales, January 2022 to December 2023

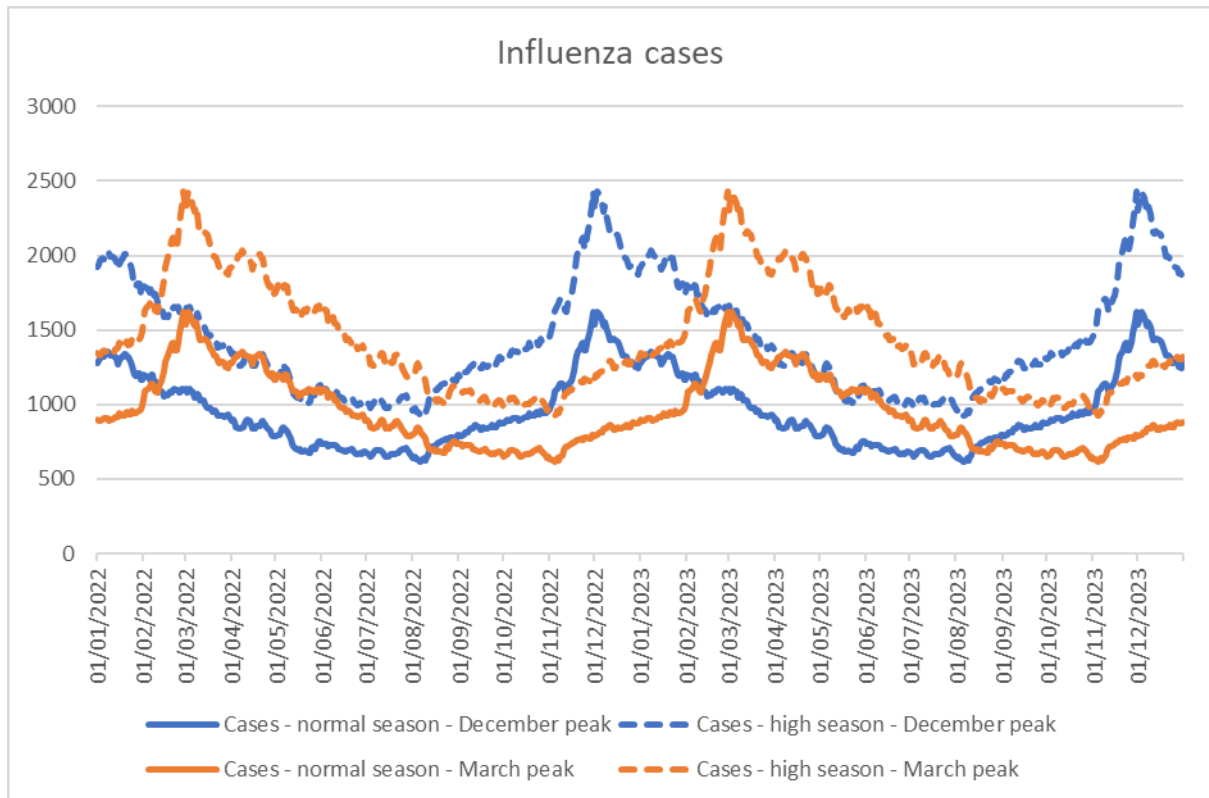
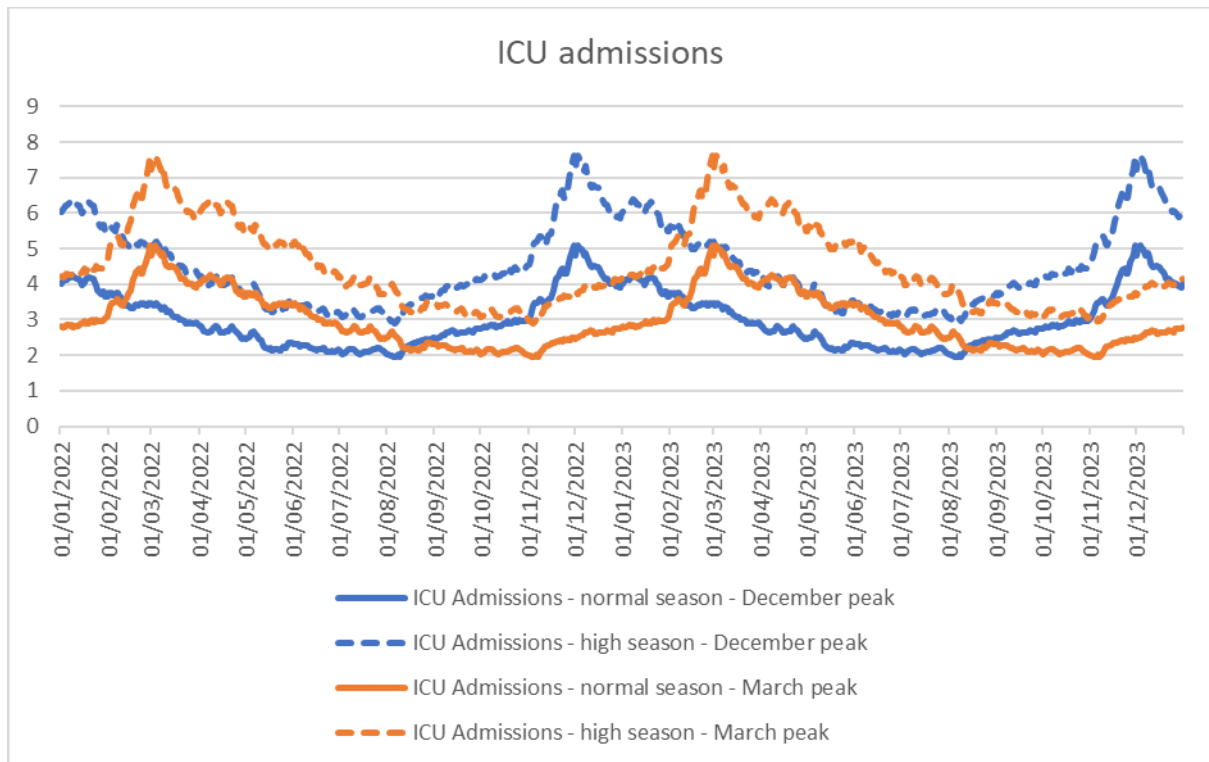


Figure 7 shows that the peak of flu cases could reach around 2,500 if there is a high season and around 1,600 cases if winter 2022/23 is a normal season. The number of cases is expected to be the same if the peak was to arise in March or December. This indicates that the pressure on the NHS is likely to remain unchanged if the peak comes later in the winter period.

ICU Admissions

Figure 8: Modelled scenarios for the number of influenza (flu) ICU admissions in Wales, January 2022 to December 2023



ICU flu admissions in Wales could reach around five per day in a normal season and around eight per day in a high season. This is more than double the number of estimated deaths during the summer and autumn months in both normal and high seasons. It is widely understood that flu can lead to pneumonia, therefore some patients admitted to hospital (not necessarily ICU) with flu may have developed pneumonia by the time they are admitted to ICU.

Deaths

Figure 9: Modelled scenarios for the number of deaths due to influenza (flu) in Wales, January 2022 to December 2023

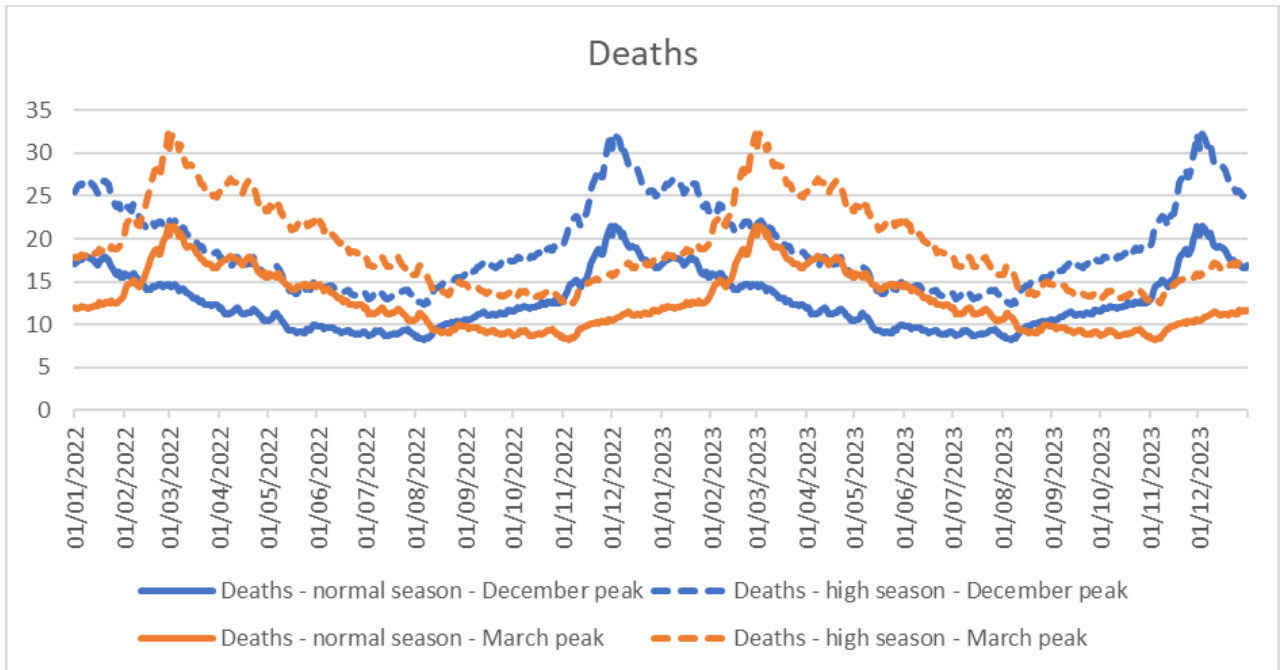


Figure 9 shows that in a normal season there could be around 22 deaths per day due to flu in Wales, compared to 32 in a high season. Similarly to ICU admissions, this is more than double the number of estimated deaths during the summer and autumn months.

As outlined above, flu can lead to pneumonia therefore it is important to remember that some deaths where flu instigated the causal chain of events leading to a person's death will not be included in the numbers presented in figure 7. Looking at flu and pneumonia as the underlying cause of death combined, so far in 2022 (January to October 2022), this is the seventh leading cause of death in Wales, with 1,046 deaths to usual residents to these causes. This is an aged-standardised mortality rate of 36.6 deaths per 100,000 people.⁵

⁵ [Monthly mortality analysis, England and Wales - Office for National Statistics \(ons.gov.uk\)](https://ons.gov.uk)

Table 1a to 1c: Influenza (flu) most likely, reasonable worst case and sensitivity scenario in Wales, November 2022 to March 2023**Table 1: flu tabulation**

Table 1a: flu tabulation, Most Likely Scenario					
	Symptomatic cases (estimated from admissions)	admissions	ICU admissions	Deaths	ongoing illness post-flu[3]
Nov-22	37,300	1,700	120	500	550
Dec-22	43,740	2,000	140	580	650
Jan-23	39,940	1,820	130	530	590
Feb-23	31,350	1,430	100	420	460
Mar-23	30,950	1,410	100	410	460
Total [2]	183,270	8,370	570	2,430	2,750
Table 1b: flu tabulation, Reasonable Worst Case					
	Symptomatic cases (estimated from admissions)	admissions	ICU admissions	Deaths	ongoing illness post-flu[3]
Nov-22	55,940	2,550	180	740	830
Dec-22	65,610	3,000	210	870	970
Jan-23	59,910	2,740	190	800	890
Feb-23	47,030	2,150	150	620	700
Mar-23	46,420	2,120	150	620	690
Total [2]	274,900	12,550	860	3,650	4,120
Table 1c: flu tabulation, Sensitivity scenario (late, March 2023, season peak)					
	Symptomatic cases (estimated from admissions)	admissions	ICU admissions	Deaths	ongoing illness post-flu[3]
Nov-22	21,550	980	70	290	320
Dec-22	26,130	1,190	80	350	390
Jan-23	28,710	1,310	90	380	420
Feb-23	35,330	1,610	110	470	520
Mar-23	43,740	2,000	140	580	650
Total [2]	155,470	7,100	490	2,070	2,330

Note

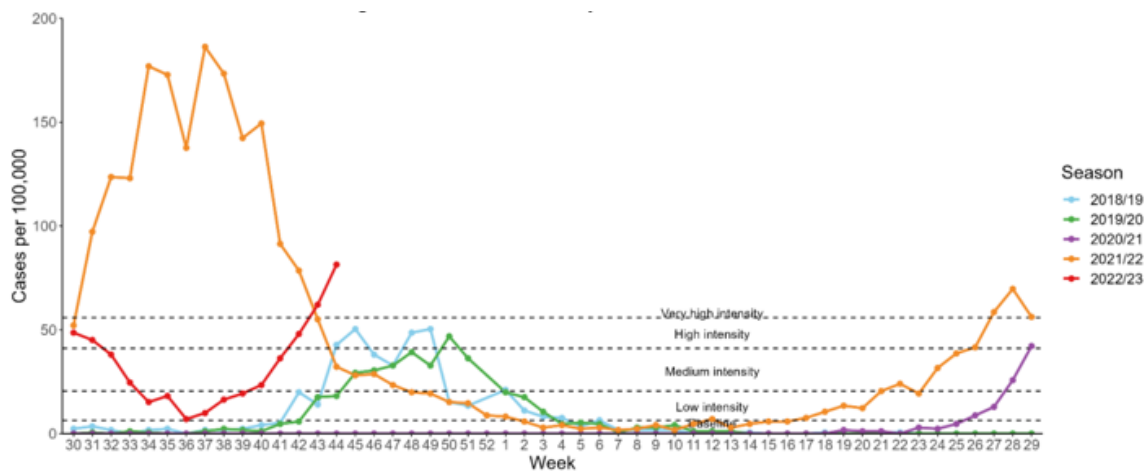
1. [The social value of a COVID case paper](#) provides a relationship of admissions to cases. It also provides a relationship of cases to ICU admissions and deaths, based on England's 2017/18 flu season
2. Totals may not match exactly due to rounding;
3. Based on this article [Long COVID? Long Flu? Long Pneumonia? Yes. They All Happen.](#) ([epicresearch.org](#)).

These tables suggest that if there is a normal flu season, 5.6% of Wales' population may be a symptomatic case at some time this winter (183,270 over 3,267,500 'flu tabulation, Most Likely Scenario'). In that scenario flu/pneumonia hospital admissions might be 2,000 in total over the peak month. Two other scenarios are shown and in one of them, the Reasonable Worst Case scenario, flu/pneumonia hospital admissions might be 3,000 in total over the peak month. For comparison, [StatsWales](#) records 32,148 admissions (for all causes, not just flu) over the month of December 2021.

Respiratory syncytial virus (RSV)

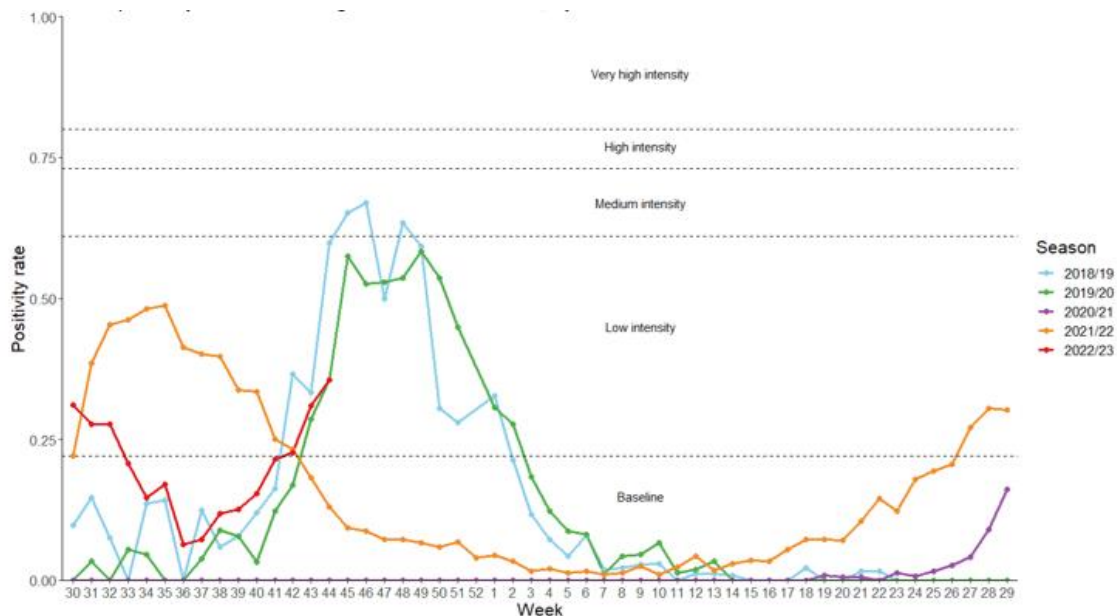
The incidence rate of respiratory syncytial virus (RSV) in Wales has been increasing in recent weeks in Wales. This is a virus that typically infects up to 90% of children in the first two years of life, and some children get acutely ill (usually with bronchiolitis) and require hospital treatment. Due to those children born since the start of the pandemic having had reduced contacts due to restrictions, the increased number of infections could be due to more children having not been infected and produced antibodies in the first two years of their life. The rise in numbers could also be due to increased testing for the virus.

Figure 10: RSV incidence rate in those aged under 5 in Wales, by week



*RSV seasons are monitored from W30 to W29, the most recent data is presented in red

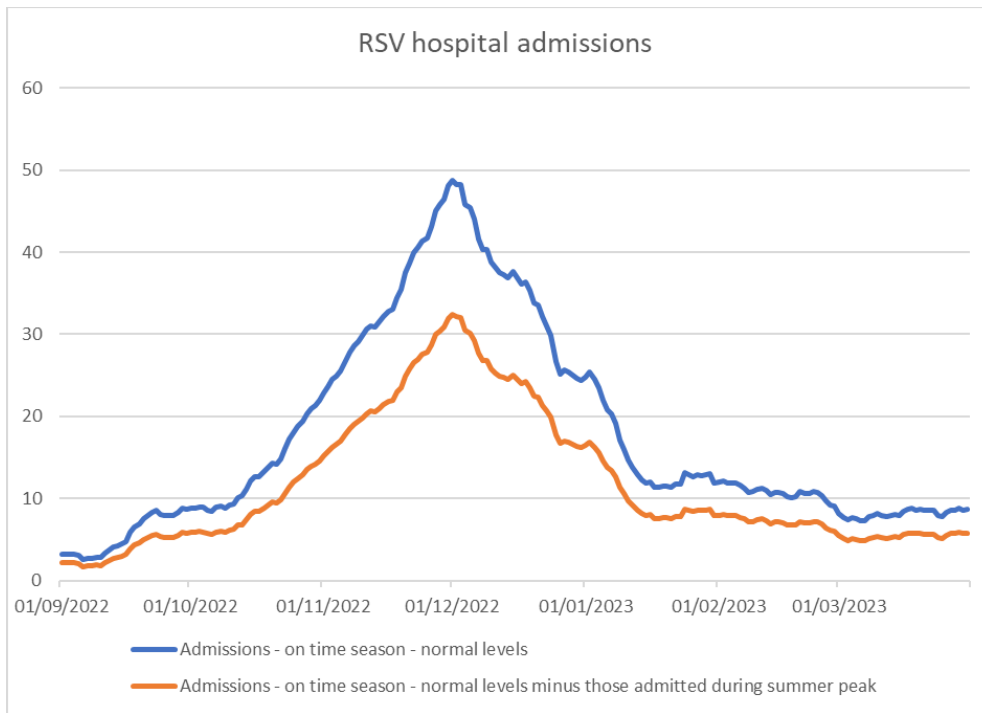
RSV cases began to rise around 15 weeks earlier than a usual season in 2022, then came to a peak in July, before decreasing to low intensity in late August. The peak of incidence was less than a third of what was seen in winter 2021 but higher than that of previous winters. However, this was likely due to increased testing being carried out. Since then, incidence began to rise again in September and are still rising rapidly as of November, reaching a higher peak than the one seen in July.

Figure 11: RSV positivity rate in those aged under 5 in Wales, by week

Although the incidence rate is 'very high intensity' for those aged under five in Wales, the positivity rate is 'low intensity', likely reflecting increased testing. As seen in figure 9, the 2022/23 positivity is currently tracking closely to the 2018/19 and 2019/20 positivity for this time of year. This could therefore indicate that although the incidence rate is high, we are likely to see a winter season of RSV similar to pre-pandemic levels.

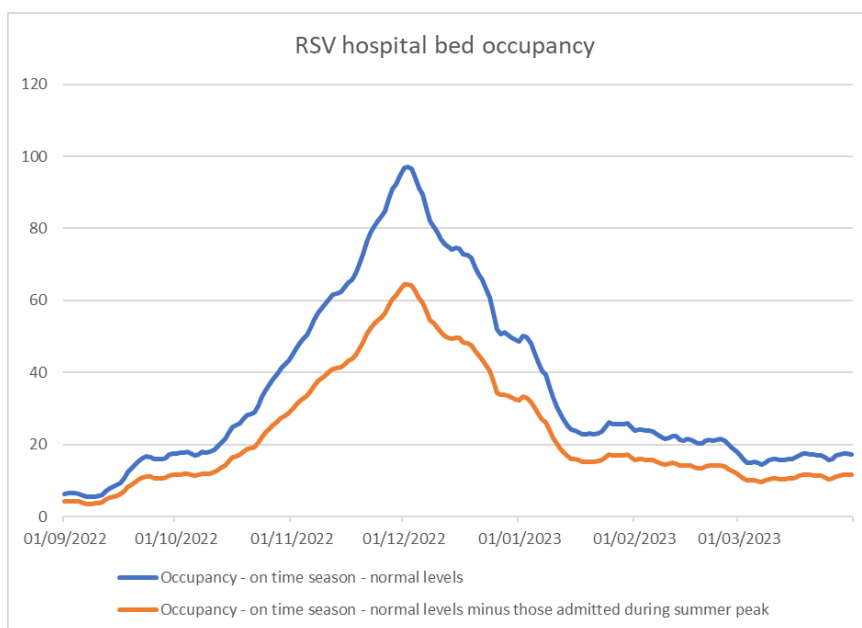
In the previous winter modelling paper, early peaks were modelled for RSV, as that is what the data was indicating at the time. Now, as cases begin to rise again, we have modelled for peaks hitting at the usual pre-2020 timing, with one scenario showing 66.5% of usual winter levels (based on 33.5% of the usual numbers already having been admitted in the summer), and another scenario showing a normal, pre-2020 height peak.

Figure 12: RSV-bronchiolitis hospital admissions modelled scenarios in Wales, September 2022 to March 2023



Bronchiolitis hospital admissions could reach nearly 50 hospital admissions per day if we see a ‘normal’ season. However, as there was a rise in incidence earlier than we would expect in 2022, this could reduce to just above 30 hospital admissions due many having already been infected.

Figure 13: RSV-bronchiolitis hospital bed occupancy modelled scenarios in Wales, September 2022 to March 2023



Hospital bed occupancy due to RSV over the 2022/23 winter period could reach around 65 beds. This model has been adjusted to remove the number of people impacted by the wave of RSV earlier in 2022. The peak is expected to plateau to between 10 to 20 cases towards the end of winter.

Figure 14: RSV-bronchiolitis ICU admissions modelled scenarios in Wales, September 2022 to March 2023

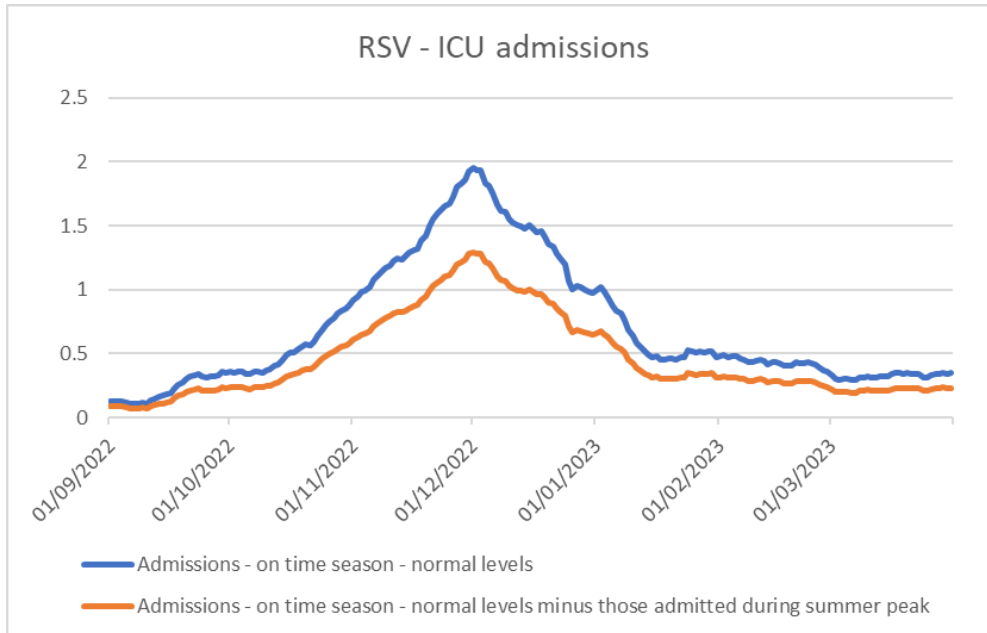
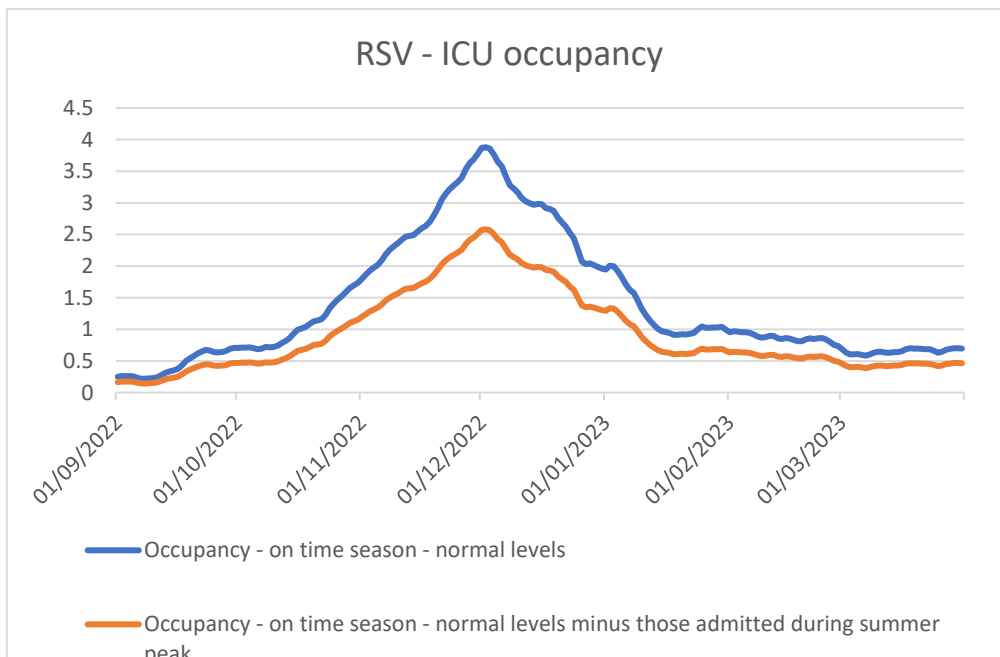


Figure 15: RSV-bronchiolitis ICU occupancy modelled scenarios in Wales, September 2022 to March 2023



In the scenarios presented here (figures 14 and 15) ICU admissions and occupancy for bronchiolitis in Wales are expected to remain low. Once adjusted to remove the earlier wave of infections, admissions could peak around one per day and occupancy around four. However this may still be additional pressure on PICU beds that have been under a lot of pressure in recent months.

Discussion

As with all modelling estimates the scenarios presented in this paper provide an overview of what 'could be'. There is an additional element of uncertainty to the 2022/23 winter period as, thus far, it has been the first year that both COVID-19 and other winter viruses have circulated together in high numbers with no form of non-pharmaceutical interventions (NPIs), such as wearing face coverings to reduce the spread of COVID-19.

All the scenarios presented in this paper suggest we will see a peak in both COVID-19 and winter viruses in the coming months. The number of infections, admissions and deaths remains uncertain but continuous monitoring will aim to inform what could happen in the short term.

In addition to helping in the near future, tracking what happens over the coming winter will help to plan better for winter 2023/24 as we continue to live with all of these viruses circulating in Wales. The work that has gone into this paper in terms of understanding the relationship between different outcomes (infections, admissions, ambulance, deaths etc) will be useful for repeating this work for winter 2023/24.