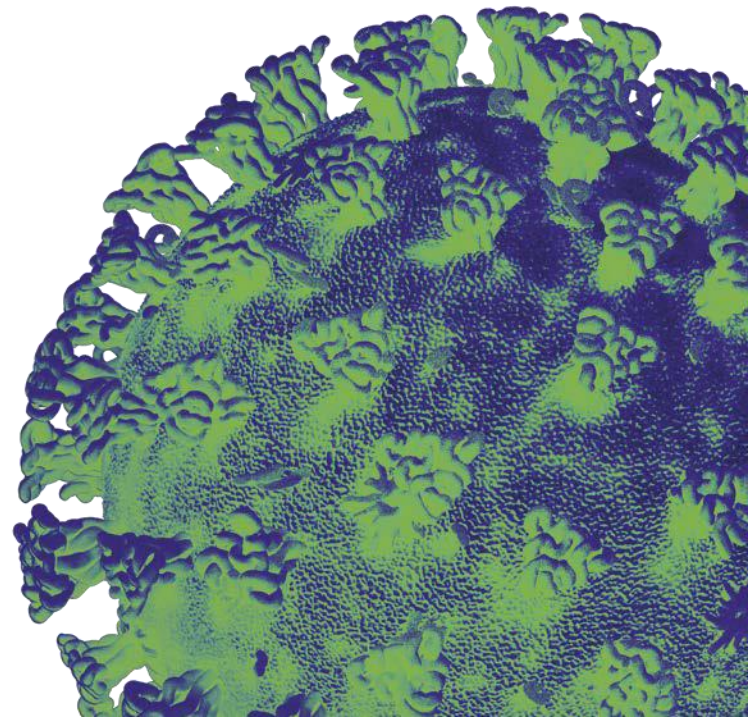
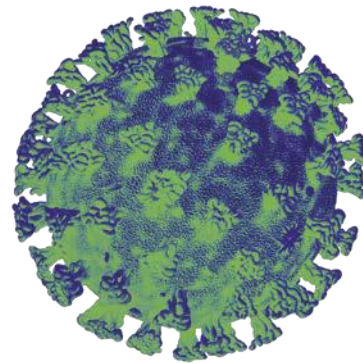
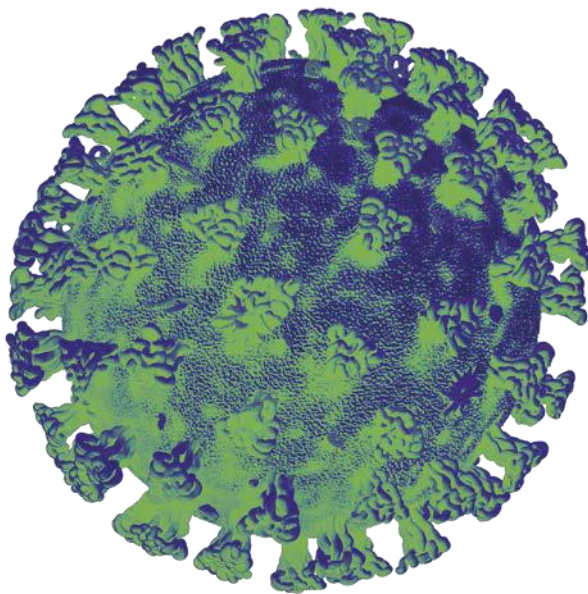




Llywodraeth Cymru  
Welsh Government

# Science Evidence Advice (SEA) Winter modelling 2022-2023

## 27 September 2022



# Winter modelling 2022-2023

Welsh Government SEA (formerly COVID-19 TAG) Policy Modelling Subgroup

## 1. Summary

- This paper provides scenarios for COVID-19, influenza and respiratory syncytial virus (RSV) models for the upcoming winter season and explore how they could impact hospital admissions and bed occupancy under different conditions (e.g. if a usual Influenza season and Omicron-like SARS-CoV2 wave coalesce).
- The scenarios are generated to help planners and policy makers consider 'what happens if' rather than 'what will be' – this is an important distinction.
- Four COVID-19 scenarios are produced for the coming winter season (an Optimistic scenario, Most Likely Scenario, Reasonable Worst Case and COVID Urgent scenario).
- Four influenza scenarios are produced, with two peaking at normal levels and two peaking at higher than normal levels. The scenarios peak at different times (two in December and two in March).
- Two RSV/bronchiolitis scenarios are produced, both peaking early in the season but one with a peak of similar height to a pre-Covid winter and another with a peak of similar height to winter 2021-2022.
- Two combined scenarios are produced (a Most Likely Scenario and a Reasonable Worst Case). The most likely scenario peaks at around 1,400 occupied beds (combined for COVID-19, RSV, flu and pneumonia) while the reasonable worst case scenario peaks at around 2,750 beds. This represents around 14-28% of total bed capacity in NHS in Wales.

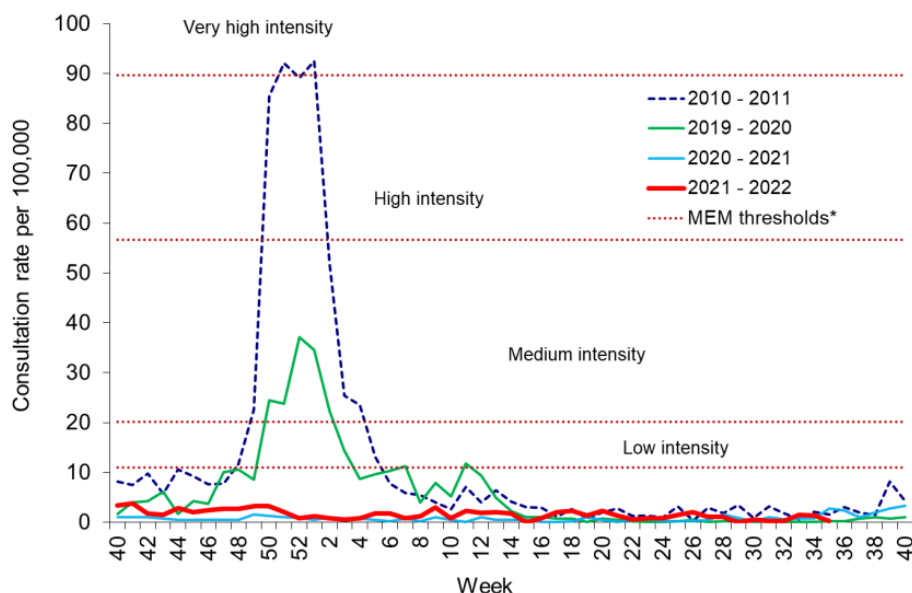
## 2. Background

Winter viruses such as influenza, pneumonia and respiratory syncytial virus (RSV) result in pressures for the NHS in Wales. Over the previous two winter periods (2020/21 and 2021/22) we have seen low levels of these viruses circulating relative to a typical year, most likely due to restrictions in place in relation to the COVID-19 pandemic. Prior to COVID-19 each disease had a regular seasonal pattern of arrival and growth in colder months, however this has changed. In 2021/22 there was an early RSV season where cases began to rise earlier than usual, causing concern for an early, larger peak, however this did not occur, with the peak in admissions reaching around two thirds of an average winter. For the winter 2022/23 period we could see a rise in winter viruses or changes to periodicity, along with a potential concomitant SARS-CoV2 wave. There is concern around how severe the winter period and there is significant uncertainty and what might unfold. This paper seeks to describe different types of potential scenarios for winter 2022/23.

Figure 1. Respiratory infection activity in Wales (PHW annual flu report)

### Respiratory infection activity in Wales

Figure 1. Clinical consultation rate for ILI per 100,000 practice population in Welsh sentinel practices (as of 04/09/2022).



In 2022 RSV is already circulating in Wales, once again earlier than a usual season, although we have not yet seen signs that the flu season is starting to increase beyond a low level of incidence and we may not have another flu season or it may be less prominent. The recent Australian flu season peaked coincided with a modestly-high comparative level of recorded COVID-19 infections, but from the Australian experiences, the implications for the forthcoming UK Winter are encouraging in that it is unlikely that the UK will experience a severe flu season, more likely it will experience a 'normal' or 'average' flu season which will not be compounded significantly by a severe-impact COVID-19 wave. In the Western Pacific region WHO Flu sentinel work is currently showing lower than normal levels in the northern hemisphere and has remained below threshold numbers for the regions' countries. In the temperate zone China (north), Mongolia, South Korea and Japan are all below threshold numbers currently. In the tropical zone influenza activity is similar to previous years. Hong Kong, China (south) and Cambodia are lower while Singapore and Lao are slightly higher than previous years.

At the time of writing, Omicron BA.5 variant remained the dominant COVID variant in Wales. Recent Omicron variants (BA.4 and BA.5) have been found to have a growth advantage over BA.2 (the previous dominant strain) and led to a surge in cases in May-June 2022, however COVID infections are now estimated to have decreased for a sixth successive week, decreasing throughout August. The Autumn COVID

booster programme<sup>1</sup> will help with protection against the virus through the winter, though it depends on a successful roll-out campaign and high levels of uptake and it is possible that further variants could arise. Some of the booster doses are the new bivalent Moderna vaccine which offers specific protection against Omicron as well as wild type variants.

### 3. COVID-19

At the time of writing, the ONS COVID Infection Survey reports that for the week ending 28 August 2022, in Wales, the estimated number of people testing positive for COVID-19 was 31,500 (95% credible interval: 21,200 to 44,200), equating to 1.04% of the population, or around 1 in 95 people.

SARS-CoV-2 continues to evolve and the most recent waves (three Omicron in the past eight months) each with growth advantage over the one before. We are still in a pandemic and COVID-19 will not go away unless there is a neutralising vaccine that is deployed globally. Understanding the impact of successive waves of SARS-CoV-2 is important as we, as a society, continue to accrue harm such as long COVID<sup>2</sup>. The cost-of-living crisis may exacerbate waves of winter viruses – for instance, due to people staying together in one room to stay warm or more syndemic potential of coldness and infection.

To aid NHS planning in Wales four COVID-19 scenarios have been prepared for Winter 2022-23. The first two (Optimistic and Most Likely Scenarios) are based on scenarios produced for the UK by SAGE<sup>3</sup> in February 2022 and the second two (Reasonable Worst Case and COVID Urgent Winter) are based on the Omicron scenarios prepared by Swansea University for Wales Winter 2021-22.

To calculate admissions from the Scientific Advisory Group for Emergencies (SAGE) scenarios, 4.73% (the Welsh proportion of the UK population) of the SAGE scenario UK admissions were taken. Subtracting the actual admissions data to date ruled out two of the SAGE scenarios (Reasonable Best Case and Central-Optimistic) since by July 2022 actual admissions had already surpassed the more optimistic SAGE scenario totals up to winter. For these scenarios it is assumed that the winter wave will start in November, and that the pattern of admissions will follow the same pattern of summer wave admissions for Omicron. Since the first two SAGE best case scenarios were already ruled out, the next best scenarios (SAGE Central Pessimistic and Reasonable Worst Case) were chosen as this winter's Optimistic scenario and Most Likely Scenario respectively. The occupancy projections were based on admissions and median length of stay.

The Omicron scenarios from the previous winter period represent what might happen if there is the emergence of a new, transmissible variant with low severity (more like

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<sup>1</sup> [Winter respiratory vaccination strategy : autumn and winter 2022 to 2023 | GOV.WALES](#)

<sup>2</sup> [Prevalence of ongoing symptoms following coronavirus \(COVID-19\) infection in the UK - Office for National Statistics \(ons.gov.uk\)](#)

<sup>3</sup> [S1513 Viral Evolution Scenarios.pdf \(publishing.service.gov.uk\)](#)

an Omicron variant) or high severity (like a Delta variant level of severity). The low severity scenario was nevertheless higher than the two scenarios derived from the SAGE scenarios, and so was chosen as this winter's Reasonable Worst Case. The high severity scenario was significantly higher than the other scenarios and as such represents a COVID Urgent scenario.

Figure 2. Optimistic COVID-19 Scenario (based on the SAGE Central-Pessimistic scenario)

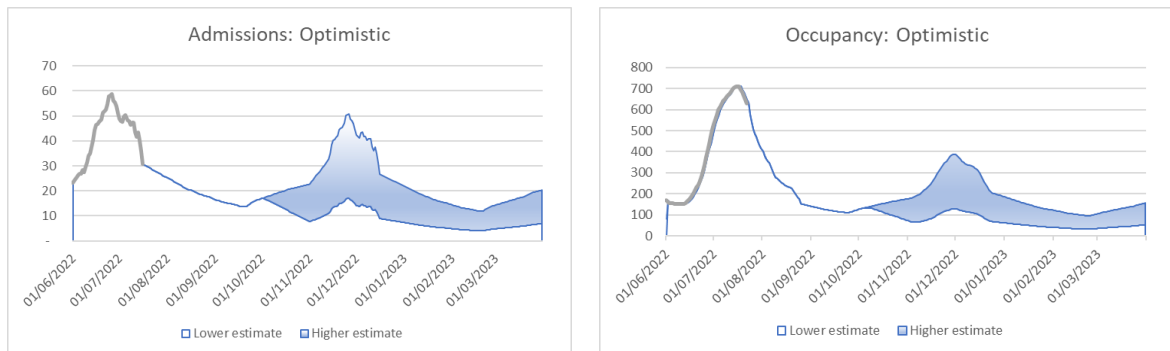


Figure 3. COVID-19 Most Likely Scenario (based on SAGE RWC)

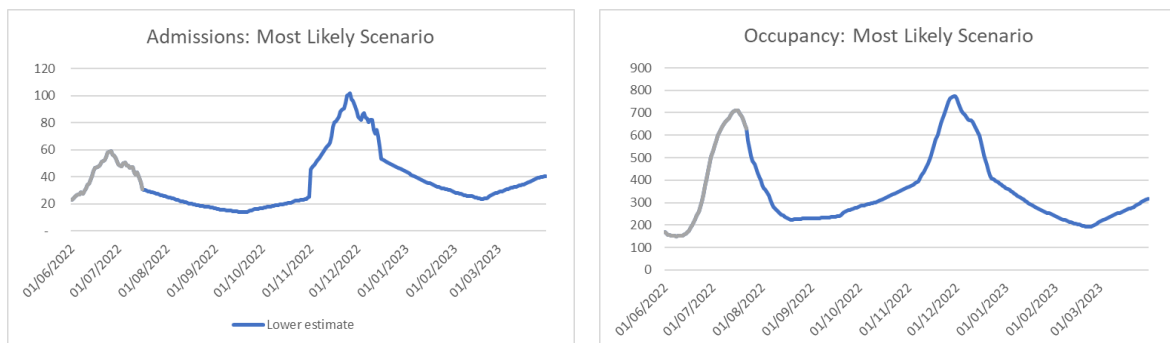


Figure 4. COVID-19 Reasonable Worst Case (based on Omicron low from 2021)

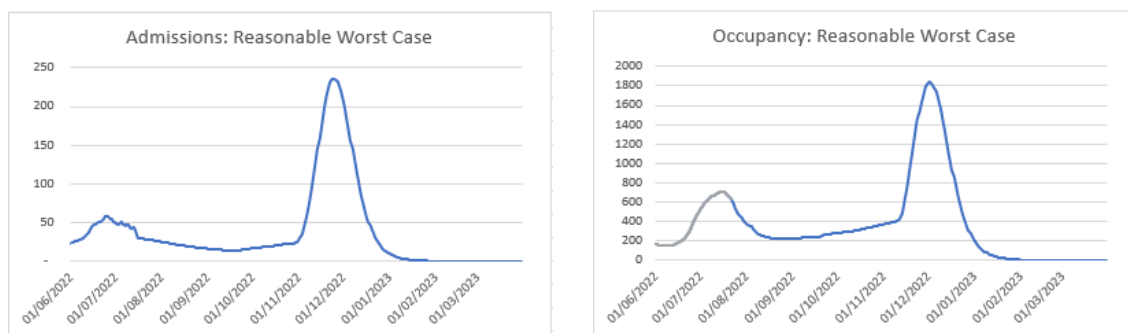


Figure 5. COVID Urgent Winter (based on Omicron high from 2021 – it is considered unlikely that these levels would be reached based on current data)



#### 4. Influenza

In any given Influenza season there is a broad temporal pattern, with onset in the southern hemisphere preceding that in the northern one. This relationship will be influenced by numerous factors including the immunity profiles of the resident populations, which can differ considerably with a consequent impact on the spread and severity of infections. For example, an H1 virus in Australia often leads to a severe season in their elderly, whereas an H1 season in the UK usually means a milder season for the UK elderly population.

Some observers have suggested that, although still imperfect, the best predictor for our vaccination match for the UK's influenza season is often based on the situation in Hong Kong. The picture in Hong Kong may often give a better indication about the vaccination match for the circulating virus that is most likely to circulate in the UK than, for example, the situation in Australia. In 2022, the flu season in Hong Kong has seen very low numbers of influenza related hospital admissions, however COVID-19 protections still in place are likely helping keep these numbers low.<sup>4</sup>

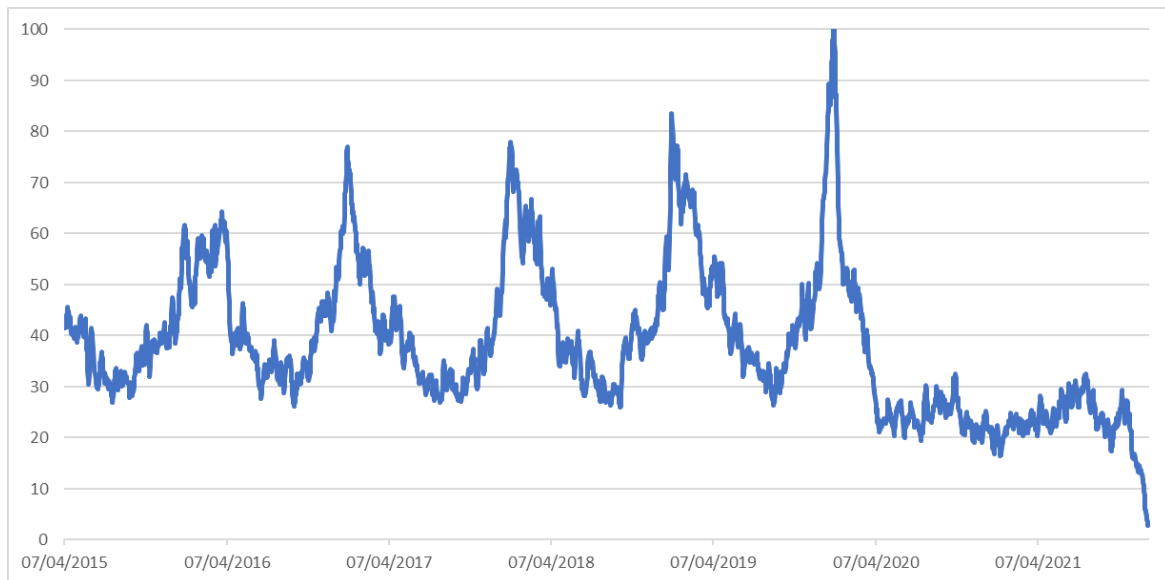
The timing of vaccine production is also highly relevant. Decisions about the composition of Influenza vaccines in a given year are always a compromise. The vaccine 'match' required is difficult to predict, especially early in the global season, as the virus may change later in the Southern Hemisphere season. That change may not be captured in time for the UK vaccine production, meaning that a different clade is in circulation and there is a vaccine mismatch. The probability of a vaccine mismatch has been reduced since quadrivalent vaccines have been introduced in around 2012, as these are targeted to four flu strains (two type A and two type B strains).

In the scenarios we have used influenza and pneumonia admissions as a lot of pneumonia peaks at the same time as influenza and may not be attributed to

<sup>4</sup> [https://www.chp.gov.hk/files/pdf/fluexpress\\_week36\\_8\\_9\\_2022\\_eng.pdf](https://www.chp.gov.hk/files/pdf/fluexpress_week36_8_9_2022_eng.pdf)

influenza in the data. However, a proportion of pneumonia may be related to other viruses (including covid-19), or bacterial infections.

Figure 6. Influenza and pneumonia hospital admissions, 2015-2021



Four scenarios were prepared for influenza for Winter 2022-2023:

- A season with a normal peak – peaking December 2022
- A season with a higher than usual peak (1.5x usual levels) peaking December 2022
- A season with a normal peak – peaking March 2023
- A season with a higher than usual peak (1.5x usual levels) peaking March 2023

To produce these models, we applied multipliers to the averages of admissions over the years 2015-2019, applied multipliers and lagged to shift the peaks to calculate estimated admissions for this winter. Occupancy was estimated using average length of stay for this 5-year period.

For this year's influenza season to resemble scenarios where influenza peaked in September 2022, significant levels of influenza activity would need to have been observed already, which they have not, so these scenarios have been omitted from the paper. Therefore, four scenarios are presented in the charts below.

Figure 7. Scenarios for Influenza and Pneumonia admissions

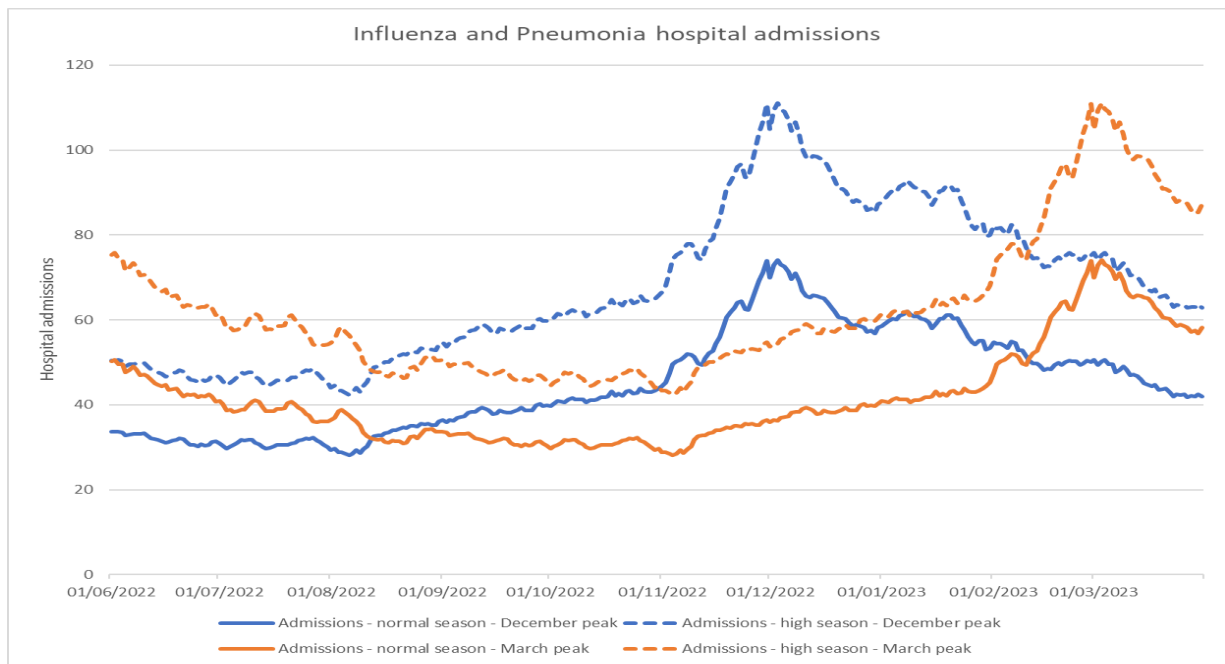
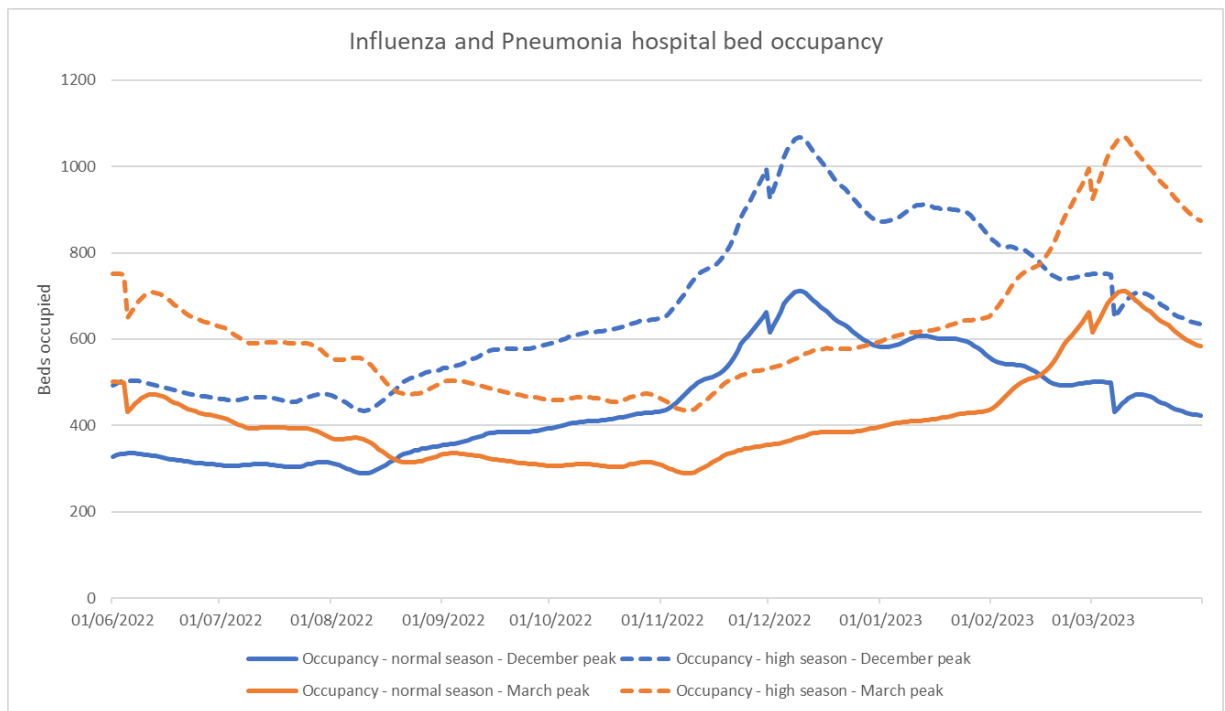


Figure 8. Scenarios for Influenza and Pneumonia bed occupancy



## 5. RSV

RSV is a virus that affects people of all ages but typically infects up to 90% of children in the first two years of life, and some children get acutely ill and require hospital treatment. RSV causes bronchiolitis – inflammation of the lungs, dry cough, and breathing problems. There is some protection against severe illness in infants in the early weeks of life, due to transplacental antibody transfer in third trimester of

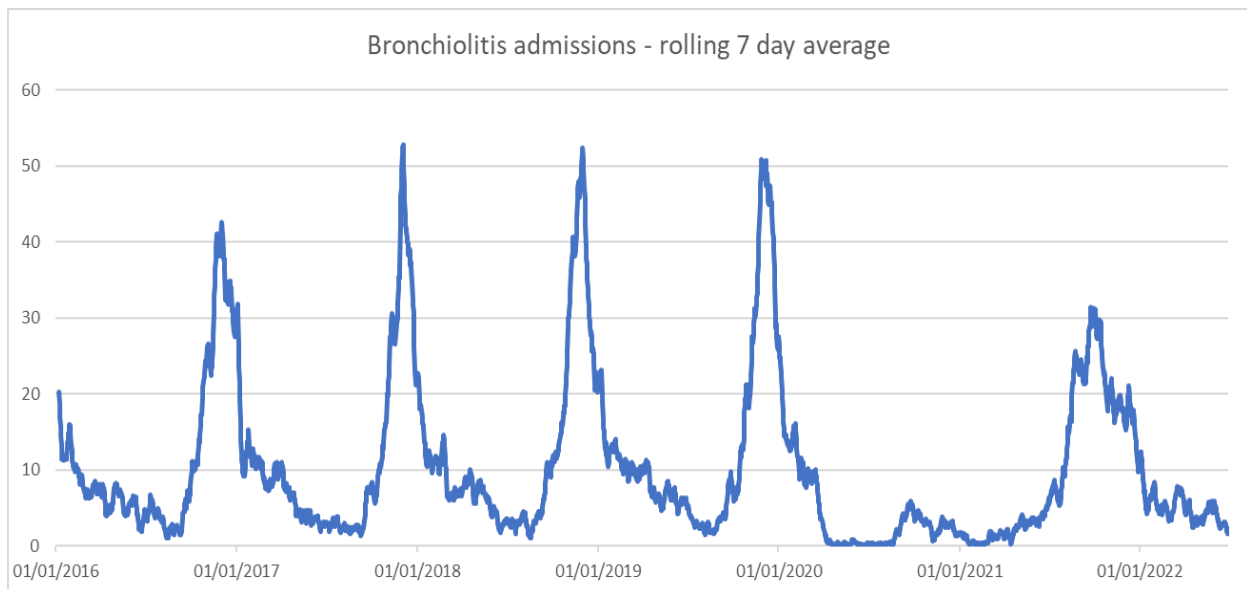


pregnancy. The monoclonal antibody treatment Palivizumab is given to some high-risk infants (mainly those born premature) to prevent severe RSV illness. This is given as a monthly injection in the RSV season.

RSV immunity through previous infection usually wanes quite quickly. Evidence suggests that young children are often infected by older siblings but children without older siblings are still infected, presumably from other children or adults.

RSV season usually starts in September and peaks in November-December. There were very few cases of RSV detected in the 2020/21 season due to COVID-19 social distancing. There was concern over a large rebound in cases in 2021/22, and this did seem likely to occur, as cases were being detected in large numbers earlier in the year than usual, although it was likely that this was at least partly down to increased testing. However, this surge of cases never manifested in difficult numbers of hospital admissions, with hospital admissions peaking at around 60% of the level of a pre-Covid winter (see figure 9).

Figure 9. Bronchiolitis hospital admissions 2016-2021



This suggests, although further research is required, that the immunity debt may still exist, or may have even grown, as there is now another year of children who did not get exposed to RSV at the usual levels, so there is again potential for hospitals to face increased pressures from RSV cases. Although it needs to be considered that the children who would normally have caught RSV in the previous two winters will now be older and therefore may be less likely to respond as severely to the illness.

So far in 2022, RSV cases have been rising rapidly again, with the season showing signs of having started already, around 15 weeks early. As with last winter, this is likely in part due to increased levels of testing being carried out.

The scenarios we have modelled for winter 2022-2023 are:

- Early season, peak of similar height to a pre-Covid winter

- Early season, peak of similar height to winter 2021-2022 (60% of usual levels)

To produce these models, we applied multipliers to the averages of admissions over the years 2015-2019, applied multipliers and lagged to shift the peaks to calculate estimated admissions for this winter. Occupancy was estimated using average length of stay for this 5-year period.

Figure 10. RSV/bronchiolitis hospital admissions

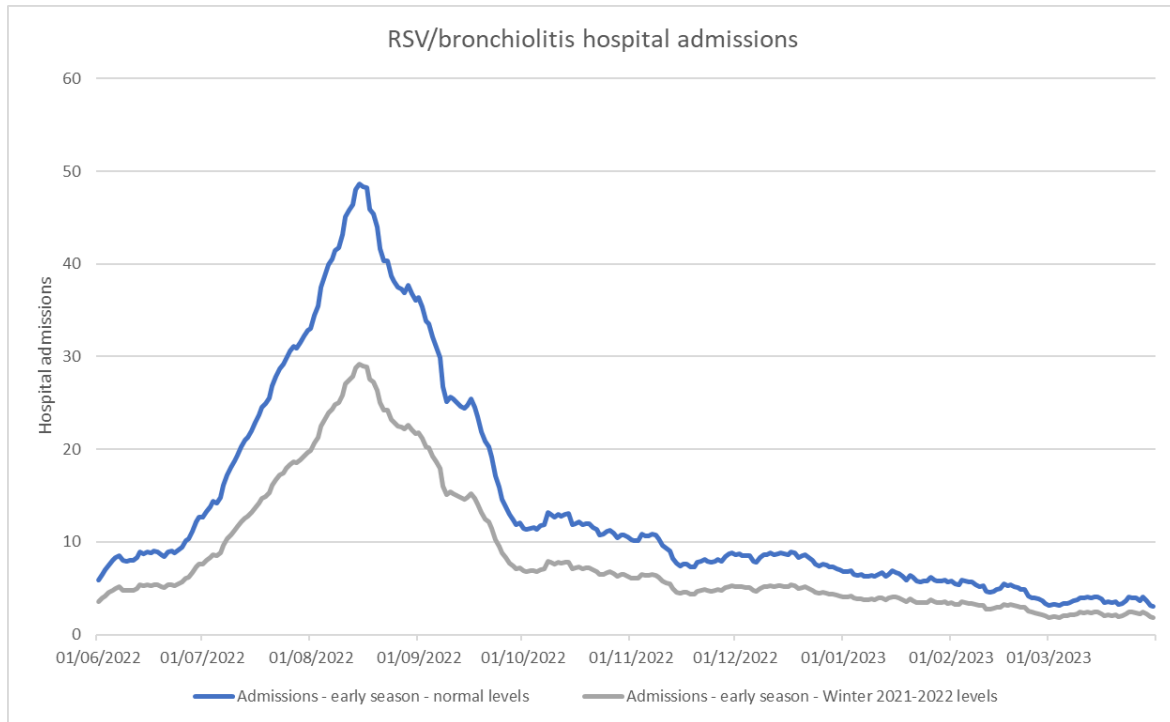
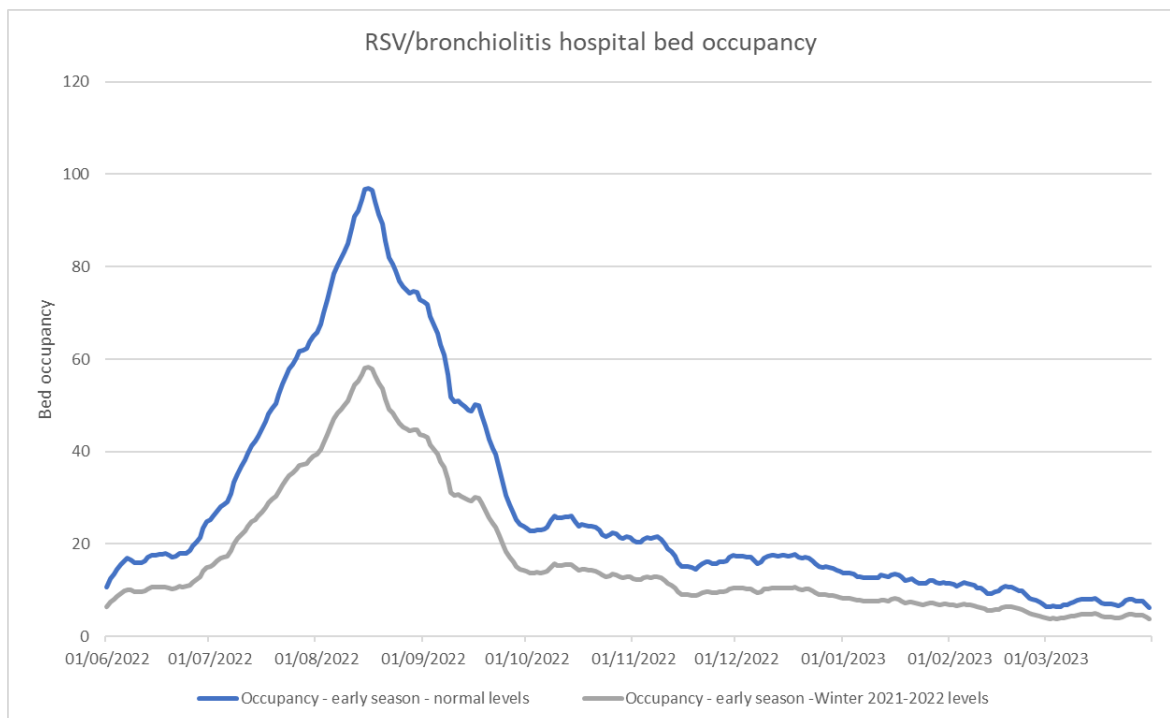


Figure 11. RSV/bronchiolitis hospital bed occupancy



## 6. Combined scenarios

In order to examine the potential impacts to the NHS of these three key winter viruses, a most likely scenario and a reasonable worst case scenario was selected for each, and these were combined.

The **Most Likely Scenario** combines the following three scenarios from above:

- COVID-19 “Most Likely Scenario”, based on the SAGE Reasonable Worst-Case scenario (The RWC was chosen because a lot of the activity has happened already from March-July 2022, so despite it being a RWC In February, it is now quite likely that we will see the remaining level of hospital activity in Winter 2022-23)
- Influenza & pneumonia – December peak, normal season
- RSV – Early season, 2021-levels

Figure 12. Combined scenario: Most likely scenario – hospital admissions

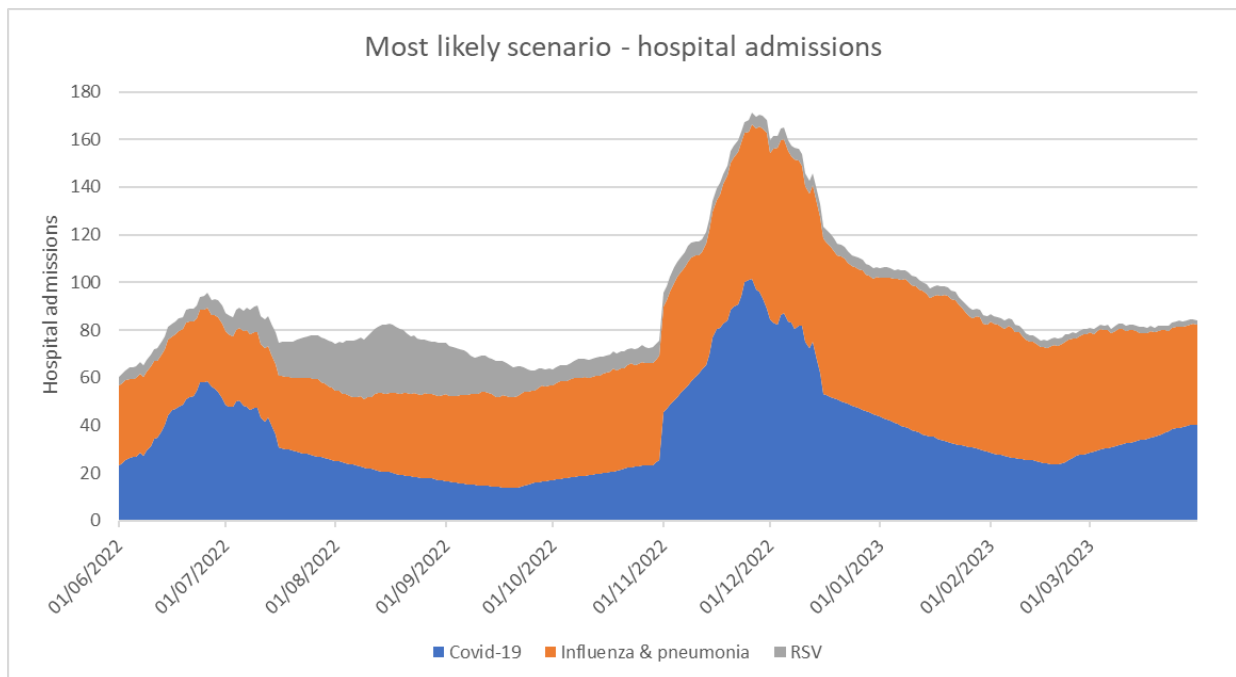
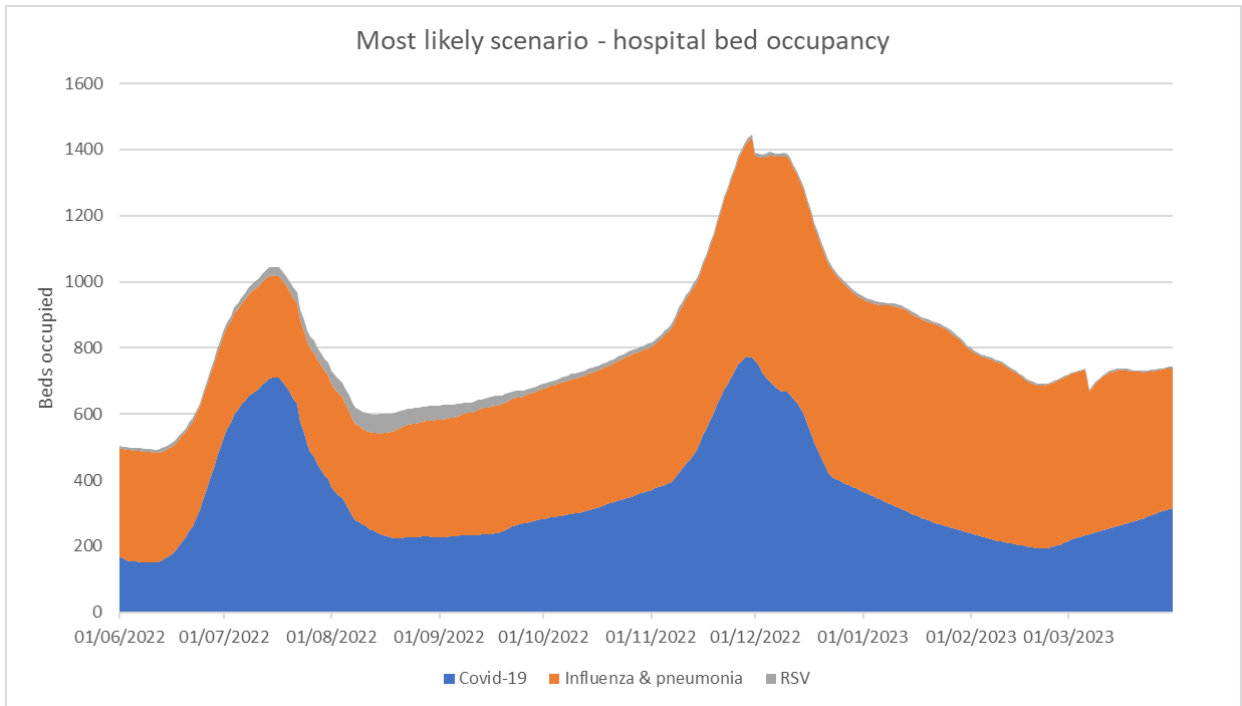


Figure 13. Combined scenario: Most likely scenario – hospital bed occupancy



We have also done a sensitivity analysis showing as above, but with a late, March 2023, peak for the influenza season.

Figure 14. Sensitivity analysis – hospital admissions

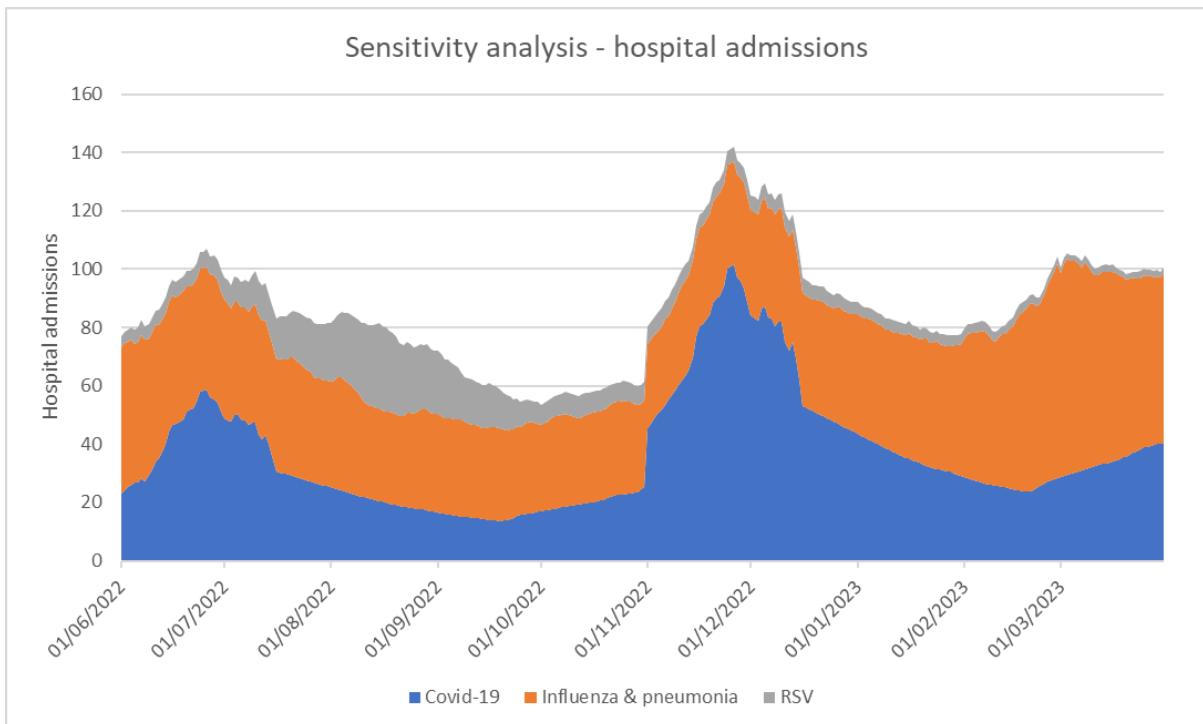
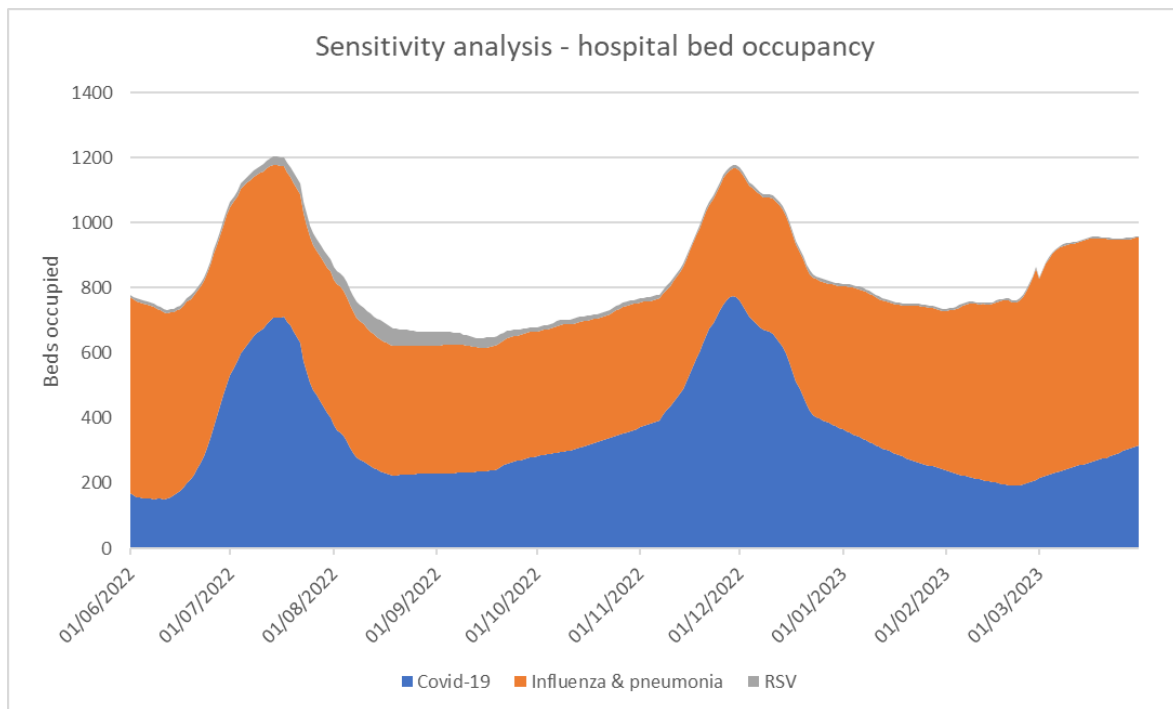


Figure 15. Sensitivity analysis – hospital bed occupancy



The **Reasonable Worst-Case** scenario combines the following three scenarios:

- COVID-19 – Omicron low scenario
- Influenza & pneumonia – December peak, 1.5x usual season
- RSV – Early season, pre-2020 levels

Figure 16. Combined scenario: Reasonable worst case – hospital admissions

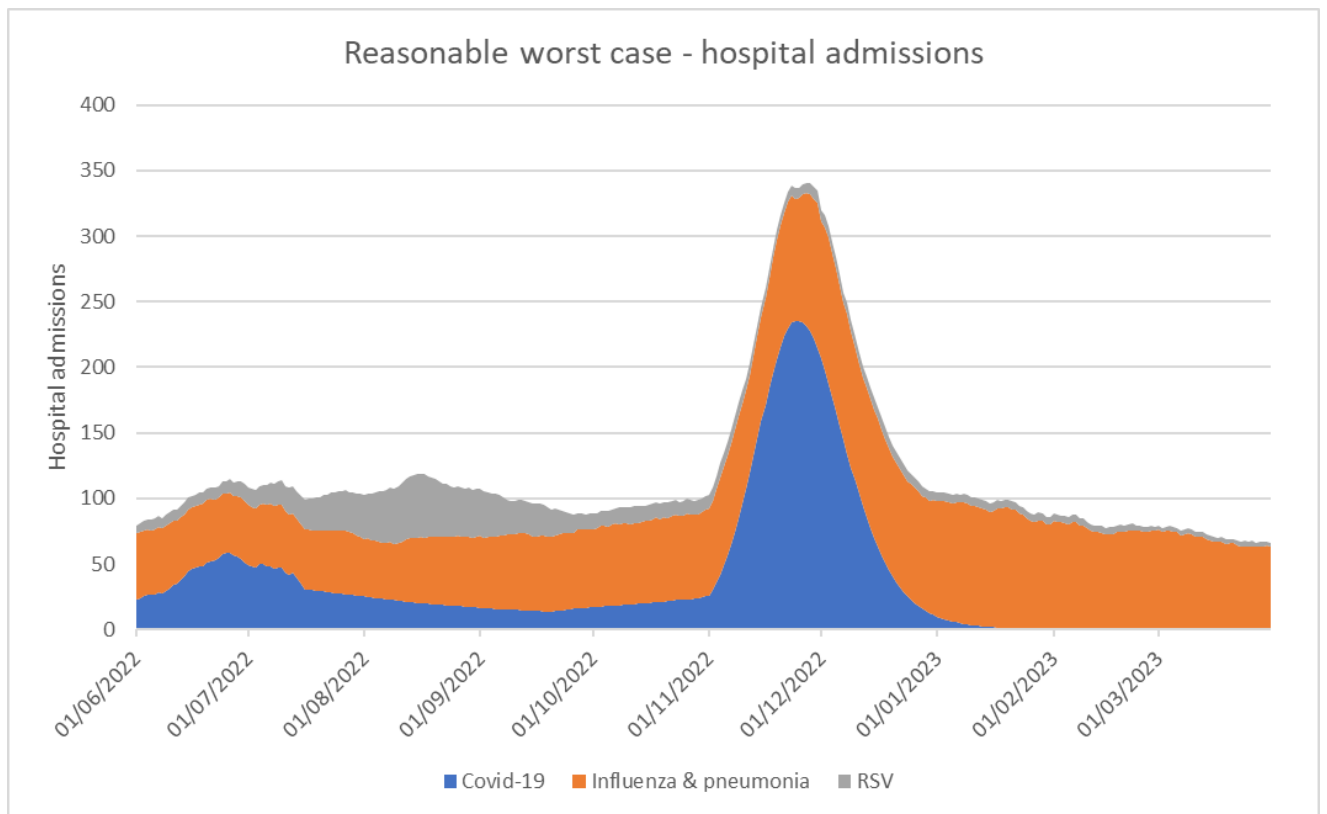
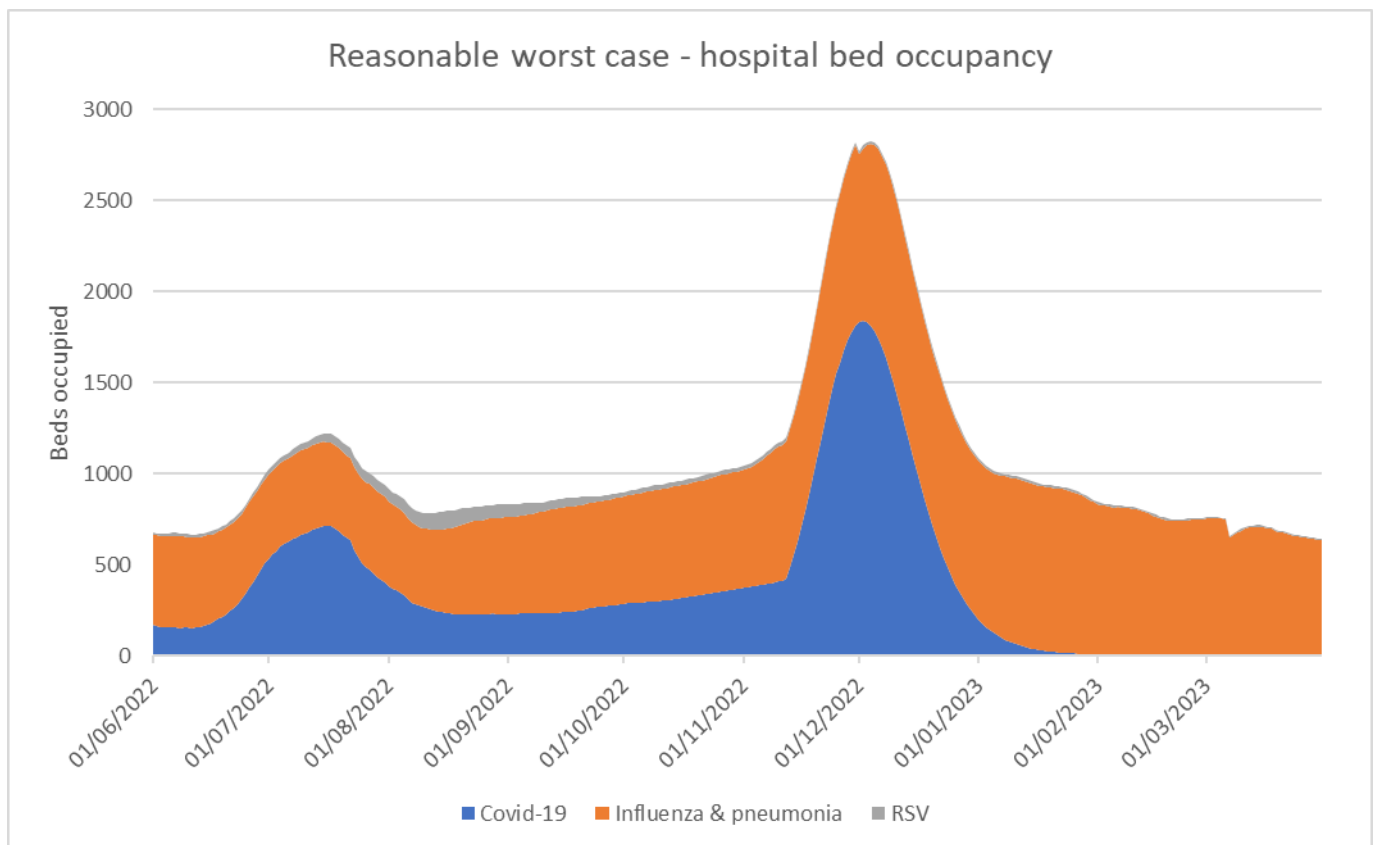


Figure 17. Combined scenario: Reasonable worst case – hospital bed occupancy



## 7. Discussion and Next Steps

The scenarios in this paper explore what ‘might happen if’ for different seasonal illnesses in Winter 2022/23. There are many different potential futures – the ‘what if’ scenarios here consider the concomitant arrival of an Influenza season and a SARS-CoV2 wave. This may not happen – however it is useful for NHS planners to use these types of scenarios to consider how these futures, if experienced, would be dealt with and an important part of the service planning process.

As we move into the winter season some scenarios might become less likely and would need to be adjusted based on new information (e.g. nature of Influenza season in far-East or identification of a SARS-CoV2 variant with growth advantage over BA.5). At the time of writing, the new RSV ‘summer’ season may have largely passed, but there may be a ‘winter’ season too.

It is still possible we may see a relatively quiet winter in terms of pressures due to influenza, covid and other respiratory viruses – however ‘hope’ is not a good planning strategy.

There is concern about the cost of living crisis and how this may exacerbate winter pressures, for instance if people are crowding into one room to stay warm and save on energy use this may increase virus transmission – however the scenarios here are broad enough to encompass the impacts this may cause in terms of influenza, RSV and COVID-19 – further work will be required to consider the health and public health impacts of cold weather and fuel poverty alongside those described above.

In terms of next steps, it may be possible to estimate pressures on intensive care unit (ICU) and paediatric intensive care unit (PICU), mortality, and pressures on the ambulance service in terms of people with flu and covid being conveyed to hospital.