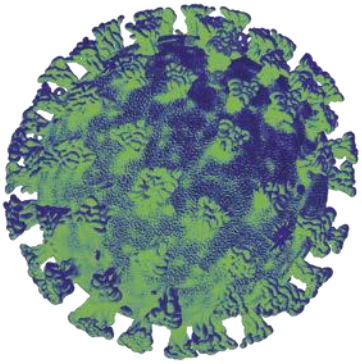
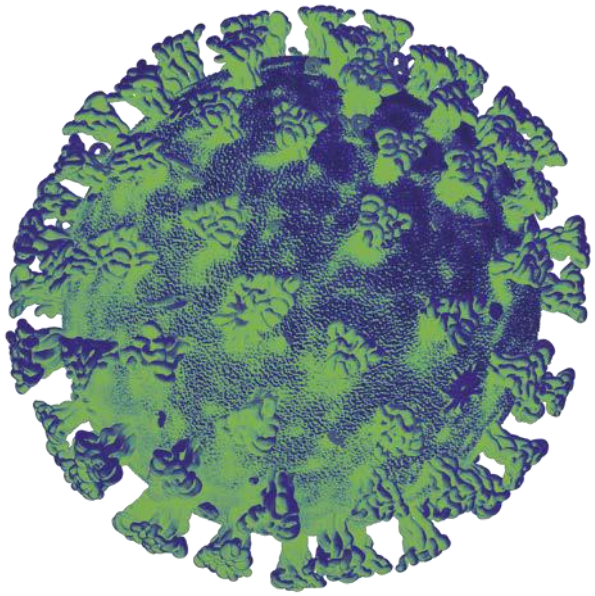
Llywodraeth Cymru
Welsh Government

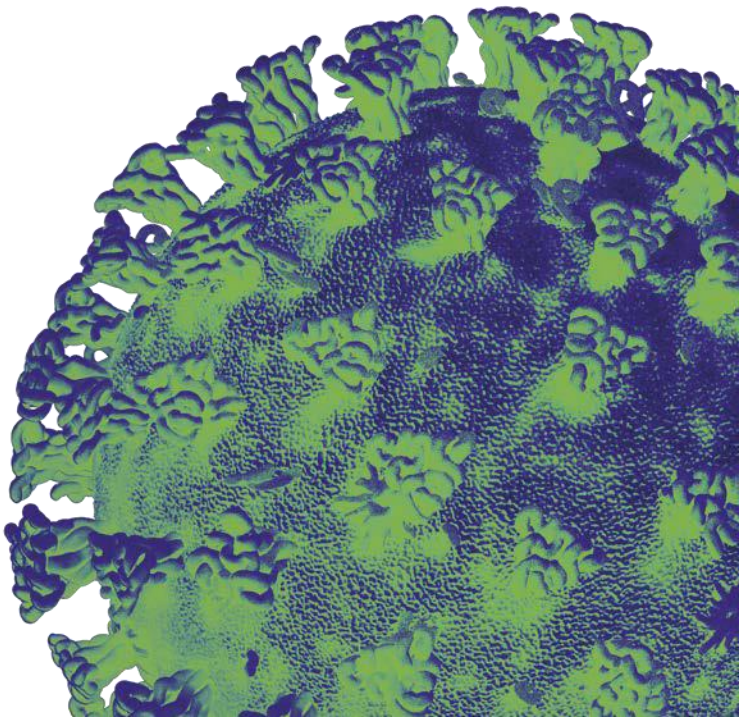
Science Evidence Advice

Comparing COVID-19 Cumulative Incidence Between Wales and England

September 2022







Objective

This paper seeks to compare the estimated cumulative COVID-19 incidence over time for Wales and England.

Summary

This paper estimates that cumulative incidence (percentage of the population infected with COVID-19) was around 57% for Wales from 27 April 2020 to 11 February 2022, whereas for England it was 71%. This indicates that differences in levels of restrictions as well as other differences in behaviour or population risk factors for transmission may have meant fewer people were infected with COVID-19 in this period in Wales compared with England. This paper discusses direct harms but does not cover wider harms (e.g. indirect health harms) as this is beyond the scope of this paper. In future it may be possible to update this analysis.

Background

Cumulative incidence here refers to the proportion of people testing positive for COVID-19 over a specified period of time.

In April 2022, ONS published analysis estimating the cumulative incidence of the people having at least one episode of COVID-19 infection in the four UK nations up to 11 February 2022. This analysis uses data from the Coronavirus Infection Survey, which began on 27 April 2020.

ONS reported cumulative incidence over time separately for each of the four UK nations. However, ONS did not report a UK-level estimate, since COVID-19 incidence was not available for all UK nations at the start of the Coronavirus Infection Survey, so the timeseries begins at different dates for each nation. This prevents direct comparison of cumulative incidence between the four UK nations.

It should be noted that the ONS COVID-19 Infection Survey is potentially not accurately representative of all groups and may be less reliable for Wales due to the proportionately smaller sample size compared with England, so care must be taken when interpreting results relating to figures and conclusions derived from the study.

For further information on how the ONS cumulative incidence is calculated and its limitations, see the article.[1]

Methodology

In this paper, in order to draw a comparison between England and Wales, cumulative incidence and a 90% confidence interval for Wales were estimated based on the percentage of the population who tested positive in England between 27 April 2020 and 29 June 2020, up to the beginning of reporting for Wales from 30 June

[1] Coronavirus (COVID-19) Infection Survey technical article: Cumulative incidence of the number of people who have tested positive for COVID-19, UK - Office for National Statistics

2020. It was assumed that incidence in Wales was similar to England for the time before data for Wales were available. This enabled a comparison to be made between England and Wales from the start of reporting in England on 27 April 2020.

In order to check that a direct comparison was appropriate, cases were plotted (from gov.uk data[2]) as a percentage of the population (using ONS mid-year estimates of the population for UK nations[3]) for Wales and England between March and August 2020 (see Figure 1). Wales and England have a similar overall trajectory between late April and late June, but the exact timing and maximum height of peaks and troughs for each nation are different. This showed that despite uncertainty in making the comparison, cases were comparable between England and Wales during this period. This supported the hypothesis that England's cumulative incidence would be a suitable proxy for Wales' cumulative incidence for this period.

However, Wales' hospital admissions were above England's for the majority of the period (Figure 2). This indicated that Wales' true cumulative incidence as at 30 June 2020 may have been slightly higher as a percentage of the population compared with England's cumulative incidence at this date.

Wales had more hospital admissions per 100,000 population than England during this time before the ONS CIS began in Wales; however the definition of a hospital admission differed, with admissions in Wales including 'confirmed and suspected' and therefore there was a background rate of 'suspected COVID-19' which sometimes was identified as not COVID-19, and therefore acted as something of a buffer which meant that hospital admissions per 100,000 population were always higher in Wales than in England.

It may also be that Wales experienced similar community infection rate to England but had more COVID-19 hospital admissions per 100,000 population, which would have been expected due to Wales having an older, more deprived, and hence more vulnerable population demographic. Therefore, although Wales experienced six times as many COVID-19 hospital admissions as England up to 30 June 2020, it is likely that assuming Wales experienced six times as many COVID-19 infections as England would be a gross over-estimate for the reasons outlined above.

Hence, a sensitivity analysis was conducted in which England's upper 90% credible limit (from the ONS analysis) was used to estimate Wales' cumulative incidence from the start of the pandemic to 30 June 2020. The credible intervals are wider for Wales than for England due to the relatively smaller survey sample size in Wales relative to England (see Figure 3 and Figure 4).

[2] Cases in the UK | Coronavirus in the UK (data.gov.uk)

[3] National level population estimates by year, age and UK country (gov.wales)

Figure 1: COVID 19 Cases for Wales and England (7 day rolling average)

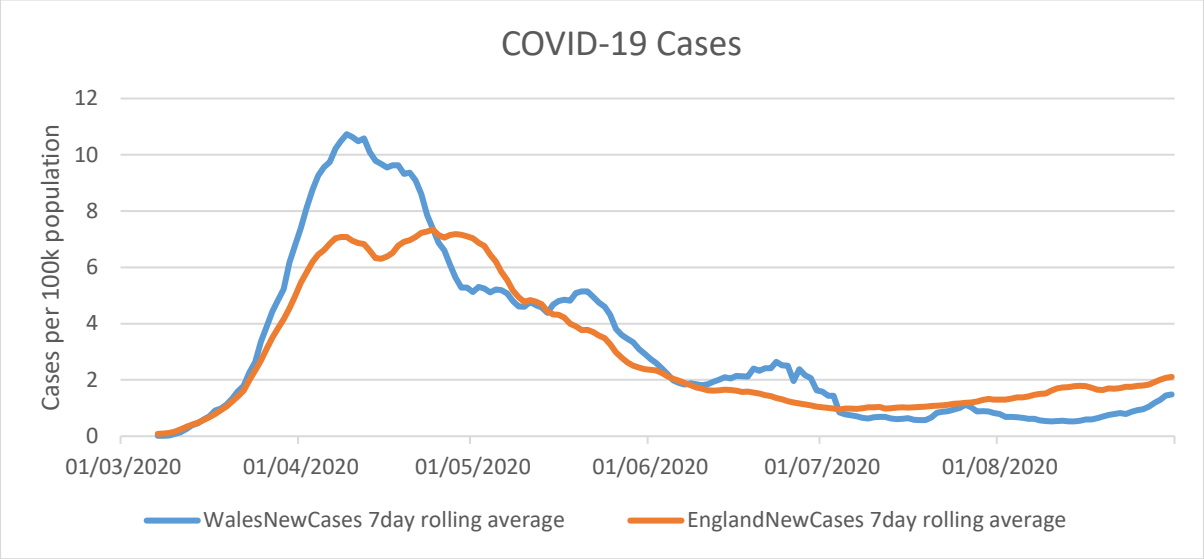
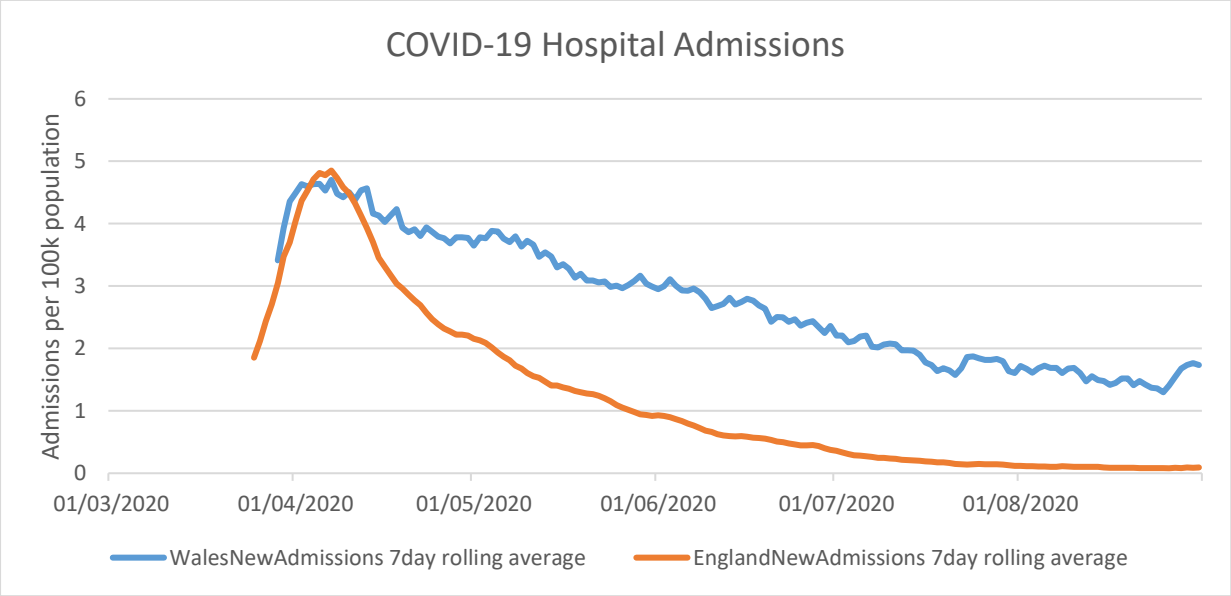


Figure 2: COVID 19 Hospital Admissions for Wales and England (7 day rolling average)



Results

	COVID-19 Cumulative Incidence up to 11 February 2022	
	England	Wales
Estimate reported by ONS (England estimate starting from 27 April 2020; Wales starting from 30 June 2020)	70.69% [65.96%, 75.64%]	56.05% [44.30%, 69.35%]
Estimate assuming England's cumulative incidence could be used as a proxy for Wales between 27 April and 29 June 2020	70.69% [65.96%, 75.64%]	57.41% [45.37%, 71.06%]

Figure 3: Cumulative incidence, England

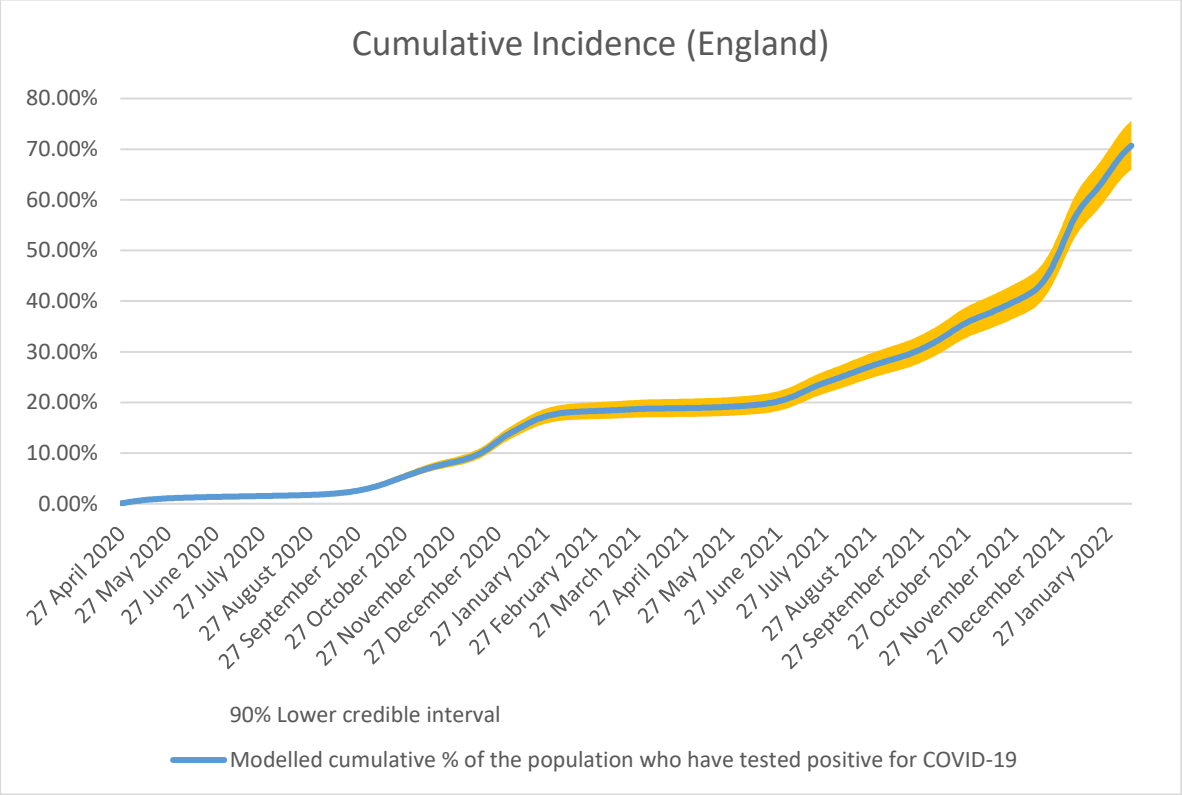


Figure 4: Cumulative incidence, Wales

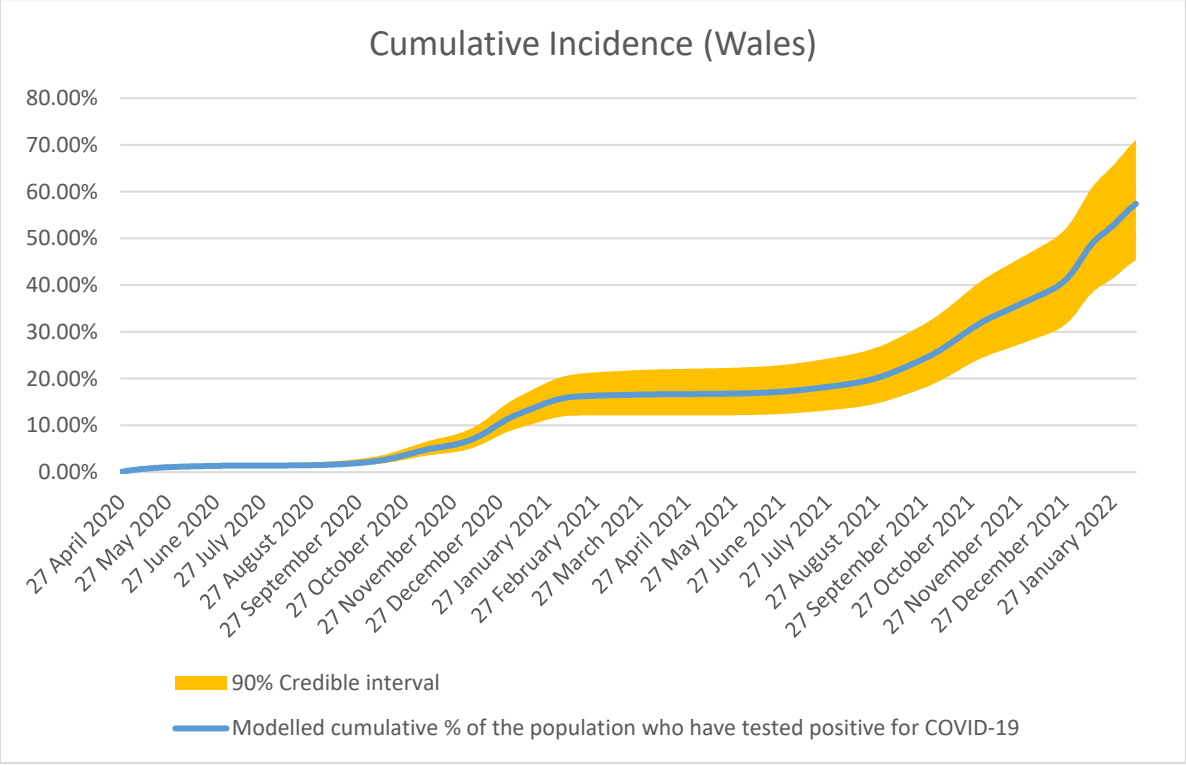


Figure 5: Cumulative incidence, Northern Ireland

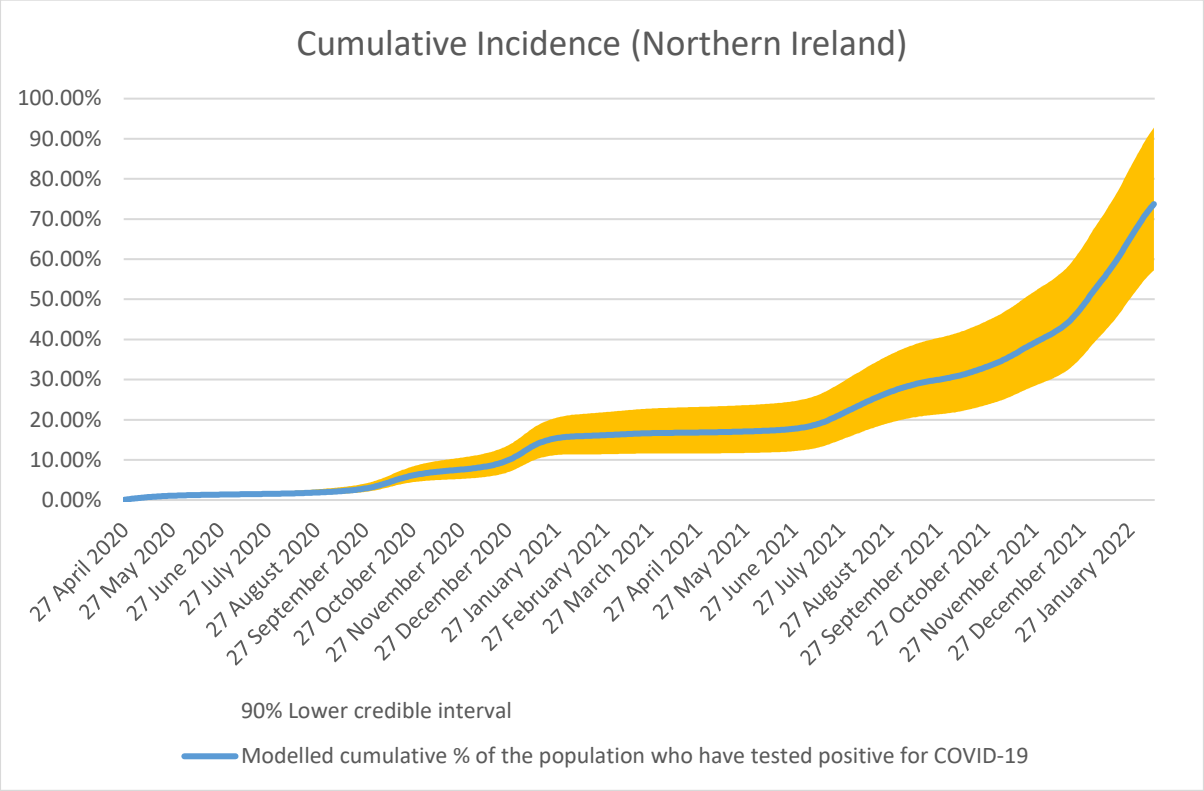
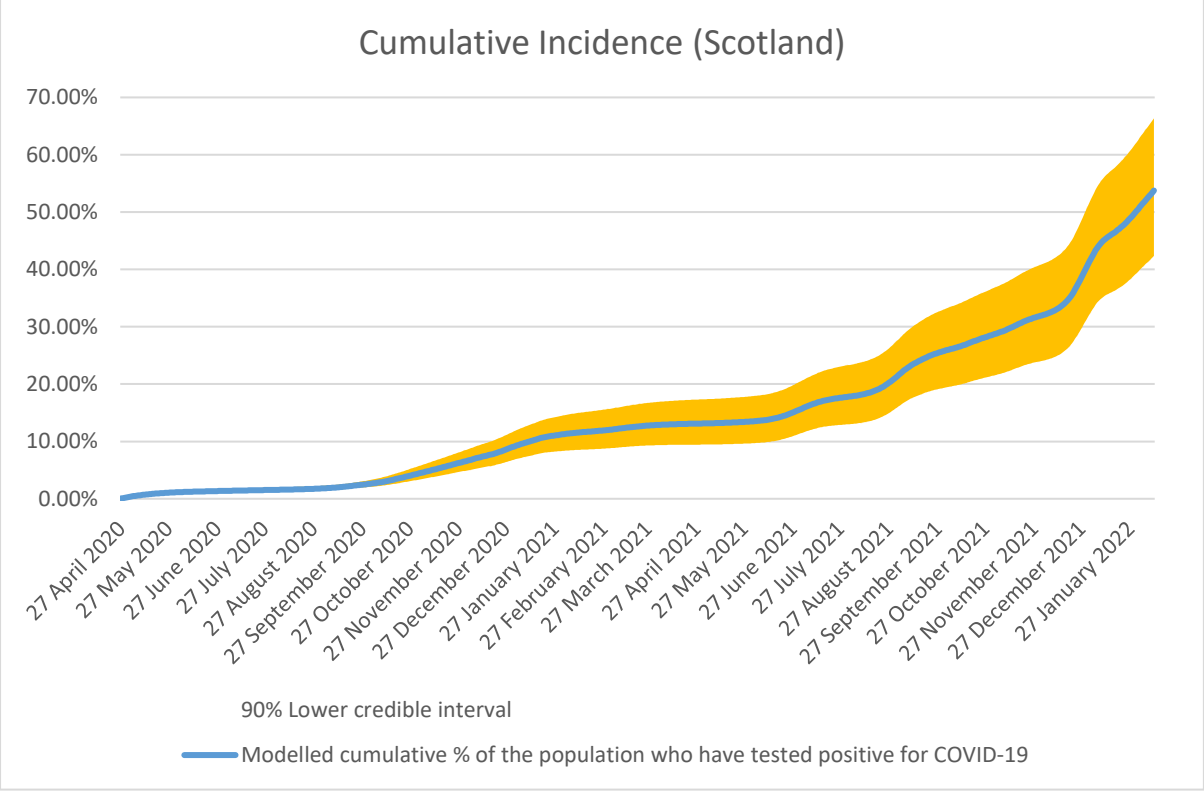


Figure 6: Cumulative incidence, Scotland



For comparison, cumulative incidence is shown in the above charts for all four nations, using England as a proxy for the start of the survey for Wales, Northern

Ireland and Scotland. By the end of the survey on 11 February 2022, Northern Ireland's cumulative incidence was estimated to be similar to England's, which were both higher than Wales' and Scotland's cumulative incidence. However, there is high uncertainty, particularly for Scotland and Northern Ireland since they have smaller sample sizes in the ONS COVID-19 Infection Survey than England does. Given the high uncertainty for estimates for Scotland and Northern Ireland, combined with the challenges associated with data being unavailable for these nations until later in the pandemic than for England and Wales, it was decided to compare Wales against England only throughout the remainder of this analysis.

In the following two charts (Figure 7 and Figure 8) the orange shading represents times where England and Wales were placed under lockdowns or restrictions.

Figure 7: Rate of change in COVID-19 cumulative incidence, England

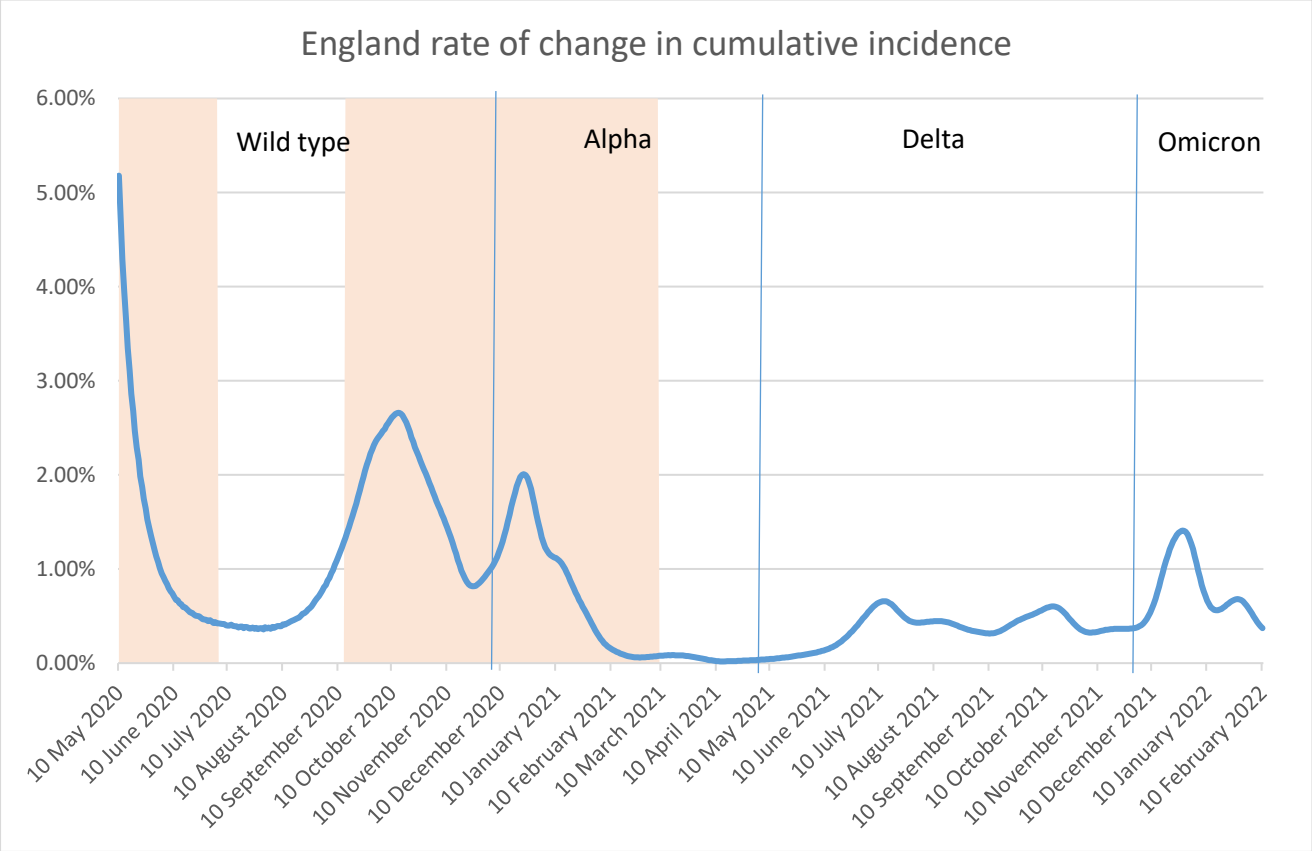
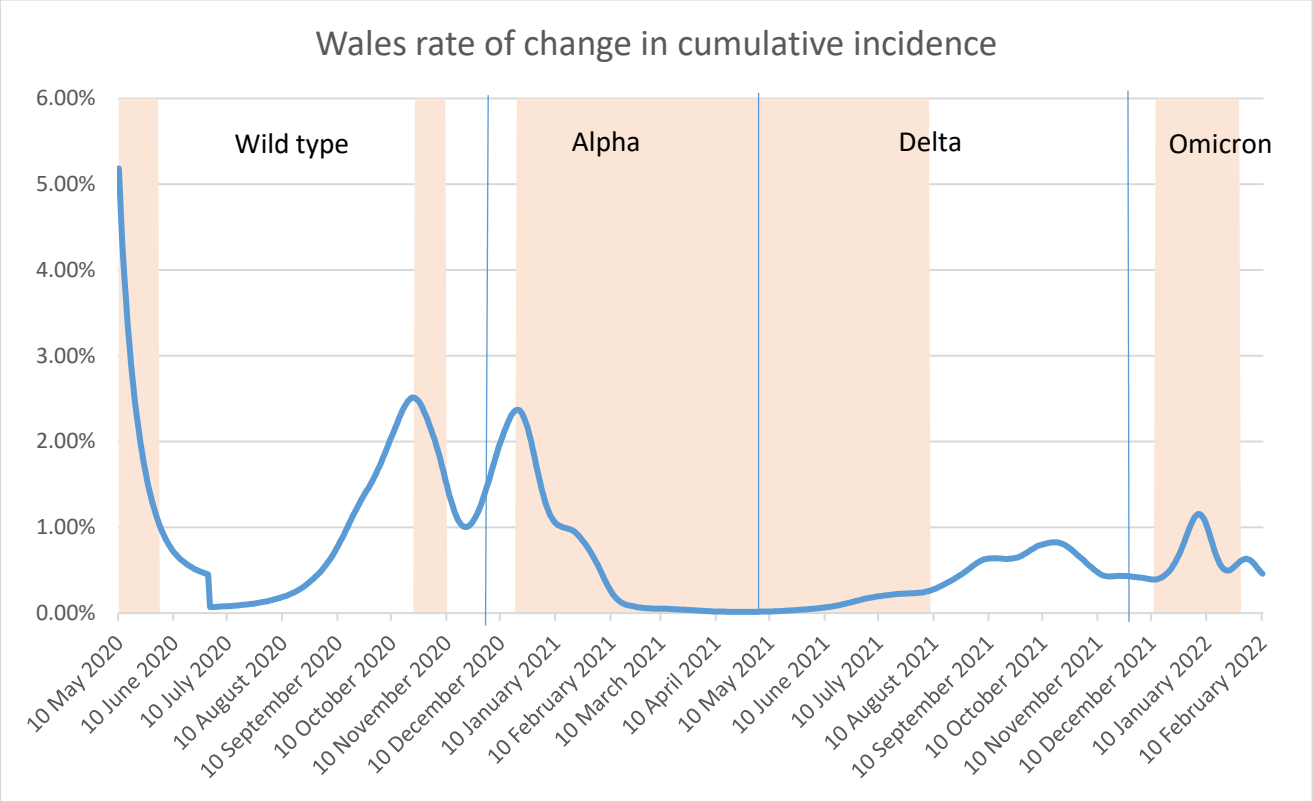


Figure 8: Rate of change in COVID-19 cumulative incidence, Wales



Autumn 2020

In Wales, a firebreak[4] was enforced from 23 October to 8 November 2020. The number of new cases (individuals testing positive for COVID-19, for the first time) each day, *"rate of cumulative incidence"*, had been increasing exponentially since July 2020. However, coinciding with the start of the firebreak, the rate of cumulative incidence stopped increasing immediately and started to decrease (Figure 8). This provides supportive evidence that COVID-19 'firebreak' protections were effective.

After the firebreak ended on 8 November 2020, the number of new cases of COVID-19 each day continued to decrease for another week. This suggests that despite the firebreak officially ending, the rate of cumulative incidence continued to reduce for a week due to a combination of people continuing cautious behaviour, reducing social mixing and dampening transmission, and the lag between infectious people coming into contact with others, transmitting the disease, incubation time, and then those contacts testing positive.

England strengthened restrictions on 14 September 2020, allowing only six individuals to socialise, the 'rule of six'. Following further rises in infection rates, England announced a lockdown for four weeks from 5 November 2020. In contrast, Wales announced a shorter and earlier, two week firebreak from 23 October 2020, after which restrictions were eased. Retention of tighter restrictions in England had a dampening effect on the rate of change in cumulative incidence: England reached a

[4] National coronavirus firebreak to be introduced in Wales on Friday | GOV.WALES

maximum of 2.01% on 23 December 2020 compared with Wales which had a maximum of 2.37% on 20 December 2020.

Between 23 October 2020 (start of Wales firebreak) and 24 November 2020 (point at which the rate of cumulative incidence started increasing again, end of wave 2), the proportion of people estimated to have tested positive for COVID-19 was 2.34% of the Wales population and 3.05% of the England population. This indicates that Wales' approach of a short firebreak followed by lighter restrictions led to fewer people testing positive for COVID-19 during this period compared to England, but more people testing positive for COVID-19 at the wave peak compared with England, leading to higher NHS pressures at the peak, but fewer overall infections and, by extension, hospitalisations and deaths. In contrast, England's approach of imposing tighter restrictions at a later date when incidence had reached higher levels resulted in more people testing positive for COVID-19 during this period, but dampening of the wave peak height, reducing maximum NHS pressures.

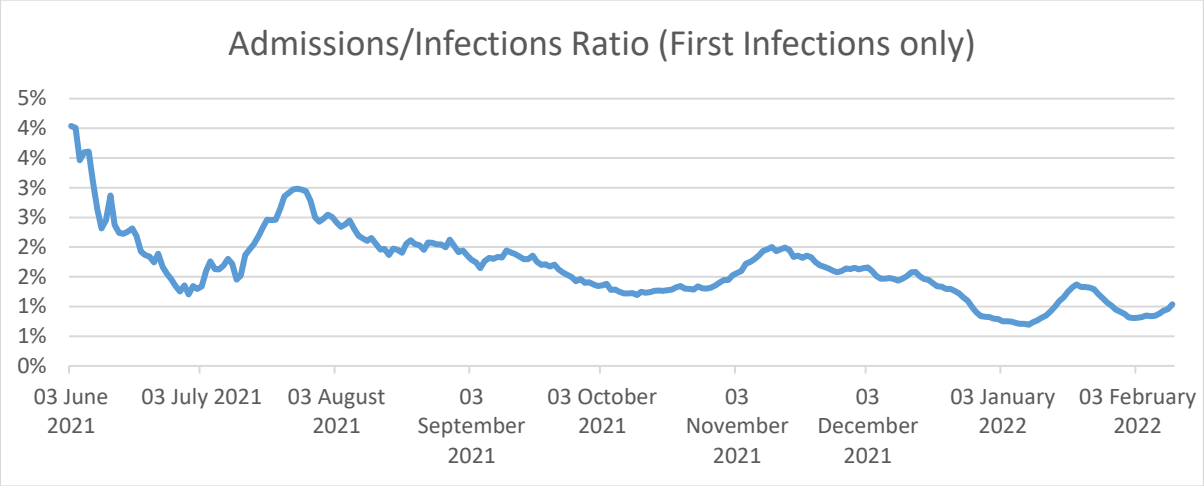
Summer 2021

Alert Level 4 restrictions[5] were introduced on 20 December 2020 in Wales, and this coincided with another reduction in rate of COVID-19 cumulative incidence (in other words the increase in cumulative incidence slowed). Rate of cumulative incidence reduced to close to zero between March and June 2021, representing a time where there were very few new infections. Restrictions were gradually eased and by the time Wales moved to Alert Level 1 from 17 July 2021, rate of cumulative incidence started to gradually increase again as the Delta variant had become dominant. England eased restrictions earlier than Wales, and rate of cumulative incidence increased earlier than in Wales. Between 4 July 2021 (when England eased restrictions) and 7 August 2021 (when Wales' lockdown ended), 1.33% of the population were estimated to have tested positive for COVID-19 in Wales, compared with 4.18% of the population for England. This indicates that Wales' approach for easing restrictions later and more slowly led to fewer people testing positive for COVID-19 during this period, and fewer people testing positive for COVID-19 at the wave peak compared with England (23.1 per 10,000 people on 12 October 2021 in Wales compared with 19.61 per 10,000 people on 17 October 2021 in England), leading to lower NHS pressures at the peak and fewer overall infections, hospitalisations and deaths. In contrast, England's approach for easing restrictions earlier resulted in more people testing positive for COVID-19 during this period and a greater wave peak height, increasing NHS pressures.

During the period between March and May 2021 – in contrast to earlier in the pandemic, and again from July to September 2021, there was faster uptake of vaccination in Wales compared with England, with a substantially higher percentage of the population of Wales receiving all available doses of the vaccine earlier than in England. This will also have contributed to the difference in the susceptible population and had a dampening effect on transmission, and the number of people who were infected, or developed symptomatic illness and therefore accessed testing.

[5] Restriction Levels in Wales: A traffic light guide (gov.wales)

Figure 9: Ratio of admissions to infections (first infections only)



Winter 2021/2022

A spike in rate of cumulative incidence occurred during the initial Omicron wave, with a similar pattern occurring in England and Wales; a significant number of new infections were observed who were not infected in the previous two years. Wales entered Alert Level 2[6] from 26 December 2021 to 28 January 2022. In contrast, England did not enforce such restrictions during that period. Wales reached a lower maximum rate of cumulative incidence (i.e. lower peak number of daily new infections) that occurred later (1.16% on 5 January 2022) when compared with England (1.41% on 27 December 2021). In other words, fewer new people were infected in Wales when compared with England during the Omicron wave which may be due to increased COVID-19 protections in Wales during this period.

Between March and September 2021, overall all-cause deaths were at or below average levels and numbers of deaths due to COVID-19 were relatively low.[7] However, from September 2021 until the end of the year numbers of excess deaths and deaths due to COVID-19 increased, which is consistent with the trend we see in rate of change in cumulative incidence.

Figure 8 shows the ratio of admissions to first infections in Wales which has an approximately decreasing trend over time. This is mainly due to the protection against severe illness and therefore hospitalisation offered by vaccination and the increasing vaccine coverage in the population over time. The trend could also be attributed to the relative decrease in severity moving from Alpha to Delta to Omicron BA.2.[8] For example, the spike during the Omicron BA.2 wave is smaller than those observed in previous waves. Note that this ratio is higher than if reinfections were included; reinfections are now estimated to account for approximately 10% of all infections[9].

[6] Restriction Levels in Wales: A traffic light guide (gov.wales)
[7] technical-advisory-group-examining-deaths-in-wales-associated-with-covid-19-30-march-2022.pdf (gov.wales)
[8] Report 50 - Hospitalisation risk for Omicron cases in England | Faculty of Medicine | Imperial College London
[9] COVID-19 daily dashboard amended to include reinfections - GOV.UK (www.gov.uk)

Comparing cumulative incidence over the whole pandemic for Wales and England

ONS estimated that as at 11 February 2022, 70.69% [65.96%, 75.64%] of the English population had tested positive for COVID-19 since the start of the survey. In comparison, ONS estimated that 56.05% [44.30%, 69.35%] of the Welsh population had tested positive between 30 June 2020 and 11 February 2022. In the period 27 July 2020 to 11 February, ONS estimated that 72.22% [56.03%, 90.89%] of the population of Northern Ireland had tested positive. In the period 22 September 2020 to 11 February 2022, it was estimated that 51.48% [40.47%, 63.62%] of the population of Scotland had tested positive.

Using England's cumulative incidence as a proxy for Wales' cumulative incidence between 27 April 2020 and 29 June 2020, the cumulative incidence estimate for Wales increases slightly to 57.41% [45.37%, 71.06%] as at 11 February 2022. The figure for Wales may be lower in part because of the stricter restrictions generally imposed over the pandemic, although it may mean that more of the population is susceptible to infection in future, since previous infection, as well as vaccination, reduces the chance of future infection. Cumulative incidence may be lower in Wales due to other reasons like differences in population behaviours, and proportionately more people living in rural areas. It is worth noting that restrictions in Wales were not always more stringent than in England, for instance Wales mandated face coverings later than England, and Wales at times allowed bigger household bubbles to mix than England.

Sensitivity Analysis

Using England's lower credible figures to estimate Wales' cumulative incidence between 27 April 2020 and 29 June 2020 resulted in a cumulative incidence estimate of 57.12% as at 11 February 2022. Similarly, using England's upper credible figures during the period 27 April 2020 to 29 June 2020 results in a cumulative incidence estimate of 57.76%. Overall, since England's 90% confidence interval was relatively narrow, estimates of cumulative incidence in Wales as at 11 February 2022 using England's upper credible limit were still significantly below England's estimated cumulative incidence.

Conclusion

The aim of this paper was to compare the estimated level of cumulative incidence for Wales with England. In particular, cumulative incidence for Wales was estimated going back to the start of the survey when ONS started estimating cumulative incidence for England so that a comparison could be made. Note that there is significant uncertainty in using England as a proxy, but adding on the additional accumulated incidence for that earlier period only increased Wales' cumulative incidence by 1.36%. So Wales' cumulative incidence over the whole pandemic was estimated as being 13.28% below England's cumulative incidence estimate at 11 February 2022. This chimes with the finding that excess deaths were around 20% lower in Wales than England, although much of this difference was concentrated in the first wave of COVID-19, which peaked before the ONS Coronavirus Infection

Survey began reporting in England on 27 April 2020, the period considered in this paper. Excess mortality is an important metric to be considered alongside cumulative incidence and is explored further in the TAG reports on excess mortality.[10]

If there is another significant wave of COVID-19 caused by, a new variant for example, Wales may need to be cautious to dampen widespread infection rates (measures include encouraging a high level of booster vaccine uptake) and reduce maximum NHS pressures.

In future it may be possible to update this analysis to look beyond February 2022, and also estimate cumulative incidence for particular groups, for instance using SAIL data.

[10] https://gov.wales/sites/default/files/publications/2022-03/technical-advisory-group-examining-deaths-in-wales-associated-with-covid-19-30-march-2022.pdf