COVID-19 In England: The Relationship Between Reported Cases and Hospital Admissions by Region

Objectives

01

To evaluate the long-term correlation between regional COVID-19 cases and hospital admissions.

02

To investigate if patterns in new cases can help forecast regional healthcare challenges.

03

To determine whether there is a delay between increasing hospital admissions and cases in particular areas.

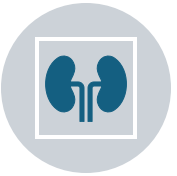
04

To explore which regions saw a greater hospitalisation rate in relation to the number of cases.

Why these Fields?

Hospital admissions: shows the impact of healthcare.

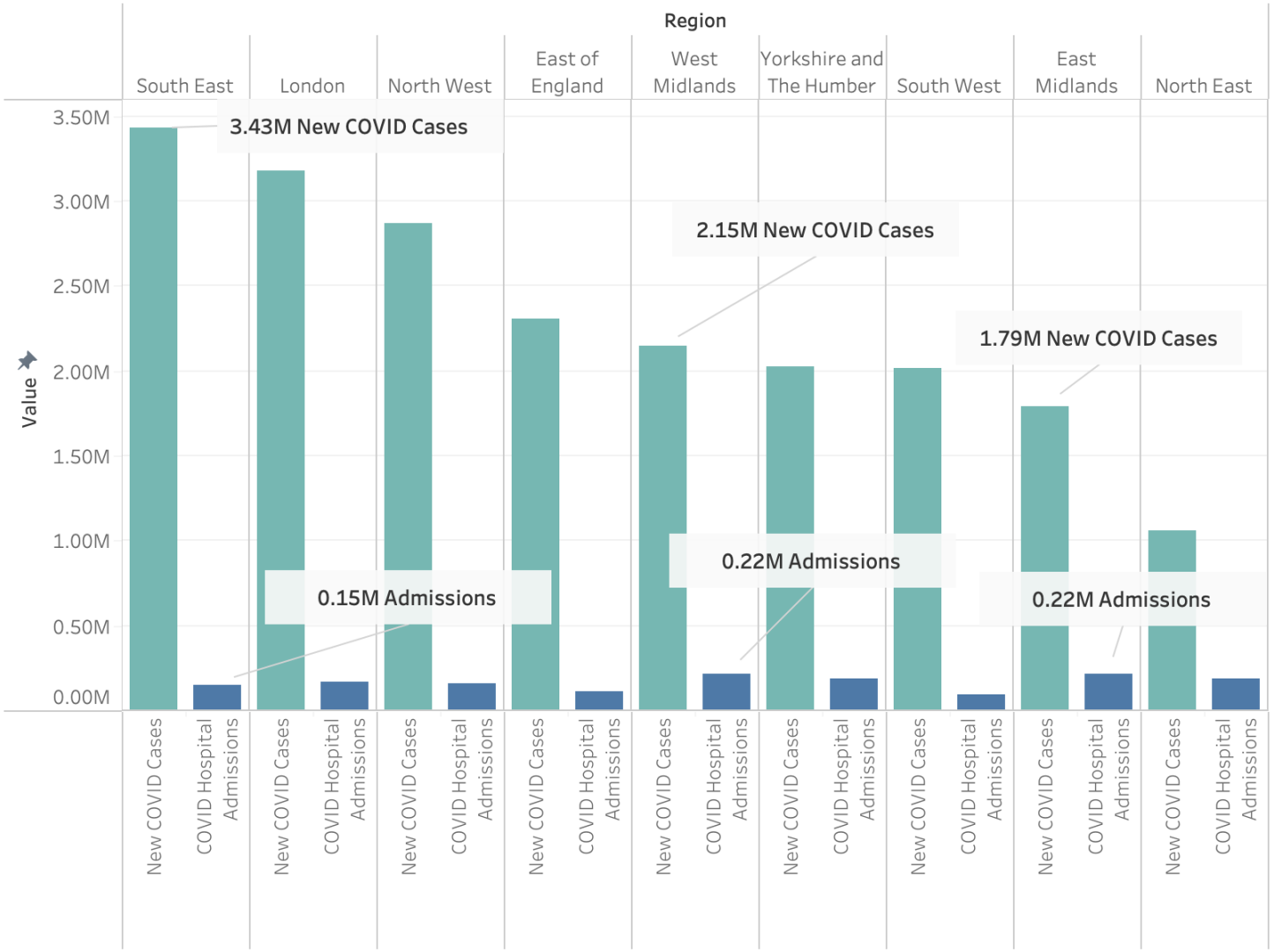
Region and date : temporal and geographic trend analysis.



Cases by specimen date: Reflects early signals of infection and development.

Total Cases vs Total Admissions per Region

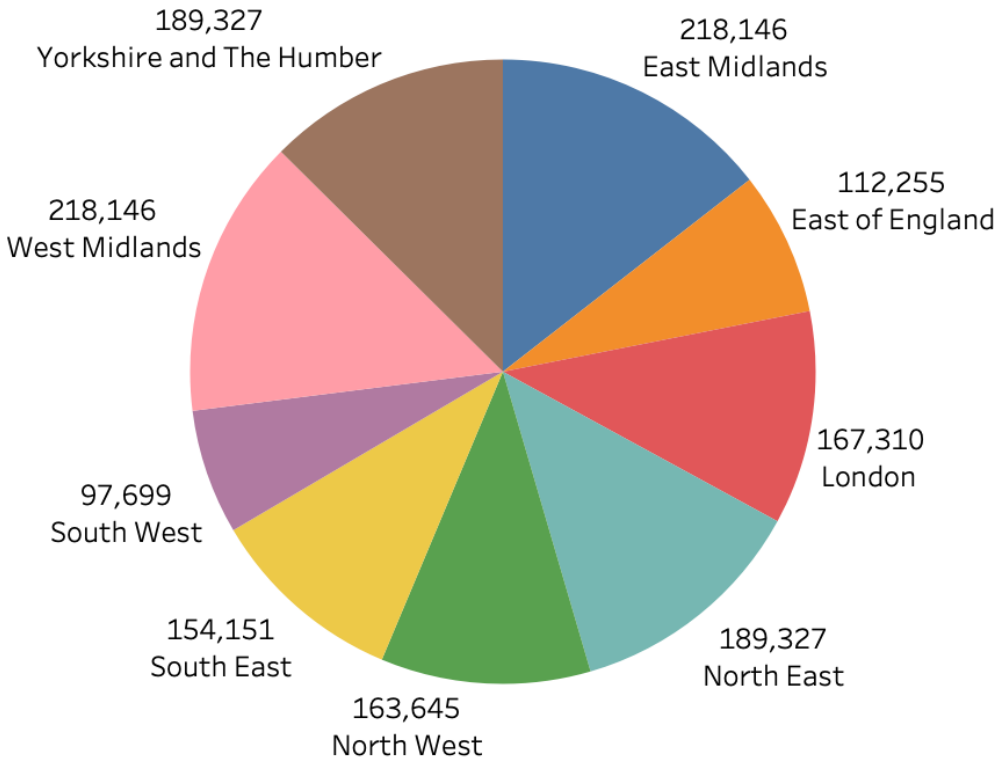
The Region with the highest **COVID cases** is **South East** with **3.43M** new cases reported in total. The **East Midlands** has one of the lowest COVID cases but has the highest **hospital admissions** with **0.22M**.



This graph shows the total cases plotted against hospital admissions per region during 2020-2023. New COVID Cases are highlighted the light blue bars.

- The region with the highest COVID Cases is South-East, followed by London.
- Although South-East has the highest COVID Cases reported, the hospital admissions are on the lower end when comparing with other regions.
- Surprisingly, the regions with lower COVID cases reported have higher hospital admissions.
- The regions West midlands, East Midlands, North-East and Yorkshire and the Humber have the highest hospital admissions during 2020-2023.

Proportion of Total Hospital Admissions by Region



This pie chart shows the total of hospital admissions by region for the years 2020-2023.

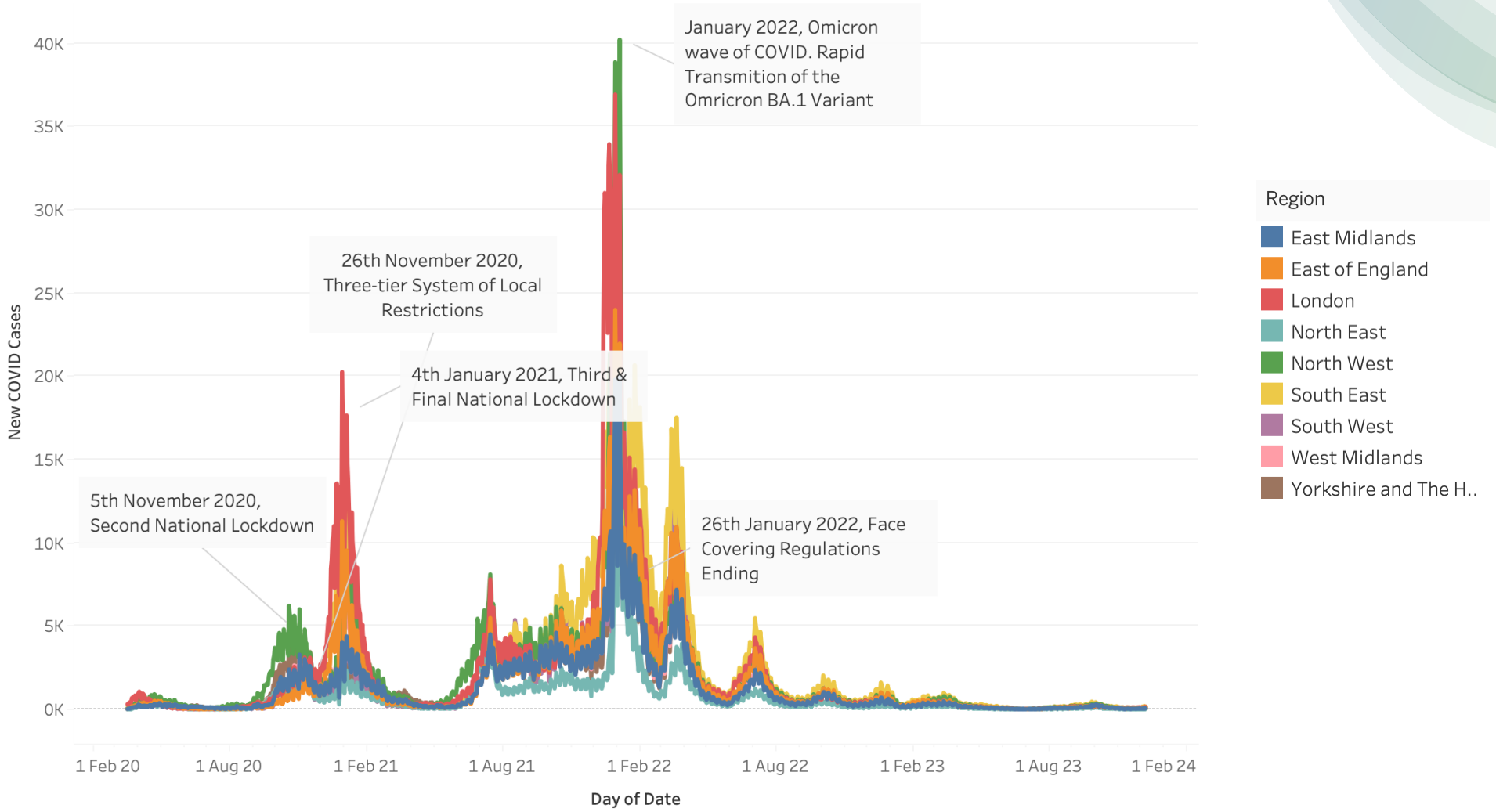
- Aligning with the bar chart from earlier it highlights how the Midlands regions (West, East and Yorkshire and the Humber) have a higher hospital admission rate compared to other regions.

- This is surprising as you would expect a more densely populated area like London to have more hospital admissions, especially when considering the cases of COVID reported.
- This potentially highlights inequalities within the healthcare system in areas like the midlands.

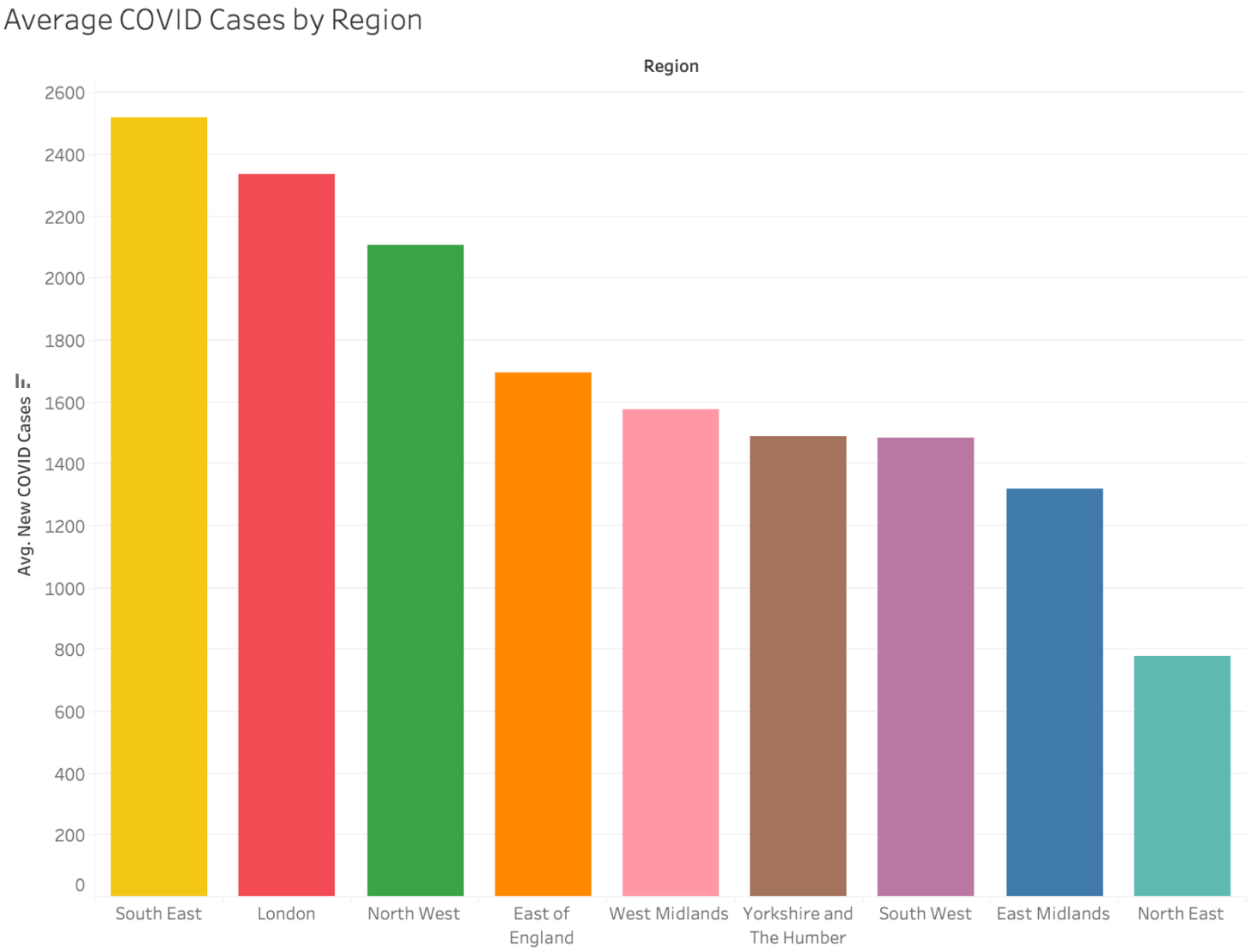
Distribution over Time

Daily COVID Cases

The **North West Region** had the **highest peak** of new COVID cases in a single day on 4th January 2022. **40,221** new COVID **cases** were reported.



Regional Trend Comparison

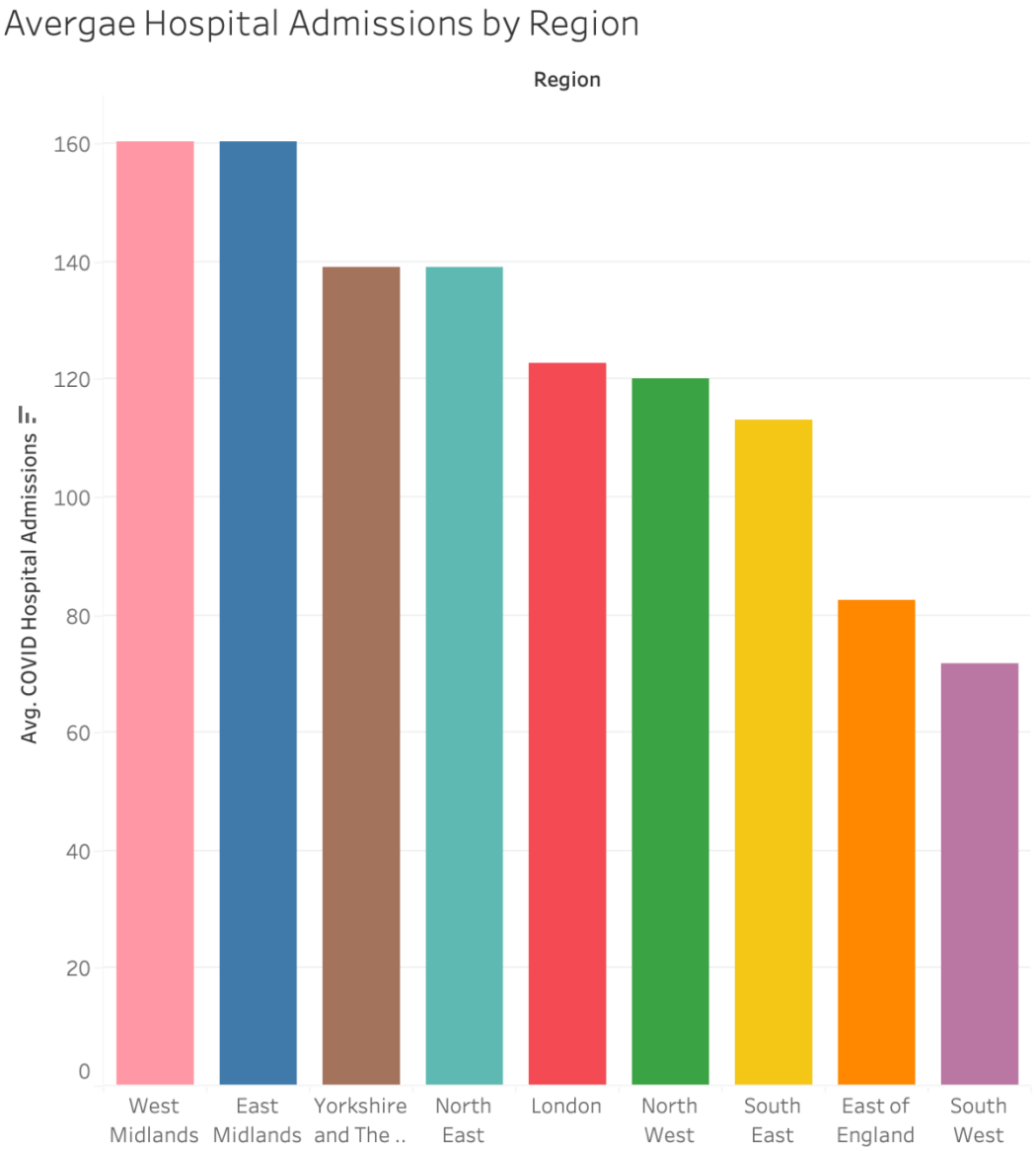


This bar chart shows the average COVID Cases by region daily from 2020 – 2023.

- Again, highlighting how the South-East region had the highest new COVID cases reported.

- The North-East region has the lowest reported new cases or COVID. Possibly showing distrust with healthcare and highlighting the inequalities in that region.

Regional Trend Comparison

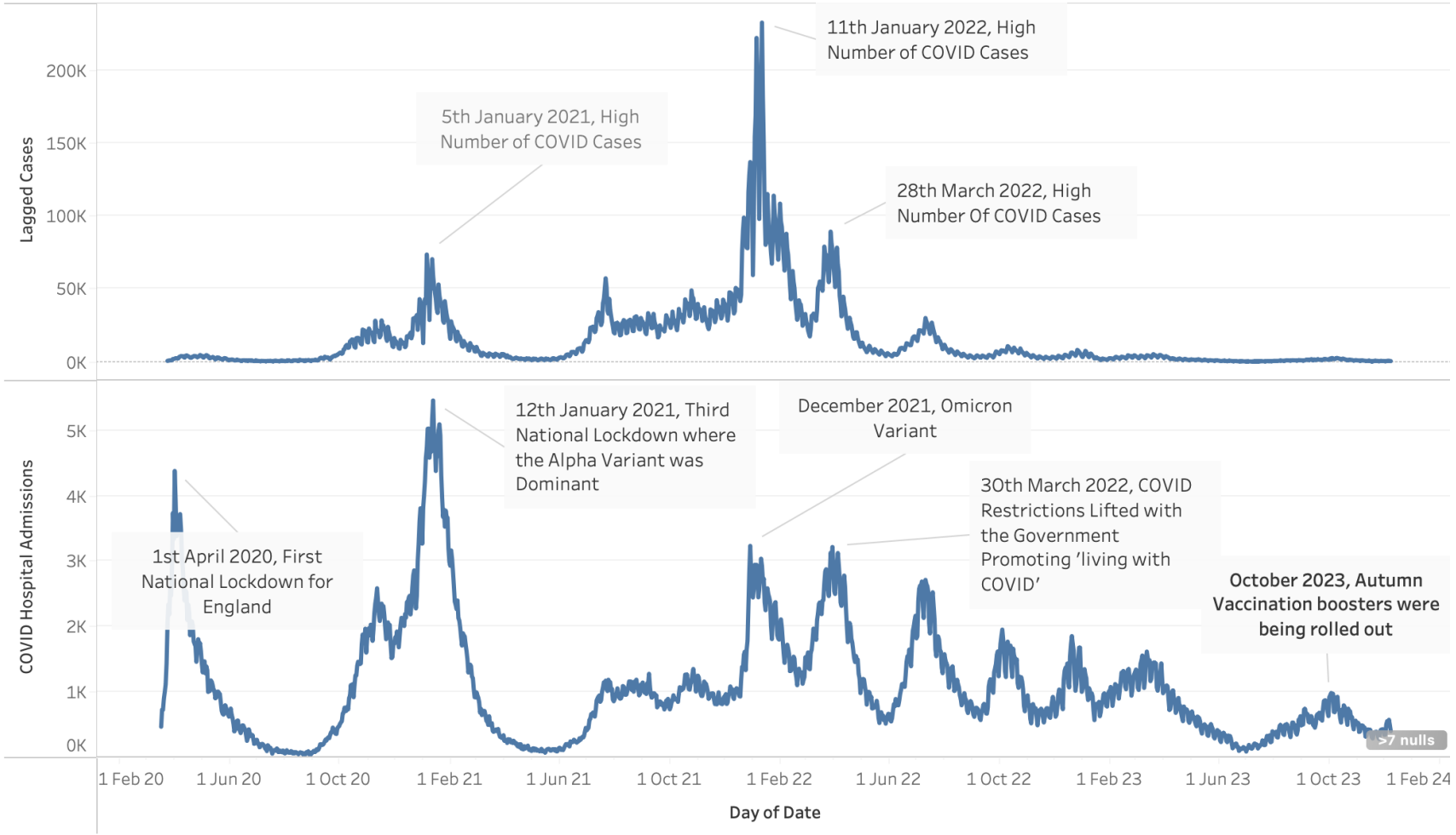


- The West Midlands had the highest average hospital admission per day between 2020 – 2023. With ~ 160 hospital admissions each day.
- The South-West Region had the lowest with ~ 70 hospital admissions each day.

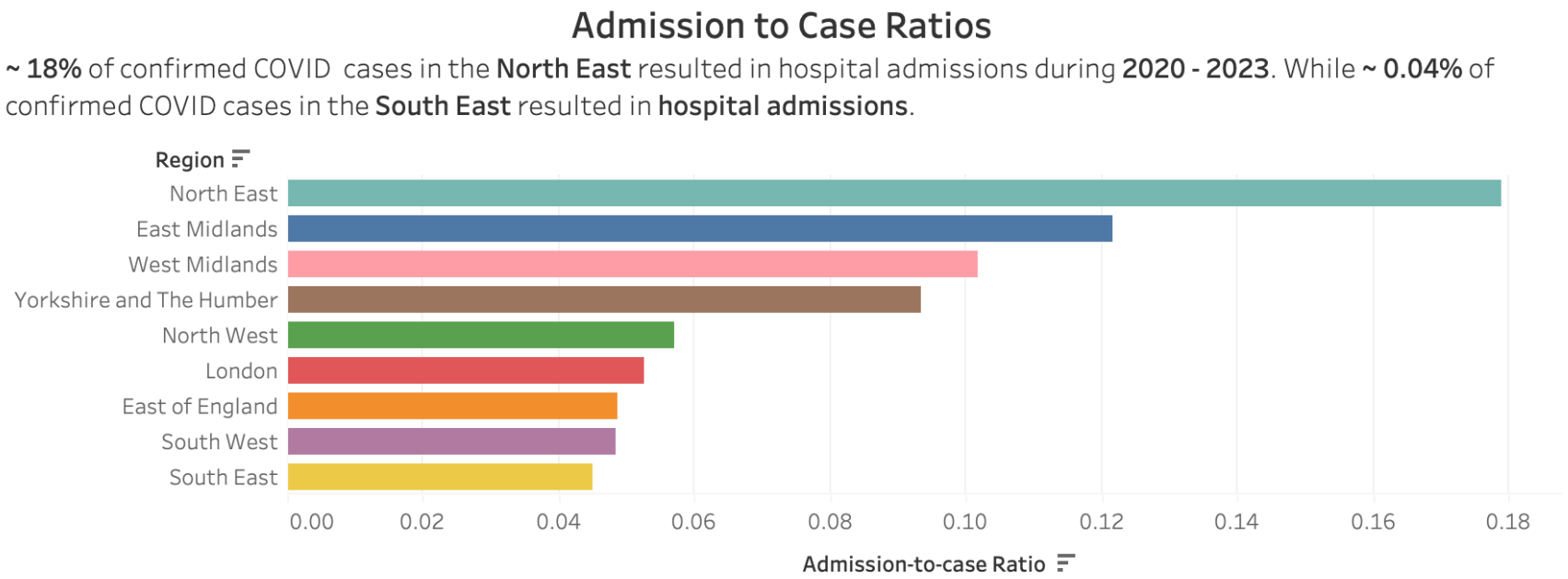
Lag Analysis

Lagged Cases vs Admissions

This line graph shows the relationship between lagged COVID cases and hospital admissions in England. Peaks of infection is follwed by hospital admissions, usually a 7-day lag.

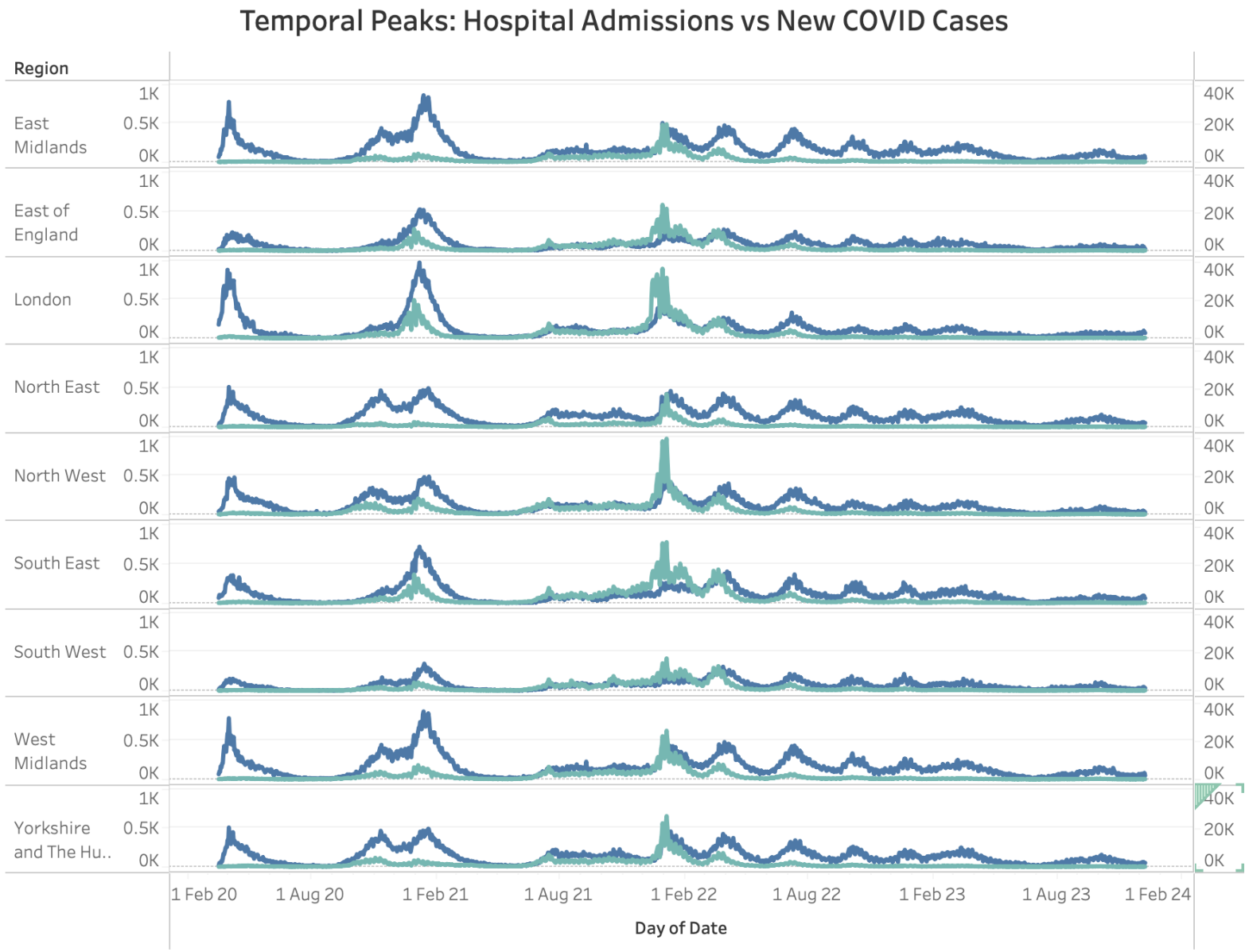


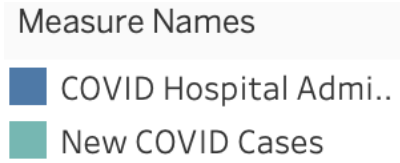
Admissions to Case Ratios



A ratio of **~18%** highlights how a high proportion of reported COVID cases require hospitalisation. This could suggest a more vulnerable population, like an aging population.

Temporal Peaks

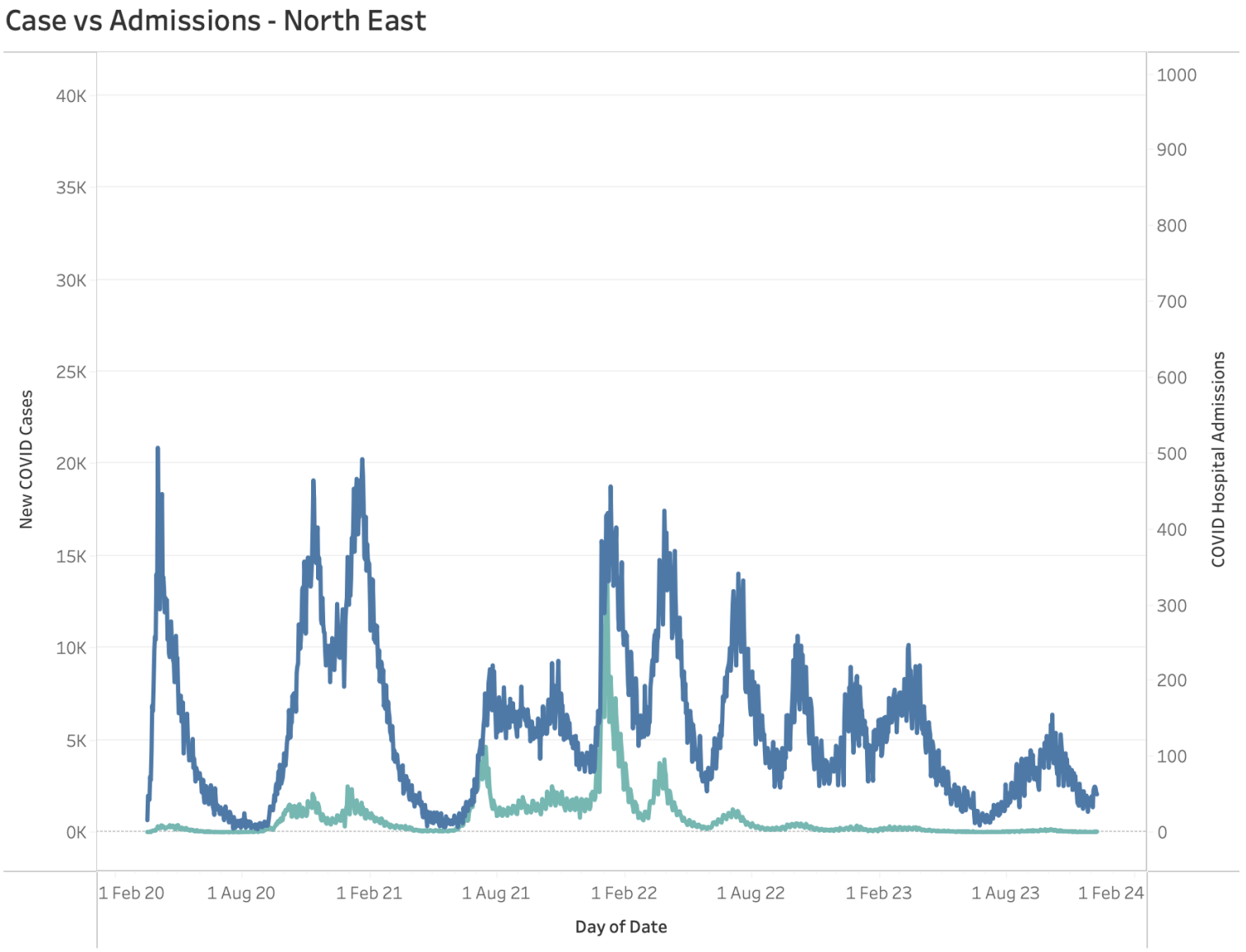


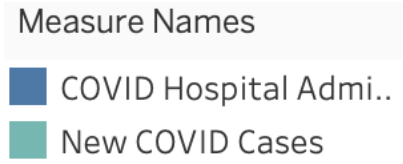


This graph shows the overall temporal peaks of new COVID cases and hospital admissions.

- It also shows how regional peaks match up with the overall national peaks.
- Highlighting how after restrictions have been placed the rates for covid cases and hospital admissions decrease.

Regional Highlight

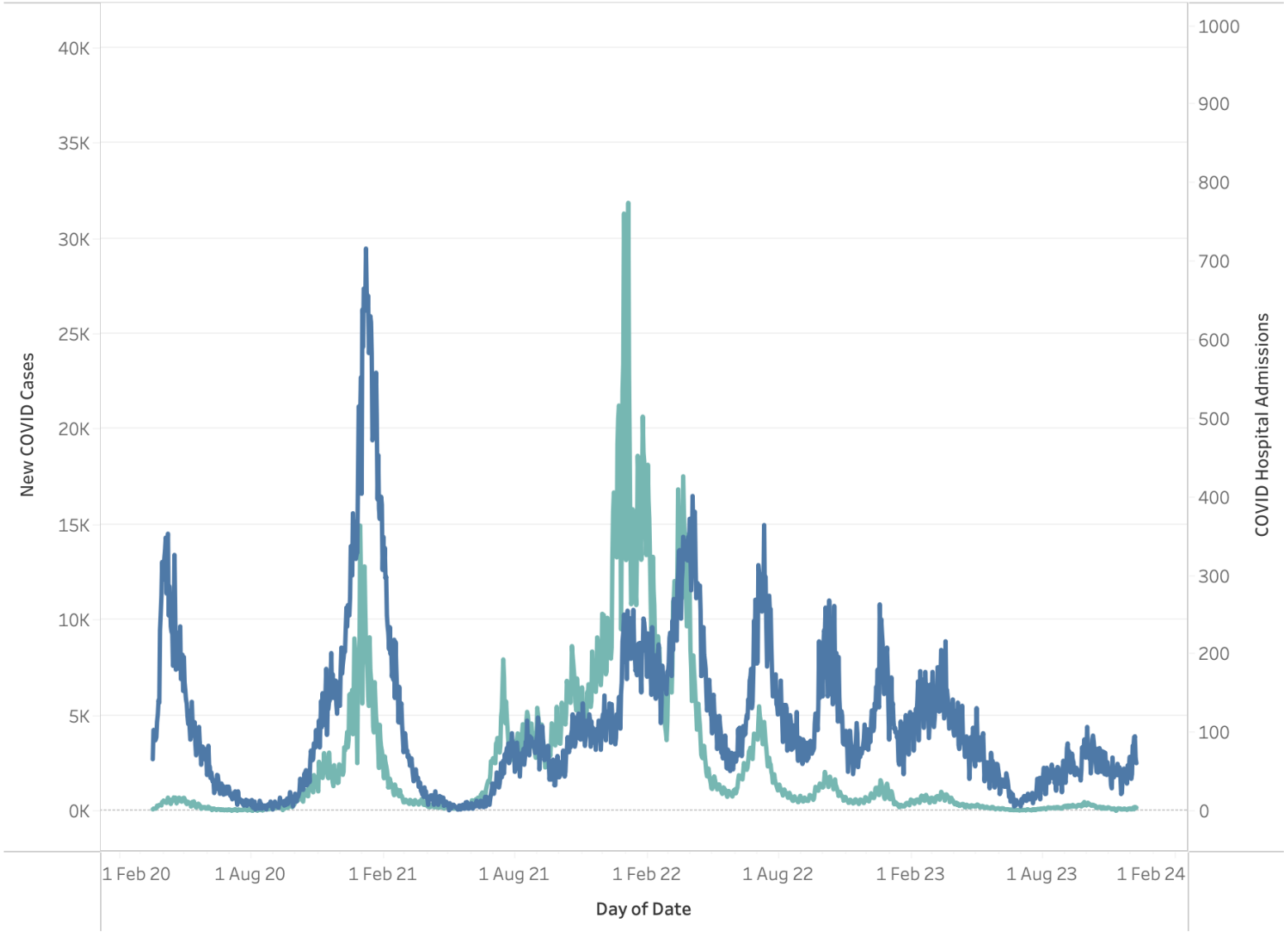




This is a closer look at COVID Cases and hospital admissions in the North-East region.

- Hospital admission tend to follow the new covid cases after a few days, highlighting the lag effect of data collection.
- The highest peak of hospital admission was during the first national lockdown around February/March 2020/

Case vs Admissions - South East



Measure Names

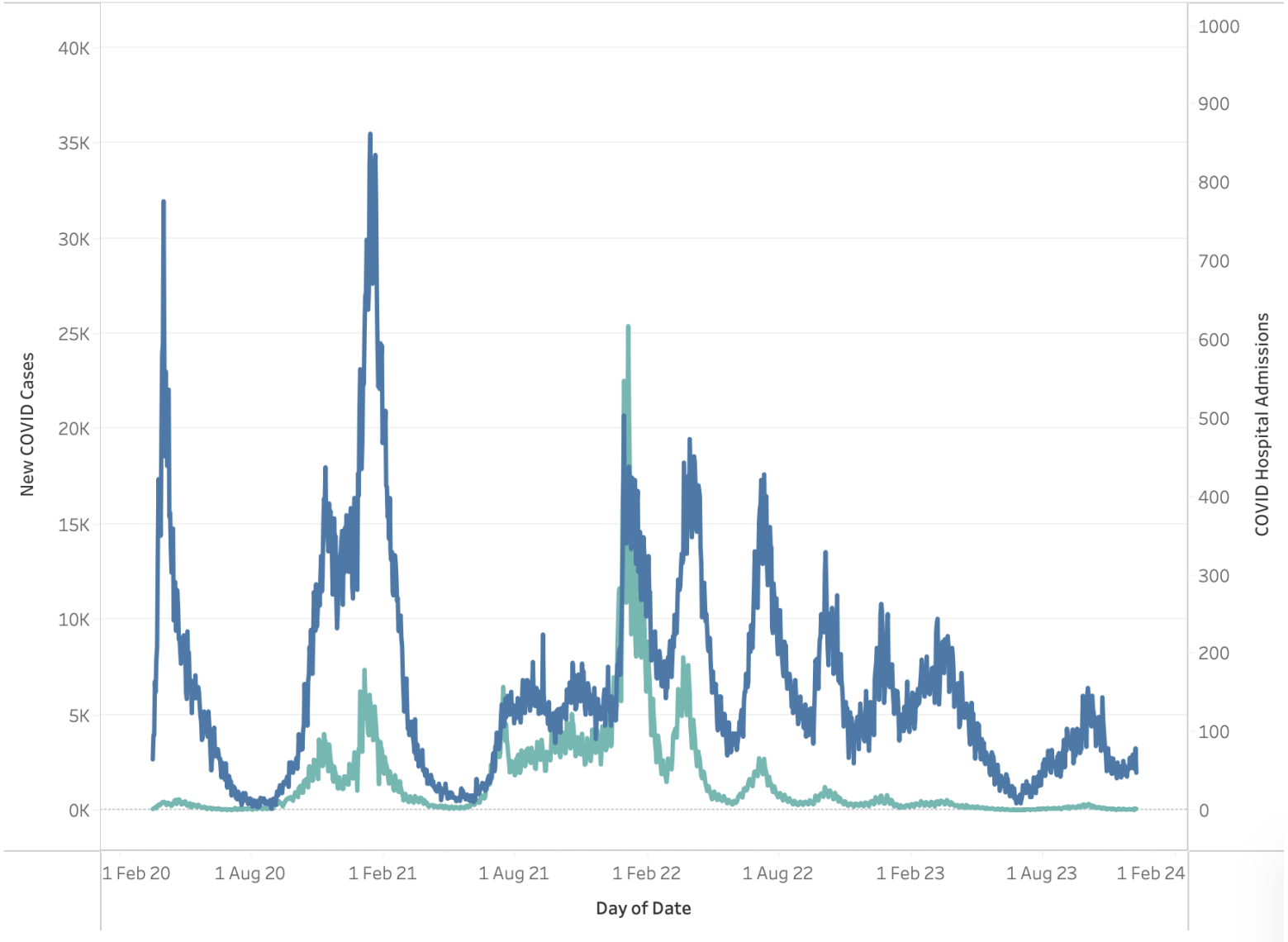
COVID Hospital Admi..

New COVID Cases

This again shows how the peaks of hospital admissions follows after new covid cases.

- Where there is a high peak of new Covid cases there is a lower hospital admission compared to when there is a low peak of cases.

Case vs Admissions - West Midlands



- The West Midlands region continues to show a high rate of hospital administrations.
- This graph shows more high peaks of hospital admissions when compared to other regions.
- Highlighting potential underlying health issues along with healthcare inequalities and socioeconomic issues.

Local and Population Behaviours of Regions

London: Had an early vaccine uptake. Residents of London followed government restrictions closely (Halvorsrud et al., 2022).

South-East: Vaccine uptake in this region was high. Although commuting between different regions maintained the transmission rate (Anderson, 2023).

East of England: This region had lower case rates in the beginning but as movement between regions increased, the later waves came (GOV.UK, 2020).

West Midlands: This region saw strong community health initiatives to combat the inequalities that were prevalent

North-West: A highly dense population in this region led to further outbreaks. There was uncertainty among disadvantaged areas when it came to vaccines.

South-West: This region a slower vaccine rollout in the more rural area but high compliance with government regulations (Flynn et al., 2020).

North-East: This region had resistance to the early government restrictions.

Yorkshire & the Humber: A majority working-class population and saw issues with isolation (UK, 2023).

East Midlands: This region had outbreaks that were mostly linked to essential employees.

Media Comparison

London: An Early epicentre in 2020 with rapid COVID cases and Hospital Admissions. Sharp winter peaks from December 2020 - January 2021 due to the Alpha and Omicron Variants (Elliott et al., 2022a).

South-East: High case numbers throughout, more prominent in the urban areas. High pressure during Alpha and Omicron waves (Elliott et al., 2022b).

North-West: Severe impact during the variant waves. Area with more comorbidities had a high admission to case ration.

East of England: The peaks mirrored national trends. Hospitals in more rural areas had more strain.

West Midlands: High infection rates due to the different variant waves. Due to major health inequalities there was a high admission to case ratio (Direct and Indirect Health Impacts of COVID-19 in England, 2021).

Media Comparison

Yorkshire and Humber: Due to underlying health vulnerabilities, the admissions to case ratio were increased. This region struggled during early 2021 and during the Omicron variant.

South-West: This region has a lower population density and therefore, the cases and admission rates were lower in the early pandemic stages. The Admissions stayed lower than other regions, but peaks showed strain on the local hospitals (Direct and Indirect Health Impacts of COVID-19 in England, 2021).

East Midlands: This region is mixed between urban and rural which led to uneven healthcare pressures.

North-East: Had the highest admission to case ratios, highlighting higher vulnerability. The ageing population and health inequalities were a factor.

Regional Disparties

- **North-West** & **London** saw higher case volumes because of the higher population density.
- **East England** & **South-West** saw lower cases volumes as they were more rural, which ultimately led to a delayed spread.
- **London** had a lower ration of admission to case due to the younger population and more readily available access to vaccines.
- Regional areas (**West Midlands**) with higher levels of deprivation had terrible outcomes, highlighting the health inequalities.
- Local responses impacted the regional growth.

System Lag

System lag is the delay between infection and hospital admissions. From the data, this was typically 7 days during COVID.

This can happen for a multitude of reasons. The main reason being that the symptoms can take a while to develop after infection and often people will not reach out for help until their symptoms have gotten worse.

From the data we saw that on 5th January 2021 cases peaked, while hospital admissions did not peak until 7 days later.

In Future works, data interpretation must be prepared to anticipate lags.

Limitations

1. **Data Reporting Delays**: especially during peak times.
2. **Testing Availability**: asymptomatic vs symptomatic testing.
3. **Population Differences:** deprivation levels and age affect risk factor.
4. **Lag effects**: real-time interpretation may not be accurate due to hospital administration lags.
5. **Underreporting of cases:** many asymptomatic cases went unreported.

Final Thoughts

- By studying the admissions to case ratios, we are able to gain insight into local vulnerability and overall pressure to the NHS.
- The disparities across regions show how inequality can impact healthcare and ultimately impacted the pandemic growth across England.

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