Enhancing Epidemiological Surveillance by Streamlining Syndromic Data

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Abstract

Syndromic surveillances systems allow Epidemiologists to be alerted to possible disease outbreaks in the population more quickly than the time it takes for diagnostic testing to yield definitive results. Syndromic surveillance systems are used extensively around the world but received increased attention after the COVID -19 pandemic. Due to an increase in emergency department (ED) visits with a wide variety of chief complaints ranging from fever, shortness of breath, to unknown respiratory distress, syndromic surveillance emerged as a key tool in the monitoring of COVID-19 spread through analysis of ED visits. Countries such as France and the United States relied on these systems to monitor the spread and symptoms associated with this emerging virus. To further explore syndromic surveillance data, Nassau County investigated whether 2022 syndromic surveillance data for Respiratory and Fever emergency department visits could be used as an indicator to detect upcoming increases in Influenza and COVID-19 cases. Through this investigation, we discovered that fever and respiratory ED visits increased on syndromic surveillance one to two days before we recorded a peak in COVID-19 cases and 1-2 weeks for Influenza cases. The results establish that syndromic surveillance is a helpful tool for local health departments (LHDs) to monitor and manage upcoming increases in disease.

Objectives

The objective of this study was to determine whether emergency department syndromic surveillance data could signal LHDs of an upcoming increase in cases before transpiring into a large-scale outbreak.

Methods

The New York State Electronic Syndromic Surveillance System (SS) provides real time data on hospital emergency department visits. We retrieved 2022 data for Fever and Respiratory syndrome and compared it to 2022 Influenza and COVID-19 confirmed case counts. Influenza and COVID-19 case counts were retrieved from the Communicable Disease Electronic Surveillance System (CDESS) through the New York State Health Commerce System. Data wrangling was performed on Microsoft Excel by cleaning, organizing, and structuring both CDESS and SS data to correspond to a similar format. Data visualizations were created for the variables Age, Zip Code, and comparative graphs were created for both Influenza and COVID -19 corresponding with both Fever and Respiratory syndrome. In order to identify whether syndromic surveillance data predicted an upcoming increase in Influenza or COVID-19 cases, we broke down both datasets into several time frames including months and different weeks. The time frames were kept consistent among all visualizations for comparative purposes.

Results

NCDOH explored whether emergency department syndromic surveillance data could be used as a signal to alert local health departments of upcoming increases in infectious diseases. We explored confirmed cases of Influenza and COVID-19 and compared them to Respiratory and Fever ED visits. In most cases, syndromic surveillance preceded confirmed Influenza and COVID-19 cases. We discovered that syndromic surveillance successfully recorded peaks in Respiratory and Fever visits approximately one to two days before confirmed COVID-19 cases. Likewise, syndromic surveillance recorded a peak in Respiratory and Fever ED visits approximately 1-2 weeks prior to a peak in Influenza cases. This demonstrates that syndromic surveillance can be used as a monitoring tool by LHDs in order to track disease trends, identify outbreaks, and increase LHD response preparedness. In some cases, syndromic surveillance will precede confirmed cases, thus notifying LHDs of an upcoming spike. In other cases, a simultaneous increase in syndromic surveillance and CDESS will increase LHD understanding of the scope of the outbreak, its impact on public health, and inform LHD response.

Influenza

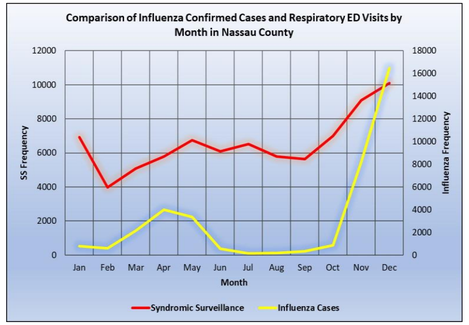

Figure 1: Respiratory ED Visits began to increase during mid-September, shortly before Influenza cases began to rise in October.

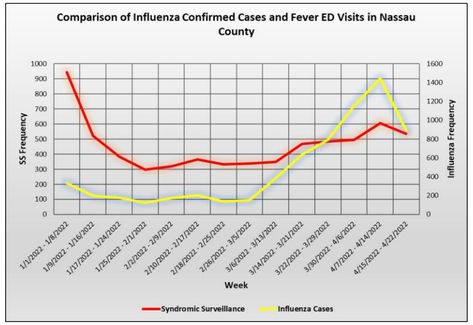

Figure 4: The observed trend between Fever ED Visits and Influenza Cases is identical. In this case, while syndromic surveillance may not have preceded a rise in Influenza cases, it still occurred concurrently.

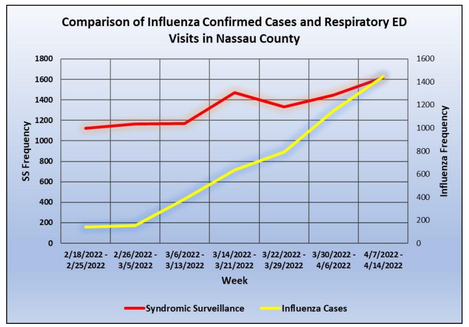

Figure 2: Respiratory ED Visits began to increase during the week of 2/18/2022-2/25/2022, one week before Influenza cases began to rise during the week of 2/26/2022-3/5/2022.

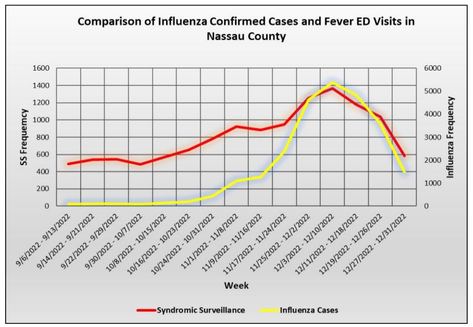

Figure 5: Fever ED Visits began to increase during the week of 9/30/2022-10/7/2022, two weeks before Influenza cases began to slowly rise during the week of 10/16/2022-10/23/2022.

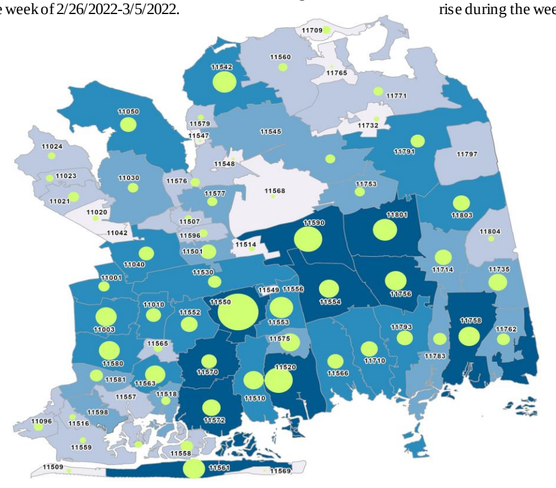

Figure 3: Respiratory ED visits are proportionate to Influenza Cases. This map shows that the areas with high numbers of Influenza cases also have high numbers of Respiratory ED visits. Created on ArcGIS Pro.

COVID-19

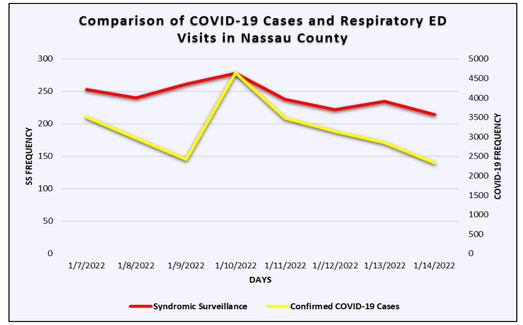

Figure 6: Respiratory ED visits began to increase on January 8, 2022, one day before confirmed COVID-19 cases began to increase on January 9, 2022.

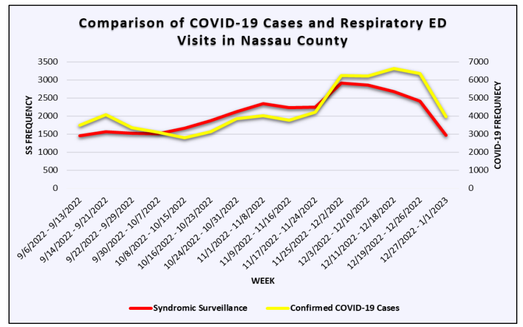

Figure 7: Respiratory ED visits began to increase during the week of September 30 – October 7, one week before confirmed COVID-19 cases began to increase during October 8-15.

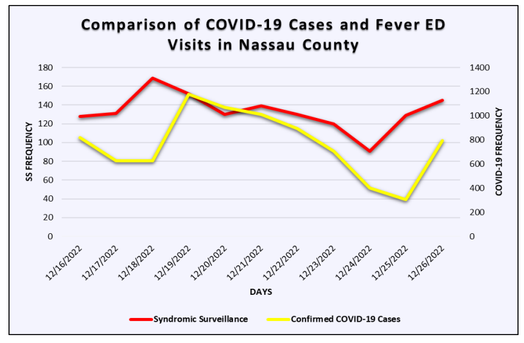

Figure 8: Fever ED visits began to increase on December 17, one day before confirmed COVID-19 cases began to increase on December 18. Additionally, Fever ED visits began to increase on December 24, one day before confirmed COVID-19 cases began to increase on December 25.

Conclusion

Early detection of unusually high numbers of illnesses being reported in hospitals is paramount to protecting populations from infectious disease outbreaks. We compared syndromic surveillance reports to confirmed case counts to see if the two reporting systems were aligned to accurately monitor disease trends in Nassau County, New York. Respiratory and Fever syndromic surveillance data from 2022 often preceded confirmed Influenza and COVID-19 cases by one to two days. We also looked at October 2019 to March 2020 (data not shown) to see if syndromic surveillance predicted the incoming COVID-19 outbreak and found that there was an increase in syndromic reports before high numbers of COVID-19 confirmed cases began to be reported.

ArcGIS mapping showed that syndromic surveillance reports were proportionately representative of confirmed COVID-19 and Influenza cases. Most Influenza cases occurred in patients under the age of 19 years old (data not shown). COVID-19 patients were distributed among all ages (data not shown). Respiratory and fever syndromic surveillance reports peaked in the age group 0 to 9 years old (data not shown).

The results of this study suggest that syndromic surveillance systems can be used by LHDs to better prepare for responding to emerging infectious disease outbreaks. Infectious diseases can spread rapidly, so receiving a prior signal can be helpful in outbreak preparedness. Public health professionals may prevent numerous infections by being more aware of trends across syndromic surveillance.

Limitations of using syndromic surveillance include potentially missing data since syndromic surveillance only records ED visits. Additional sources of data such as urgent care systems are not yet available. In addition, not all cases who get sick with Influenza or COVID-19 go to the ED, thus limiting our understanding of the true estimate of disease in the population. This is exacerbated by the use of COVID-19 home tests. An additional limitation is that syndromic surveillance data includes Nassau and non-Nassau county residents who visit Nassau County hospitals. However, despite the limitations, syndromic surveillance is still a valuable tool for monitoring disease trends and early detection of outbreaks for LHDs.

Acknowledgements

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