The Potential of Hospital Data Sources for Influenza Surveillance

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Objective

To determine the relative alert time of influenza surveillance based on hospital data sources compared to notifiable disease reporting.

Background

Influenza is an important public health problem associated with considerable morbidity and mortality [1]. A disease traditionally monitored via legally mandated reporting [2], researchers have identified alternative data sources for influenza surveillance. The hospital environment presents a unique opportunity for comparative studies of biosurveillance data with high quality and various level of clinical information ranging from provisional diagnoses to laboratory confirmed cases. This study investigated the alert times achievable from hospital-based sources relative to reporting of influenza cases. The earlier detection of influenza could potentially provide more advanced warning for the medical community and the early implementation of precautionary measures in vulnerable populations [3].

Methods

We studied hospital-based data sources including emergency department symptom presentations (ICD-10: J10-18), laboratory requests for sputum samples or influenza serology/direct detection, laboratory results, final diagnoses (ICD-10: J10-18) and notifiable report data. We defined the alert time to be the time that the CUSUM value exceeded a threshold based on a false alarm rate of 1-12 per year. CUSUM analyzed forecast residuals from a 56-day moving window time series model with day of week effects.

We defined the 'potential influenza outbreak' period as 1st June – 31st December, a period the health community typically uses for Western Australia. We defined the day of alert relative to the outbreak start date, as established by notifiable report data. If no alert occurred during this period, we set the time of alert to the last day of the outbreak period, (day 214). Relative alert time is calculated by subtracting the day of alert for notifiable report data from the day of alert in each data source. A negative value indicates an alert that preceded notifiable reporting.

Results

The ranges over 1-12 false alarms per year of the average relative alert times in days were as follows: (1) diagnosis -15.75:68, (2) lab results -22.25:25.75, (3) lab request serology/direct detection -13:14.25, (4) lab request sputum sample -33:-3.75 and (5) symptoms -25.5:-3.25 (Figure 1). Sputum sample requests were always more timely than any other data source at all false alarm rates considered.

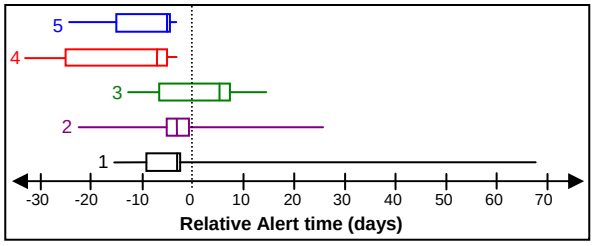

Figure 1 – Box plot of the average relative alert time of each data source over notifiable reporting over four years of data.

Conclusions

Based on four years of data from one Western Australian hospital, if one had the alternative of building an early warning system for influenza based on these data sources and detection algorithm, the best option would be to use requests for sputum samples followed by emergency room symptom presentations.

The methods described provide a new comparative measure for surveillance data, and in this experiment, show promise for earlier influenza detection. Further experiments should extend the results using a reference date of detection that better approximates the real world standard of practice.

References

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