Comparing the Utility of Ambulatory Care and Emergency Room Data for Disease Outbreak Detection

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Objective

To compare the ability to detect disease outbreaks of separate and combined data streams from ambulatory care and emergency department from Harvard Pilgrim Health Care.

Background

A variety of electronic health event data sources have been proposed and used for the early detection of disease outbreaks. While there is some information available about the utility of these data sources [1,2], few formal comparisons have been made among them. Alternatively, these data sources can be combined in order to generate a common sequence of outbreak signals. However, different sources of data can be correlated since individuals may seek care in a variety of settings, including hospital emergency departments and ambulatory clinics resulting in multiple reports for the same individual case in different data sources. Therefore, combining these data sources properly is a difficult task since the hypothesis of independent sources is invalid in most cases, resulting in new or missed signals when compared to separate data streams analysis.

Methods

Using historical HPHC (Harvard Pilgrim Health Care) episodes data from 2003 to 2006 we mimic a daily prospective surveillance system. The following syndromes are evaluated: respiratory (RESP), influenza-like illness (ILI), upper and lower gastrointestinal illness (UGI, LGI). The residential zip code is used as the spatial component. To ensure an appropriate comparison we use the same detection algorithm, the space-time permutation scan statistic [3,4], which automatically adjusts for any purely temporal or purely spatial variation. For each syndrome three data streams are evaluated, ambulatory care (AC), emergency (ER), and the combined data streams (AC&ER).

Results

We are currently evaluating detected signals with recurrence intervals (RI) greater than 365 days for each data stream, which represents the expected time between seeing an outbreak with an equal or higher likelihood ratio assuming that the null hypothesis of no cluster is true. Combined data streams (AC&ER) provided signals with both increased and reduced RI when compared to ER or AC alone, as shown in Figure 1. This might associated with the merging procedure which does not consider repeat encounters within 42 days of a previous one. Unique signals were also detected for separate and combined data streams.

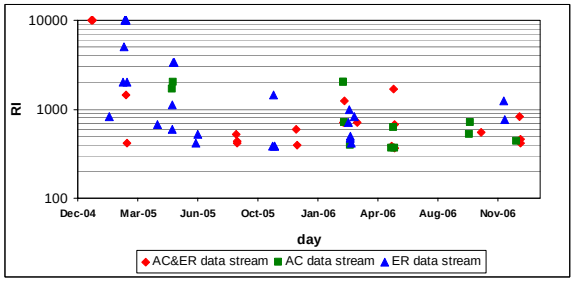

Figure 1. Detected signals with Recurrence Interval greater than 365 (reference line) days for AC, ER and AC&ER (combined) data streams. The x-coordinates represent the day of the signals and y-coordinate the associated Recurrence Interval.

Conclusions

The optimal way to use separate and combined AC and ER data streams is being investigated. Further analysis will include the multivariate permutation scan statistic, available in the SaTScan software. Results indicate that the three data sources appear to contain independently useful information for disease outbreak detection.

References

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