Evaluation of the DC Department of Health's Syndromic Surveillance System

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Objective

This paper evaluates an emergency room syndromic surveillance system based on simulation studies and comparisons with other surveillance systems.

Background

Immediately following September 11, 2001, the District of Columbia Department of Health began a syndromic surveillance program based on emergency room (ER) visits. ER logs are faxed on a daily basis to the health department, where health department staff code them on the basis of chief complaint, recording the number of patients in each of the following syndromic categories: death, sepsis, rash, respiratory complaints, gastrointestinal complaints, unspecified infection, neurological, or other complaints[1]. These data are analyzed daily and when a syndromic category shows an unusually high occurrence, a patient chart review is initiated to determine if the irregularity is a real threat.

A time series analysis of the data from this system has shown that with the application of a variety of detection algorithms, the syndromic surveillance data does well in identifying the onset of the flu season.[2]. In addition, simulation studies using the same data have shown that over a range of simulated outbreak types, the univariate and multivariate CUSUM algorithms performed more effectively than other algorithms. The multivariate CUSUM was preferred to the univariate CUSUM for some but not all outbreak types[3].

Methods

In this paper we extend these analyses in two steps. First, we use the data from our original analysis and findings from our simulation studies of multivariate detection algorithms to identify algorithms and parameters that perform as well as possible in our dataset. Second, we add two additional years of data not available for our previous analysis and examine the data signaling the beginning of the flu season and the gastrointestinal outbreaks. We also compare the existence and timing of anomalies suggesting gastrointestinal outbreaks and the flu season in the DC syndromic surveillance data with other syndromic and non-syndromic data sources in the region.

Results

The analysis shows that in terms of sensitivity analyses and detection of known outcomes, the choice of a detection algorithm's parameters matters in terms of performance. Figure 1 illustrates this in terms of a ROC curve for unspecified infection in one hospital for various outbreak sizes (x). Dashed lines represent k = 1.5 and solid lines represent k = 0.5. We also found that the multivariate CUSUM algorithm outperforms the two univariate methods in two of three settings examined.

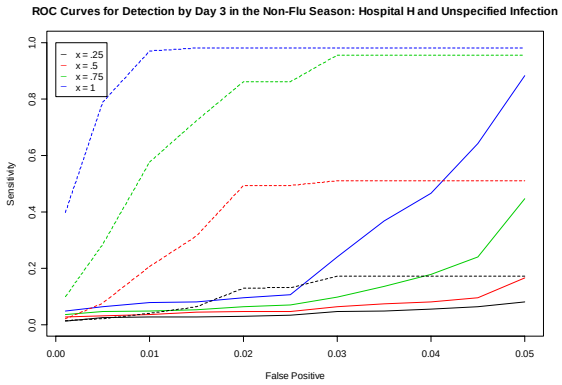

Figure 1 – ROC Curves for Unspecified Infection in one hospital.

Comparing unspecified infection cases in DC hospitals using optimal detection algorithms to CDC's sentinel physician data for the Mid-Atlantic states for four years in which there was a discernable influenza outbreak, we found that in two of these years, DC syndromic surveillance outperformed the other two systems, and in one year it flagged only two days after the CDC system. Given a built in delay of about two weeks in the CDC system, this is a substantial advantage.

References

[1] Begier EM, et al, The National Capitol Region's Emergency Department Syndromic Surveillance System. *Emerging Infectious Diseases* 2003, 9: 393-396.

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[3]Stoto MA, et al, Evaluating statistical methods for syndromic surveillance, forthcoming in *Statistical Methods in Counter-Terrorism*, Olwell D, Wilson AG, Wilson G, eds., Springer, 2006.

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