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Novel approach to statewide biosurveillance using emergency medical services (EMS) information

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Objective

To develop a statewide biosurveillance system based on emergency medical services (EMS) information, which employs both symptom-based illness categorization and spatiotemporal analysis.

Introduction

The purpose of the National Collaborative for Bio-preparedness (NCB-P) is to enhance biosurveillance and situational awareness to better inform decision-making using a statewide approach. EMS represents a unique potential data source because it intersects with patients at the point of insult or injury, thus providing information on the timing and location of care. North Carolina uses a standardized EMS data collection system, the Prehospital Medical Information System (PreMIS), to collect information on EMS encounters across the state using the National EMS Information System (NEMSIS) template (1). Since NEMSIS is planned to be incorporated by EMS agencies in every state, an EMS-based approach to biosurveillance is extensible nationally.

Methods

De-identified records from all EMS encounters in North Carolina from 2009 to 2010 were utilized in the project. Based upon a previous analysis of emergency department (ED) presentations, an interdisciplinary team (EMS, emergency department, epidemiology and public health) then developed an approach to assign EMS records to 1 of the 20 symptom-based illness categories (gastrointestinal illness, respiratory, etc). EMS encounter records were characterized into these illness categories using a novel text analytic program (SAS Institute, Cary, NC). Baseline patterns of EMS encounters were developed for each illness category across the state, local regions (3-digit zip code) over time. Event alerts were identified across the state and by regions in illness categories using either change detection with cumulative sum (CUSUM) analysis (3 standard deviations) or a novel text-proportion (TAP) analysis approach (SAS Institute).

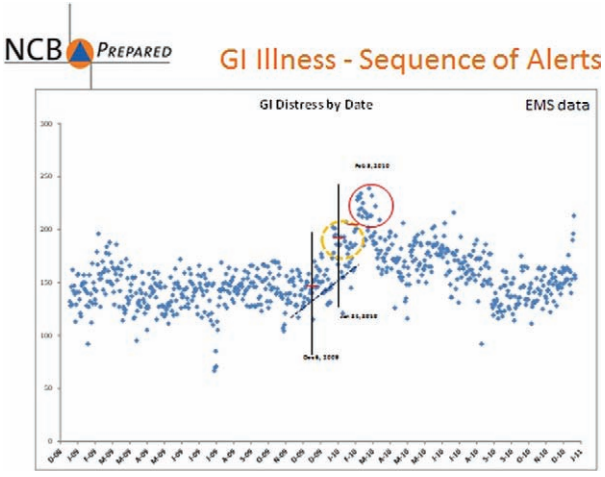

Fig. 1. Gastrointestinal (GI) Illness Sequence of Alerts. Daily GI events in statewide EMS encounters over a two year period using change alerts of 3 standard deviations from mean (red circle), CUSUM analysis (yellow circle) and novel TAP analysis approach (Dec. 6, 2009).

Results

2.4 million EMS encounter records over a 2-year period were analyzed. The initial analysis focused upon gastrointestinal illness given the potential relationship of gastrointestinal distress to infectious outbreaks, food contamination and intentional poisonings (ricin). After accounting for seasonality, a significant gastrointestinal event was detected in February 2010 (see red circle on graph in Fig. 1). This event coincided with the announcement of a norovirus outbreak (2). The use of CUSUM approach (yellow circle on graph) detected the alert event as early as January 24, 2010. Using the novel TAP approach on a regional basis detected the alert as early as December 6, 2009.

Conclusions

Advantages of EMS data include being an early point of contact with patients and providing information on the location of insult or injury. Surveillance based on EMS information system data can detect outbreaks of illness of interest to public health. A novel text proportion technique shows promise as a useful early event detection method.

Keywords

Biosurveillance; analytics; detection; emergency; preparedness

References

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