Evaluation of the Rhode Island Real-time Outbreak and Disease Surveillance (RI RODS) System: Disparate Data

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OBJECTIVE

This paper presents findings related to the evaluation of the chief complaint classifier used in the pilot implementation of a syndromic surveillance system in Rhode Island.

BACKGROUND

Rhode Island implemented the Real-time Outbreak and Disease Surveillance (RODS) system, developed in 1999 by the University of Pittsburgh's Center for Biomedical Informatics. This system is based on real-time information from hospital emergency departments (ED) that is transmitted and analyzed electronically for the purpose of early detection of and situational awareness for public health emergencies. Through this system, chief complaint is reported in real-time. Diagnoses, coded in the *International Classification of Diseases, 9th Revision, Clinical Modification (ICD-9-CM),* are reported to the RI RODS system as they become available [1]. Three hospitals are currently participating in a pilot implementation of the Rhode Island Real-time Outbreak and Disease Surveillance (RI RODS) system.

Preliminary work by a CDC Working Group (CDCWG) developed recommendations for syndrome definitions for use in syndromic surveillance programs. Ten syndromes, based on ICD-9-CM diagnosis codes, identified diseases associated with critical bioterrorism-associated agents or indicative of naturally occurring infectious disease outbreaks. As a component of the evaluation of the RI RODS system, we evaluated the RI RODS chief complaint classifier (CoCo) using ICD-9-CM codes and the CDCWG work as the gold standard.

METHODS

60,715 ED visits were reported to RI RODS in May – August 2006. Each visit was assigned to a CDCWG syndrome based on first-listed ICD-9-CM diagnosis code using CDCWG syndrome definitions. Sensitivity analysis was performed between the syndrome assigned by CoCo and the CDCWG syndrome. The time-delay between patient registration and availability of electronic ICD-9-CM diagnosis was quantified for each ED visit during the study period.

RESULTS

Although specificity values were high for all syndromes, there was wide variation in sensitivity by syndrome. Among the syndromes, sensitivity was highest for hemorrhagic illness (70.8%), followed by gastrointestinal (68.4%) and lowest for botulism-like (11.4%). Negative predictive values were greater than 92% for all syndromes but positive predictive values ranged from 25.0% for botulism-like to 74.6% for respiratory. Of ED visits with an ICD-9-CM diagnosis identified by CDCWG, CoCo failed to classify correctly more than one-half of respiratory and botulism-like diagnoses.

Overall, the average length of time between registration and availability of electronic ICD-9-CM diagnosis code was 3.9 days (median 3.4 days), ranging from 0.05 days to 136.4 days).

CONCLUSIONS

The non-specific nature of chief complaints coupled with the delay in the availability of a patient's final diagnosis creates a challenge for early detection systems and highlights the need for real-time ICD-9-CM coding. Despite these limitations, sensitivity analysis provides insight regarding chief complaint classifier performance that can be used to optimize performance. CoCo has moderate sensitivity for most syndromes and high specificity for all syndromes. CoCo performs well in identifying true negatives but performs substantially less well in identifying true positives. CoCo classification results in a large number of false positives when compared to CDCWG syndrome definitions as the gold standard.

Rhode Island will consider monitoring ICD-9-CM codes as part of its surveillance activities. Definitive clinical information, even with a 4-day lag, could supplement RI RODS in early identification and characterization of outbreaks, identify missed outbreaks and evaluate previous alert investigation decisions.

REFERENCES

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