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A System for Surveillance Directly from the EMR

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Objective

Our objective was to conduct surveillance of nosocomial infections directly from multiple EMR data streams in a large multi-location Canadian health care facility. The system developed automatically triggers bed-day-level-location-aware reports and detects and tracks the incidents of nosocomial infections in hospital by ward.

Introduction

Hospital acquired infections are a major cause of morbidity, mortality and increased resource utilization. CDC estimates that in the US alone, over 2 million patients are affected by nosocomial infections costing approximately $34.7 billion to $45 billion annually (1). The existing process of detection and reporting relies on time consuming manual processing of records and generation of alerts based on disparate definitions that are not comparable across institutions or even physicians.

Methods

A multi-stakeholder team consisting of experts from medicine, infection control, epidemiology, privacy, computing, artificial intelligence, data fusion and public health conducted a proof of concept from four complete years of admission records of all patients at the University of Ottawa Heart Institute . Figure 1 lists the data elements investigated. Our system uses an open source enterprise bus 'Mirth Connect' to receive and store data in HL7 format. The processing of information is handled by individual components and alerts are pushed back to respective locations.The free text components were classified using natural language processing. Negation detection was performed using NegEx (2). Data-fusion algorithms were used to merge information to make it meaningful and allow complex syndrome definitions to be mapped onto the data.

Results

The system monitors: Ventilator Associated Pneumonia (VAP), Central Line Infections (CLI), Methicillin Resistant Staph Aureus (MRSA), Clostridium difficile (C. Diff) and Vancomycin resistant Enterococcus (VRE).

21452 hospital admissions occurred in 17670 unique patients over four years. There were 41720 CXRs performed in total, of which 10546 were classified as having an infiltrate. 4575 admissions were associated with at least one CXR showing an infiltrate, 2266 of which were hospital-acquired. Hospital acquired infiltrates were associated with an increased hospital mortality (6.3% vs 2.6%)* and length of stay (19.5 days vs 6.5 days)*. 253 patients had at least one positive blood culture. This was also associated with an increased hospital mortality (23,3% vs. 2.8%)* and length of stay (10.8 vs 40.9 days)*. (* all p values < 0.00001)

Conclusions

This proof of concept system demonstrates the capability of monitoring and analyzing multiple available data streams to automatically detect and track infections without the need for manual data capture and entry. It acquires directly from the EMR data to identify and classify health care events, which can be used to improve health outcomes and costs. The standardization of definitions used for detection will allow for generalization across institutions.

Data element/source	**Microbiology**
Medical Record Number	bacteriology requests
Patient Record System	bacteriology results
year of birth	virology request
Sex	virology results
partial postal code	**Hematology**
Ward	CBC results
Transfers	**Biochemistry**
date of admission	Creatinine
date of discharge	**Pharmacy**
isolation/respiratory, enteric precautions status	orders for antidiarrheals, antibiotics, antivirals
MRSA/VRE screening status	medication list
Radiology	**Surgical Information Management System**
Chest x-ray requests	Operative report or surgical list
Chest x –ray results	**Other information**
Emergency Room	Clinical Stores:
Chief complaint	Requests and utilization of ventilators, masks, gloves, hand sanitizer and linens
Final diagnosis	Payroll:
CTAS code	Staffing levels, absenteeism
Date of ER visit	

Keywords

electronic health records; surveillance; pneumonia; hospital acquired infections

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References

1. Report on CDC Website (http://www.cdc.gov/hai/pdfs/hai/scott_cost-paper.pdf) Accessed: 10th September, 2012.
2. Chapman, W. et. al. 2001. Evaluation of negation phrases in narrative clinical reports. Proc AMIA Symposium, 105-114.

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