CHAPTER 4. The Utility of Emergency Department Triage Chief Complaints for Real-Time Respiratory Illness Monitoring and Outbreak Detection in Ontario

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Introduction

Minimizing the impacts of health events is a primary goal of public health. Critical to this effort is detecting health events as early as possible so that control and mitigation interventions can be initiated before impacts are widespread. Syndromic surveillance has the potential to detect infectious disease outbreaks before they are identified through conventional diagnostic/laboratory-based surveillance methods by making use of alternative more timely data sources [1]. Many of these alternative data, such as over-the-counter drug sales, absenteeism records, telephone health hotlines, and emergency department triage data, are already routinely collected. The goal of syndromic surveillance is to compile, analyze, and monitored such data in real-time (or near real-time). This paper describes an investigation to assess the utility of a triage chief complaints (CC) based Emergency Department Surveillance System (EDSS) in Kingston, Ontario as a monitoring tool for respiratory illness by comparing it retrospectively to National Ambulatory Care Reporting System (NACRS) and Telehealth Ontario data.

Typically, emergency department (ED) syndromic surveillance makes use of a patients' presenting chief complaint, as recorded by a triage nurse. These data have been shown to be good indicators of patient illness, especially in the case of respiratory and gastrointestinal illnesses[2]. Chief complaint data from ED's were successfully integrated into several surveillance systems, notably at the 2000 Sydney Olympic games[3], the 2002 Salt Lake City Olympic games[4], and the 2003 Rugby World Cup in Australia[5]. Chief complaint data have shown to be effective in the early identification of influenza outbreaks[6], and are particularly effective in tracking common symptoms such as injury and respiratory disease[5]. ED syndromic surveillance systems make use of routine data collected during the triage process, thereby minimizing additional workload on hospital staff.

In September 2004, Kingston, Frontenac and Lennox and Addington (KFL&A) Public Health launched a program to develop and evaluate an Emergency Department Surveillance System (EDSS) in collaboration with the Ontario Ministry of Health and Long Term Care (MOHLTC) – Public Health Branch, Queen's University, Kingston General Hospital (KGH) and Hotel Dieu Hospital (HDH). The goal of the program is to

monitor changes in the incidence of endemic disease and also to detect new or emerging disease threats. ED visits are collected electronically in near real-time from seven area hospitals. Non-nominal patient data collected include date and time of visit, demographics, five-digit postal code of residence, Canadian Triage Acuity Score (CTAS), and chief complaint or reason for visit. Data is fed into an automated information management/technology (IM/IT) platform where they are classified into syndromes, aggregated, displayed using graphs and maps, and to which statistical aberration detection algorithms are applied. The University of Pittsburgh's Real-Time Outbreak and Disease Surveillance (RODS) system was adapted and used during the time period of this study[7].

The National Ambulatory Care Reporting System (NACRS) gathers data for hospital-based and community-based ambulatory care, day surgery, outpatient clinics, and emergency departments. Records contain patients' diagnoses using the International Classification of Diseases, Tenth Revision (ICD-10). Every hospital in Ontario submits data to the NACRS, thus the system includes demographic, clinical, and administrative data for the whole province[8]. The NACRS patient data are accurate and comprehensive, and have been used in several retrospective studies[9-11]. The accuracy of the data is assured by checks for duplicate records, missing data, and inconsistencies. Erroneous records in the database are deleted, and individual hospitals are asked to re-submit the corrected data[8]. Although an excellent source of ED data, the NACRS data are not available in real-time, and thus the usefulness of the NACRS as a timely epidemiological surveillance data source is limited.

Telehealth Ontario is the provinces' teletriage helpline available free to all Ontario residents 24 hours a day, 7 days a week. Callers are connected to skilled nurses who assess symptoms over the phone using standardized algorithms and assist callers in making the most appropriate healthcare decision[12]. For each call, caller demographics are recorded, together with the nurse-identified guideline. Each call is classified into one of 486 guidelines based on information obtained (eg. symptoms, history, etc).

Methods

Daily counts of Kingston area respiratory-related discharge diagnoses based on ICD-10-CA codes (Table 1) were obtained from the NACRS database (July 4th 2004 to March

31st 2006). Daily counts of respiratory-related chief complaints (Table 2) from patients presenting to Kingston area hospitals were collected from the KFL&A EDSS (July 4th 2004 to March 31st 2006). From June 2004 to August 2005, the EDSS gathered data from all hospitals in the KFL&A Public Health jurisdiction. Starting September 2005, hospitals in the Hastings & Prince Edward Counties Health Unit (HPECHU) jurisdiction were joined to the EDSS. For both the EDSS and the NACRS, patients were linked to the Kingston area based on patient Health Unit status as recorded in the respective databases.

Weekly Telehealth counts of respiratory-related cases from the Kingston area based on Telehealth guidelines (Table 3) were obtained (July 4th 2004 to March 31st 2006). The categorization of Telehealth calls into upper or lower respiratory episodes was based on classifications schemes previously developed by researchers involved with Real-time Outbreak and Disease Surveillance (RODS) system (7), the Electronic Surveillance System for the Early Notification of Community-based Epidemics (ESSENCE) system[13], and the National Health Service Direct[14,15]. Telehealth Ontario calls were geolocated to Kingston based on the home address (Forward Sortation Area) of the caller.

All of the collected data were compiled into weekly totals (Sunday to Saturday). The significance of weekly lags were considered using time series analysis and the PROC ARIMA procedure. Spearman correlation coefficients were produced using PROC CORR. All statistical procedures were carried out using SAS software, version 9.1 (SAS Institute, Cary, NC, USA).

Results

During the period of July 2004 to the end of March 2006, the EDSS contained 30,417 respiratory-related cases presenting to one of the seven area hospitals. In the same time period, Telehealth Ontario received 4,247 upper and lower respiratory-related calls, and the NACRS contained 19,315 cases diagnosed with respiratory-related illness (of which 3% were specifically diagnosed with influenza) from Kingston area FSAs.
Analysis (Figure 1, Table 4) comparing the EDSS respiratory chief complaints to the Telehealth respiratory calls resulted in a Spearman Correlation Coefficient of 0.91,

indicating good correlation. The analysis comparing the EDSS respiratory chief complaints to all NACRS respiratory disease diagnoses calculated a Spearman Correlation Coefficient of 0.98 indicating very good correlation. The EDSS respiratory chief complaints and the NACRS influenza diagnoses analysis demonstrated a Spearman Correlation Coefficient of 0.52 indicating that the two series were moderately correlated. All correlations were highly significant (P-Values < 0.0001). Correlations were highest and most significant when no lags were included in the models.

Discussion

This study demonstrated that Emergency Department (ED) triage chief complaints accurately reflect respiratory illness both among ED patients and in the community, and ED chief complaint data can be used as a timely data source for respiratory illness surveillance. ED triage chief complaints in the Kingston areas were strongly correlated in time with both NACRS respiratory discharge diagnoses and Telehealth respiratory related calls. Whereas NACRS data is unavailable to public health stakeholders in a timely enough fashion to be useful for the day-to-day monitoring of respiratory disease trends in the community, ED triage chief complaints can successfully contribute to real-time public health surveillance as demonstrated by the KFL&A EDSS program.

As EDSS respiratory-related chief complaints correlated very well with NACRS respiratory-related discharge diagnoses and only moderately with NACRS influenza-specific diagnoses, we believe that influenza infections represent only a small fraction of the entire respiratory burden in the community during a given year. In fact, only three percent of the total NACRS respiratory patients were specifically diagnosed with influenza during the study period. In addition to influenza, respiratory syncytial virus (RSV) has been found to significantly influence trends in respiratory illness, and when considered together, lab results for RSV and influenza have been shown to produce good correlation with respiratory syndrome frequency fluctuations[16]. Figure 1 shows that the total number of EDSS respiratory-related chief complaints peaked during the influenza season's (early-November 2004 to mid-April 2005 and early-December 2005 to early-May 2006) as expected; however, EDSS chief complaints continued to fluctuate in the influenza off-season. We believe that the latter observation is also likely due to the influence of other respiratory pathogens. The nature of the EDSS data does not allow

one to separate respiratory complaints that were related to influenza from those related to other pathogens.

The results of this study demonstrated that at a local level respiratory data from Telehealth Ontario corresponded well to both the NACRS discharge diagnoses and the EDSS chief complaints. These results reflect the findings of previous work that demonstrate on a provincial level that Telehealth Ontario respiratory call data correspond very well to respiratory related ICD-10 NACRS discharge diagnoses[12]. These results thus suggest that together with EDSS data, Telehealth Ontario call data also have the potential to contribute to real-time respiratory disease surveillance systems. Ontario Telehealth data, like ED data can be easily leveraged in near real-time.

Emergency Department triage chief complaints accurately reflect the true conditions of patients as demonstrated by the strong correlation with the NACRS discharge diagnoses. The strong correlations between ED triage chief complaints and the NACRS discharge diagnoses and Telehealth calls, strongly suggest that the EDSS program is able to accurately monitor the status of respiratory illnesses in the community and contribute to the early detection of respiratory illness outbreaks.

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Table 4-1. NACRS communicable respiratory syndromes coded by hospital health staff post-discharge from ICD-10-CA classifications

ICD-10-CA CODE	*CODE DESCRIPTION*
J00	Acute nasopharyngitis (common cold)
J01	Acute sinusitis
J02	Acute pharyngitis
J03	Acute tonsillitis
J04	Acute laryngitis and tracheitis
J05	Acute obstructive laryngitis (croup) and epiglottitis
J06	Acute upper respiratory infections of multiple and unspecified sites
J10	Influenza, due to identified influenza virus
J11	Influenza, virus not identified
J12	Viral pneumonia, not elsewhere classified
J16	Pneumonia due to other infectious organisms, not elsewhere classified
J17	Pneumonia in diseases classified elsewhere
J18	Pneumonia, organism unspecified
J20	Acute bronchitis
J21	Acute bronchiolitis
J22	Unspecified acute lower respiratory infection
J40	Bronchitis, not specified as acute or chronic
J41	Simple and mucopurulent chronic bronchitis
J42	Unspecified chronic bronchitis

Table 4-2. Respiratory illness syndrome with corresponding EDSS chief complaint

SYNDROME	***EDSS CHIEF COMPLAINT***		
Respiratory	Otitis	Swollen neck	Fever and Cough
	Ear pain/ache	Sore throat/rash	Fever, Abd pain
	Sinusitis	Nasal congestion	Nausea and cough
	Laryngitis	Throat problem	Cough/Wheeze
	Croup	Ear infection	Cough/Croupy
	Pharyngitis	Difficulty breathing	Cold
	Epiglotitis	Stuffy nose	Sore throat/chills
	URI	Difficulty swallowing	Left earache
	Right earache	Sinus congestion	Sore throat, weakness
	Bronchitis	Productive cough	Croup
	Bronchiolitis	Lungs full	Head cold/Runny nose
	Pneumonia	Tonsilitis	Bilateral ear infection
	Cough	Sinus pain	Cough, fatigue
	Chest congestion	Throat swelling	Rough cough
	Tracheitis	Cold symptoms	Hoarse voice
	RSV	Strep throat	Flu symptoms/cough
	Cough/indrawing	Shortness of breath/cough	
	Barky cough	Sore throat, muscle aches	

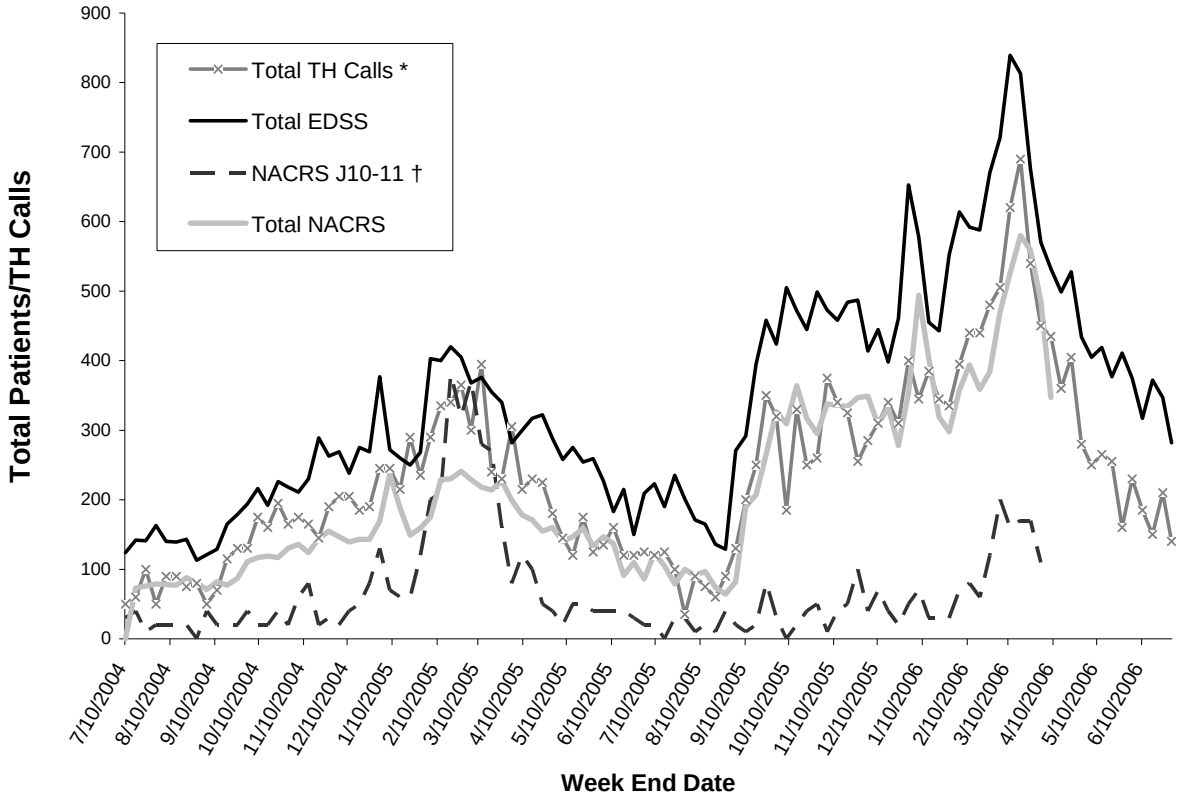
Table 4-3. Upper and lower respiratory illnesses syndromes with corresponding Telehealth Ontario guidelines

SYNDROME	*TELEHEALTH ONTARIO GUIDELINE*
Upper Respiratory	Colds (Adult After Hrs)
	Colds (Pediatric After Hrs)
	Congestion (Pediatric After Hrs)
	Croup (Pediatric After Hrs)
	Ear - Congestion (Adult After Hrs)
	Ear - Congestion (Pediatric After Hrs)
	Ear - Discharge (Adult After Hrs)
	Ear - Discharge (Pediatric After Hrs)
	Earache (Adult After Hrs)
	Earache (Pediatric After Hrs)
	Hoarseness (Adult After Hrs)
	Hoarseness (Pediatric After Hrs)
	Respiratory Multiple Symptoms (Adult After Hrs)
	Respiratory Multiple Symptoms (Pediatric After Hrs)
	Sinus Pain and Congestion (Adult After Hrs)
	Sinus Pain Or Congestion (Pediatric After Hrs)
	Sore Throat (Adult After Hrs)
	Sore Throat (Pediatric After Hrs)
Lower Respiratory	Cough - Acute Non-productive (Adult After Hrs)
	Cough - Acute Productive (Adult After Hrs)
	Cough - Chronic (Adult After Hrs)
	Cough (Pediatric After Hrs)
	Coughing Up Blood (Adult After Hrs)
	Wheezing – Other Than Asthma (Pediatric After Hrs)

Table 4-4. Spearman Correlation Coefficients between EDSS, NACRS, and Telehealth respiratory related cases (lag 0)[1].

	Telehealth	EDSS	NACRS (all)	NACRS (influenza only)
Telehealth	1	0.91	0.92	0.60
EDSS	0.91	1	0.98	0.52
NACRS (all)	0.92	0.98	1	-
NACRS (influenza only)	0.60	0.52	-	1

[1] All values were significant, P-Values < 0.0001



*Telehealth call counts were multiplied by 5 for visibility on the graph

†NACRS J10-11 counts were multiplied by 10 for visibility on the graph

Figure 4-1: Weekly totals of EDSS respiratory chief complaints, NACRS respiratory visits, NACRS influenza visits and Telehealth respiratory calls (July 2004 to June 2006)