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Syndromic Surveillance Using Regional Emergency Medicine Internet

Study objective: We demonstrate the feasibility and utility of emergency department (ED) syndromic surveillance using a regional emergency medicine Internet application to minimize impact on ED and public health staffing.

Methods: Regional (multi-ED) surveillance was established for 2 periods, one characterized by a high-profile national sports event and the other during an international disease outbreak. Counts of patient visits meeting syndrome criteria and total patient visits were reported daily on the secure regional emergency medicine Internet site and downloaded by public health staff. Trends were analyzed and displayed on the secure Web site. ED participants were surveyed about the acceptability and time cost of the project.

Results: In the first ("All Star Game") project, 8 departments reported daily counts for 4 weeks, covering more than 26,000 patient visits. In the second ("severe acute respiratory syndrome" [SARS]) project, an average of 11 departments in the same region reported daily data on febrile respiratory illnesses, travel, and contacts for 10 weeks. Experience with the first project allowed for rapid implementation of the second project during a 3-day period. In both instances, the surveillance efforts were undertaken without the need for extraordinary ED or public health staffing requirements.

Conclusion: A regional emergency medicine Internet approach permitted rapid implementation of multisite syndromic surveillance without additional staff. Some problems were identified with the first project, related to clinician checklist completion and manual data tabulation and entry. The SARS project addressed these by simplifying data collection and restricting it to triage.

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EMERGENCY DEPARTMENT SYNDROMIC SURVEILLANCE  Foldy et al

Editor’s Capsule Summary
What is already known on this topic
Coordinated syndromic surveillance in emergency departments (EDs) may be helpful in detection of emerging public health threats.

What question this study addressed
A large, urban center providing regional surveillance data collection and analysis conducted 2 trials. The trials measured whether the center could rapidly gear up when needed, whether EDs could easily provide accurate data, and the actual patterns of syndromic information during 2 significant events (a high-profile national sports event and the severe acute respiratory syndrome outbreak).

What this study adds to our knowledge
For the initial event, 8 EDs reported counts for 4 weeks, covering 26,888 patient visits. Syndrome criteria were met by 1.1% of cases. Performance was improved in the second event. Data collection took less than 3 minutes per patient, and the center was able to initiate surveillance rapidly.

How this might change clinical practice
A regional center with secure Internet-based connections to reporting EDs may be an efficient way to implement syndromic surveillance, without unduly burdening the EDs themselves.

INTRODUCTION
Rapid detection of terrorist-induced or natural outbreaks is needed for timely intervention to limit exposure and to implement prophylaxis. Traditional reporting of confirmed diseases is slow and insensitive for these purposes, although it remains necessary. Syndromic surveillance augments traditional surveillance by monitoring other information to alert of possible outbreaks.1 Early emergency department (ED) syndromic surveillance initiatives used added personnel for on-site record abstraction and thus were reserved for extraordinary circumstances (eg, “drop-in” surveillance during major political or sporting events).2 Milwaukee EDs use a regional emergency medicine Internet application to communicate among themselves and with ambulance dispatchers. Regional emergency medicine Internet is also used for communications between the Milwaukee Health Department and EDs during emergencies such as heat waves and outbreaks.3,4 We twice used the regional emergency medicine Internet application for drop-in ED surveillance at lower cost using routine personnel.

The initial (“All Star Game”) project was conducted in summer 2002 when an estimated 1.2 million people visited Milwaukee, WI, for the Major League Baseball All Star Game and other events. Eight Greater Milwaukee EDs voluntarily monitored visit volumes of syndromes suggestive of terrorism-related diseases and logged them daily on the regional emergency medicine Internet site where the Milwaukee Health Department downloaded them. Trends and alerts were shared with authorized partners using regional emergency medicine Internet.

Syndromic surveillance was reinitiated in spring 2003 for severe acute respiratory syndrome (SARS). According to the Centers for Disease Control and Prevention (CDC) case definition and triage advice, we created an ED triage screening tool adopted by most area hospitals (also distributed nationally at the Frontlines of Medicine Project, http://www.frontlinesmed.org). An average of 11 Milwaukee-area EDs agreed to report daily visit proportions with SARS features detected using the form for 10 weeks (March 19 through May 31, 2003). In addition to Milwaukee Health Department review, CDC staff remotely downloaded and analyzed data using the Early Aberration Reporting System for several weeks.5

METHODS
The Milwaukee Health Department provided standard screening tools for data collection (and to identify patients requiring infection control measures for SARS). For the All Star Game project, 2002 Winter Olympics surveillance chart review forms were modified to a syndrome checklist for clinician completion at patient discharge.6 (Figure E1 available at http://www.mosby.com/AnnEmergMed.) Every ED patient was to be assessed for 6 syndromes: respiratory disease with fever, febrile rash, bloody diarrhea, central nervous system infection, botulism-like symptoms, and sepsis or unexplained shock. For the SARS project, a 3-item triage questionnaire was designed for patients with fever (or fever history) at triage. (Figure E2 available at http://www.mosby.com/AnnEmergMed.) Patient identification and date were recorded on each form and retained in case follow-up investigation was warranted. Protected health information (as defined by the Health Insurance Portability and Accountability Act) was not transmitted on regional emergency medicine Internet or otherwise shared unless required by a mandated public health investigation.

All Star Game surveillance ran 4 weeks, establishing a baseline beginning several days before the All Star Game and continuing 8 days after the final event. SARS project surveillance was under way for 5 weeks at the time this article was written, with total surveillance expected a minimum of 8 weeks.

The regional emergency medicine Internet software application (EMSystem, Mequon, WI) automatically prompted ED staff each morning to report 24-hour totals.
of patient visits meeting syndrome criteria and the total number of ED visits. Milwaukee Health Department staff downloaded these data from the regional emergency medicine Internet in spreadsheet form and calculated daily counts of syndrome visits, the proportion of syndrome visits to total visits, and standard scores (the daily difference from the cumulative mean expressed as a percentage of the SD) for each syndrome, for each ED separately, and in total. These data were displayed alongside other surveillance information on a “surveillance dashboard,” permitting easy visual review for aberrant trends indicating a possible outbreak. (Figure E3 available at http://www.mosby.com/AnnEmergMed.) During SARS surveillance, data were also analyzed at the CDC using the Early Aberration Reporting System program to detect significant departures from baseline trends. The “surveillance dashboard” was posted on the regional emergency medicine Internet, viewable by authorized public health, ED, and emergency preparedness staff.

We evaluated the All Star Game project as much as practical according to draft CDC recommendations. Although we could not directly measure the syndrome checklist predictive value, we did compare Web-reported totals with ED-retained checklists to assess reporting completeness. ED nursing directors and 2 providers from each site were asked to complete a questionnaire to further characterize the acceptability and time-cost of the system. Although initial subjective evaluation of the SARS project can be provided, final evaluation has not been completed because the project is ongoing. Because both projects were urgently implemented surveillance programs organized by the local public health authority and did not involve any individually identifiable health records, the projects were not reviewed by an institutional review board.

RESULTS

In the All Star Game project, after minor initial reporting inconsistencies, all EDs reported patient volumes daily to the Milwaukee Health Department. EDs reported a total of 314 cases meeting syndrome criteria out of 26,888 patient visits. (In contrast, community physicians and urgent care clinics who volunteered for the project reported a total of 214 cases meeting syndromic criteria of only 2,242 total encounters that, on investigation, reflected an outbreak of pharyngitis in youth camps they served.) In EDs, no syndrome category showed a sustained increase in daily visits or visit proportions, and no other unexpected findings were observed.

We discovered that many EDs varied from the proposed screening strategy by placing checklists only on the medical records of “suspicious” patients (selective instead of universal screening). Several EDs also reported supplementing counts by reviewing triage logs or records because of poor anticipated or observed clinician cooperation with checklist completion. One ED (“ED A”) relied exclusively on log and record review, rather than clinician-completed checklists. There was a wide range in the proportion of syndrome visits to overall visits reported by EDs (0.04% to 2.8%). The highest proportion of syndrome visits to total visits was reported by ED A, but it cannot be determined whether this was coincidental or because centralized record review produced superior case ascertainment.

Independent record reviews to calculate the predictive value of the syndrome checklist were not performed. However, we evaluated the accuracy of Web reporting by reviewing the concordance between electronic summaries and checklists retained in the EDs. On several days, some EDs reported more syndrome visits on regional emergency medicine Internet than were reflected by syndrome-positive checklists and on other days, fewer. These over-reported and underreported 24-hour totals almost completely cancelled one another and were due to 1-day differences between the actual patient visit (recorded on the checklist) and the date on which the regional emergency medicine Internet was used to report the case. Thus, they did not bias overall temporal incidence trends.

Disparities in reports of rarer conditions occasionally resulted in alarming syndrome rates, requiring telephone follow-up with the affected ED. For example, one ED reported 3 “central nervous system infection” cases in 1 day, representing 43% of total central nervous system infection reports throughout the 4-week surveillance period. A telephone call was sufficient to ascertain that this was keystroke error (confirmed by review of checklists and triage logs). Such events were evaluated rapidly by telephone contact without the need for public health staff to visit the ED or for other excessive staff time. They also indicate that a modest sustained (3-day) or sharp increase in the numbers or proportions of persons with syndromes in the region would likely be detected, despite the observed inconsistencies in screening and reporting practices.

In the SARS project, the inconsistencies of screening and reporting were addressed by locating patient screening at the triage desk rather than asking clinicians to fill out a form at patient discharge. This process change required cooperation from a smaller number of ED staff.
and provided greater control of the forms in a single location. EDs were also asked to collect forms in midnight-to-midnight batches and directly record on the regional emergency medicine Internet screen the date for which daily visit totals were reported. With these changes, the use of a more simplified screening tool, and possibly a learning effect from the previous ED experience with All Star Game surveillance, the early SARS project experience indicates greater ease and consistency of screening and reporting.

Seven of the 8 (88%) ED coordinators completed a survey on their experience with the All Star Game project. Six of 7 (86%) ED coordinators were glad they participated (1 was neutral), and a majority agreed that tabulating form data and reporting it electronically on the regional emergency medicine Internet were “easy.” Respondents’ mean estimate of the time checklist completion added to patients’ stay in the ED was 4 minutes (range zero to 5 minutes). The mean estimate of added staff time for the surveillance project was 9 minutes per patient (range 3 to 25 minutes). Systematic measurements of time are not yet available for the SARS project, but initial observations suggest the simpler screening and reporting system are efficient. When the SARS screening tool is used only for patients with measured fever or history of fever, only 5% to 8% of overall patients have a screening form completed. Observations suggest that completion of this form requires less than 3 minutes, and it takes a staff person 5 minutes to enter the 24-hour counts on the regional emergency medicine Internet each day. The one-time cost of modifying the regional emergency medicine Internet software for these specific projects was $10,000.

The “surveillance dashboard” document was shared with participants on the regional emergency medicine Internet. The system is used often to alert participants of public health concerns, such as homeland security alert levels, SARS, extreme heat, and West Nile virus. Users can choose to receive these alerts using several communication modes, including desktop Web browser, e-mail, or pager. Images of the Web site alert function are available at http://www.mosby.com/AnnEmergMed (Figure E4).

Willingness of EDs to volunteer for these 2 surveillance projects illustrates general acceptance of regional emergency medicine Internet-supported surveillance, at least for short durations. In the SARS project, triage-based screening has helped minimize the perceived effort to participate. Further analysis of the SARS surveillance will occur at the conclusion of the effort.

Of significance is the ease with which the second project was launched. From concept to full implementation in Milwaukee, the SARS surveillance project was launched in 3 days. Because the same regional emergency medicine Internet tools are available globally by Internet, the Frontlines of Medicine work group is working to recruit additional regions in other areas of the country to implement similar SARS surveillance projects. Further information is available at http://www.frontlinesmed.org/sars-sp.

**DISCUSSION**

We twice successfully implemented temporary, voluntary, active, daily surveillance for syndromes suggestive of bioterrorism-related illness or emerging infectious disease across multiple EDs at modest cost, using existing public health and ED resources, which was facilitated by an existing, secure regional emergency medicine Internet software application. A sustained (3-day) or marked increase in the absolute or proportional numbers of syndrome cases would have been readily apparent by visual review of trend graphs, and data were also readily downloaded into the Early Aberration Reporting System detection program. Follow-up investigation is easily directed to specific EDs, specific syndromes, and specific date ranges, minimizing unnecessary epidemiologist labor. The All Star Game surveillance project was well accepted by ED managers, with modest impact on patient ED visit time. Continuing use of regional emergency medicine Internet, established relationships between local public health and EDs, and the immediacy of a plausible threat contributed to rapid establishment of the second (SARS) project.

Reliance on multiple clinicians to complete a syndrome checklist either during or after care was the apparent weak point of All Star Game project implementation, affecting the uniformity and reliability of reporting. This weak point was improved in the SARS project by focusing on a simple modification of everyday triage routines. Shared sentinel surveillance code sets, such as those provided by the Frontlines of Medicine, and cross-platform coding and electronic transmission standards, such as those developed for the Health Insurance Portability and Accountability Act and the Public Health Information Network, should permit automatic and consistent collection and transmission of sentinel surveillance markers from routinely created records such as triage logs or billing codes.8,9 The regional emergency medicine Internet software application provides a convenient and practical
network for the collection, analysis, and dissemination of such surveillance.

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