International Society for Disease Surveillance
Conference 2010

Track 3: Applications of Methodologies to New Domains

3. Using administrative databases to identify cases of chronic kidney disease: a systematic review
   R Blouin, M Hall, and S Saydah

5. OutbreakMD: tracking and identifying disease outbreaks in post-earthquake Haiti
   R Chunara, C Freifeld, and JS Brownstein

7. 911 and EMS data for detection of drinking water contamination
   C Dangel, D Gibbons, SC Allgeier, A Haas, and T Ellis

9. Finding medically unexplained symptoms within VA clinical documents using v3NLP
   G Divita, and QZ Trietler

11. Identification and tracking of heat-related illnesses using syndromic surveillance
    Z Faigen, I Ajit, S Aslam, and S Adams

13. The use of Craigslist posts for risk behavior and STI surveillance
    JA Fries, A Segre, L Polgreen, and P Polgreen

15. Identifying water contamination from syndromic surveillance signals
    A Haas, C Dangel, SC Allgeier, and D Gibbons

17. The use of NC DETECT ED data to examine heat-related illness
    A Ising, S Rhea, L Deyneka, and H Vaughan-Batten

19. Use of syndromic surveillance systems for oral health surveillance
    RS King, L Deyneka, H Vaughan-Batten, L Barker, V Robison, S Benoît, and HS Burkom

21. Public health surveillance after the Haiti earthquake: the Florida experience
    A Kite-Powell, J Hamilton, I. Eisenstein, and R Hopkins

23. Automated surveillance and public health reporting for gestational diabetes incidence and care using electronic health record data
    M Klompas, J McVetta, E Eggleston, T Mendoza, PR Daly, P Oppedsisano, B Beagan, K Golden, R Lazarus, and R Platt

25. Exploring illness prediction in type 1 diabetes mellitus pre-symptom onset
    JN Lauritzen, E Arslan, JG Bellinga, K Van Vuurden, OK Hejlesen, and G Hartvigsen

27. Use of the National Poison Data System for surveillance of human health effects from the Deepwater Horizon Oil Spill
    R Law, C Martin, A Wolkin, and A Bronstein

28. Adapting a syndromic biosurveillance system to monitor veterans’ health impact associated with the gulf coast oil spill
    MC Rangel, RA Martinello, C Lucero, G Oda, M Holodniy, M Peterson, and VJ Davey, the VA Gulf Coast Oil Spill Task Force

30. Anticipatory surveillance for mass gatherings: a novel application of mass media surveillance
    SR Mekaru, K Khan, N Nelson, D Hartley, and J Brownstein

32. Enhancement of ESSENCE-based chemical surveillance by incorporation of real-time poison information center data
    JL Schauben, Sharon M Watkins, Carina Blackmore, and PR Mulay

34. Utilization of Florida poison control data and Emergency Department chief complaint data to identify clusters of carbon monoxide poisoning
    P Mulay, S Watkins, and C Blackmore

35. Application of biosurveillance methodology to the 2010 Asian foot-and-mouth disease outbreaks
    AR Reilly, EA Iarocci, A Endo, DM Hartley, and NP Nelson

37. Increased emergency department presentations for head trauma following media coverage of a fatal epidural hematoma
    DK Richardson, M Paladini, T Azarian, A Baer, M Rennick, and D Weiss

39. Predicting extreme asthma events in London using quantile regression models
    IN Soyiri, and DD Reidpath

41. Evaluation of a post earthquake internally displaced persons surveillance system (IDPSS)—Haiti, 2010
    A Sprecher, C El Bcheraoui, M Willis, E Jentes, R Tohme, J Walldorf, Beckett G, C Dubray, S Wiktor, S Blank, and R Magloire
43. Using chief complaint data to evaluate the effectiveness of a statewide smoking ban
    WE Storm, BL Bennett, and BE Fowler

45. FluView interactive: using user-centered design and usability heuristics to improve visualization of influenza information
    MH Torres-Urquidy, K Kniss, A McIntyre, L Brammer, and L Finelli

47. Challenges of introducing disease surveillance technology in developing countries: experiences from India and Sri Lanka
    C Weerasinghe, N Waidyanatha, A Dubrawski, and M Baysek
ABSTRACT

Using administrative databases to identify cases of chronic kidney disease: a systematic review

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Objective
This poster summarizes a systematic literature conducted to (1) describe published methods for researching chronic kidney disease (CKD) in administrative databases and (2) summarize the reported validity of methods of searching for CKD in administrative databases.

Introduction
CKD is currently the ninth leading cause of death in the United States. The prevalence of end-stage renal disease, the most severe form of CKD, has doubled in the last decade.¹ Early detection and treatment of CKD is critical to slowdown the progression of the disease and to decrease the risk of other chronic conditions, such as cardiovascular disease.² One accessible and cost-effective method for health research activities involves use of medical administrative databases, such as insurance claims databases and institutional medical record systems. Individuals with diabetes, for example, have been accurately identified in Medicare and Veteran’s Administration databases using clearly defined and highly valid search algorithms.³ However, little is known about the validity of administrative databases for identifying CKD. A systematic review of the literature was conducted to identify the validity of published methods for searching administrative databases for cases of CKD.

Methods
Publications were identified through use of Medline, Cochrane Library, EMBASE, EconLit, Cumulative Index to Nursing and Allied Health, and Web of Knowledge. Articles were included if they were published in peer reviewed journals, constituted original research, focused on adults aged 18 years or older, contained some description of the search algorithm used to identify CKD within an administrative database, and were written in or translated into English. Case studies, news or magazine articles, or clinical articles were excluded. A multiphase process was implemented to review and determine final relevancy of each identified article. The content of all relevant articles was recorded in an Excel-based data abstraction form.

Results
The literature review yielded 38 articles that described methods for identifying CKD in a wide variety of administrative databases (that is, electronic medical record systems, Veteran’s Administration files, Medicare claims databases, health management organization claims databases, and disease registries). Algorithms were identified for general CKD, stages 3–5 CKD, renal failure, and diabetic nephropathy. Most of the identified algorithms used International Classification of Diseases, 9th Revision (ICD-9) diagnostic codes as the algorithms’ foundation. Algorithms for Stages 3–5 CKD, however, relied on laboratory serum creatinine values converted to estimated glomular filtration rates rather than ICD-9 codes. There was wide variation in the performance of published algorithms. Overall, the algorithms found for general CKD, renal failure, and diabetic nephropathy tended to demonstrate high specificity but lower sensitivity.

Conclusions
Historically, ICD-9 codes have not differentiated between the five stages of CKD, but new stage-specific ICD-9 codes were introduced in 2005. Our literature review did not identify any validated ICD-9 algorithms for stage-specific CKD; both the frequency of use and validity of these new codes are unclear. Researchers should focus on search methods and algorithms that match their own working definition of CKD, have been validated in similar databases, and have been used with similar patient populations. The high specificity and lower sensitivity of the algorithms suggest...
that the algorithms might, for research studies and to assess the quality of care, identify cohorts of individuals with CKD, but would not perform well for surveillance purposes.

Acknowledgements
This paper was presented as a poster at the 2010 International Society for Disease Surveillance Conference, held in Park City, UT, USA, on 1–2 December 2010.

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ABSTRACT

OutbreakMD: tracking and identifying disease outbreaks in post-earthquake Haiti

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Objective

OutbreakMD is a mobile Web application that was piloted in post-earthquake Port-au-Prince, Haiti. The application is designed for collecting, organizing and visualizing clinical information from individual patients to better monitor emerging infectious disease in disaster situations, in situations with limited public health infrastructure and unreliable Internet connectivity.

Introduction

HealthMap is a real-time disease epidemic intelligence tracking and visualization system that collects information from general news media, individual first-hand reports and public health sources around the world. Gaps in this effort clearly occur during times of crisis where traditional mechanisms may be dismantled. Clinical information gathered by deployed physicians can play a key role in providing early insight on emerging public health threats. We developed OutbreakMD to gather such information in real-time and combine with existing HealthMap informal and formal surveillance techniques.

With Haiti already carrying a significant endemic burden of infectious disease, including tuberculosis, malaria, and HIV, the aftermath of the earthquake of January 12, 2010 has exacerbated the spread of disease while treatment capacity has diminished. This application allows a clinician to rapidly enter patient demographics and case information, and then identify high-risk areas and times by examining the aggregated data spatially and temporally. These insights can be coupled with other public health information sources and can be used to inform responders on how to best target prevention such as vector control and water purification, as well as to identify internally displaced person camps and other specific communities where additional resources are needed.

Methods

Implemented in HTML5, a new Web standard that supports offline data storage, OutbreakMD can be used to collect data
even when no network connection is available. Once a connection becomes available, the system automatically uploads stored reports to a secure online database, capturing patient demographics, address, symptom and clinical test results. Seamless online and offline use makes the application particularly suited to resource poor settings where both Internet and cell phone connectivity are available but often unreliable. Although the current version is designed for the Apple iPad, OutbreakMD is compatible with a range of mobile devices such as iPhone, Android and desktop browsers, so the application can be easily carried and used in the clinic. Once the data are captured and synchronized online, a time-series view of the number of unique patients presenting with symptoms in each of the disease categories, as well as spatial visualization of patient locations (Figure 1) are generated in real-time from the electronic records and made available online.

Results
Over the course of three months subsequent to the Haiti earthquake, data was collected from 117 unique patients. We found that the predominant disease burden was of Tuberculosis, with distribution highest in South Central Port-au-Prince; however a greater number of cases is required for statistical significance. We are currently examining how resolution (exact latitude and longitude versus suburb-level location) affects spatial visualization of the information. This will be relevant in order to automate data processing for locations that are not readily mapped (such as informal camps) while maintaining the quality of information. With enough volume of patient information we will be able to evaluate which levels of spatial resolution will be useful for population public health surveillance.

Conclusion
OutbreakMD is a platform for real-time collection of clinical data in the field with the goal of rapid public health surveillance in disasters and resource-poor settings, and the potential to play a key role in closing the loop between clinical providers and responders.

Acknowledgements
This paper was presented as an oral presentation at the 2010 International Society for Disease Surveillance Conference, held in Park City, UT, USA, on 1–2 December 2010.
ABSTRACT

911 and EMS data for detection of drinking water contamination

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Objective
This paper describes the design, application and use of 911 and Emergency Medical Services (EMS) data in a drinking water contamination warning system.1

Introduction
The Public Health Surveillance (PHS) component (one of five monitoring and surveillance components deployed in the Cincinnati drinking water contamination warning system) functions to detect public health incidents resulting from exposure to toxic chemicals that produce a rapid onset of symptoms. Within the PHS component, four data streams were monitored: 911 calls, Emergency Medical Services (EMS) logs, Local Poison Control Center call data, as well as Emergency Department data (via EpiCenter). The focus of this paper centers on the 911 and EMS surveillance tools. The 911 data is dependent on information provided by the caller and the information entered by the dispatcher. EMS data, on the other hand, is recorded by a medical professional, and although not provided as rapidly as 911 data, provides more detailed information. The data included in 911 and EMS alerts, when utilized together, can provide timely and beneficial information during investigation of a possible drinking water contamination incident.

Methods
911 calls are captured electronically via a computer aided dispatch system. Calls are classified into standard incident code categories based on information a caller reports to the 911 dispatcher. Call data that meets established filtering criteria is transferred from the Cincinnati Fire Department’s (CFD) source database to a dedicated application database at the local water utility. Automated surveillance once every hour using the SaTScan (SaTScan Software, Boston, MA, USA) space-time scan statistics searches for unusual clusters of 911 calls assigned to selected symptom categories. If an unusual cluster is detected, an alarm is generated.

CFD emergency medical technicians (EMT) collect EMS run information using a wireless tablet, and capture patient data such as age, gender, vital signs, chief medical complaint, EMT medical observations, and incident zip code. EMS run data are transferred from CFD’s source database to a dedicated application database at the local water utility. The EMT’s medical observations are categorized into syndromes and analyzed by the CDC’s Early Aberration Reporting System (EARS) software (Early Aberration Reporting System, Atlanta, GA, USA). Surveillance of EMS data occurs on an hourly basis. If unusual conditions are detected in the EMS runs, an alarm is generated.

For both 911 and EMS, once an alarm is generated, an email notification is sent to the local public health partners who have primary responsibility to lead the ensuing investigation.

Results
Alarms from the 911 and EMS surveillance tools were investigated by the public health partners. Although no true water contamination event occurred during the study, a handful of public health events were detected. Various drills and exercises allowed the public health partners and local water utility to investigate alerts, which suggested possible water contamination, and to gain a better understanding of the surveillance tools’ capabilities. The 911 and EMS alarm occurrence was tracked during the study, and it was determined that there was a need to modify the existing alerting criteria for each tool given the high rate of false alarm occurrence. Upon implementation of additional alerting restrictions, alarm frequency decreased significantly and was accepted as more beneficial to detecting a waterborne public health event.

Conclusions
The results of the pilot in Cincinnati demonstrate that 911 and EMS surveillance tools can produce timely and beneficial data in detecting a drinking water contamination incident, and provide dual use benefits for detection of other non-water related public health outbreaks.
Acknowledgements
This paper was presented as an oral presentation at the 2010 International Society for Disease Surveillance Conference, held in Park City, UT, USA on 1–2 December 2010.

Reference
1 US EPA. Water security initiative: Cincinnati pilot post-implementation system status report, 2008 EPA 817-R-08-004.
ABSTRACT

Finding medically unexplained symptoms within VA clinical documents using v3NLP

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Objective

Pro-WATCH (protecting war fighters using algorithms for text processing to capture health events), a syndromic surveillance project, includes a task to identify medically unexplained symptoms. The v3NLP entity extraction tool is being customized to identify symptoms, then to assign duration assertions to address part of this project. The v3NLP tool was recently enhanced to find problems, treatments, and tests for the i2b2/VA challenge. The problem capability is being further refined to find symptoms. Machine learning models will be developed using an annotated corpus currently in development to find duration assertions.

Introduction

Pro-WATCH (protecting war fighters using algorithms for text processing to capture health events), a syndromic surveillance project for veterans of operation enduring freedom (OEF)/operation Iraqi freedom (OIF), includes a task to identify medically unexplained symptoms (MUS). The v3NLP entity extraction tool is being customized to identify symptoms within VA clinical documents, and then refined to assign duration. The identification of medically unexplained symptoms and the aggregation of this information across documents by patient’s is not addressed here.

Methods

The v3NLP tool, previously known as HITEXt,¹ includes the capability to identify medical statements from the notes sections within VA clinical documents. The v3NLP is built using GATE² pipelines. It includes cTAKES³ POS tagger and noun phrase parser. The v3NLP recently adopted NLM's MetaMap⁴ phrase to concept mapping tool to map to Unified Medical Language System (UMLS) concepts (http://www.nlm.nih.gov/research/umls/). The v3NLP includes a section identification component.

The tool has been further developed to address the 2010 i2b2/VA NLP challenge. This challenge called for the identification of problems, treatments and tests within clinical documents. The challenge also called for the assignment of given assertions associated with medical problems and the identification of relationships between the problem, treatment and tests. The tool was augmented with a statistical machine learning component to improve its performance at identifying problems, treatments and tests, trained on annotated text. The features used included the presence of frequently occurring salient words, concepts and semantic types returned by MetaMap, generalizations of the semantic types, the parts of speech and words around medical concepts, document type and section headings.

For this Pro-WATCH task, the problems found using v3NLP will be further refined down to symptoms, partially by semantic type assignment, but also possibly by the use of an additional machine learning model, trained using annotations from a training corpus currently under development.

A statistical machine learning model will be developed to address the duration component of the symptom identification. The training corpus is expected to have duration assertions. The presence of salient duration words and concepts will be considered some of the features to learn from.

Conclusion

The VINCI team is leveraging the knowledge gained, the methodology, and the software components from the i2b2/VA challenge to address the ProWATCH MUS task. It will further extend v3NLP’s capabilities based on machine learning from human annotations.

Acknowledgements

This paper was presented as a poster at the 2010 International Society for Disease Surveillance Conference, held in Park City, UT, USA on 1–2 December 2010.

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Identification and tracking of heat-related illnesses using syndromic surveillance

Z Faigen, I Ajit, S Aslam, and S Adams

Objective
This paper describes the use of the electronic surveillance system for the early notification of community-based epidemics, a syndromic surveillance system, to monitor heat-related illnesses throughout the state of Maryland during the summer of 2010.

Introduction
The summer of 2010 in Maryland was characterized by unusually high temperatures. This type of increased and prolonged heat can potentially make residents sick, and extreme exposure can even kill people at highest risk. Numerous deaths throughout the state were attributed to this heat wave. The Maryland Department of Health and Mental Hygiene (DHMH) addressed this public health issue by using public messaging and maintaining constant situational awareness through the electronic syndromic surveillance. Thus, the electronic surveillance system for the early notification of community-based epidemics (ESSENCE) was used to monitor heat-related illnesses throughout the state.

Methods
All acute care hospitals in the state of Maryland ($n=45$) report data on emergency department (ED) visits to ESSENCE in near real-time manner. Therefore, ED visits for heat-related illnesses were reviewed closely on a daily basis throughout the summer months (1 May to 8 August 2010). DHMH used its syndromic surveillance system as a tool to enhance case finding efforts as well as to monitor levels of heat-related illnesses across the state. Daily reports were provided to public health leaders to enhance situational awareness and inform decision making. The counts of ED visits for heat-related illnesses were also compared with the daily temperature data collected at the Baltimore–Washington International Thurgood Marshall Airport, located in Anne Arundel County, to assess the relationship between air temperature and the number of ED visits for heat-related illnesses.

Results
The age group with the highest number of heat-related illnesses was 65+ years old, with 18–44 years old and 45–64 years old having the next highest number of cases, respectively. The region of Maryland with the highest proportion of cases was Baltimore City. There were more female cases than male cases. The peak of emergency department visits for heat-related illnesses occurred on 7 July 2010, corresponding with a 3 day stretch of extremely high temperatures from 5 July to 7 July 2010, with maximum temperatures ranging from 100°F to 105°F. Overall, there was a positive correlation between air temperature and the number of ED visits for heat-related illnesses (Figure 1).

Conclusions
Syndromic surveillance proved to be a vital tool in supporting decision makers by providing timely and ongoing
situational awareness of heat-related illnesses. The data indicated that there was a positive correlation between air temperature and the number of ED visits for heat-related illnesses. These results demonstrate yet another useful way in which electronic surveillance, and specifically ESSENCE, can be used to help protect the public’s health. DHMH is continuing to monitor this data closely to maintain situational awareness of heat-related illness activity in Maryland.

Acknowledgements
This paper was presented as a poster at the 2010 International Society for Disease Surveillance Conference, held in Park City, UT, USA on 1–2 December 2010.
ABSTRACT

The use of Craigslist posts for risk behavior and STI surveillance

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Objective
This paper describes a novel method of obtaining large scale, geographically diverse behavioral data about Men who use the Internet to seek Sex with Men (MSM) by examining anonymous Craigslist message posts to predict HIV/AIDS.

Introduction
The rise and associated risks of using the internet to find sexual partners among men who have sex with men (MSM) has been noted by many researchers.1,2 The anonymity and relative ease of finding partners on the internet has facilitated casual sexual encounters that can encompass a variety of unsafe sexual practices, from anonymous partners to ‘Party and Play’ activities (PNP), slang for illegal drug use, unprotected sex, group sex and so on. These anonymous sexual encounters make it more difficult for public health officials to notify exposed partners.

In addition, detailed data regarding risk behaviors are generally obtained via conventional survey techniques, which are expensive to conduct. Thus, a general method of empirically deriving large scale, location-specific behavioral data could be immensely useful in understanding or anticipating STI outbreaks.

Craigslist is a website specializing in online classified advertisements around the world. Our hypothesis is that Craigslist contains rich behavioral data regarding MSM communities and that such information can function as proxy for external prevalence rates for diseases (that is, HIV/AIDS).

Methods
Beginning 1 July, 2009, daily Craigslist RSS feeds were collected for eight personals categories in 416 local Craigslist sites around the United States. As of 1 September, 2010, 54,450,547 individual posts have been collected. Of the 6,951,603 posts in California, ~57% can be classified as MSM specific. Approximately 60% of these MSM posts can be naively geocoded to specific counties using the Google Maps API. All geocoded messages are then searched to identify two message categories: (1) self-disclosed, positive HIV status, (2) PNP.

California’s department of public health provides quarterly statistics on HIV/AIDS cumulative case counts for all counties in the state. March 2010 summary data were used to calculate the prevalence rate used in this analysis.3

To find proxies for HIV prevalence in each county in California, we used ordinary least squares (OLS). The dependent variable in all models was the actual HIV rate in each county (number of HIV cases divided by the county population). Independent variables included broadband penetration by housing unit as well as variables generated from Craigslist. We considered the number of MSM posts, and within the MSM categories, we also considered the number of posts with self-disclosed HIV status and PNP.

Results
MSM posts with HIV status disclosed as a fraction of MSM personal posts is a positive predictor of HIV rates (coefficient = 5.4; P < 0.001; $R^2 = 0.85$). MSM posts as a fraction of all personal posts is a positive predictor of HIV rates but the $R^2$ was relatively low (coefficient = 0.0068; $P = 0.008$; $R^2 = 0.24$). In contrast, PNP posts as a fraction of all personal posts is a positive predictor of HIV rates with a higher $R^2$ (coefficient = 0.56; $P < 0.001$; $R^2 = 0.75$).

Conclusions
Our Craigslist HIV-positive self-disclosure rate is a proxy for HIV among Californian MSM communities at the county level. Future models will explore this relationship in more depth. The second two models show that there are meaningful behavioral data embedded within messages. When considering just counts of MSM posts, the amount of variation that can be explained is rather modest but including posts denoting high-risk behavior, the $R^2$ increases considerably—much more of the variability in HIV rates is explained. These results suggest that more sophisticated data mining techniques could yield an important source of behavioral data to help understand and perhaps anticipate STI activity.

Acknowledgements
This paper was presented as an oral presentation at the 2010 International Society for Disease Surveillance Conference, held in Park City, UT, USA on 1–2 December 2010.
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Identifying water contamination from syndromic surveillance signals

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Objective
To develop standard operating procedures (SOPs) to identify or rule out possible water contamination as a cause for a syndromic surveillance alarm.

Introduction
The EPA Water Security initiative contamination warning system (CWS)¹ detection strategy involves the use of multiple monitoring and surveillance components for timely detection of drinking water contamination in the distribution system. The public health surveillance (PHS) component of the contamination warning system involves the analysis of health-related data to identify disease events that may stem from drinking water contamination. Public health data include hospital admission reports, infectious disease surveillance, emergency medical service reports, 911 calls and poison control center (PCC) calls. Automated analysis of these data streams results in alerts, which are investigated by health department epidemiologists. A comprehensive operational strategy was developed to describe the processes and procedures involved in the initial investigation and validation of a PHS alert. The operational strategy established specific roles and responsibilities, and detailed procedural flow descriptions. The procedural flow concluded with the determination of whether or not an alert generated from surveillance of public health data streams is indicative of a possible water contamination incident.

Methods
Cincinnati was chosen to be the first pilot city for implementation of a drinking water CWS. Over the course of development and deployment of the PHS component, local partners from the Greater Cincinnati Water Works (GCWW), Cincinnati Fire Department (CFD), city and county health departments, PCC and local and federal law enforcement met quarterly to develop and test the PHS alert response strategy. Initially, alerts were received by the health department or PCC. Owing to the branching and looping flow patterns within water distribution systems, water contamination, particularly with extremely toxic chemicals, will likely feature spatial clustering of cases with similar medical complaints. If the underlying data for the alert demonstrates clustering of cases with similar symptoms, the epidemiologist will investigate other public health data streams for corresponding trends. If the investigator believes that water contamination could be the cause of the alert, regardless of whether it is the primary suspected cause, all local partners convene to discuss the alert. GCWW provides information on water quality data and customer complaints from the impacted area. CFD reports or confirms unusual activity from emergency responders. PCC specialists provide information on PCC calls as well as expert toxicological interpretation of the data. On the basis of all information gathered, the utility and local partners make a joint decision regarding whether water contamination is possible.

Results
In addition to routine false alarm investigations, the operational procedures were evaluated during exercises involving simulated water contamination. The exercises illustrated the value of leveraging knowledge from multiple disciplines. Possible water contamination determinations were made in ~90 min based on the correlation of public health alerts with anomalous water quality data. Additionally, PCC specialists assisted GCWW to prioritize its sampling strategy on the basis of suspected contaminants. During exercise debriefs, all partners agreed that the communication resulted in increased confidence in the joint decision that water contamination was possible. Although water contamination is often ruled out for PHS alerts on the basis of initial criteria, in one instance the partners were convened to discuss an alert generated by multiple EMS runs involving respiratory distress in the central business district of Cincinnati. The investigator suspected that the alert was the result of a weekend festival coinciding with a heat wave. However, the alert met the clustering of similar cases criteria.

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After convening a 15 min conference call in which GCWW reported no anomalous water quality or utility conditions in and around the area, the alert was attributed to the heat wave.

**Conclusions**
The Cincinnati pilot applied an effective procedure for identifying possible water contamination from syndromic surveillance alerts.

**Acknowledgements**
This paper was presented as an oral presentation at the 2010 International Society for Disease Surveillance Conference, held in Park City, UT, USA on 1–2 December 2010.

**Reference**
1 US EPA. Water Security Initiative: Interim Guidance on Developing an Operational Strategy for Contamination Warning Systems. EPA 817-R-08-002 2008.
ABSTRACT

The use of NC DETECT ED data to examine heat-related illness

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Objective
To examine the utilization of NC emergency departments for heat-related illness by age, disposition and cause based on chief complaint and triage note categorization.

Introduction
NC DETECT provides near-real-time statewide surveillance capacity to local, regional and state level users across NC with twice daily data feeds from 119 (99%) emergency departments (EDs), hourly updates from the statewide poison center, and daily feeds from statewide EMS runs, select urgent care centers and veterinary lab data. The NC DETECT Web Application provides access to aggregate and line listing analyses customized to users’ respective jurisdictions. Several reports are currently available to monitor the health effects of heat waves. Heat wave surveillance is essential as temperature extremes are expected to increase with climate change.1

Methods
NC DETECT has three reports related to heat waves: heat-related illness (HRI) by keyword, by ICD-9-CM codes and dehydration (keyword). The ICD-9-CM report captures the most visits for HRI compared with the HRI keyword and dehydration reports. Statewide data were extracted from the ICD-9-CM report for the months of May to September for 2008 (n = 2314) and 2009 (n = 1671) and May to July for 2010 (n = 2168). The burden of HRI ED visits compared with total ED visits was examined by age group (0–9; 10–14; 15–18; 19–24; 25–44; 45–64; 65+) for each month under study. Patient disposition for HRI visits was also examined by age group. Finally, line-listing data were used to assign each HRI ED visit to one of the following categories: exercise/recreation, work, home (maintenance), negligence, no A/C, substance abuse or undefined. Visit categories were examined by age group over the study period.

Results
From May to September 2008 and 2009 and May to July 2010, visits by patients 25–44 years of age reflected the highest proportion of ED visits compared with the other age groups (range of 33.8–45.3%). Children 15–18 years of age had the highest percentage of HRI visits compared with all ED visits within their age group (0.23% average from 2008–2010). Those patients of 65 years and older were more commonly admitted to the hospital after a HRI ED visit than patients from other age groups (Figure 1). Approximately 79% of HRI visits had an undefined cause for the visit (Figure 2). The most common identified causes for all ED HRI visits were exercise/recreation (~10%) followed by work (~8%) and home maintenance (~3%).

Discussion
By conference time, ICD-9-CM comorbidities for heat-related ED visits will be examined and an analysis of NC regional temperatures and heat-related ED visits will be complete.

Figure 1
Proportion of HRI ED Visits Admitted.

Emerging Health Threats Journal 2011, 4:s30. doi: 10.3134/ehtj.10.030
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Conclusions
NC DETECT receives triage notes for roughly 30% of all ED visits and this data element provide more detail than the chief complaint; however, detailed information about HRI cause was often absent. Of those that are able to be categorized, exercise/recreation is the most common cause of HRI ED visits. Prevention messages targeted to those supervising organized sports as well as those exercising individually may help to reduce these types of visits.

Acknowledgements
This paper was presented as an oral presentation at the 2010, International Society for Disease Surveillance Conference, held in Park City, UT, USA on 1–2 December 2010.

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ABSTRACT

Use of syndromic surveillance systems for oral health surveillance

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Objective
This paper describes use of national and state syndromic surveillance systems for monitoring and evaluating usage of hospital emergency departments for ambulatory care sensitive dental problems.

Introduction
National and state surveillance systems for oral health have relied on sample-based screenings and self-reported surveys.¹ Recent publications suggest the need and potential for use of data from syndromic surveillance systems and insurers to monitor indicators of oral health status, utilization of care, and costs of treatment.²,³ Few consensus indicators for oral health derived from these data sources exist, with the exception of a set of five ICD-9 codes comprising ambulatory care sensitive dental problems (ACS-DP).⁴ This paper describes North Carolina's Disease Event Tracking and Epidemiologic Collection Tool (NC DETECT) data analyzed within CDC's BioSense System to report state and county population-based rates of hospital emergency department (ED) utilization for ACS dental conditions.

Methods
The total number of ED visits to facilities reporting to NC DETECT and the number of visits containing ICD-9 codes 521, 522, 523, 525, and 528 in any of 11 final diagnosis fields were tabulated for 2009. These ICD-9 codes are related to tooth decay, gum diseases, and oral abscesses. Visit records were deduplicated by a system generated unique identifier. The number of ED visits for ACS-DP was tabulated by unique visitor and percentage of repeat visits was calculated. NC DETECT is a statewide early event detection system with 112 out of 112 24/7 EDs reporting in 2009, allowing population-based rates of ED utilization for ACS-DP. Rates per 10,000 population were calculated for the state of North Carolina and each of the 81 counties where facilities are located. Statewide population rates were age adjusted to the NCHS 2000 standard population. County rates may include visits by patients residing in other counties.

Results
County rates per 10,000 population ranged from 2.2 to 3627.7 (median 105.3), with statewide rate of 114.5 (112.2 age adjusted). The greatest utilization was among 25–44 year olds (Figure 1). More detailed results will address the burden of repeat visits and regional and coverage-related effects.

Conclusions
The NC DETECT and CDC BioSense syndromic surveillance systems could be considered for routine surveillance of emergency department use for ambulatory care sensitive dental conditions. Population-based rates can be calculated for areas with high-population coverage among reporting hospital systems; visit-based rates can be calculated for all participating hospital systems.

Acknowledgements
This paper was presented as an oral presentation at the 2010, International Society for Disease Surveillance
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ABSTRACT

Public health surveillance after the Haiti earthquake: the Florida experience

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Objective
To describe the public health surveillance efforts designed to measure syndromic and disease-specific conditions in patients who were in Haiti during or after the earthquake, and evacuated to Florida.

Introduction
On 12 January 2010 at 1652 hours local time, an earthquake measuring 7.0 on the Richter scale struck near the Haitian capital of Port-au-Prince and created enormous devastation. Florida, as the state closest to Haiti, became an initial focal point for assisting the federal repatriation and humanitarian parole efforts. Florida supported shipments of personnel and relief supplies into Haiti, and served as the point of entry for repatriated U.S. citizens and those evacuated from Haiti for medical care. As of 9 February 2010, there were ~22 500 arrivals in Florida from Haiti related to repatriation and medical humanitarian missions. These patients primarily arrived in Miami, Tampa and Orlando areas. Approximately 650 people arrived in Florida during this period as medical evacuees, and were transported to and often directly admitted to hospitals for treatment of severe or complicated injuries. Some of these patients also generated emergency department (ED) visits on arrival.

Methods
Two Florida disease surveillance systems were used to monitor the impact of the Haitian earthquake. (1) ED chief complaint data captured in the statewide Electronic Surveillance System for the Early Notification of Community-Based Epidemics (ESSENCE). On 15 January 2010, the Florida Department of Health, Bureau of Epidemiology, requested that hospitals reporting to ESSENCE add the word ‘Haiti’ to chief complaints of visits to EDs in persons who were in Haiti for medical care. As of 9 February 2010, there were ~22 500 arrivals in Florida from Haiti related to repatriation and medical humanitarian missions. These patients primarily arrived in Miami, Tampa and Orlando areas. Approximately 650 people arrived in Florida during this period as medical evacuees, and were transported to and often directly admitted to hospitals for treatment of severe or complicated injuries. Some of these patients also generated emergency department (ED) visits on arrival.

Results
From 15 January 2010 to 1 March 2010, 30 hospitals in 11 counties reported 239 patients where Haiti or earthquake was mentioned in the chief complaint. ED visits that were injury-associated accounted for 47.7%, and another 23.8% were classified as possibly infectious disease related. Of these, 57.9% were categorized as gastrointestinal illness, 19.3% included fever, 17.5% as respiratory illness and the remaining 5% fell outside of those categories. In all, 28% of the ED visits with Haiti or earthquake mentioned were not categorized.

In all, 42 reportable diseases were reported to the Florida Department of Health among people returning from Haiti after the earthquake. More than a third of the illnesses were malaria (16). Other diseases and conditions reported include lead poisoning (8), giardiasis (5), dengue fever (2), hepatitis A (2), possible exposure to rabies (2), shigellosis (2), tetanus (2), cryptosporidiosis (1), Haemophilus influenzae invasive disease (1) and salmonellosis (1). In several instances these illnesses were identified in individuals who originally presented for care for trauma or injuries. When compared with reportable disease reports associated with travel to Haiti in 2009, these data show a small increase in reports of malaria and lead poisoning.

Conclusions
The findings from these two surveillance systems underscore previous knowledge that earthquakes cause injuries because of the impact and because of the rescue and clean-up...
activities. In addition, the findings also indicate that due to the pre-earthquake water and sanitation and other environmental issues, persons with travel to Haiti or who are from Haiti are at risk of vectorborne and waterborne diseases such as malaria and giardia. Relatively minor modifications to surveillance systems enabled FDOH to monitor the impact of this event on their communities. This surveillance approach did not cover those persons who were medically evacuated on life-flights and directly admitted to facilities for life-threatening care.

Acknowledgements
This paper was presented as an oral presentation at the 2010 International Society for Disease Surveillance Conference, held in Park City, UT, USA on 1–2 December 2010.
ABSTRACT

Automated surveillance and public health reporting for gestational diabetes incidence and care using electronic health record data

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Objective

To develop an electronic, prospective surveillance system to describe the incidence, care, and complications of gestational diabetes using live electronic health record data from a large defined population.

Introduction

Public health departments have a strong interest in monitoring the incidence, care, and complications of gestational diabetes, as it is associated with poor outcomes for infants and increased risk of diabetes type II for mothers. Gestational diabetes rates are also a possible early marker for changes in the incidence of diabetes type II in the general population. However, diabetes is not generally a reportable condition and therefore, public health surveillance is limited to periodic telephone surveys (subject to self-report inaccuracies), sponsored clinical examinations (expensive, small sample size, no information about processes of care), and occasional research studies. Automated analysis of electronic health record data is a promising method to complement existing surveillance tools with longitudinal, continually updated, clinically rich data derived from large populations. We describe a pilot project to automatically survey electronic health record data in order to identify cases of gestational diabetes, describe their patterns of care and complications, and report summary data to the state health department.

Methods

The Electronic medical record Support for Public Health (ESP) system is a generalizable public health surveillance platform that can continually extract structured data from any electronic health record system, analyze the data for conditions of public health interest, and then transmit individual case reports or summary data to designated public health agencies. ESP was originally designed for notifiable disease detection and reporting, but modules have since been added for syndromic surveillance and vaccine adverse event detection. We created a new ESP module to detect gestational diabetes. The ESP diabetes module was developed within the ESP installation at Atrius Health, a multisite ambulatory practice based in Eastern Massachusetts with over 700,000 patients. Data spanning from June 2006 to March 2010 were queried. A case of gestational diabetes was defined as a pregnant patient with a positive oral glucose-tolerance test per American Diabetes Association standards. We also assessed the added value of ICD9 codes and suggestive prescriptions to augment case detection. The sensitivity and positive predictive value of each case detection method was assessed by full text chart review of a sample of patients. When patients met case criteria for gestational diabetes, ESP summarizes patients’ age, race/ethnicity, postal code, referral for medical nutrition therapy, prescriptions for insulin, and postpartum testing for frank diabetes. Results are summarized and stratified by race, age or zip code. Summary data will be presented visually to the state health department via secured website.

Results

Screening for positive oral glucose-tolerance tests in pregnant women detected 706 cases of gestational diabetes between June 2006 and March 2010. Over 2300 patients had ICD9 codes for gestational diabetes during this same period, but on chart review the positive predictive value for this ICD9 code was only 38%. An ICD9 code for gestational diabetes and concurrent prescription for insulin test strips or lancets, however, had a positive predictive value of 91%. Adding this criterion to oral glucose-tolerance test criteria increased case yield by 38%. Analysis of care showed that 70% of patients were referred to
medical nutrition therapy, 28% were prescribed insulin, but only 25% received recommended postpartum testing for frank diabetes. Of these, 5% were found to have frank diabetes.

Conclusions
Electronic health record data can provide a comprehensive picture of the epidemiology of a chronic disease including incidence, care, and complications. This has the potential to provide more accurate, timely, complete, and detailed information to public health practitioners compared with existing surveillance methods.

Acknowledgements
This paper was presented as an oral presentation at the 2010 International Society for Disease Surveillance Conference, held in Park City, UT, USA on 1–2 December 2010.
ABSTRACT

Exploring illness prediction in type 1 diabetes mellitus pre-symptom onset

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Objective
To develop an illness prediction model that can predict illness in type 1 diabetes mellitus (T1DM) patients before onset of symptoms, using the patient’s observable parameters.

Introduction
Illnesses like infections, cold, influenza and so on in type 1 diabetes mellitus (T1DM) patients, can compromise the daily patient administered diabetes treatment. This in turn may result in fluctuating blood glucose concentrations, especially hyperglycemia for prolonged periods, which over time can cause serious late complications.1,2 The illness prediction project at Tromsø Telemedicine Laboratory aims to construct a prediction model that, through use of patient observable parameters, for example, blood glucose, insulin injections and body temperature, can significantly identify risk of developing illnesses, before onset of symptoms and before illness onset.

Such a model could potentially enable T1DM patients to fight the illnesses, and prepare for an adequate change in the T1DM-management earlier on.

Methods
By collecting the patient’s monitored data concerning the health and illness of T1DM patients, the project group is working towards a classification of a patient’s health into three stages: ‘healthy’, ‘in risk of developing illness’ and ‘ill, with presence of symptoms’. To obtain this data, a Smartphone application was developed, intended for monitoring diabetes treatment (blood glucose concentrations, insulin injections, food intake and physical activity) and general health status (symptoms of illness) for T1DM patients. The application was based on a newer iteration of the Few Touch Application by Årsand et al.,3 but modified to address T1DM patients and additionally collect symptom data. The application was tested initially by two T1DM patients with connection to the project and subsequently refined, in order to prepare the application for use in a large field study.

Results
The results of the initial user study of two T1DM patients showed that the developed application was usable for collecting diabetes and health related parameters and that the users did register symptoms. Although they did not consider the application difficult to use, the users expressed a wish for more predefined parameters to choose from, instead of manually symptom input via text. These findings, along with minor issues have been fixed and the application symptom input features is being expanded to include the following symptoms: headache, abdominal pain, sore throat, joint/muscle pain, presence of fever, degree of fever, presence of cold, feeling weak, illness, influenza and free text input for other observations.

The project group will conduct a study in Seattle in autumn 2010, two studies in Norway 2010–2011 and a study in Denmark 2011. Utilizing the refined application, the project group hopes to achieve the following from these studies:

(1) Provide T1DM patients with a system that offers assistance in the daily patient administered diabetes management, including an overview of current treatment and health situation. (2) Produce data sets for analysis, as input to the development of the illness prediction model. (3) Produce a model that can significantly predict illness in the individual T1DM patients, using available information and patient measurable parameters. (4) Implementing the prediction model in the application and conduct a field study, to assess the patient usefulness of the model.

Conclusions
Developing a model for predicting illness in T1DM patients, before onset of symptoms, may help patients avoid illness and hyperglycemias. To develop a model, user studies centered on data gathering must be conducted to determine if it is possible to uniquely classify a patient as being ‘healthy’, ‘in risk of developing illness’ or ‘ill, with presence
of symptoms’ at a given time. Such studies are being prepared and will be conducted in near future.

Acknowledgements
This paper was presented as an oral presentation at the 2010 International Society for Disease Surveillance Conference, held in Park City, UT, USA on 1–2 December 2010.

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ABSTRACT

Use of the National Poison Data System for surveillance of human health effects from the Deepwater Horizon Oil Spill

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Objective
The objective of this study was to describe how National Poison Data System (NPDS) was used for surveillance of human health effects associated with crude oil and dispersant exposures during the Deepwater Horizon Oil Spill.

Introduction
NPDS is the only source for national surveillance data regarding human exposures to hazardous substances and their health effects. It is a near real-time surveillance system operated by the American Association of Poison Control Centers (AAPCC) in cooperation with CDC’s National Center for Environmental Health. The system receives, analyzes, and displays data from 60 regional Poison Centers (PCs). On 20 April 2010, an explosion occurred on the Deepwater Horizon oil rig, causing oil to be continuously spilled into the Gulf of Mexico. In response, AAPCC created a code that was sent to all 60 PCs, allowing the centers to identify and properly code all calls associated with the oil spill at the local level. This enabled CDC to track all spill-related exposure and information calls.

Methods
Beginning 30 April, CDC used NPDS to monitor daily oil spill-associated calls (identified by querying the system using the oil spill code) for trend analysis. CDC also used NPDS to identify anomalies through automated analyses of callers’ self-reported clinical data, which include 131 pre-coded signs, symptoms, and laboratory abnormalities referred to as clinical effects (CEs). On 4 May, a CE definition was created for the Deepwater Horizon oil spill to identify statistically significant increases in the volume of CEs for the four affected Gulf States (Alabama, Florida, Louisiana, and Mississippi). This CE definition automatically monitored all 131 CEs for the Gulf States over a 24-h window and sent notifications when the observed number of calls for a CE exceeded the historical baseline plus two standard deviations. Anomalies triggered by the CE definition were then reviewed to determine whether they were related to the oil spill, meaning that at least one call was related to the oil spill. We use descriptive statistics to summarize the findings.

Results
From 30 April to 31 July, NPDS identified 1675 calls in total with the oil spill code, 1028 of which were identified as calls reporting a potential exposure. The top 10 reported health effects included headache (247), nausea (165), coughing and choking (114), shortness of breath (109), throat irritation (108), vomiting (86), dermal irritation and pain (74), dizziness (60), diarrhea (52), and rash (40). Oil spill calls peaked for all four Gulf States during the week of 20 June to 26 June, after which there was a steady decline in calls. The percent of calls by state were Alabama (24.5%), Louisiana (24.0%), Mississippi (22.2%), and Florida (21.5%).

From 4 May to 31 July, NPDS identified 88 CE anomalies within the Gulf States. Of these 88, 44 (50%) were determined to be related to the oil spill. The most common of these was headache, which triggered the CE definition 16 times (36%).

Aggregate NPDS data were reported to CDC’s Emergency Operations Center and state-specific NPDS case line lists were reported to state PH officials on a daily basis. Monitoring and trend analysis associated with the oil spill is still ongoing.

Conclusions
Summary analyses of oil spill data from NPDS were shared with federal, state, and/or local PH officials to improve situational awareness and inform decision making for interventions as necessary. Collaboration between PH and PC staff was crucial for surveillance success. During the response to the Deepwater Horizon oil spill, NPDS demonstrated utility for conducting near real-time human health effects surveillance associated with a known public health emergency affecting four states.

Acknowledgements
This paper was presented as an oral presentation at the 2010 International Society for Disease Surveillance Conference, held in Park City, UT, USA on 1–2 December 2010.
ABSTRACT

Adapting a syndromic biosurveillance system to monitor veterans’ health impact associated with the gulf coast oil spill

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Objective
To describe a surveillance system created to identify acute health issues potentially associated with the Deepwater Horizon oil spill among Veterans in the Gulf of Mexico coastal region.

Introduction
On 20 April 2010, an explosion on an offshore drilling rig in the Gulf of Mexico led to a prolonged uncontrolled release of crude oil. Both clean-up workers and coastal residents were potentially at high risk for respiratory and other acute health effects from exposure to crude oil and its derivatives, yet there was no surveillance system available to monitor these health effects. The Department of Veterans Affairs (VA) conducts routine surveillance for biological threats using the Electronic Surveillance System for Early Notification of Community Based Epidemics (ESSENCE).1 ESSENCE captures specific patient care visit ICD-nine codes belonging to selected conditions that could represent a biological threat. VA operates 153 medical centers and over 1000 free standing patient care facilities across the United States. We describe the adaptation of ESSENCE to allow surveillance of health conditions potentially related to the oil spill.

Methods
VA facilities in the immediate gulf coast region were identified. The ICD-nine codes resulting from patient visits to 34 VA coastal emergency departments and outpatient clinics along the Florida gulf coast and panhandle and coastal areas of Alabama, Mississippi, Louisiana and Texas were downloaded weekly from ESSENCE starting on MMWR week 32 (27 June–03 July). ICD-nine codes were grouped into five syndrome categories; respiratory (excluding asthma), asthma, gastrointestinal, heat effects and neurological. Weekly visits counts for each of these syndromes were summarized in tables by state. The current frequency for each syndrome was compared with the frequency during the same week in 2009. Current measures that were significantly above modeling predictions for at least 1 day during the week were flagged as yellow (above 95% CI) or red (above 99% CI) alerts, respectively, for further investigation.

Results
To date, there has been one sustained significant increase in the frequency of asthma noted in coastal Texas. Sporadic, non-sustained, increases in respiratory, digestive and asthma syndromes have been identified in other geographic regions and are being monitored (Table 1).

Conclusions
Monitoring acute health effects potentially associated with the Gulf oil spill is critical to provide an understanding of the
impact of the spill and improving the ability of the VA to care for those residing and/or working in the gulf coast area. VA has adapted ESSENCE to perform surveillance for medical syndromes to provide an early warning for acute health effects potentially associated with the spill. The ESSENCE modifications were rapidly developed and implemented using existing resources. The modified system is able to provide real-time indication of the health impact because of either natural or man-made environmental crises.

Acknowledgements
This paper was presented as a poster at the 2010 International Society for Disease Surveillance Conference, held in Park City, UT, USA, on 1–2 December 2010.

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ABSTRACT

Anticipatory surveillance for mass gatherings: a novel application of mass media surveillance

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Objective
To present the value of early media-based surveillance for infectious disease outbreaks during mass gatherings, and enable participants and organizers to anticipate public health threats.

Introduction
Public health and medical research on mass gatherings (MGs) are emerging disciplines. MGs present surveillance challenges quite different from routine outbreak monitoring, including prompt detection of outbreaks of an unusual disease. Lack of familiarity with a disease can result in a diagnostic delay; that delay can be reduced or eliminated if potential threats are identified in advance and staff is then trained in those areas. Anticipatory surveillance focuses on disease threats in the countries of origin of MG participants. Surveillance of infectious disease (ID) reports in mass media for those locations allows for adequate preparation of local staff in advance of the MG. In this study, we present a novel approach to ID surveillance for MGs: anticipatory surveillance of mass media to provide early reconnaissance information.

Methods
First, we identify the geographic focus and scope of symptomology for the surveillance system. The ideal anticipatory surveillance system monitors for both diseases and symptoms in all countries of origin of visitors to the MG, preferably well in advance. These locations may be identified through study of historic air travel patterns or travel visa distribution. Local media sources are likely to report early signs of an outbreak and therefore are a critical component of the system. Disease inclusion criteria may be on the basis of virulence, R₀ value, herd immunity, or diversity of serotype distribution. For a novel disease, mass media keywords searches based solely on disease names will miss a potential threat; broad search terms must also be included (for example, ‘sick’ or ‘ill’).

Traditional mass media surveillance systems like HealthMap may examine tens of thousands of internet addresses hourly. Those systems must maintain a high level of specificity to avoid a flood of irrelevant material. For an anticipatory surveillance system, geographic restriction reduces the number of sources examined. After constructing the catalog of media, a multi-step automated search process with lower specificity ultimately achieves greater sensitivity than large-scale mass media surveillance.

Finally, human review of the data set flags potentially important articles.

Results
We have created anticipatory surveillance systems for two MGs: the 2010 Winter Olympics in Vancouver¹ and the 2010 FIFA World Cup in South Africa. We created internet accessible maps displaying potentially important public health alerts from the selected geographic focus (Figure 1). Through inclusion of context important information on the maps (for example stadium locations or high volume countries), these maps provide public health and medical specialists timely, context-rich surveillance intelligence that is normally inaccessible to them.

These anticipatory surveillance systems identified the danger of measles in Oceania before the Winter Olympics;
British Colombia experienced a subsequent measles outbreak of the same variant.

**Conclusions**  
Anticipatory surveillance is a logical extension of research in MGs. High volume, automated internet search technology supports a level of surveillance inconceivable at the start of MG studies. Geographic restriction of sources allows for an expanded dictionary of disease related keywords. Multi-step review, both automated and human, improves both sensitivity and specificity of the system.

**Acknowledgements**  
This paper was presented as an oral presentation at the 2010 International Society for Disease Surveillance Conference, held in Park City, UT, USA on 1–2 December 2010.

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ABSTRACT

Enhancement of ESSENCE-based chemical surveillance by incorporation of real-time poison information center data

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Introduction

Florida Department of Health (FDOH) has developed a statewide syndromic surveillance system based on the Electronic Surveillance System for the Early Notification of Community-based Epidemics (ESSENCE). Authorized users can currently access data from the Florida Poison Information Center Network (FPICN), Emergency Room chief complaints (ED), Florida reportable disease system (Merlin) and the Florida death records through ESSENCE under one portal. The purpose of this paper is to summarize efforts to enhance statewide real-time chemical surveillance by incorporating FPICN data into ESSENCE.

Methods

FDOH began by selecting elements from FPICN data fields needed for chemical surveillance. Chemical substances were reviewed and prioritized for real-time monitoring. Case definitions for priority substances/syndromes were created using combinations of clinical effects and laboratory diagnosis. The interim system was tested and released to Florida county health department users on March 2009. Surveillance standards were developed for reportable and non-reportable chemical exposure-related illnesses. The ESSENCE system was upgraded with the implementation of new syndrome categories, as well as advanced query and analytical functions on August 2010. All users are required to complete 3 h of online training before gaining access to FPICN data through ESSENCE.

Results

Priority chemicals are currently monitored through FPICN on a daily basis and results are compared with other data sets in ESSENCE. FDOH monitors about 50 chemical agents in near-real time including carbon monoxide, pesticides, arsenic, mercury, aquatic toxins and food-borne illness. Exposure calls with acute health effects are also monitored in addition to chemical substances. Poison control data have been actively monitored during the Deep Water Horizon event as a key surveillance component. Currently, there are more than 85 users in 31 Florida counties with training and access to FPICN data through ESSENCE.

Challenges addressed during system development included data field selection and mapping between systems, case definition and syndrome alignment, initiation and maintenance of consistent data uploads to ESSENCE and assurance of accurate data transcription between the two systems. Incorporation of the poison center data component into ESSENCE has resulted in a more integrated working relationship between FDOH and FPICN. Both parties worked to address data and quality control issues.

Conclusions

The use of poison center data offers unique opportunities over conventional data sets used for surveillance providing data in real time from a non-hospital source. FPICN data along with ED data was extensively used to identify clusters of carbon monoxide and pesticide poisoning during year 2009–10. Additionally, FPICN data have been used to monitor national emergencies like the H1N1 flu outbreak and the Deep Water Horizon event.

Limitations include non-alignment of substance categories in the disparate systems and differences in definitions of exposure and illness, which limits the ability to determine true exposures from non-exposures and true illness from non-illness, based solely on FPICN call data. The collaboration between FDOH and FPICN provided an opportunity to successfully bridge the differing terminologies and ideologies embedded in each system. ESSENCE-PIC provides an epide-
miological interface to the FPICN data with flexibility to compare results among different data sources. Analysis of near-real-time FPICN data provides situational awareness of chemical-related illnesses by rapidly identifying potential clusters of poisoning or injury and allows public health officials to prevent additional morbidity or mortality from occurring in Florida. Florida’s experience with real-time electronic surveillance demonstrates that ESSENCE-PIC will help identify seasonal variation and occurrence of unusual chemical events.

Acknowledgements

This paper was presented as a poster at the 2010 International Society for Disease Surveillance Conference, held in Park City, UT, USA on 1–2 December 2010.
Utilization of Florida poison control data and Emergency Department chief complaint data to identify clusters of carbon monoxide poisoning

P Mulay, S Watkins, and C Blackmore

ABSTRACT

Utilization of Florida poison control data and Emergency Department chief complaint data to identify clusters of carbon monoxide poisoning

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Introduction
The Florida Department of Health (FDOH) previously monitored Florida Poison Information Center (FPICN) data for timely detection of increases in carbon monoxide (CO) exposures before, during, and after hurricanes. Recent analyses have noted that CO poisonings have also increased with generator use and improper heating of homes during cold winter months in Florida. Similarly, increases in CO poisoning cases related to motor vehicles have been observed during summer months. CO is an odorless, colorless, poisonous gas causing sudden illness and death, if present in sufficient concentration in ambient air. The most common signs and symptoms include headache, nausea, lethargy/fatigue, weakness, abdominal discomfort/pain, confusion, and dizziness. This presentation summarizes Florida’s experience in identifying CO poisoning clusters using ESSENCE-based syndromic surveillance.

Methods
The ESSENCE-based syndromic surveillance system provides access to data from the FPICN, Emergency Department (ED) chief complaints and the FDOH reportable disease surveillance system (Merlin). ESSENCE was monitored for CO exposures during September 2009 through to August 2010, and all identified CO clusters were followed up and investigated. A cluster was defined as any two or more related cases of CO exposure. All CO cases matching the current case definition for CO poisoning were identified and entered into the FDOH disease reportable system, Merlin. Case ascertainment from these various sources was compared.

Results
The total number of CO clusters identified through ESSENCE-ED and FPICN data before investigation were 34 (88 reports of CO poisoning) and 19 (52 reports of CO poisoning), respectively. A total of 13 clusters were identified by both the sources (total reports of CO poisoning: ED-35 and FPICN-46). Most of the clusters (ESSENCE-ED-15, FPICN-12, and both-2) identified through ED and FPICN data did not contain cases that matched the Florida case definition for CO poisoning and were therefore not counted as cases or confirmed clusters. About 11 clusters reported by ED and FPICN data (ED-4, FPICN-5, and both-2) did not have sufficient patient information for follow-up and were not confirmed.

Among all the reports that contained confirmed cases after investigations, 156 cases (confirmed-118, probable-16, and suspected-22) were reported from 1 September 2009 to 31 October 2010 in Florida. A total of 114 cases (confirmed-86, probable-13, and suspected-15) were associated with 34 different clusters. In all, 42 reported cases were not associated with cluster. Among all the confirmed clusters, ESSENCE-ED data have identified 15 clusters (61 cases), FPICN identified 2 clusters (6 cases), and 9 clusters (29 cases) were identified through both the sources. The remaining 8 clusters (18 cases) were identified by other sources such as hospitals (3), medical examiners’ office (2), and a call from citizen/Media (3).

Conclusions
Additional data sources such as FPICN and ED chief complaint data are very efficient in detecting reportable conditions like CO poisoning. Three out of four recent clusters were detected using ESSENCE. Timely investigation and reporting of CO poisoning can be ensured by early notification to the local CHDs.

Acknowledgements
This paper was presented as an oral presentation at the 2010 International Society for Disease Surveillance Conference, held in Park City, UT, USA on 1–2 December 2010.
ABSTRACT

Application of biosurveillance methodology to the 2010 Asian foot-and-mouth disease outbreaks

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Objective

Our objective is to demonstrate how biosurveillance, using direct and indirect indications and warning (I&W) of disease within vernacular internet news media, provides early warning and situational awareness for infectious animal diseases that have the potential for trade and economic implications in addition to detecting social disruption.1,2 Tracking of I&W during the 2010 Japan foot-and-mouth disease (FMD) epidemic and outbreaks in other Asian countries was selected to illustrate this methodology.

Introduction

Argus is an event-based, multi-lingual, biosurveillance system, which captures and analyzes information from publicly available internet media. Argus produces reports that summarize and contextualize direct, indirect, and enviroclimatic I&W of human, animal, and plant disease events, and makes these reports available to the system’s users. Early warning of highly infectious animal diseases, like FMD, is critical for the enactment of containment and/or prevention measures aiming to curb disease spread and reduce the potential for devastating trade and economic implications.1–3

Methods

Argus reports meeting the inclusion criteria identified below were retrieved from the Argus archive: (1) Disease Entities: FMD and undiagnosed animal disease (2) Location: Japan (3) Time Period: January–August 2010. The reports were reviewed for relevant I&W of FMD, with the goal of identifying factors that contributed to disease spread. For geospatial visualization, the location was expanded, and Argus reports were used to create a map of FMD type O outbreaks in East Asian countries.

Results

After 10 years without incidence of FMD, suspected cases were reported in April 2010 among beef cattle in Miyazaki prefecture, Japan.4 Following the initial identification of cases, unusual events that were socially disruptive occurred, including the cancellation of local festivals, sporting events, and restrictions in public places. These events demonstrate an uncommon event where an animal disease affected the normal functioning of human society.

Despite the implementation of quarantine and prevention measures, disease spread rapidly within the prefecture and Japanese officials theorized that among other factors, delays in early detection greatly contributed to this outcome. In May, Japan implemented its first ever FMD vaccination campaign, suspending its ability to engage in agricultural trade with the U.S. and other countries in accordance with the World Animal Health Organization (OIE) Terrestrial Animal Health Code; on 28 May 2010, the United States Department of Agriculture placed import restrictions on beef from Japan.4,5 With the outbreak reportedly coming to a close, Miyazaki prefecture is estimated to have suffered nearly USD$583–699 million in damages and must endure the disease’s stigma.3–5

By July, 2010, suspected or confirmed FMD type O outbreaks were reported in at least six East Asian countries: Japan, China, South Korea, North Korea, Taiwan, and Hong Kong, and affected additional animal species, especially swine.4,5 Causal links among these outbreaks is not confirmed.

Conclusions

Socially disruptive events found in publicly available media suggest that there were I&W of the 2010 Japan FMD type O outbreak. Attention to such I&W in the future may enable more attuned surveillance for early warning of outbreaks. Further, identifying patterns in I&W between the East Asian outbreaks will aid in regional situational awareness to FMD events.

Acknowledgements

This paper was presented as an oral presentation at the 2010 International Society for Disease Surveillance Conference, held in Park City, UT, USA on 1–2 December 2010.

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ABSTRACT

Increased emergency department presentations for head trauma following media coverage of a fatal epidural hematoma

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Objective

This study describes an increase in head trauma-related visits to emergency departments (ED) in New York City, New York; Boston, Massachusetts; Duval County, Florida; and Seattle, Washington following the widespread media coverage of actress Natasha Richardson’s head injury and subsequent fatal epidural hematoma.

Introduction

Previous reports have demonstrated the media’s influence on ED visits in situations such as dramatized acetaminophen overdose, media report of celebrity suicides, television public announcements for early stroke care and cardiac visits following President Clinton’s heart surgery. No previous study has demonstrated the influence of media-publicized trauma on ED visits. On 16 March 2009, the actress Natasha Richardson suffered a traumatic brain injury leading to her death on 18 March; these events were widely publicized by national news sources. The health departments of New York City, Boston, Duval County and Seattle monitor ED visits daily, and capture 95, 100, 100 and 95% of all ED visits, respectively. The data collected include basic demographic information, chief complaint and in some cases ICD-9 diagnosis codes.

Methods

Each health department independently reviewed their ED visit data from January 2008 (when possible) through August 2010 for head injury-related visits. The head injury syndrome consisted of any visit with a chief complaint of ‘head trauma,’ ‘head injury,’ ‘struck head,’ or ‘hit head,’ or an ICD-9 code of 959.01 (injury to head). Visits meeting the syndrome criteria were compared by week and age. The data were analyzed across all sites by week of visit and age group.

Results

The figure below shows the weekly plot of total ED visits for head trauma 2008–2010; NYC, Duval County, Seattle.

Conclusions

Following this event, a significant increase in ED visits for head trauma was noted in the four sites participating in this study. This surge of presentations for head trauma was most pronounced in pediatric patients, despite the event being the death of an adult, possibly reflecting heightened concern over head-related injuries by parents. EDs should prepare for a surge in visits following news media reports of head trauma, particularly among pediatric populations. While increased awareness of trauma is important to public health,
this may need to be balanced with community education about need for emergent hospital-based evaluation. Further studies are needed to see if any increased pathology is found following similar events.

Acknowledgements
This paper was presented as an oral presentation at the 2010, International Society for Disease Surveillance Conference, held in Park City, UT, USA, on 1–2 December 2010.
ABSTRACT

Predicting extreme asthma events in London using quantile regression models

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Objective
This paper describes a framework for creating a time series data set with daily asthma admissions, weather and air quality factors; and then generating suitable lags for predictive multivariate quantile regression models (QRMs). It also demonstrates the use of root mean square error (RMSE) and receiver operating characteristic (ROC) error measures in selecting suitable predictive models.

Introduction
The burden of asthma is a major public health issue, and of a wider interest particularly to public health practitioners, health care providers and policy makers, as well as researchers. The literature on forecasting of adverse respiratory health events like asthma attacks is limited. It is an unclear field; and there is a need for more research on the forecasting of the demand for hospital respiratory services.

Methods
Asthma hospital admissions from the hospital episode statistics (HES) database in the UK, weather and air quality measures obtained via the UK Met Office databases were used in the analysis (2005–2006). The key variables in the data were examined for their distribution and properties. Suitable time series lags were generated and converted into non-time series for bivariate quantile regression analysis. Multivariate QRMs were developed to predict extreme asthma events defined as > the 90th percentile. RMSE and ROC curves were used to compare error measures of each predictive model.

Results
All the potential predictors were independently significant with asthma daily admissions (P<0.01), however most proved to be insignificant in multivariate analysis when controlling for the other factors. Three significant predictive models were constructed: Model-I involved an 18-day lag barometric vapour pressure and a 3-day lag Nitrogen dioxide. Model-II included barometric pressure (18-day lag), Nitrogen dioxide (3-day lag) and air temperature (21-day lag), and then Model-III had barometric pressure (18-day lag), Nitrogen dioxide (3-day lag), air temperature (21-day lag), humidity (4-day lag) and formaldehyde (3-day lag). But for humidity and formaldehyde concentrations, all the variables were at least statistically significant at P<0.01 (see Table 1). Model-II had better predictive values for both normal and extreme asthma events compared with the other two

| Table 1 | QRM predictions of extreme (>90th percentile) asthma events in London |
|---------|-------------------|---|---|---|---|---|
| Asthma predictive models |  | I |  | II |  | III |  |
|  | s.e. | Coef* |  | s.e. | Coef* |  | s.e. | Coef* |
| Barometric pressure HPa (18-day lag) | −0.18 | 2.00*** |  | −0.3 | 1.44*** |  | −0.24 | 0.85*** |
| Nitrogen dioxide (3-day lag) | −7.20e+07 | 1.8e+08* |  | −7.50e+07 | 4.4e+08*** |  | −8.90e+07 | 2.9e+08** |
| Air temperature °C (21-day lag) | −0.18 | −0.84*** |  | −0.16 | −1.11*** |  | −0.05 | −0.04 |
| Humidity % (4-day lag) |  |  |  |  |  |  |  |  |
| Formaldehyde (3-day lag) |  |  |  |  |  |  |  |  |
| Specification test: (Linktest) hat sq P-value | 0.155 | 0.922 |  | 0.136 |  |

*Expected change in log count for a one-unit increase in variable and degree of significance: *P<0.1, **P<0.01, ***P<0.001; kgm⁻³; standard error (s.e.).
models, and again had lower error measures compared with Model-I and Model-III.

**Conclusions**

Asthma daily admissions can be predicted from a combination of weather and air quality indicators including average daily measures of barometric pressure, Nitrogen dioxide, air temperature, humidity, and formaldehyde using QRMs. Barometric pressure, nitrogen dioxide, and air temperature were the best predictors of asthma daily admissions.

**Acknowledgements**

This paper was presented as an oral presentation at the 2010 International Society for Disease Surveillance Conference, held in Park City, UT, USA, on 1–2 December 2010.
ABSTRACT

Evaluation of a post earthquake internally displaced persons surveillance system (IDPSS)—Haiti, 2010

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Objective
We evaluated internally displaced persons surveillance system (IDPSS) to determine its suitability for use during a complex humanitarian emergency.

Introduction
On January 12, 2010, a magnitude 7.0 earthquake struck Haiti, killing >230,000 persons and placing an estimated 1.5 million into internally displaced persons (IDP) camps. IDPs are at increased risk for communicable diseases resulting from unhealthy living conditions. The Haitian Ministry of Public Health and Population (MSPP) established the IDPSS to detect outbreaks and characterize disease trends within these camps.

IDPSS gathers data on IDPs seen in clinics run by non-governmental agencies (NGOs). Physician tally sheets are totaled and sent to the MSPP by E-mail or on paper for those without internet connection. Each Monday, analyses of surveillance data through the preceding week are distributed. Reports, guidelines, and forms are sent to MSPP partners and NGOs through the system’s Google group (Mountain View, CA, USA), an internet-based discussion forum.

Methods
We assessed the suitability of IDPSS by examining its simplicity, flexibility, acceptability, and timeliness because these criteria were considered the most relevant in an emergency context. We interviewed NGO surveillance managers and Centers for Disease Control and Prevention and MSPP staff, and analyzed IDPSS clinic report submission data for February 18 (date of inception)–April 22. We also reviewed materials available on the system’s Google group internet site (reporting forms, case definitions, guidelines, and weekly reports).

Results
IDPSS’ use of aggregate data, stratification into only two age groups, ages <5 and ≥5 years, and use of case definitions that allowed NGOs to make a reporting determination at the point of care, make the system simple. The flexibility of the system was demonstrated by a transition to a new reporting form, and changes in case definitions and reporting frequency (from daily to weekly) that were all implemented without an interruption of the system. Although IDPSS added work and a redundancy existed between it and the surveillance conducted by certain NGOs, NGO representatives reported that IDPSS was acceptable to them, even modifying their own surveillance systems to integrate better with IDPSS. However, completeness of report submission from NGOs was low and varied by site. Throughout February 18–April 9, a total of 78 clinics submitted at least one daily report. Among these, the median number of reports submitted per site was only three (range, 1–33). The most commonly stated reason for low report submission was the added work required. System managers reported an improvement with the switch to weekly reporting. This also had an effect on timeliness. During the daily reporting period, managers received reports within 1 day and the majority within 1 week. With the switch to weekly reporting, the majority of reports were received each week. However, after 2 months, reports were frequently submitted 2–3 weeks late.

Conclusions
IDPSS provided communicable disease surveillance in the IDP camps well suited for humanitarian emergencies, meeting an international standard of practice. It is timely enough to allow for rapid intervention and flexible enough to respond to the demands of a dynamic situation. Although it is a simple system, its workload diminishes its acceptability to NGOs. Using the Google group improved simplicity, acceptability, and timeliness by providing a common conduit for surveillance communication. Future surveillance systems for humanitarian emergencies should implement similar internet-based forums (for example, the IDPSS Google group) to facilitate communication. Surveillance
systems should take advantage of the NGOs’ internal surveillance to avoid duplication of effort; however, this requires standardization of surveillance procedures by the humanitarian community.

Acknowledgements
This paper was presented as a poster at the 2010 International Society for Disease Surveillance Conference, held in Park City, UT, USA on 1–2 December 2010.
ABSTRACT

Using chief complaint data to evaluate the effectiveness of a statewide smoking ban

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Objective
The objective of this study, after completion of the preliminary analysis, was to evaluate whether or not the smoke-free law in Ohio has made a positive change in reducing the effects of secondhand smoke exposure by comparing syndromic surveillance data (trends for emergency department, and urgent care chief complaint visits), related to heart attack and/or acute myocardial infarction (AMI) before and after the smoking ban.

Introduction
In November 2006, Ohioans supported a statute that set into law a requirement that all public places, and places of employment in Ohio prohibit smoking.1 The law took effect in December 2006; however, the rules for implementation were not finalized until June 2007. The primary purpose of the law was to protect employees in all workplaces from exposure to environmental tobacco smoke. When determining how best to evaluate the health impact of a smoke-free law as it relates to secondhand smoke exposure, most studies have reviewed the incidence of heart attacks or AMIs. In the 2006 Surgeon General’s Report, ‘The Health Consequences of Involuntary Exposure to Tobacco Smoke,’2 secondhand smoke exposure is causally associated with cardiovascular events, including AMI. The Institute of Medicine also released a report in 2009 from a meta-analysis, ‘Secondhand Smoke Exposure and Cardiovascular Effects: Making Sense of the Evidence,’3 of 11 epidemiologic studies, reviewing the incidence of acute coronary events following the passing of a smoke-free law. Each of the 11 studies showed a decrease in heart attack rates after implementation of smoke-free laws. The purpose of this study was to evaluate this relationship in Ohio.

Methods
Syndromic surveillance data from hospital emergency department and urgent care chief complaints were collected and analyzed from the state of Ohio’s EpiCenter system, for 2005–2010. Although these data types are pre-diagnostic in nature, they are more readily accessible than discharge data. Heart attack and AMI were defined rather specifically in the analysis (chief complaints must have included a reference to heart attack/pain/problems or AMI, and excluded common visits solely for cardiac conduction, or volume concerns, or general respiratory problems). These data were combined and analyzed as a total percentage of visits by month, using SAS v 9.2 (SAS Institute Inc., Cary, NC, USA). Data analyses were performed in 87 of Ohio’s 88 counties. Franklin County was excluded from analyses as Columbus, Ohio (located within this county) passed its own smoke-free ban before the state ban.

Results
Figure 1 below shows the trends of total percentage of emergency department and urgent care visits related to heart attack and AMI in all Ohio counties (excluding Franklin), 2005–2010, by month.

![Figure 1: Total Percentage of ED Visits Related to Heart Attack/AMI in All Ohio Counties (excluding Franklin), 2005–2010, by month.](image-url)
attack/AMI from 2005–2010 for all Ohio counties, excluding Franklin County. When comparing the means pre- and post-smoking ban, the data showed almost a 30% reduction in mean total percentage of visits for heart attack/AMI post-smoking ban.

Conclusions
On the basis of these results, the data suggest since the smoke-free law in Ohio has been passed, a reduction in the harmful effects of secondhand smoke exposure has also been observed by reducing heart attack and AMI, as defined by pre-diagnostic chief complaint data; however, no causal assumptions can be made. Additional analyses should be completed to further evaluate this relationship, and to control for age and gender of the patients. Further, collection of patient diagnosis from the healthcare facilities would provide strength in validating the observed results.

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This paper was presented as a poster at the 2010 International Society for Disease Surveillance Conference, held in Park City, UT, USA, on 1–2 December 2010.

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ABSTRACT

FluView interactive: using user-centered design and usability heuristics to improve visualization of influenza information

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Objective
The objective of this study is to report on the use of User-Centered Design and Usability Heuristics to improve visualization of influenza-related information at the national level. The intention of the prototype is to make data more accessible to different stakeholders including the general public, public health officials at the local and state level, and other experts.

Introduction
Given the periodic nature of influenza activity, it is important to develop visualization tools that enable enhanced decision-making. User-Centered Design is a set of software development methodologies that primarily employ user needs to develop applications. Similarly, Usability Heuristics provide a set of rules that increase the performance of user interfaces, and ease of use. We combined some of these techniques to develop FluView Interactive, a prototype that will enable users to better understand influenza information.

Methods
Our goal was to improve the visualization of nationally reported data about influenza. In particular, we intended to enhance the accessibility of information presented in FluView. FluView is one of the websites maintained by CDC, and it presents information collected by different reporting entities across the United States. First, we identified the need to present data interactively, given the particular needs of different stakeholders. Given the information already available, we conducted interviews with the staff members supporting influenza-like illness surveillance network. From these interviews, we elaborated a Paper prototype for testing (Figures 1 and 2). This prototype was tested with a user who had experience working at local public health department. The development team analyzed the subject feedback, and made modifications to the prototype that addressed the user needs. After these changes, one of the developers evaluated the application using Nielsen’s Heuristics and suggested further modifications that improve usability.

Results
During paper testing, the user was able to identify the level of influenza activity. However, certain quality measures were not clear. In addition, comparing information between seasons was not easily achieved. After modifications, we conducted another evaluation using Usability Heuristics. This led to the inclusion of seasonal information for enabling immediate assessment and evaluation of trends. We included buttons to allow seasonal comparison.

Conclusions
Our prototype experienced various changes, given the different methodologies used. These methodologies allowed us to rapidly create an application while improving information access and reducing development costs.

Acknowledgements
This paper was presented as a poster at the 2010 International Society for Disease Surveillance Conference, held in Park City, UT, USA, on 1–2 December 2010. We thank the Center for Disease Control and Prevention’s GRASP team, James Jellison, Kang Sang and Venkata Vundi for their technical assistance.

Disclaimer
The findings and conclusions in this report are those of the authors and do not necessarily represent the views of the Centers for Disease Control and Prevention.
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ABSTRACT

Challenges of introducing disease surveillance technology in developing countries: experiences from India and Sri Lanka

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Objective
We review challenges faced during the initial period of implementation of a Real-Time Biosurveillance Program (RTBP) in developing countries.

Introduction
Modern information and communication technologies have increasingly prominent roles in health care systems. To capitalize on attainable benefits, it is essential to thoroughly and purposefully weave them into the existing business processes. The challenges of doing so can be exacerbated by specific local circumstances of developing countries. We share our experiences from fielding a system designed to support real-time collection and analysis of public health data in rural areas of Sri Lanka and India. Its strong transformational potential has been proven, however, success of the ultimate field use requires overcoming multiple organizational and utility challenges.

Methods
RTBP comprises of three functional modules: data collection, event detection and analysis, and alerting.1 Data collection relies on a mobile phone application mHealthsurvey to transfer paper records of outpatient visits to a central database. Data are then analyzed using T-Cube Web Interface (TCWI) – a web browser-based tool for event detection and interactive statistical analysis and visualization. Alerts raised using TCWI are disseminated through the Sahana Alerting Broker to designated responders and health officials via SMS, Email, and Web postings. RTBP business process involves data collection personnel, analysts, and responders. Technology must be tailored to match the capabilities of human resources and fit within limitations of available infrastructure.

Results and conclusion
Health officials were initially exposed to a generic version of TCWI. It provided a wide range of richly parameterized analytic algorithms to interactively process daily loads of data. The RTBP team was quick to realize that health officials in India and Sri Lanka had limited hands-on experience with advanced statistical analyses, despite having learned advanced statistics as part of their curricula. On the other hand, the primary duty of an epidemiologist is to monitor a set of routine hypotheses involving escalating fever diseases, communicable diseases, and unusual clusters of patients reporting with common symptoms. The subsequent revision of TCWI featured a vastly simplified and hence less intimidating user interface. It included one-button invocation of the results of routine surveillance using massive screening and pivot tables functions. This automated process presents the epidemiologist with a daily ranked list of possible disease outbreaks and simple means of interactive evaluation of findings to decide whether any required response or mitigation actions.

Health officials have been comfortable with the pre-existing paper-based disease notification process. It is limited to monitoring, reporting, and responding to some 25 notifiable disease cases, so the comprehensiveness of RTBP imposed a change of the mindset of its users. Initially, it was not easy to sell them on the importance of syndromic surveillance. But, doctors in developing countries examine about 100 patients a day and even experienced physicians cannot fully diagnose more than 20% of their patients. The rest receives uncertain preliminary diagnoses. As unlike the original system RTBP can record syndromes, it can identify escalating clusters of disease despite the limited accuracy of diagnostic data.

Another issue affecting reliability of event detection was the ability of health workers to submit accurate data. Initially, we saw multiple instances of systematic data entry errors such as entering a lexically close but incorrect disease name (whooping cough for worm infestation), misrepresenting health events (reporting toxoid vaccinations as cases of...
typhoid), and the actual patient visitation date, or delays in data submission combined with errors in case date stamps.

Successful deployment of a sophisticated system like RTBP in a developing country requires a top-down-bottom-up, iterative, use-case-oriented approach. Close collaboration between developers, implementers, and users, and extensive field testing allow identifying challenges, overcoming them, and achieving practical solutions. RTBP is currently used in the field benefiting vulnerable populations in pilot regions of India and Sri Lanka.

Acknowledgements
This paper was presented as an oral presentation at the 2010 International Society for Disease Surveillance Conference, held in Park City, UT, USA, on 1–2 December 2010. Work supported in part by the International Development Research Centre of Canada (Award 105130) and by National Science Foundation (Grant 0911032).

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