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## Contents

# Roles of Health Literacy in Relation to Social Determinants of Health and Recommendations for Informatics-Based Interventions: Systematic Review

## Abstract

**Objective** To extend an open source analytics and visualization platform for measuring the quality of electronic health data transmitted to syndromic surveillance systems. **Introduction** Effective clinical and public health practice in the twenty-first century requires access to data from an increasing array of information systems. However, the quality of data in these systems can be poor or “unfit for use.” Therefore measuring and monitoring data quality is an essential activity for clinical and public health professionals as well as researchers<sup>1</sup>. Current methods for examining data quality largely rely on manual queries and processes conducted by epidemiologists. Better, automated tools for examining data quality are desired by the surveillance community. **Methods** Using the existing, open-source platform Atlas developed by the Observational Health Data Sciences and Informatics collaborative (OHDSI; [www.ohdsi.org](http://www.ohdsi.org)), we added new functionality to measure and visualize the quality of data electronically reported from disparate information systems. Our extensions focused on analysis of data reported electronically to public health agencies for disease surveillance. Specifically, we created methods for examining the completeness and timeliness of data reported as well as the information entropy of the data within syndromic surveillance messages sent from emergency department information systems. **Results** To date we transformed 111 million syndromic surveillance message segments pertaining to 16.4 million emergency department encounters representing 6 million patients into the OHDSI common data model. We further measured completeness, timeliness and entropy of the syndromic surveillance data. In Figure-1, the OHDSI tool Atlas summarizes the analysis of data completeness for key fields in over one million syndromic surveillance messages sent to Indiana’s health department in 2014. Completeness is reported by age category (e.g., 0-10, 20-30, 60+). Gender is generally complete, but both race and ethnicity fields are often complete for less than half of the patients in the cohort. These results suggest areas for improvement with respect to data quality that could be actionable by the syndromic surveillance coordinator at the state health department. **Conclusions** Our project remains a work-in-progress. While functions that assess completeness, timeliness and entropy are complete, there may be other functions important to public health that need to be developed. We are currently soliciting feedback from syndromic surveillance stakeholders to gather ideas for what other functions would be useful to epidemiologists. Suggestions could be developed into functions over the next year. We are further working with the OHDSI collaborative to distribute the Atlas enhancements to other platforms, including the National Syndromic Surveillance Platform (NSSP). Our goal is to enable epidemiologists to quickly analyze data quality at scale. **References** 1. Dixon BE, Rosenman M, Xia Y, Grannis SJ. A vision for the systematic monitoring and improvement of the quality of electronic health data. *Studies in health technology and informatics*. 2013;192:884-8.

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# Roles of Health Literacy in Relation to Social Determinants of Health and Recommendations for Informatics-Based Interventions: Systematic Review

## Abstract

**Objective** To describe the implementation process, successes, challenges, and lessons learned of the application of tablet for data collection and data system in HIV sentinel surveillance in Vietnam. **Introduction** Vietnam has routinely monitored HIV sero-prevalence among key populations through its HIV sentinel surveillance system (HSS). In 2010, this system was updated to include a behavioral component (HSS+) among people who inject drugs, female sex workers, and men who have sex with men. HSS+ has historically used a paper-based questionnaire for data collection(1). At the end of the survey, provincial data were manually entered into computers using EpiData Entry forms (<http://www.epidata.dk/>) and submitted to the Vietnam Authority of HIV/AIDS Control (VAAC). As a result, feedback to provinces on data issues was not provided until after fieldwork completion. One recent survey used tablets for data collection and found that it saved time, required fewer staff, and reduced costs compared to paper-based data collection(2). In 2017, Vietnam introduced tablet for behavioral data collection in HSS+ to improve data quality, resource saving, and to provide more timely access to data. **Methods** Development of data entry forms and data system Survey data entry forms were designed using free Epi Info™ software for mobile devices(3) and installed on tablets. A SQL database was established via SFPT data transfer to the current database in VAAC's server. Field data were instantly synced to the national database when the internet signal was available (Picture 1). Real-time data analysis was granted to surveillance staff at all levels using authorized access to the database via Epi Info™ Cloud Data Analytics (ECDA), dashboards were used to track progress and data quality (Figure 1). HSS+ data were frequently reviewed by the National Surveillance Technical Working Group (NSTWG) and timely feedback was provided. **Deployment** Manuals and e-learning materials were developed. The NSTWG conducted a pilot to test the forms and data flow from field to the national database before installed into all tablets. Four to seven tablets were distributed to each province depending on number of HSS+ sites and populations. Surveillance staff at Provincial AIDS Centers (PACs) were trained by the NSTWG on how to use the tablet to interview, check, update, save data, and sync data to cloud and to the national database, and to backup the provincial dataset. They then provided trainings to their local field staff. The NSTWG provided technical assistance and troubleshooting through field visits and online support to help local staff address issues regarding tablet use in addition to other HSS/HSS+ issues. **Results** Currently, 18 HSS+ provinces have implemented the 2017 HSS+. Of these, nine provinces applied tablets exclusively. Two provinces used tablets, but also used paper-based questionnaires when not enough tablets were available. Seven Global Fund supported provinces used the paper-based questionnaires and entered data into tablets after interview completion due to copies of completed paper-based questionnaires are required by these provincial project management units (PMU) for fund re-imburement. Additional updates were required after the first few days, which created issues around updating forms once revised forms were sent out by NSTWG. Another challenge was that local staff were not familiar with using tablets at the beginning. Also frequent complaints were mainly on data entry and synchronization regarding participant identity code or a record could not be synced. The NSTWG and PAC staff were able to monitor the HSS+ progress and provided feedback daily. Most commonly, feedbacks were provided on participant codings and site names. Using the tablet did not require staff, time or money for data entry and eliminated data entry errors. In general, staff preferred to use this data collection mode. **Conclusions** This mobile device application for data collection in routine HSS+ in Vietnam is feasible and accepted. However, harmonization and coordination from the central Global Fund PMU and provincial PMU will be required to successfully roll-out this system in all HSS+ provinces. This application in addition to ECDA help to improve data quality, due to timeliness of the data, is cost saving and reduces workload. Most importantly, better quality and timely data will facilitate preparation for timely local planning and response. **References** 1. Thanh DC et al. Brief behavioural surveys in routine HIV sentinel surveillance: a new tool for monitoring the HIV epidemic in Vietnam. *Western Pacific Surveillance and Response Journal*. Vol 6, No. 1/2015 2. National Institute of Hygiene and Epidemiology. HIV/STI Integrated Biological and Behavioural Surveillance in Vietnam. Hanoi, 2014. 3. <https://www.cdc.gov/epiinfo/mobile.html>

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# Roles of Health Literacy in Relation to Social Determinants of Health and Recommendations for Informatics-Based Interventions: Systematic Review

## Abstract

**Objective** The aims of this project were 1) to assess the validity of a surveillance case definition for identifying heroin overdoses (HOD) in a NEMESIS 3-compliant, state ambulance reporting system; and 2) to develop an approach that can be applied to assess the validity of case definitions for other types of drug overdose events in similar data state data systems. **Introduction** In 2016, the Centers for Disease Control and Prevention funded 12 states, under the Enhanced State Opioid Overdose Surveillance (ESOOS) program, to utilize state Emergency Medical Services (EMS) and emergency department (ED) syndromic surveillance (SyS) data systems to increase timeliness of state data on drug overdoses. A key aspect of the ESOOS program is the development and validation of case definitions for drug overdoses for EMS and ED SyS data systems. Kentucky's ESOOS team conducted a pilot validation study of a candidate EMS case definition for HOD, using data from the Kentucky State Ambulance Reporting System (KStARS). We examined internal, face validity of the EMS HOD case definition by reviewing pertinent information captured in KStARS data elements; and we examined external agreement with HOD cases identified Kentucky's statewide hospital billing database. **Methods** From KStARS, we extracted EMS emergent transports by any ambulance service to hospitals in a single, large health care system in Kentucky. We included responses with dispatch dates between January 1, 2017 and March 31, 2017. From Kentucky's statewide hospital claims data system, we extracted inpatient discharges, ED visits and observational stays at the destination hospitals, with admit dates in the same range. We classified EMS cases as HOD based on specific combinations of the following criteria for EMS data elements: primary or secondary provider impression of heroin poisoning (T40.1X4), heroin-related keywords in the patient care narrative or chief complaint, and patient's response to naloxone as indicated in the medications list<sup>1</sup>. We used standard drug overdose case definitions for ICD-10-CM-coded hospital billing data<sup>2</sup> to classify hospital records from the destination facilities to the same categories. We produced descriptive analyses of the heroin overdose cases detected in both data sources, EMS and hospital. To assess the degree of overlap in the HOD cases identified by the two data systems, we matched the identified EMS HOD cases against the entire set of UKHC hospital cases. Finally, we assessed the validity of the classification of EMS cases as heroin overdoses by reviewing the EMS patient care narratives and related EMS data elements, as well as the ICD-10-CM hospital diagnostic codes for cases that matched to a hospital record. **Results** We identified 5,517 emergent EMS transports to the destination hospitals in the first quarter of 2017. Of these, 94 (17/1,000) were identified by our case definition as a HOD. We identified 29,631 unduplicated, emergent encounters at the destination hospitals (including inpatient discharges, ED visits, and observational stays; and excluding elective and newborn encounters). Of these, 105 (3.5/1,000) included a diagnostic code for HOD. Linkage of EMS and hospital cases indicated that 141 unique HOD cases were identified in the two files combined. Of these, 58 (41%) were identified as HOD in both systems. 23 HOD cases identified in EMS were matched to a hospital record that had no mention of a HOD; and 13 could not be matched to a hospital record. Additionally, 47 HOD cases identified in the destination hospitals were not matched to an EMS transport to those destination facilities. Overall, 76 out of the 94 (81%) EMS cases identified as heroin overdoses were judged likely to be true heroin overdoses, as indicated by either 1) positive response to naloxone and patient admission of recent heroin use, or 2) hospital diagnosis of heroin overdose, or both. For 2% of identified cases, there was evidence of a false positive finding. The remaining 17% of identified heroin cases were inconclusive: there was information suggestive of opioid overdose, but no clear evidence to suggest, nor to rule out, that the opioid was heroin. Generally, inconclusive cases were identified as heroin overdoses due to positive response to naloxone, combined with mention of the word "heroin" in the narrative that did not indicate an HOD. Examples of the latter include negations (patient denies heroin use) or a bystander who stated that the patient had a history of heroin use. **Conclusions** We assessed the performance of a straightforward case definition for heroin overdose for EMS data. Face validity of 81% of identified heroin overdoses was supported by clerical review of EMS records and/or hospital ICD-10-CM diagnostic codes. Some proportion of the other 19% of cases that were identified as heroin overdoses may have been overdoses involving opioids other than heroin, but we could not quantify that proportion based on the available information. Future work will consider sensitivity (true heroin overdoses that may fail to be captured by this case definition) and refinements to the basic definition that may yield improved results. Lessons learned from this pilot project will inform subsequent, larger-scale validation studies for EMS drug overdose case definitions. **References** 1. Rhode Island Enhanced State Opioid Overdose Surveillance (ESOOS). Case Definition for Emergency Medical Services. Aug 2017. 2. Injury Surveillance Workgroup 7. Consensus Recommendations for National and State Poisoning Surveillance. The Safe States Alliance. Atlanta, GA. April 2012.

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## Abstract

**Objective** To create chronic disease categories for emergency department (ED) chief complaint data and evaluate the categories for validity against ED data with discharge diagnoses and hospital discharge data. **Introduction** Syndromic Surveillance (SS), traditionally applied to infectious diseases, is more recently being adapted to chronic disease prevention. Its usefulness rests on the large number of diverse individuals visiting emergency rooms with the possibility of real-time monitoring of acute health effects, including effects from environmental events and its potential ability to examine more long-term health effects and trends of chronic diseases on a local level [1-3]. **Methods** Emergency department chief complaint (CC) data captured by the Cook County Department of Public Health local instance of ESSENCE from Jan 1, 2006 – Dec 31, 2013 was utilized to generate chronic disease categories for: CVD, AMI, ACS, angina, stroke, diabetes, hypertension, asthma, and COPD based on disease symptoms, natural language processing for free text chief complaints, and associated terms present in EMR system menus. A standard category was created for each chronic disease category based on discharge diagnoses (ICD-9 code), and their associated terms. The ICD-9 based categories were applied to the discharge diagnosis field within the ED data. The chief complaint based chronic disease category definitions were compared to the standard classification by determining the sensitivity, specificity, positive predictive value, and negative predictive value. The standard chronic disease categories created with ICD-9 codes for the chronic disease category validation were also applied to Illinois hospital discharge data for Cook County from Jan 1, 2006 – Dec 31, 2013. This data was compared to the chief complaint categories from the ED data for the same time period by visual analysis through time series and strength of correlation by Pearson correlation coefficient analysis. ESSENCE version 1.17 was utilized for the free-text query development and SAS 9.4 was utilized to perform the analyses. **Results** For the validation analysis, 1,366,525 (24.76%) ED visits of individuals 40 years and older and 867,509 (15.72%) ED visits of individuals less than 18 years of age with a valid chief complaint and discharge diagnosis were included. Validation results are presented in Table 1. Specificity was generally high for most of the categories, with the narrow definitions having a higher specificity (Narrow AMI = 0.9996, Broad AMI = 0.9119). However, the loss in sensitivity is substantial in moving from the broader definition to the narrow definition (Broad AMI = 0.5444, Narrow AMI = 0.1040). The positive predictive values had a wide range from 0.0128 for the Broad ACS category to 0.7199 for the Narrow Asthma definition. The negative predictive values were high for all chronic disease categories ranging from 0.9501 for the Narrow CVD category to 0.9996 for Angina. The Pearson correlation coefficients are presented in Table 2. Graphs showing the comparisons of the chief complaint based ED data to the hospitalization data by chronic disease category definition are presented in Figure 1. Pearson correlations ranged from 0.9323 for Narrow Asthma to 0.1992 for Hypertension. **Conclusions** Based on the high specificity and correlation coefficients in comparison to hospital discharge data, emergency department chief complaint data captured with syndromic surveillance could be utilized to examine chronic disease categories: asthma, COPD, CVD, AMI, ACS, stroke, and diabetes at a local, state or national level. **References** 1. Bassil, K.L., et al., Temporal and spatial variation of heat-related illness using 911 medical dispatch data. *Environ Res*, 2009. 109(5): p. 600-6. 2. Mathes, R.W., K. Ito, and T. Matte, Assessing syndromic surveillance of cardiovascular outcomes from emergency department chief complaint data in New York City. *PLoS One*, 2011. 6(2): p. e14677. 3. Zanobetti, A. and J. Schwartz, Air pollution and emergency admissions in Boston, MA. *J Epidemiol Community Health*, 2006. 60(10): p. 890-5.

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## Abstract

**Objective** To compare and contrast two ESSENCE syndrome definition query methods and establish best practices for syndrome definition creation. **Introduction** The Kansas Syndromic Surveillance Program (KSSP) utilizes the ESSENCE v.1.20 program provided by the National Syndromic Surveillance Program to view and analyze Kansas Emergency Department (ED) data. Methods that allow an ESSENCE user to query both the Discharge Diagnosis (DD) and Chief Complaint (CC) fields simultaneously allow for more specific and accurate syndromic surveillance definitions. As ESSENCE use increases, two common methodologies have been developed for querying the data in this way. The first is a query of the field named “CC and DD.” The CC and DD field contains a concatenation of the parsed patient chief complaint and the discharge diagnosis. The discharge diagnosis consists of the last non-null value for that patient visit ID and the chief complaint parsed is the first non-null chief complaint value for that patient visit ID that is parsed by the ESSENCE platform. For this comparison, this method shall be called the CCDD method. The second method involves a query of the fields named, “Chief Complaint History” and “Discharge Diagnosis History.” While the first requires only one field be queried, this method queries the CC History and DD History fields, combines the resulting data and de-duplicates this final data set by the C\_BioSense\_ID. Chief Complaint History is a list of all chief complaint values related to a singular ED visit, and Discharge Diagnosis History is the same concept, except involving all Discharge Diagnosis values. For this comparison, this method shall be called the CCDDHX method. While both methods are based on the same query concept, each method can yield different results. **Methods** A program was created in R Studio to analyze a user-provided query. Simple queries were randomly generated. Twenty randomly generated queries were run through the R Studio program and disparities between data sets were recorded. All KSSP production facility ED visits during the month of August 2017 were analyzed. Secondly, three queries actively utilized in KSSP practice were run through the program. These queries were Firework-Related Injuries, Frostbite and Cold Exposure, and Rabies Exposure. The queries were run on all KSSP production facility ED visits, and coincided with the timeline of relevant exposures. **Results** In the random query trials, an average of 5.4% of the cases captured using the CCDD field method were unique and not captured by the same query in the CCDDHX method. Using the CCDDHX method, an average of 6.1% of the cases captured were unique and not captured by the CCDD method. When using the program to compare syndromes from actively utilized KSSP practice, the disparity between the two methods was much lower. **Firework-Related Injuries** During the time period queried, the CCDD method returned 171 cases and the CCDDHX method returned 169 cases. All CCDDHX method cases were captured by the CCDD method. The CCDD method returned 2 cases not captured by the CCDDHX method. These two cases were confirmed as true positive firework-related injury cases. **Frostbite and Cold Exposure** During the time period queried, CCDD method returned 328 cases and the CCDDHX method returned 344 cases. The CCDDHX method captured 16 cases that the CCDD method did not. The CCDD method did not capture any additional cases when compared to the CCDDHX method. After review, 10 (62.5%) of these 16 cases not captured by the CCDD method were true positive cases. **Rabies Exposure** During the time period queried, the CCDD method returned 474 cases and the CCDDHX method returned 473 cases. The CCDDHX method captured 7 cases that the CCDD method did not. The CCDD method returned 8 cases not captured by the CCDDHX method. After review, the 7 unique cases captured in the CCDDHX method contained 3 (42.9%) true positive cases and 3 (37.5%) of the 8 cases not captured by the CCDDHX method were true positives. **Conclusions** The twenty random queries showed a disparity between methods. When utilizing the same program to analyze three actively utilized KSSP definitions, both methods yielded similar results with a much smaller disparity. The CCDDHX method inherently requires more steps and requires more queries to be run through ESSENCE, making the method less timely and more difficult to share. Despite these downsides, CCDDHX will capture cases that appear throughout the history of field updates. Further variance between methods is likely due to the CCDD field utilizing the ESSENCE-processed CC while the CCDDHX field utilizes the CC verbatim as produced by the ED facility. This allows the CCDD method to tap into the powerful spelling correction and abbreviation-parsing steps that ESSENCE employs, but incorrect machine corrections and replacements, while rare, can negatively affect syndrome definition performance. The greater disparity in methods for the random queries may be due to the short (3 letter) text portion of the queries. Short segments are more likely to be found in multiple words than text of actual queries. Utilizing larger randomly generated text segments may resolve this and is a planned next step for this research. Our next step is to share the R Studio program to allow further replication. The Kansas Syndromic Surveillance Program is also continuing similar research to ensure that best practices are being met.

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# Roles of Health Literacy in Relation to Social Determinants of Health and Recommendations for Informatics-Based Interventions: Systematic Review

## Abstract

Objective Plan, develop, and pilot an open source system that could be integrated into the PCORnet (PCORI) and Sentinel (FDA) national common data models (CDMs) to generate antimicrobial use (AU) reports submittable to CDC's National Healthcare Safety Network (NHSN). The system included ancillary tables, and data quality and report generation queries. The DataMIME system will allow hospitals to generate comparable AU reports for hospital inpatients. Introduction Despite decades of attempts to promote judicious AU, the US has high rates of per-person antimicrobial consumption, and extremely high rates of carbapenem use<sup>1</sup>. Such profligate use is a key factor in the high rate of antimicrobial-resistant infections seen in US healthcare facilities<sup>2</sup>. Antimicrobial stewardship (AS) programs have been identified as a critical component of intervention strategies<sup>3</sup>. A core component of AS programs is tracking AU, which is needed to monitor trends in use, focus interventions on aberrant behaviors, promote judicious use, and evaluate the effectiveness of interventions. A system designed to extend two national data models would provide a scalable platform for rapid adoption of AU reporting. Methods Virtual meetings were held with all participating sites (five hospitals in IL, LA, and TN) to develop the ancillary tables to capture intrahospital patient movement, and administration of antimicrobial agents. Ancillary tables were designed & sites populated the tables with calendar year 2016 data. Data characterization was performed to assess overall table statistics, and verify mappings of facility unit locations to NHSN location codes, medications to RxNorm, and routes of administration to one of four SNOMED categories. Additional characterization focused on CDC's NHSN Validation Protocol for the AU module. Analytical queries were developed to produce the output metrics required for submission to the NHSN AU module. Results Two ancillary tables and two look-up tables were developed: a bed information table (Table 1) to capture local location codes with a date-time stamp for precise tracking of patient location; a separate location look-up table allows mapping to other terminologies (Table 2); and, an inpatient drug administration table (Table 3) to capture data from the electronic medication administration record (eMAR) or bar coding medication administration (BCMA) system, utilizing a route of administration look-up table (Table 4). The data model was structured to accommodate use cases with alternative mapping terminologies for local location code, local term for route of administration, local codes for medication, and the option of including the NDC code. All sites populated the ancillary tables. For the bed information table, all sites utilized their ADT table information for patient movement. For the medication administration table, most sites limited the inclusion criteria to the 89 antimicrobial agents required for reporting to the NHSN AU module. Aggregate results from participating sites for facility-wide measures and select antimicrobial agents are presented in Table 5. Conclusions The data model developed was able to produce the metrics required for reporting to CDC's NHSN AU module. The data dictionary language, implementation guidance, mappings, and queries will be distributed as a tool-kit for other PCORnet and Sentinel sites for reporting to the AU module. In addition, this CDM could allow for the development of additional metrics including excessive use of antibiotic combinations of redundant spectra, syndrome specific antibiotic use, or increased use of excessively broad spectrum antibiotic classes. References 1. Van Boeckel TP, Brower C, Gilbert M, Grenfell BT, Levin SA, Robinson TP, Teillant A, Laxminarayan R. Global trends in antimicrobial use in food animals. *Proc Natl Acad Sci USA* 2015; 112(18):5649-54. 2. CDC. Antibiotic resistance threats in the United States, 2013. Atlanta, GA: US Dept. of HHS, CDC; 2013. 3. Dellit TH, Owens RC, McGowan JE, Gerding DN, Weinstein RA, Burke JP, et al. IDSA and the SHEA Guidelines for Developing an Institutional Program to Enhance Antimicrobial Stewardship. *Clin Infect Dis* 2007; 44(2):159-77.

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## Abstract

**Objective** To develop a syndrome definition and analyze syndromic surveillance data usefulness in surveillance of firework-related emergency department visits in Kansas. **Introduction** Across the U.S.A., multiple people seek treatment for fireworks-related injuries around the July 4th holiday. Syndromic surveillance in Kansas allows for near real-time analysis of the injuries occurring during the firework selling season. During the 2017 July 4th holiday, the Kansas Syndromic Surveillance Program (KSSP) production data feed received data from 88 EDs at excellent quality and timeliness. Previous and current firework safety messaging in Kansas is dependent on voluntary reporting from hospitals across the state. With widespread coverage of EDs by KSSP, data can be more complete and timely to better drive analysis and public information. **Methods:** KSSP data was queried through the Electronic Surveillance System for the Early Notification of Community-based Epidemics (ESSENCE) v.1.20 provided by the National Syndromic Surveillance Program. Data between June 12, 2017 and August 13, 2017 were queried. The first query (Query A, Table 1.) searched the Discharge Diagnosis History field for the “W39” ICD-10 Diagnosis code, “Discharge of firework.” These records were searched for common firework terms contained in the Chief Complaint History field. These firework-related free text terms (Query B, Table 1.) were then combined with other potential firework-related terms to create a preliminary free text query (Query C, Table 1.). This preliminary query was run on the Chief Complaint History field. Data were then searched for false positive cases and appropriate negation terms were included to accommodate this. The new query with negation terms (Query D, Table 1.) was run on the Chief Complaint History field, combined with the results from the Discharge Diagnosis History field, and then combined records were de-duplicated based on a unique visit identifier. The final data set was then classified by the anatomical location of the injury and the gender and age group of the patient. **Results:** The initial query (Query A, Table 1.) for the diagnosis code “W39” returned 101 unique ED visits. Of these 101 unique ED visits, the following terms were identified in the Chief Complaint History field: shell, artillery, bomb, sparkler, grenade, fire cracker, firework, and firework show. These key terms were translated into Query B, Table 1. Other key terms deemed likely to capture specific firework-related exposures were then included into Query C, Table 1., including roman, candle, lighter, M80, and punk. Query C was then used to query the Chief Complaint History field, returning 144 unique ED visits. Cases captured by Query C were then reviewed by hand for false positives and the negation terms, lighter fluid, fish, nut, and pistachio, were incorporated the Query D, Table 1. The previous process for Query C was then repeated on Query D, leaving a remaining 136 unique cases. Query A’s 101 unique ED visits was then combined with the 136 unique ED visits captured by Query D and de-duplicated. The de-duplicated data set contained 170 unique ED visits which were then reviewed by hand for false positives. The final removal of false positives from the combined and de-duplicated data set left a remaining 154 unique ED visits for firework-related injuries during this time period. For these data, the most common victims of firework injuries were males, accounting for 65.5% of all firework related ED visits and children ages 0 to 19 accounting for 44.2% of these visits. At every age breakout, male injuries exceeded female injuries. The most common anatomical location of the injury was one or both hands with 38.3% of all injuries mentioned hands as their primary injury. Injuries to the eyes, face, and head accounted for the second most injuries (28.6% of all patients). **Conclusions:** The selling of fireworks will be a yearly occurrence of a specific exposure that can potentially lead to injuries. Utilizing syndromic surveillance to review the holiday firework injuries is a very rapid method to assess the impact of these injuries and may allow for future direction of public information during the holiday. Having a syndrome definition that builds on knowledge from previous years will allow for quicker case identification as well. State public information regarding firework safety can be significantly bolstered by accurate and rapid data assessment. Developing a firework injury syndrome definition that is accurate and returns information rapidly has allowed for increased buy-in to the Kansas Syndromic Surveillance Program from public information offices, fire marshal’s offices, and other program fields.

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# Roles of Health Literacy in Relation to Social Determinants of Health and Recommendations for Informatics-Based Interventions: Systematic Review

## Abstract

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**Objective:** The purpose of this project is to demonstrate progress in developing functional data models and semantic definitions (content standards) for data elements and value sets comprising information categories supporting PH Emergency Preparedness and Response. (EPR) The objective is to explain the concepts and methods used to define core PH Emergency Management and Preparedness and Response functions, Information Exchange Requirements (IERs), data elements, and value sets to create a PH Emergency Operations Center (EOC) Minimum Data Set Specification. The primary focus of this presentation is to describe the value of semantic data interoperability and provide operational examples of the value and return-on-investment gained through building semantically interoperable data exchange through content standardization. **Introduction:** Effective prevention, detection, and rapid response to PH emergencies rely on sufficient and timely delivered information. PH EOC data flows are based on critical information requirements, addressing needs of EOC staff for timely delivered analytical products that provide situational awareness, event-specific data, event investigation tools, resource management etc1. The ability of PH EOC systems to automatically and accurately interpret meaning of the exchanged data depends on a level of semantic data interoperability and utilization of a common information exchange reference model (CIERF) that conforms to established data standards. PH EOC data interoperability requires mutual development and close collaboration with partners to develop a PH EPR CIERF, common terminology and standardized vocabulary. **Methods:** The CDC's Situational Awareness Branch (SAB) facilitates national activities on development PH EOC informatics through participation in the WHO EOC Network (EOC-NET) 2, and collaboration with national organizations and CDC partners on content standardization. The following sources were used for this analysis: 1) 26 content standards developed by national and international standard development organization, 2) WHO's Framework for a Public Health Emergency Operations Centre2, and 3) PH EOC data requirements3 that were published by CDC's SAB . These data requirements were included into the CDC Vocabulary and Access Distribution System (VADS) 4, which serves as the primary vocabulary content browser for PH EPR informatics. **Results:** In analyzing the PH EPR content standards, the CDC's SAB arrived at the following results. The CDC EOC's process of development and implementation content standards is based on the PH EOC critical information requirements. These requirement became business rules for the PH EPR CIERF. The current, version 2, of the PH EPR CIERF consists of 12 information modules including PH EOC minimum data set (MDS), patient clinical observations, emergency medical systems (EMS), data elements for emergency departments (DEEDS), WHO MDS for Health Workforce Registry, Resource Utilization Message Component (vocabulary for hospital resources), vocabulary for the national trauma standard. These PH EPR CIERF modules are interoperable and built on existing data standards. These modules were codified by VADS and ready for utilization by international and national PH EOC partners. At the stage of this analysis the PH EPR CIERF codification schema was prepared for adding it into the Logical Observation Identifiers Names and Codes (LOINC) content standard. The current PH EOC MDS version was released in September 2017. The common terminology and vocabulary that were included into this version are conformant with existing national and international content standards and specifications. Comparatively to the previous version 1, the current PH EOC MDS contains more than 60% new and updated terminology and value sets. Added to the PH EOC MDS version 2 new features are the Situational Analysis concept model, that also incorporates a nomenclature and structure for the Public Health EOC Situational Report (SITREP). Also, the Managing and Commanding conceptual model was updated by adding concepts and vocabulary for the agency internal communication, including standardized knowledge repository for managing standard operating procedures (SOP) and reports for leadership. The CDC's SAB directly supports the CDC Surveillance Data Platform (SDP) and national organizations on development of electronic forms and form builders. These efforts will provide additional capabilities for collecting and electronically sharing standardized SA information utilizing web-enabled Services and mobile capabilities. **Conclusions:** CDC's EOC and Division of Emergency Operations Staff is improving the application of emergency management and PH practice in preparing and responding to emergencies through partnerships and coordinated work with Standard Development Organizations (SDOs) to add critical EPR vocabularies to national and international standards. This work supports National Emergency Management Organizations and is a reference source for the WHO EOC-NET guiding documents supporting international efforts to strengthen Global Health Security.

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## Abstract

**Objective:** Previous research identified data gaps between traditional paper-based STI notifiable condition reporting and pilot electronic initial case reporting (eICR) relying on Continuity of Care Documents (CCDs) exported from our clinical partner's electronic health record (EHR) software. Structured data capture is needed for automatic processing of eICR data imported into public health repositories and surveillance systems, similar to electronic laboratory reporting (ELR). Coding data gaps (between paper and electronic case reports) using standardized vocabularies will allow integration of additional questions into EHR or other data collection systems and may allow creation of standard Clinical Data Architecture (CDA) templates, Logical Observation Identifiers Names and Codes (LOINC) panels, or Fast Healthcare Interoperability Resources (FHIR) resources. Furthermore, identifying data gaps can inform improvements to other standards including nationwide standardization efforts for notifiable conditions. **Introduction:** Under the CDC STD Surveillance Network (SSuN) Part B grant, WA DOH is testing eICR of sexually transmitted infections (STI) with a clinical partner. Existing standard vocabulary codes were identified to represent previously-identified information gaps, or the need for new codes or concepts was identified. **Methods:** In prior work, CCDs were securely received from our clinical partner and then analyzed for gaps compared to the existing paper-based STI case reporting form. Now, codes associated with gap concepts were identified in standard vocabularies such as LOINC and SNOMED CT. Standards were searched using online browsers offered by the standards development organizations (SDO) to identify potential codes, which were reviewed with public health epidemiologists and clinicians. Gaps were listed, and wording and intent was compared to standard codes including accessory information found in the SDO browsers and a final table of recommended codes was produced. **Results:** Acceptable congruity between currently used case reporting questions and coded vocabularies was found for the majority of data gaps previously identified. Where data need was incongruous with standard coded vocabularies, new codes or concepts could be proposed to the SDO. Pregnancy status is often missing from CDA documents but is well-conceptualized in both LOINC and SNOMED CT systems under several codes, including any current laboratory tests for pregnancy. HIV status is similarly well-conceptualized in both LOINC and SNOMED CT both as a problem list item well as thru a variety of laboratory tests. However, problem list EHR models lack standard inclusion of date of last HIV test or dates of current pregnancy as an associated coded data element which is desirable for public health. Information about the case patient's sexual partners, need for partner STI treatment, and partner treatment completed is lacking in standard CCD documents. Number of current sexual partners [requiring treatment] – has a SNOMED-CT code, but lacks a match in LOINC coding system. This gap identified the need for exploration of how information about sexual partners can best be represented in interoperability artifacts, including the most useful division of information content between the information model and the standard terminology. Needed concept could resemble 'record target' found in HL7 version 3.0 and would allow data to be provided without specifying additional codes. Exploration of information model options or new codes is recommended. Many codes are possible for site of infection and specific symptoms but the overall concepts of 'symptomatic infection' and 'site of infection' as coded elements would need to be added. **Conclusions:** This coded element gap analysis found that most information requested in an STI case report can be found in a CCD. Gaps can be addressed by using existing standard terms except for concepts about sexual partners that might be better addressed by exploring the information model rather than through the addition of standard codes. Standards use will facilitate complete case reporting using CDA or FHIR, for example, within a 'blue button' or other system with functionality for exchanging additional information about notifiable condition case patients. Collaboration with clinicians, public health practitioners, informaticians, and EHR vendors in will help determine how these concepts might best be modeled. Understanding data gaps involves working closely with a broad range of stakeholders, to understand why gaps exist and how well proposed solutions will meet stakeholder needs.

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## Abstract

**Objective:** This session will present the impacts of enhancements made to National Syndromic Surveillance Program (NSSP) BioSense Platform Onboarding in 2017 from the perspective of CDC and public health jurisdictions. **Introduction:** In 2017, the National Syndromic Surveillance Program (NSSP) continued to expand as a national scope data source with over 6,500 facilities registered on the BioSense Platform, including 4,000 active, 1,800 onboarding, and 700 planned or inactive facilities. 2,086 of the active facilities are Emergency Departments across 49 sites in 41 states. The growth of data available in NSSP has been driven by continued enhancements to tools and processes used by the NSSP Onboarding Team. These enhancements help to rapidly integrate new healthcare facilities and onboard new public health sites in support of American Hospital Association (AHA) Emergency Department (ED) representativeness goals. Furthermore, with these improvements to the onboarding process, including the Master Facility Table update process and automated data validation reporting, NSSP has broadened stakeholder participation in the onboarding process. **Description:** This panel presentation will focus on the impact of the enhancements to NSSP Onboarding processes and tools that are the key enablers for NSSP to gather a site and nationally representative data source for event detection and novel surveillance. Panelists include Mr. Travis Mayo, NSSP Onboarding Manager, who will present the key enablers to accelerating NSSP Onboarding including enhancements to the management of the Master Facility Table (MFT), tailoring of the Engage, Connect, Validate, and Operate methodology, and the introduction of automated data validation reports. Building on the enablers presented by Mr. Mayo, Mr. Michael Coletta, will present on NSSP priorities and initiatives to optimize program efficiency in support of onboarding new sites and continuing to onboard facilities in support of national objectives for ED representatives. Mrs. Sophia Crossen will present the impact of NSSP changes in Kansas onboarding and surveillance initiatives. Mrs. Kirsten Oliver, will demonstrate how NSSP onboarding has impacted syndromic surveillance activities in West Virginia. With the need to always be looking ahead, each panelist will draw on their experiences in 2017, including their perspective on opportunities in 2018 to continue to enhance NSSP onboarding. These perspectives will serve as a basis for launching into questions and discussions from the audience to collect NSSP onboarding experiences in 2017 and ideas for continued enhancement in 2018. **How the Moderator Intends to Engage the Audience in Discussions on the Topic:** The round table will present the improvements implemented by NSSP Onboarding and discuss the following: - What strengths and weaknesses have the enhancements surfaced in onboarding processes - How have the enhancements impacted local onboarding initiatives and priorities - How have the enhancements changed the roles of key players in the onboarding process

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# Roles of Health Literacy in Relation to Social Determinants of Health and Recommendations for Informatics-Based Interventions: Systematic Review

## Abstract

**Objective:** To use Epi Info Cloud Data Analytics (ECDA) to improve the management, quality and utilization of the Vietnam National HIV Surveillance data. **Introduction:** HIV surveillance in Vietnam is comprised of different surveillance systems including the HIV sentinel surveillance (HSS). The HSS is an annual, multi-site survey to monitor HIV sero-prevalence and risk behaviors among key populations. In 2015, the Vietnam Administration on HIV/AIDS Control (VAAC) installed the Epi Info Cloud Data Analytics (ECDA), a free web-based analytical and visualization program developed by the Centers for Disease Control and Prevention (CDC)(1) to serve as an information management system for HIV surveillance. Until 2016, provincial surveys, recorded on paper, were computerized and submitted to VAAC, which was responsible for merging individual provincial datasets to form a national HSS dataset. Feedback on HSS issues were provided to provinces 3 to 6 months after survey conclusion. With the use of tablets for field data collection in 2017, provincial survey data were recorded electronically and transferred to VAAC at the end of each survey day, thus enabling instant updating of the national 2017 HSS dataset on daily basis. Upon availability of the national HSS dataset on VAAC's server, ECDA enhanced wider access and prompt analysis for staff at all levels (figure 1). This abstract describes the use of ECDA, together with tablet-based data collection to improve management, quality and use of surveillance data. **Methods:** After the installation of the ECDA on VAAC's server in 2015, investments were made at all levels of the surveillance systems to build the capacity to operate and maintain the ECDA. These included trainings on programming, administration, and utilization of ECDA at the central level; creating a centralized database through abstracting and linking different surveillance datasets; developing analysis templates to assist provincial-specific reports; and trainings on access and use of the ECDA to provincial staff. One hundred and eighty five ECDA analyst accounts, authorized for submission, viewing and analysis of data, were created for surveillance staff in 63 provinces and 7 agencies. Six administrator accounts, created for users at central and regional level, were authorized for editing data and management of user accounts. In 2017, more ECDA activities were conducted to: (i) develop analysis dashboards to track progress and data quality of HSS provincial surveys; (ii) facilitate frequent data reviews at central and regional levels; (iii) provide feedback to provinces on survey issues including sample selection. **Results:** Since 2015, separate national datasets including the HSS, HIV case reports, HIV routine program reports were systematically cleaned and merged to form a centralized national database, which was then centrally stored and regularly backed up. Access to the national database was granted to surveillance staff in all 63 provinces through 185 designated ECDA accounts. During the 2017 HSS surveys, 70 ECDA users in 20 HSS provinces were active to manage and use the HSS data. Twelve weekly reviews of HSS provincial data were conducted at national level throughout the 2017 HSS survey. Ninety percent of provinces received feedback on their survey data as early as the first week of field data collection. The national 2017 HSS dataset and its analysis were available immediately after the completion of the last provincial survey, which was about 3 to 6 months quicker than reports of previous years. More importantly, the fresh results of the 2017 HSS survey were available and used for the 2018 Vietnam HIV national planning circle (table 1). **Conclusions:** ECDA is a quick, relevant, free program to improve the management and analysis of HIV surveillance data. Using ECDA, it is easy to generate and modify analysis dashboards that enhances utilization of surveillance data. Successful administration and use of the ECDA during the 2017 HSS survey is positive evidence for Ministry of Health to consider institutionalization of the program in Vietnam surveillance systems.

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## Abstract

**Objective:** Using the Wisconsin Enhanced Opioid Surveillance System, the present study evaluates the heroin hospitalization risk among the opioid recipients using the Prescription Drug Monitoring Data (PDMP) with following specific objectives: 1. Evaluate the risk of heroin overdose hospitalization following the prescription of opioid. 2. Assess the time elapsed between last prescribed opioid and first heroin overdose hospitalization. 3. Identify the main predictors of heroin overdose hospitalization among prescribed opioid users. **Introduction:** Nationally and in Wisconsin, heroin is the leading cause of opioid related death and hospitalization. Opioids are commonly prescribed for pain. Every day, over 1,000 people are treated in emergency departments for misusing prescription opioids<sup>1</sup>. In 2015, more than 15,000 people died from overdoses involving prescription opioids<sup>1</sup>. Approximately, three out of four heroin users report having abused prescription opioids prior to using heroin<sup>2</sup>. In Wisconsin from 2010 to 2014 the number of deaths involving any opioid increased by 51% and for heroin increased by 192%. Through the federal government funding and support Wisconsin has established a statewide tool to help combat the ongoing prescription drug abuse epidemic by providing valuable information about controlled substance prescriptions that are dispensed in the state. PDMP is continue to be among the most promising state-level interventions to improve opioid prescribing, inform clinical practice, and protect patients at risk. **Methods:** This was a Retrospective cohort study of PDMP patients who were prescribed an opioid and were subsequently hospitalized for heroin overdose between 2013 and 2015. Our analysis used a combination of univariate and survival data analysis to estimate the risk of heroin overdose hospitalization from the time of the last prescribed opioid to the first day of hospitalization. The outcome was defined as Heroin Hospitalization with any code of 965.01 (ICD9 2013 first quarter to third quarter of 2015), T40.1X1A, T40.1X4A (ICD10 fourth quarter of 2015). The exposure was defined as Prescription of Opioid limited to DEA class I, II, III, & IV. Our analysis used a combination of univariate and survival data analysis to estimate the risk of heroin hospitalization from the time of the last prescribed opioid to first day of hospitalization due to heroin overdose. Cox Regression Hazard modeling was used to analyze survival time data and to identify the main predictors of heroin hospitalization. Data were analyzed using the SAS 9.2 and the study was initiated with the Data Governance Board Approval. **Results:** From 2013 to 2015, a total of 1,397,493 unique patients that were hospitalized linked to 1,448,224 patients reported in the PDMP who received controlled substance. Among those 699,014 (48%) had at least one hospitalization event and out of those 396 (6%) had at least one hospitalization episode due to heroin. Annual ED visit rates due to heroin overdose have doubled from 179 in 2013 to 396 in 2015. On average, people who stopped receiving prescription drugs were at a 72% increased risk of being hospitalized for heroin overdose within five months with Log-Rank Test significance (p=0.01). Males, 90 morphine milligram equivalent recipients, and kidney disease morbidity were 3.63, 2.99, and 5.64 times higher risk to have heroin overdose hospitalization, respectively. **Conclusions:** Patients with a history of stopping prescription drugs within the previous five months are at higher risk for subsequent hospitalization for heroin overdose. Factors such as alcohol use, age, gender, and tapering of prescription influence the risk of heroin hospitalization. It may be prudent to transition patients to alternative treatments before they become addicted to the prescribed drugs.

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# Roles of Health Literacy in Relation to Social Determinants of Health and Recommendations for Informatics-Based Interventions: Systematic Review

## Abstract

**Objective:** To provide a forum to engage key stakeholders to discuss the process for updating and revising the Implementation Guide (IG) for Syndromic Surveillance (formerly the PHIN Message Guide for Syndromic Surveillance) and underscore the critically of community and stakeholder involvement as the Implementation Guide is vetted through the formal Health Level Seven (HL7) balloting process in 2018. **Introduction:** Syndromic surveillance seeks to systematically leverage health-related data in near "real-time" to understand the health of communities at the local, state, and federal level. The product of this process provides statistical insight on disease trends and healthcare utilization behaviors at the community level which can be used to support essential surveillance functions in governmental public health authorities (PHAs). Syndromic surveillance is particularly useful in supporting public health situational awareness, emergency response management, and outbreak recognition and characterization. Patient encounter data from healthcare settings are a critical inputs for syndromic surveillance; such clinical data provided by hospitals and urgent care centers to PHAs are authorized applicable local and state laws. The capture, transformation, and messaging of these data in a standardized and systematic manner is critical to this entire enterprise. In August 2015, a collaborative effort was initiated between the CDC, ISDS, the Syndromic Surveillance Community, ONC and NIST to update the national electronic messaging standard which enables disparate healthcare systems to capture, structure, and transmit administrative and clinical data for public health surveillance and response. The PHIN Messaging Guide for Syndromic Surveillance -Release 2.0 (2015) provided an HL7 messaging and content reference standard for national, syndromic surveillance electronic health record technology certification as well as a basis for local and state syndromic surveillance messaging implementation guides. This standard was further amended with the release of the PHIN Messaging Guide for Syndromic Surveillance - Release 2.0, Erratum (2015) and the HL7 Version 2.5.1 PHIN Messaging Guide for Syndromic Surveillance- Release 2.0, NIST Clarifications and Validation Guidelines, Version 1.5(2016). ISDS is now engaged in a process, supported by a CDC Cooperative Agreement, to formally revise the existing guide and generate an HL7 V 2.5.1 Implementation Guide (IG) for Syndromic Surveillance v2.5 for HL7 balloting in 2018. This roundtable will provide a forum to present and discuss the HL7 Balloting process and the outstanding activities in which the Syndromic Surveillance community must participate during the coming months for this activity to be successful. **Description:** The scope of this project is to provide an updated and consolidated version of the IG v2.5 that includes issues identified in the previously published Erratum and Clarification documents as well as concerns expressed via a community commenting. **How the Moderator Intends to Engage the Audience in Discussions on the Topic: Moderator Engagement on Topic:** Through this Roundtable moderators will provide an overview of 1.) Recent accomplishments on this project, 2.) Pending deliverables for 2018, 3.) Critical milestones and dates, and 4.) How to participate in the review and balloting process through narrative, handouts, and visual aids. **Recent accomplishments:** To date this review process has identified and updated a wide-range of specification and requirements described within the IG 2.0. These include: specifications for persistent patient ID across venues of service, inclusion of the ICD-10-CM value set for diagnosis, removal of the ICD-9-CM requirement for testing and messaging, modification of values such as pregnancy status, travel history, and medication lists, and update of value sets and PHIN VADS references for FIPS, SNOmed, ICD-10-CM. **Deliverables Include:** Completion of the Project Documents as required by Project Insight as described in the 2018 Balloting Calendar (figure 1). Provide a copy of the IG to the Public Health and Emergency Response HL7 Workgroups prior to the ballot Submit the final version of the IG for balloting Reconcile (with the HL7 Public Health Workgroup and other co-sponsoring workgroups) any comments submitted during the balloting process Finalize the IG for submission as a Standard for Trial Use. This IG v2.5 will replace or supersede all previous guide releases and related documentation and will no longer be a CDC or PHIN artifact. **CONCLUSIONS:** The results of this multi-agency comment and review process will be synthesized and compiled by ISDS. The updated version of the IG v2.5 will be made available to the Public Health community following the completion of the HL7 Balloting in May 2018. Future revisions of the IG v2.5 will be vetted through HL7 Public Health Workgroup. This systematic and structured review and documentation process has allowed for the synthesis and reconciliation of a wide range of disparate specifications, historical hold-overs, and requirements via the perspectives of a diverse range of public health partners. As we continue to move through this review process we believe that the final HL7 balloted "Standard for Trial Use" IG v2.5 will be a stronger more extensible product in supporting syndromic surveillance activities across a wider and more diverse range of clinical venues, EHR implementations, and PHAs.

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## Abstract

**Objective:** The objective of this abstract is to illustrate how the Utah Department of Health processes a high volume of electronic data. We do this by translating what reporters send within an HL7 message into \"epidemiologist\" language for consumption into our disease surveillance system. **Introduction:** In 2013, the Utah Department of Health (UDOH) began working with hospital and reference laboratories to implement electronic laboratory reporting (ELR) of reportable communicable disease data. Laboratories utilize HL7 message structure and standard terminologies such as LOINC and SNOMED to send data to UDOH. These messages must be evaluated for validity, translated, and entered into Utah's communicable disease surveillance system (UT-NEDSS), where they can be accessed by local and state investigators and epidemiologists. Despite the development and use of standardized terminologies, reporters may use different, outdated versions of these terminologies, may not use the appropriate codes, or may send local, home-grown terminologies. These variations cause problems when trying to interpret test results and automate data processing. UDOH has developed a two-step translation process that allows us to first standardize and clean incoming messages, and then translate them for consumption by UT-NEDSS. These processes allow us to efficiently manage several different terminologies and helps to standardize incoming data, maintain data quality, and streamline the data entry process. **Methods:** UDOH uses the Electronic Message Staging Area (EMSA) to receive ELR messages, manage terminologies such as LOINC and SNOMED, translate messages, and automatically enter laboratory data into UT-NEDSS. LOINC and other terms, such as facility name, sent by reporting facilities in an HL7 message are considered child terms. All child terms are mapped to a master LOINC or term and each master LOINC or term is mapped to a specific value within UT-NEDSS. In EMSA, the rules engine used for automated processing of electronic data is set to run at the master level and these rules will determine how the message is processed. No rules are set up or run on child terms. **Results:** As of 09/20/2017, EMSA contains 2,613 unique child LOINC terms that are mapped to 906 master LOINC terms. Those 906 master LOINC terms are mapped to 179 UT-NEDSS test types and 2003 child facility names are mapped to 1043 master facility names. **Conclusions:** Mapping child terminologies from an HL7 message to a master vocabulary helps us to standardize incoming data, allows us to accept non-standard terminologies and correct reporting errors. Translating this data into a format that is understandable to epidemiologists and investigators enables UT-NEDSS to work effectively in identifying outbreaks and improving health outcomes. This framework is working for ELR and will continue to grow and accept more data and the different terminologies that come with that.

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# Roles of Health Literacy in Relation to Social Determinants of Health and Recommendations for Informatics-Based Interventions: Systematic Review

## Abstract

**Objective:** To evaluate the effect and implications of changing the chief complaint field during the National Syndromic Surveillance Program (NSSP) transition from BioSense 2.0 analytical tools to BioSense Platform – ESSENCE Introduction: In January 2017, the NSSP transitioned their BioSense analytical tools to Electronic Surveillance System for Early Notification of Community-Based Epidemics (ESSENCE). The chief complaint field in BioSense 2.0 was a concatenation of the record’s chief complaint, admission reason, triage notes, and diagnostic impression. Following the transition to ESSENCE, the chief complaint field was comprised of the first chief complaint entered or the first admission reason, if the chief complaint was blank. Furthermore, the ESSENCE chief complaint field was electronically parsed (i.e., the original chief complaint text was altered to translate abbreviations and remove punctuation). This abstract highlights key findings from Maricopa County Department of Public Health’s evaluation of the new chief complaint field, its impact on heat-related illness syndromic surveillance, and implications for ongoing surveillance efforts. **Methods:** For this evaluation, we used the heat-related illness query recommended in Council of State and Territorial Epidemiologists’ (CSTE)2016 Guidance Document for Implementing Heat-Related Illness Syndromic Surveillance. Before the transition, we used BioSense 2.0’s, phpMyAdmin analytical tool to generate a list of patients who visited Maricopa County emergency departments or inpatient hospitals between 5/1/2016 – 9/30/2016 due to heat-related illness. After the transition, we used the CC and DD Category “Heat-related Illness, v1” in ESSENCE, which was based on the CSTE heat-related illness query, to generate a list of patients for the same time period. We compared the line-lists and time-series trends from phpMyAdmin and ESSENCE. **Results:** The phpMyAdmin analytical tool identified 785 heat-related illness records with the query (Figure). 642 (82%) of these heat-related illness records were also captured by ESSENCE. Reasons for 143 (18%) records not being identified by ESSENCE included: the patient’s admission reason field contained keywords that were not available in the ESSENCE chief complaint field (n=94, 66%); data access changed, which disabled access to patients who resided in zip codes that crossed a county border (30, 21%); discrepancies between ESSENCE parsing and text in the original chief complaint (11, 8%); heat-related illness discharge diagnoses were removed by the facility after the phpMyAdmin line-list for heat-related illness was extracted (7, 5%); and one record was undetermined. Conversely, ESSENCE captured 36 additional heat-related illness records, not previously captured by phpMyAdmin. Reasons included: a query exclusion term was located in the patient’s admission reason but not the ESSENCE chief complaint field (16, 44%); a heat-related illness discharge diagnosis code was added by the facility after the data were extracted by phpMyAdmin (4, 11%); and 16 (44%) were undetermined. Time-series trend evaluation revealed a significant correlation between the two surveillance tools (Pearson coefficient = 0.97, p < 0.01). **Conclusions:** Though the data trends over time were not significantly affected by changes in the chief complaint field, differences in the field’s composition have important implications for syndromic surveillance practitioners. Free-text queries designed to search the chief complaint field in ESSENCE may not retrieve records previously identified with BioSense 2.0 analytical tools, which may limit individual case-finding capacity. The elimination of admission reason from the chief complaint field in ESSENCE has the greatest effect on case-finding capacity. Furthermore, surveillance reports produced by ESSENCE cannot be directly compared to reports that were previously published with data from BioSense 2.0. These limitations may be addressed if ESSENCE creates a feature that allows users to easily query fields (e.g., admission reason) in addition to the chief complaint field.

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## Abstract

**Objective:** As part of New York City Department of Health and Mental Hygiene's (NYC DOHMH) efforts to improve provider reporting, the Division of Disease Control surveyed and conducted focus groups with users of a web-based reporting portal called Reporting Central (RC) to learn about their experience with submitting provider reports through RC and the impact of their experience on data submission. **Introduction:** The New York City Department of Health and Mental Hygiene's (NYC DOHMH) Division of Disease Control (DDC) conducts surveillance of more than 90 specific diseases and conditions and relies on both provider reports and electronic laboratory reports for data. While laboratory reports provide vital laboratory data and represent the majority of the surveillance data that DOHMH receives, they are not always timely or sufficient to confirm a case. Provider reports, in contrast, contain data often not available in laboratory reports and can be more prompt than laboratory reports. Health care providers submit provider reports through multiple channels, including through mailing or faxing paper forms, phone calls, and Reporting Central (RC). In 2016, providers used RC to submit ~51,000 provider reports. **Methods:** In June 2017, we used phone calls and messages posted on RC's homepage to recruit a convenience sample of ~50 RC users who agreed to participate in a survey and focus group. Participants were assigned to one of five focus groups based on the type and size of the facility where they worked at the time of recruitment: large outpatient facilities (n=2), small outpatient facilities (n=1) and inpatient facilities (n=2). Participants were asked to complete a 14-question paper survey before the focus group. Using a discussion guide informed by DOHMH surveillance subject matter experts, a moderator facilitated discussions on 1) facilitators of/barriers to using RC and 2) recommendations for improving RC. Each focus group lasted ~90 minutes. The discussions were audio- and video-recorded and transcribed. Survey results were descriptively summarized with Excel. Focus group data were thematically analyzed with Nvivo by two coders. **Results:** Forty-seven participants responded to the survey, and 45 individuals from a total of 37 health care facilities joined the focus groups. About 70% of survey participants rated the difficulty level of RC as 3 or less on a 1-7 scale (with 7 being the most difficult), and 30% of participants rated the difficulty level as 1. Participants from inpatient facilities rated RC as more difficult to use (mean rating=3.2) compared with participants from large outpatient facilities (mean rating=2.5) and participants from small outpatient facilities (mean rating=1.8). Survey respondents from inpatient facilities reported taking 3-30 minutes (mean=11.4) to submit one report using RC, compared with 3-15 minutes (mean=7.8) for survey respondents from large outpatient facilities and 3-10 minutes (mean=4.4) for survey respondents from small outpatient facilities. In subsequent focus group discussions, the majority of participants said that RC is intuitive, the section flow is easy to follow, and training new users requires little effort. Participants with experience using paper forms stated that reporting through RC is quicker and easier than reporting via paper forms. Two themes emerged from the analysis of focus group data, revealing the impact of participants' experiences with submitting provider reports on timeliness and quality of data reporting. **Timeliness of Data Submission** Participants noted that flawed functionalities (e.g., lack of auto-save functionality and insufficient time before automatically getting logged out of RC) lead to delayed data submission. Participants from inpatient facilities demonstrated more familiarity with time requirements for reporting and acknowledged the priority of submitting reports in their daily work routine. Participants from outpatient facilities, by contrast, did not acknowledge this priority when describing their reporting workflow and showed less understanding of the importance of timely reporting. Participants from small outpatient facilities questioned the necessity of requiring providers to report because DOHMH is also receiving data from laboratories. **Quality of Data Submission** Participants noted the complexity of selecting the correct data from a long drop-down menu that populates from previous saved entries as a possible contributor to erroneous data entry. Lack of access to some required data and the omission of fields in RC for capturing some relevant data such as patient's gender, housing status, etc. also compromise quality. **Conclusions:** The majority of participants stated that RC is intuitive and easy to use compared to paper forms. This finding encourages us to promote RC adoption among health care providers who currently use paper reports or do not report. Focus group participants' proposed enhancements to RC to facilitate timeliness, and quality of data submission include 1) enabling auto-save or save function to reduce data loss in case of crash and automatic log-out, and 2) increasing the amount of time for completing the report, including the amount of time during which the computer is inactive, before automatic log-out. This second enhancement might be particularly helpful for inpatient facilities that frequently report complex cases. The findings also suggest the potential value of educating health care providers, especially at small outpatient clinics, about the importance and necessity of timely data submission.

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## Abstract

**Objective:** To streamline emergency department data processing in Oregon ESSENCE (Oregon's statewide syndromic surveillance) by systematically and efficiently addressing data quality issues among submitting hospital systems. **Introduction:** Oregon Public Health Division (OPHD), in collaboration with The Johns Hopkins University Applied Physics Laboratory, implemented Oregon ESSENCE in 2011. ESSENCE is an automated, electronic syndromic surveillance system that captures emergency department data from hospitals across Oregon. While each hospital system sends HL7 2.5.1-formatted messages, each uses a uniquely configured interface to capture, extract, and send data. Consequently, ESSENCE receives messages that vary greatly in content and structure. Emergency department data are ingested using the Rhapsody Integration Engine 6.2.1 (Orion Health, Auckland, NZ), which standardizes messages before entering ESSENCE. Mechanisms in the ingestion route (error-handling filters) identify messages that do not completely match accepted standards for submission. A sub-set of these previously-identified messages with errors are corrected within the route as they emerge. Existence of errors does not preclude a message's insertion into ESSENCE. However, the quality and quantity of errors determine the quality of the data that ESSENCE uses. Unchecked, error accumulation also can cause strain to the integration engine. Despite ad-hoc processes to address errors, backlogs accrue. With no meta-data to assess the importance and source of backlogged errors, the ESSENCE team had no guide with which to mitigate errors. The ESSENCE team needed a way to determine which errors could be fixed by updating the Rhapsody Integration Engine and which required consultation with partner health systems and their data vendors. To formally address these issues, the ESSENCE team developed an error-capture module within Rhapsody to identify and quantify all errors identified in syndromic messages and to use as a guide to prioritize fixing new errors. **Methods:** Members of OPHD's informatics team and the Oregon ESSENCE team met to brainstorm solutions to error accumulation and message-processing inefficiencies. The team agreed that existing infrastructure and resources were sufficient to accomplish this project. Using Rhapsody, the team created filters that generated error messages each time an HL7 message failed to validate pre-determined message parameters (a standard HL7 2.5.1 syndromic message definition). In order to capture information about errors that were currently being fixed by the ingestion route, two filters were inserted into the processing route: one before and one after previously-existing error-fixing message-modifiers. The team created a FileMaker database to collect information about each error identified, including submitter, location of error (segment, field, component), type of error (too long for field, not in value set, doesn't adhere to correct message structure). The team enabled error-capture for 81 days (June 16 – September 5, 2017) at which point they evaluated error data so as to guide repair of message modifying filters within the integration engine. **Results:** The module captured 16,273,963 error messages over 81 days. The two error capture filters (before and after existing modifiers) each generated 50% of the error messages. The module identified errors across seven HL7 message segments (DG1, EVN, OBX, PID, PR1, PV1, PV2). One submitter produced 87% of the error messages. Of those, 93% were errors in two fields in the PID segment. Based on the results, ESSENCE team members contacted this submitter and resolved this error, greatly reducing the ingestion and error assessment burden of Rhapsody and the development team. Currently the ESSENCE team is still analyzing the rest of the errors, applying fixes and contacting submitting facilities as needed. Once completed, the ESSENCE team will enable the error capture module bi-annually to continue refinement of its system strategically guide data quality work. **Conclusions:** Oregon ESSENCE developed a tool to evaluate errors in emergency department HL7 messages it receives for syndromic surveillance. Its quick development and reusability make it a cost-effective and sustainable data quality solution for focusing effort in regional installations of syndromic surveillance.

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## Abstract

**Objective:** The objective of this presentation is to use a congruence of standardization protocols to effectively ensure that the quality of the data elements and exchange formats within the NTSS are optimal for users of the system. **Introduction:** Disease surveillance systems remain the best quality systems to rely on when standardized surveillance systems provide the best data to understand disease occurrence and trends. The United States National Tuberculosis Surveillance System (NTSS) contains reported tuberculosis (TB) cases provided by all 50 states, the District of Columbia (DC), New York City, Puerto Rico, and other U.S.-affiliated jurisdictions in the Pacific Ocean and Caribbean Sea [1]. However, the NTSS currently captures phenotypic drug susceptibility testing (DST) data and does not have the ability to collect the rapid molecular DST data generated by platforms such as Cepheid GeneXpert MTB/RIF, Hain MTBDRplus and MTBDRsl, Pyrosequencing, and Whole Genome Sequencing [2-6]. Moreover, the information exchanges within the NTSS (represented in HL7 v2.5.1 [7]) are missing critical segments for appropriately representing laboratory test results and data on microbiological specimens. **Methods:** The application of the standardization protocols involves: (a) the revision of the current Report of Verified Case of Tuberculosis (RCVT) form to include the collection of molecular DST data; (b) the enhancement of the TB Case Notification Message Mapping Guide (MMG) v2.03 [8] to include segments for appropriately reporting laboratory test results (i.e., using Logical Observation Identifiers Names and Codes (LOINC) as a recommended vocabulary) and microbiology related test results (i.e., using Systematized Nomenclature of Medicine -- Clinical Terms (SNOMED CT) as a recommended vocabulary); and (c) the standardization of the laboratory testing results generated by the variety of molecular DST platforms, reported to TB health departments through electronic laboratory results (ELR), using those same standardized LOINC and SNOMED CT vocabularies in HL7 v2.5.1 [7]. **Results:** The application of the standardization protocols would optimize early detection and reporting of rifampin-resistant TB cases; provide a high-quality data-driven decision-making process by public health administrators on TB cases; and generate high-quality datasets to enhance reporting or analyses of TB surveillance data and drug resistance. **Conclusions:** This study demonstrates that it is possible to apply standardized protocols to improve the quality of data, specifications and exchange formats within the NTSS, thereby streamlining the seamless exchange of TB incident cases in an integrated public health environment supporting TB surveillance, informatics, and translational research.

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## Abstract

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**Objective:** To assess the integration process of HIV data from disparate sources for reporting HIV prevention metrics in Scott County, Indiana **Introduction:** In 2015, the Indiana State Department of Health (ISDH) responded to a large HIV outbreak among persons who inject drugs (PWID) in Scott County<sup>1</sup>. Information to manage the public health response to this event and its aftermath included data from multiple sources such as surveillance, HIV testing, contact tracing, medical care, and HIV prevention activities. Each dataset was managed separately and had been tailored to the relevant HIV program area's needs, which is a typical practice for health departments. Currently, integrating these disparate data sources is managed manually, which makes this dataset susceptible to inconsistent and redundant data. During the outbreak investigation, access to data to monitor and report progress was difficult to obtain in a timely and accurate manner for local and state health department staff. ISDH initiated efforts to integrate these disparate HIV data sources to better track HIV prevention metrics statewide, to support decision making and policies, and to facilitate a more rapid response to future HIV-related investigations. The Centers for Disease Control and Prevention (CDC) through its Info-Aid mechanism is providing technical assistance to support assessment of the ISDH data integration process. The project is expected to lead to the development of a dashboard prototype that will aggregate and improve critical data reporting to monitor the status of HIV prevention in Scott County. **Methods:** We assessed six different HIV-related datasets in addition to the state-level integrated HIV dataset developed to report HIV monitoring and prevention metrics. We conducted site visits to the ISDH and Scott County to assess the integration process. We also conducted key informant interviews and focus group discussions with data managers, analysts, program managers, and epidemiologists using HIV data systems at ISDH, Scott County and CDC. We also conducted a documentation review of summary reports of the HIV outbreak, workflow, a business process analysis, and information gathered during the site visit on operations, processes and attributes of HIV data sources. We, then, summarized the information flow, including the data collection process, reporting, and analysis at federal, state and county levels. **Results:** We have developed a list of lessons learned that can be translated for use in any state-level jurisdiction engaged in HIV prevention monitoring and reporting: **Standardization of data formats:** The disparate data sources storing HIV-related information were developed independently on different platforms using different architectures; they were not necessarily designed to link and exchange data. Hence, these systems could not seamlessly interact with each other, posing challenges when rapid data linkage was needed. To better manage unstructured data coming from disparate data sources and improve data integration efforts, we recommend standardization of data formats, unique identifiers for registered individuals, and coding across data systems. Use of standard operating procedures can streamline data flow and facilitate automated creation of integrated datasets. This approach may be helpful for future integration efforts in other healthcare domains. **Data integration process:** Manually integrating data is time intensive, increases workload, and poses significant risk of human error in data compilation. Hence, it may compromise data quality and the accuracy of HIV prevention metrics used by decision-makers. We propose an automated integration process using an extract, transform and load (ETL) method to extract HIV-related data from disparate data sources, transforming it to fit the prevention metrics reporting needs and loading it into a state-level integrated HIV dataset or database. This approach can drastically decrease dependency on manual methods and help avoid data compilation errors. **Dashboard development:** Major challenges in the process of integrating HIV-related data included disparate data sources, compromised data quality, and the lack of standard metrics for some of the HIV-related metrics of interest. Despite these challenges to data integration, creation of a dashboard to track HIV prevention metrics is feasible. Integrating data is a critical part of developing an HIV dashboard that can generate real-time metrics without creating additional burden for the health department staff, if manual integration is no longer needed. **Stakeholder participation:** Due to the immediate need for outbreak response, involvement of stakeholders at all levels was limited. Active stakeholder engagement in this process is essential. The stakeholders' interest and participation can be improved by helping them understand the value of each other's data, and providing regular feedback about their data and its best use in public health interventions. **Conclusions:** This assessment highlighted the importance of standardizing data formats, coding across systems for HIV data, and the use of unique identifiers to store individuals' information across data systems. Promoting stakeholder understanding of the value and best use of their data is also essential in improving data integration efforts. The results of this assessment offer an opportunity to learn and apply these lessons to improve future public health informatics initiatives, including HIV (but not limited to HIV), at any state-level jurisdiction

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## Abstract

**Objective:** This investigation takes a closer look at Other syndrome in ESSENCE and Null syndrome in LEEDS to understand what types of records are not tagged to a syndrome to elucidate data quality issues. **Introduction:** The Louisiana Office of Public Health (OPH) Infectious Disease Epidemiology Section (IDEpi) conducts syndromic surveillance of Emergency Department (ED) visits through the Louisiana Early Event Detection System (LEEDS) and submits the collected data to ESSENCE. There are currently 86 syndromes defined in LEEDS including infectious disease, injury and environmental exposure syndromes, among others. LEEDS uses chief complaint, admit reason, and/or diagnosis fields to tag visits to relevant syndromes. Visits that do not have information in any of these fields, or do not fit any syndrome definition are tagged to Null syndrome. ESSENCE uses a different algorithm from LEEDS and only looks in chief complaint for symptom information to bin visits to syndromes defined in ESSENCE. Visits that do not fit the defined syndromes or do not contain any symptom information are tagged to Other syndrome. Since the transition from BioSense to ESSENCE, IDEpi has identified various data quality issues and has been working to address them. The NSSP team recently notified IDEpi that a large number of records are binning to Other syndrome, which led to the investigation of the possible underlying data quality issues captured in Other syndrome. **Methods:** Daily submissions of electronic data are imported to and processed by LEEDS and ESSENCE for syndrome classification. LEEDS and ESSENCE were queried to first pull total visits and the percent of those visits tagged to Other syndrome in ESSENCE and Null syndrome in LEEDS between the dates of 1/01/2017 and 10/02/2017. The counts and percentages from both systems were compared. The percentage of total visits tagged to Other syndrome was stratified by facility to determine if there were significant differences between facilities. A line level review of visits tagged to Null syndrome in LEEDS and Other syndrome in ESSENCE was also conducted. This review showed that many records were pain related and many records were missing chief complaint. Both systems were then queried for the percent of visits in Other and Null syndrome that did not have symptom information and the percent of visits in Other and Null syndrome that mentioned “pain” in chief complaint. **Results:** The average daily total visits in ESSENCE was 3279 visits per day compared to 5959 average visits per day in LEEDS, with counts in ESSENCE significantly dropping between 6/1/2017 and 7/1/2017. The average percentage of visits tagged to Other syndrome in ESSENCE was 63.16% while the percent of visits tagged to Null syndrome in LEEDS was 34.46%. In ESSENCE, 24.22% of all visits tagged to other syndrome were pain related and 23.98% of all visits tagged to Other syndrome did not have any symptom information in chief complaint. In LEEDS, 43.03% of all visits tagged to Null syndrome were pain related and 3.6% of all visits tagged to Null syndrome had no symptom information. Finally, the percentage of total visits tagged to Other syndrome, stratified by facility, showed some facilities were disproportionately contributing to Other syndrome and that some facilities had major lapses in data in ESSENCE. **Conclusions:** The dramatic difference in total visits between ESSENCE and LEEDS can be attributed to multiple reasons, most of which are likely related to the transition from BioSense to ESSENCE. This difference makes it difficult to compare data between the two systems, and IDEpi is continuing to work on understanding and resolving why these counts are so different. One of the reasons for the higher percentage of total visits binned to Other syndrome in ESSENCE compared to Null syndrome in LEEDS is related to the different processing methods of the two systems. LEEDS uses chief complaint, admit reason and diagnosis fields for symptom information, while ESSENCE only uses chief complaint. This allows LEEDS to tag more visits to syndromes other than Null syndrome. LEEDS also has more defined syndromes, which also contributes to the lower percentages of Null syndrome. The higher percentage of Other syndrome with no chief complaint in ESSENCE can partially be attributed to HL7 formatting issues. ESSENCE is not able to read chief complaint when it is populated if some HL7 formatting issues are present, while LEEDS is still able to read chief complaint when the same HL7 formatting issues exist. Finally, the percentage of total visits tagged to Other syndrome, stratified by facility has provided the facility level information necessary to address some of these data quality issues. Some of the facilities with lapses in data can be traced back to issues in the Master Facility Table (MFT), while other facilities have HL7 formatting issues that need to be addressed directly with the facility. In conclusion, exploring Other syndrome in ESSENCE can provide an interesting perspective into data quality. IDEpi’s ability to compare Other syndrome in ESSENCE to Null syndrome in LEEDS has helped to further identify the data quality issues.

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## Abstract

**Objective:** Provide justification for the collection and reporting of urgent care (UC) data for public health syndromic surveillance. **Introduction:** While UC does not have a standard definition, it can generally be described as the delivery of ambulatory medical care outside of a hospital emergency department (ED) on a walk-in basis, without a scheduled appointment, available at extended hours, and providing an array of services comparable to typical primary care offices.<sup>1</sup> UC facilities represent a growing sector of the United States healthcare industry, doubling in size between 2008 and 2011.<sup>1</sup> The Urgent Care Association of America (UCAOA) estimates that UC facilities had 160 million patient encounters in 2013.<sup>2</sup> This compares to 130.4 million patient encounters in EDs in 2013, as reported by the National Hospital Ambulatory Medical Care Survey.<sup>3</sup> Public Health (PH) is actively working to broaden syndromic surveillance to include urgent care data as more individuals use these services.<sup>4</sup> PH needs justification when reaching out to healthcare partners to get buy-in for collecting and reporting UC data. **Description:** The International Society for Disease Surveillance (ISDS) Community of Practice (CoP) platform was used to host a webinar introducing the topic of urgent care participation in syndromic surveillance. This webinar provided a valuable opportunity to obtain insight from jurisdictions pursuing and using UC data. A workgroup was formed to create documentation justifying the collection and reporting of UC data. Using this forum, the workgroup brought together partners from various jurisdictions working with UC data to participate in a literature review of SCOPUS, PubMed, and the Online Journal of Public Health Informatics publications and to share their experiences. These two main sources of information – previous literature and jurisdictional experience – were combined and condensed to provide tangible justifications for the collection and use of UC data. While the workgroup found little in the literature to justify the collection of UC data as a part of syndromic surveillance, the shared experiences of the CoP jurisdictions working to onboard UC facilities provided valuable insight. From this collaborative response, three main reasons to collect UC data were identified. 1) Healthcare reform is directing patients away from EDs and toward UC facilities. UC represents reduced cost and more efficient patient processing, thus easing the burden on both patient and healthcare system (according to a 2016 American Academy of Pediatrics article entitled “Urgent Care and Emergency Department Visits in the Pediatric Medicaid Population”). If syndromic surveillance does not adapt to include UC data, the potential exists to lose significant patient populations, which may lead to decreased situational awareness. 2) According to the Centers for Medicare and Medicaid Services Stage 3 guidance, Meaningful Use (MU) will change the relationship between eligible professionals (EPs) and syndromic surveillance by restricting EPs to those who practice in a UC facility. This approach to EP participation simplifies the syndromic surveillance MU objective, thereby making it easier for PH jurisdictions to onboard UC facilities. 3) Patients with certain conditions that are acute but non-emergent may report more frequently to an UC facility than to an ED. Broadening syndromic surveillance to include UC facilities may increase reporting of “rare event” encounters, which will lower the relative standard error for statistical calculation. Surveillance efforts for conditions like influenza-like illness and Zika virus may improve substantially with a larger data pool. **How the Moderator Intends to Engage the Audience in Discussions on the Topic:** The moderator will begin discussion with a brief presentation from the literature review and jurisdictional experience, highlighting three justifications for collecting and reporting UC data. The audience will be divided into 3 groups to discuss and validate 3 additional topics: creation of syndromic surveillance talking points to share with UC facility management, creation of jurisdictional UC facility listings, and UC onboarding best practices. Feedback from the 3 groups will be shared with the whole group, followed by a brief summary of the discussion and recommendations for next steps.

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# Roles of Health Literacy in Relation to Social Determinants of Health and Recommendations for Informatics-Based Interventions: Systematic Review

## Abstract

**Objective:** We aim to explore how to effectively leverage social media for vaping electronic cigarette (e-cigarette) surveillance. This study examines how members of a social media platform called Reddit utilize topically-oriented sub-communities for e-cigarette discussions. **Introduction:** In recent years, individuals have been using social network sites like Facebook, Twitter, and Reddit to discuss health-related topics. These social media platforms consequently became new avenues for research and applications for researchers, for instance disease surveillance. Reddit, in particular, can potentially provide more in-depth contextual insights compared to Twitter, and Reddit members discuss potentially more diverse topics than Facebook members. However, identifying relevant discussions remains a challenge in large datasets like Reddit. Thus, much previous research using Reddit data focused on selected few topically-oriented sub-communities. Although such approach allows for topically focused datasets, a large portion of related data can be missed. In this research, we examine all sub-communities in which members are discussing e-cigarettes in order to determine if investigating these other sub-communities could result in a better smoking surveillance system. **Methods:** In this study, we use an archived Reddit dataset<sup>1</sup> that had been used in previous studies<sup>2,3</sup>. We first preprocessed the dataset, which included converting text to lower case and removing punctuation. Due to the size of the dataset (114,320,798 posts and 1,659,361,605 associated comments from 239,772 sub-communities), we identified 4 terms to extract posts or comments about e-cigarettes via a lexicon-based approach. The terms are "e cig", "elec cig", and "electronic cig". We included any partial matches in this process to cover a variation of e-cigarette terms. For example, a partial match of 'cig' can cover 'cig', 'cigs', 'cigarette', and 'cigarettes'. We presented the Wordcloud of the names and frequencies of sub-communities, in which members discussed e-cigarettes. **Results:** We extracted 354,587 posts/comments that were made by 176,252 unique member IDs from 6,039 unique sub-communities. There were 6 sub-communities with more than 8,000 e-cigarette posts. The sub-communities are 'AskReddit' (59,939) 'Cigars' (51,684) 'electronic\_cigarette' (24,393), 'trees' (17,752), 'pics' (8,792), 'stopsmoking' (8,589). Other notable sub-communities are 'news' (5,010), 'politics' (4,662), 'worldnews' (3,785), 'science' (3,279), 'Drugs' (2,967), 'PipeTobacco' (2,099), 'Cigarettes' (1,401), 'teenagers' (1,016), 'AskMen' (918), 'Marijuana' (826), 'Fitness' (818), 'AskWomen' (698), 'cubancigars' (695), and 'vaporents' (608). Members were participating not only in sub-communities related to smoking and smoking cessation, but also in science, news, health, teenager, and Q&A sub-communities. The overview of the sub-communities that members participated to discuss e-cigarette are summarized in Figure 1. **Conclusions:** We present preliminary findings concerning the various sub-communities in which members had discussion on e-cigarettes in the popular social media platform Reddit. Our initial results suggest that Reddit members openly discuss electronic cigarette-related issues in many sub-communities that are unrelated to smoking. For the purpose of e-cigarettes surveillance, understanding the discussions in unrelated sub-communities, for example the subreddit 'teenagers', can provide opportunities to gain an in-depth perspective on the increased use of e-cigarettes by youth or non-smoker<sup>4</sup>. Moreover, high levels of activities in Q&A sub-communities like 'AskReddit', 'AskMen', and 'AskWomen' could indicate ineffective information dissemination regarding e-cigarettes<sup>5</sup>, warranting further investigation. For the purpose of disease surveillance, we conclude that understanding the discussion in unrelated sub-communities has the potential to improve the practice of public health surveillance.

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## Abstract

**Objective:** The aim of this project was to develop a nimble system to both monitor and report on the quality of Kentucky emergency department syndromic surveillance (SyS) data at system-wide and facility levels. **Introduction:** In 2016, the CDC funded 12 states, under the Enhanced State Opioid Overdose Surveillance (ESOOS) program, to utilize SyS to increase timeliness of state data on drug overdose events. In order to operationalize the objectives of the grant, there was a need to assess and monitor the quality of Kentucky's SyS data, with limited resources. We leveraged the NSSP's R Studio Server to automate quality assurance (QA) monitoring and reporting to meet these objectives. **Methods:** Using the R Server, we pulled data from the process messages table, aggregating messages to single patient encounters. In addition to compiling the code on a powerful remote server, the server can access the process table messages relatively quickly. We developed an R Markdown report to produce a report that includes a variety of system- and facility-level metrics that highlight key indicators of system performance and data flows. By using R, we were able to create an auto-generating QA report that runs weekly and e-mails for analyst review. **Quality metrics included:** % completeness of chief complaint and discharge diagnosis codes (overall and by facility)[Fig 1 & Fig 2]; visit trend by day of visit (with interactive spark lines)[Fig 2]; maximum date of message created, date message arrived at NSSP server, date of visit, and total messages[Fig 3]; message arrived trend (interactive sparklines)[Fig 3]; volume and type of error messages failing to process[Fig 4]; message volume by ADT type[Fig 5]; and volume of patient class by type by day[not shown]. Our SyS analyst reviews the report and delivers it to stakeholders with general comments about ongoing and newly emerging data quality concerns. **Results:** The report has proven to be beneficial in ongoing QA monitoring. The report is shared weekly with key stakeholders at the Kentucky Department for Public Health, Kentucky Health Information Exchange, NSSP, and regional ESSENCE users. Findings are reviewed at monthly SyS stakeholder meetings. The report has identified numerous errors, dead feeds, and other systems changes in near real-time; leading to corrective action and general data quality enhancement. Weekly monitoring of QA has improved data feed stability and communication of identified issue with key stakeholders. **Conclusions:** The R Studio Server provides a nimble platform to develop, refine, and automate a QA reporting system that can lead to improved SyS data quality. In Kentucky, in addition to improving overall data quality, these weekly reports and subsequent communication have help built relationships among key stakeholders and elevated the importance of syndromic surveillance data locally. Continual monitoring of data is critical to ensure quality and therefor the validity of the data.

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## Abstract

**Objective:** The objective is to develop an ensemble of machine learning algorithms to identify multilingual, online articles that are relevant to biosurveillance. Language morphology varies widely across languages and must be accounted for when designing algorithms. Here, we compare the performance of a word embedding-based approach and a topic modeling approach with machine learning algorithms to determine the best method for Chinese, Arabic, and French languages. **Introduction:** Global biosurveillance is an extremely important, yet challenging task. One form of global biosurveillance comes from harvesting open source online data (e.g. news, blogs, reports, RSS feeds). The information derived from this data can be used for timely detection and identification of biological threats all over the world. However, the more inclusive the data harvesting procedure is to ensure that all potentially relevant articles are collected, the more data that is irrelevant also gets harvested. This issue can become even more complex when the online data is in a non-native language. Foreign language articles not only create language-specific issues for Natural Language Processing (NLP), but also add a significant amount of translation costs. Previous work shows success in the use of combinatory monolingual classifiers in specific applications, e.g., legal domain [1]. A critical component for a comprehensive, online harvesting biosurveillance system is the capability to identify relevant foreign language articles from irrelevant ones based on the initial article information collected, without the additional cost of full text retrieval and translation. **Methods:** The analysis text dataset contains the title and brief description of 3506 online articles in Chinese, Arabic, and French languages from the date range of August, 17, 2016 to July 5, 2017. The NLP article pre-processing steps are language-specific tokenization and stop words removal. We compare two different approaches: word embeddings and topic modeling (Fig. 1). For word embeddings, we first generate word vectors for the data using a pretrained Word2Vec (W2V) model [2]. Subsequently, the word vectors within a document are averaged to produce a single feature vector for the document. Then, we fit a machine learning algorithm (random forest classifier or Support Vector Machine (SVM)) to the training vectors and get predictions for the test documents. For topic modelling, we used a Latent Dirichlet Allocation (LDA) model to generate five topics for all relevant documents [3]. For each new document, the output is the probability measure for the document belonging to these five topics. Here, we classify the new document by comparing the probability measure with a relevancy threshold. **Results:** The Word2Vec model combined with a random forest classifier outperformed the other approaches across the three languages (Fig. 2); the Chinese model has an 89% F1-score, the Arabic model has 86%, and the French model has 94%. To decrease the chance of calling a potentially relevant article irrelevant, high recall was more important than high precision. In the Chinese model, the Word2Vec with a random forest approach had the highest recall at 98% (Table 1). **Conclusions:** We present research findings on different approaches of relevance to biosurveillance identification on non-English texts and identify the best performing methods for implementation into a biosurveillance online article harvesting system. Our initial results suggest that the word embeddings model has an advantage over topic modeling, and the random forest classifier outperforms the SVM. Directions for future work will aim to further expand the list of languages and methods to be compared, e.g., n-grams and non-negative matrix factorization. In addition, we will fine-tune the Arabic and French model for better accuracy results.

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# Roles of Health Literacy in Relation to Social Determinants of Health and Recommendations for Informatics-Based Interventions: Systematic Review

## Abstract

**Objective:** 1. Develop an understanding of the benefits and challenges of analyzing free text fields on a population level. 2. Observe how a complex surveillance definition can be created from free text fields. 3. Observe how an ambulance data system can be used to describe the opioid epidemic. **Introduction:** In 2016, twelve states received Center for Disease Control and Prevention (CDC) Enhanced State Opioid Overdose Surveillance grants. The purpose of the grant is to explore enhanced data sources to track nonfatal opioid overdoses. One data source is ambulance runs. Wisconsin collects ambulance run information within the Wisconsin Ambulance Runs Data System (WARDS). Around 84% of all Wisconsin administrative services report into this electronic system. This is a timely, robust data system that has not been used previously to examine drug overdoses and presents an analytical challenge as it contains many free text fields. **Methods:** Wisconsin's ambulance data system is robust, well-populated, and includes the majority of Emergency Medical Services (EMS) within the state. The analytic challenge with this data is that most of the reported fields are free text, which can be difficult to analyze on a population level. Wisconsin created a case definition using SAS regular expressions to take advantage of the free text fields. A combination of fields (chief complaint, secondary complaint, medications given, and the EMS narrative) were used to determine if the ambulance run was due to an opioid overdose. It was necessary to create a definition that used a diverse combination of phrases as free text fields are prone to spelling errors and there are many phrases used to identify opioid overdoses. It was also necessary to create a definition for unwanted phrases that signal a false positive, for example, "withdrawal". **Results:** Wisconsin's opioid definition uses regular expressions to search for the words "heroin", "opioid", "narcan", or "methadone" (including various spellings). The overdose definition searches for words and phrases like "drug abuse", "drug use", "poisoning", "drug ingestion", and "overdose". The medication administered fields are examined for "narcan". In Wisconsin, the medication is listed every time it is used, so it is possible to determine the number of times Narcan was administered to a single person as well as how many ambulance runs used at least one dose of Narcan. False positives are identified with words and phrases like "withdrawal", "detox", and if Narcan was given but there is no indication that the ambulance run was due to drugs. From January 2016 – June 2017, Wisconsin had over 917,000 ambulance runs for people aged 11 years and older. We excluded non-emergency ambulance runs, like medical transports, and so our final denominator was 627,536 runs (32% of all runs were classified as non-emergencies). Suspected opioid overdoses were determined to be 1% of emergency ambulance runs. Narcan was administered in a total of 5,900 runs and the false positive flag picked up 10,399 runs that may not have been due to suspected opioid overdoses. Applying all of these components together, it was determined that in Wisconsin from January 2016 – June 2017, there were 4,041 emergency ambulance runs due to suspected, unintentional opioid overdoses for people 11 years and older (rate of 6 per 1,000 people). **Conclusions:** The use of regular expressions enables Wisconsin to extend analyses to data systems that contain robust information within free text fields. Within Wisconsin, this has been utilized to enhance opioid overdose surveillance with the use of a rapid data system previously not examined. Ambulance run information is a valuable resource to Wisconsin with the opioid epidemic. By creating case definitions with free text fields, we can quantify ambulance runs on a population level and create linkable analytic data sets to provide a more complete picture of the health of Wisconsin.

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# Roles of Health Literacy in Relation to Social Determinants of Health and Recommendations for Informatics-Based Interventions: Systematic Review

## Abstract

**Objective:** We aim to understand (1) the frequency of URL sharing and (2) types of shared URLs among opioid related discussions that take place in the social media platform called Reddit. **Introduction:** Nearly 100 people per day die from opioid overdose in the United States. Further, prescription opioid abuse is assumed to be responsible for a 15-year increase in opioid overdose deaths<sup>1</sup>. However, with increasing use of social media comes increasing opportunity to seek and share information. For instance, 80% of Internet users obtain health information online<sup>2</sup>, including popular social interaction sites like Reddit (<http://www.reddit.com>), which had more than 82.5 billion page views in 2015<sup>3</sup>. In Reddit, members often share information, and include URLs to supplement the information. Understanding the frequency of URL sharing and types of shared URLs can improve our knowledge of information seeking/sharing behaviors as well as domains of shared information on social media. Such knowledge has the potential to provide opportunities to improve public health surveillance practice. We use Reddit to track opioid related discussions and then investigate types of shared URLs among Reddit members in those discussions. **Methods:** First, we use a dataset<sup>4</sup>—made available on Reddit—that has been used in several informatics studies<sup>5,6</sup>. The dataset is comprised of 13,213,173 unique member IDs, 114,320,798 posts, and 1,659,361,605 associated comments that are made on 239,772 (including active and inactive) subreddits (i.e., sub-communities) from October 2007 to May 2015. Second, we identified 9 terms that are associated with opioids. The terms are "opioid", "opium", "morphine", "opiate", "hydrocodone", "oxycodone", "fentanyl", "heroin", and "methadone". Third, we preprocessed the entire dataset (i.e., converting text to lower cases and removing punctuation) and extracted discussions with opioid terms and their metadata (e.g., user ID, post ID) via a lexicon-based approach. Fourth, we extracted URLs using Python from these discussions, categorized the URLs by domain, and then visualized the results in a bubble chart<sup>7</sup>. **Results:** We extracted 1,121,187 posts/comments that were made by 328,179 unique member IDs from 8,892 subreddits. Of the 1,121,187 posts/comments, 82,639 posts/comments contained URLs (7.37%), and these posts consisted of 272,551 individual URLs and 138,206 unique URLs. The types of shared URLs in these opioid related discussions are summarized in Figure 1. The color and size represent the type and size respectively of shared URLs. The '.com' is in blue; '.org' is in orange; and '.gov' is in green. **Conclusions:** We present preliminary findings concerning the types of shared URLs in opioid-related discussions among Reddit members. Our initial results suggest that Reddit members openly discuss opioid related issues and URL sharing is a part of information sharing. Although members share many URLs from reliable information sources (e.g., 'ncbi.nlm.nih.gov', 'wikipedia.org', 'nytimes.com', 'sciencedirect.com'), further investigation is needed concerning many of the '.com' URLs, which have the potential to contain high and/or low quality information (e.g., 'youtube.com', 'reddit.com', 'google.com', 'amazon.com') to fully understand information seeking/sharing behaviors on social media and to identify opportunities, such as misinformation dissemination for improving public health surveillance practice.

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# Roles of Health Literacy in Relation to Social Determinants of Health and Recommendations for Informatics-Based Interventions: Systematic Review

## Abstract

**Objective:** We demonstrate an architecture for driving regional public health decisions with automated and semi-automated data collected from open source point of care systems in resource constrained environments. **Introduction:** Ministries of Health in Low and Middle Income Countries (LMIC) are making or trying to make public health decisions for infectious disease conditions like HIV using data garnered from sentinel events and disease tracking in the community. The process of gathering and aggregating data for these case-based reports for is, in all too often a cumbersome or paper-based process. The Center for Disease Control (CDC) was interested in prototyping and piloting approaches that could improve the efficiency and reliability of case reports in resource-constrained environments. One of their primary goals was to demonstrate how electronic data gathered in the front lines of care could be leveraged to automate and improve the reliability of data within case reports driving public health decisions at regional and country levels. OpenMRS is an open source medical record system platform often used in resource constrained environments.<sup>1</sup> Since OpenMRS is used as an electronic medical record system in several African countries and has been connected to regional or country-level health exchanges, the CDC was interested in building a working solution for electronic case based reporting using OpenMRS and a health information exchange. **Methods:** Working closely with the CDC, we developed a Case-Based Reporting (CBR) module for OpenMRS, using HIV as an initial use case. Trigger events were defined based on sentinel events and key clinical monitoring conditions and these were mapped or added to standard terminologies. We use Health Level 7 (HL7) messaging standards to deliver case reports from OpenMRS to the health information exchange.<sup>2</sup> We used existing manual workflows and EPI officers to define the needs for a surveillance officer role and the requirements for the CBR module. The module was developed as open source using agile methodologies. OpenHIE (ohie.org) was selected to demonstrate the ability of OpenMRS module to submit an electronic case report to a health information exchange. **Results:** We have a working, open source case-based surveillance module for OpenMRS that comes with nine pre-defined HIV-specific triggers: ● New Case ● New Disease ● New Treatment ● Evidence of Lack of Monitoring ● Evidence of Treatment Failure ● Switched to Second Line Regimen ● Treatment Stopped ● Lost to Follow Up ● Patient Died We have been able to demonstrate the automatic creation of HIV-based case reports based on data within an electronic medical record system, placement of these proposed case reports into a work queue for a surveillance officer, and successful electronic submission of these case reports into a health information exchange. **Conclusions:** This work demonstrates the ability to develop open source point of care software solutions for LMIC that can be used for sentinel awareness as well as longitudinal monitoring of individual patient care. The current scenarios, trigger identification standards, and messaging specifications are easily accessible and published on the OpenMRS Wiki.<sup>3</sup> Our incorporation of user centered design through EPI officer engagement helped ensure that our solution is responsive to the end user. The CDC is able to use this solution to demonstrate the feasibility of incorporating electronic case reporting in LMICs and to demonstrate the benefits and promote the adoption of electronic medical record systems and health information exchanges in resource constrained environments. In the next phase of this work, we will be working with the CDC to identify sites within Africa for deployment and refinement of the CBR module.

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## Abstract

**Objective:** Although relying on verbal definitions of "re-emergence", descriptions that classify a "re-emergence" event as any significant recurrence of a disease that had previously been under public health control, and subjective interpretations of these events is currently the conventional practice, this has the potential to hinder effective public health responses. Defining re-emergence in this manner offers limited ability for ad hoc analysis of prevention and control measures and facilitates non-reproducible assessments of public health events of potentially high consequence. Re-emerging infectious disease alert (RED Alert) is a decision-support tool designed to address this issue by enhancing situational awareness by providing spatiotemporal context through disease incidence pattern analysis following an event that may represent a local (country-level) re-emergence. The tool's analytics also provide users with the associated causes (socioeconomic indicators) related to the event, and guide hypothesis-generation regarding the global scenario. **Introduction:** Definitions of "re-emerging infectious diseases" typically encompass any disease occurrence that was a historic public health threat, declined dramatically, and has since presented itself again as a significant health problem. Examples include antimicrobial resistance leading to resurgence of tuberculosis, or measles re-appearing in previously protected communities. While the language of this verbal definition of "re-emergence" is sensitive enough to capture most epidemiologically relevant resurgences, its qualitative nature obfuscates the ability to quantitatively classify disease re-emergence events as such. **Methods:** Our tool automatically computes historic disease incidence and performs trend analyses to help elucidate events which a user may considered a true re-emergence in a subset of pertinent infectious diseases (measles, cholera, yellow fever, and dengue). The tool outputs data visualizations that illustrate incidence trends in diverse and informative ways. Additionally, we categorize location and incidence-specific indicators for re-emergence to provide users with associated indicators as well as justifications and documentation to guide users' next steps. Additionally, the tool also houses interactive maps to facilitate global hypothesis-generation. **Results:** These outputs provide historic trend pattern analyses as well as contextualization of the user's situation with similar locations. The tool also broadens users' understanding of the given situation by providing related indicators of the likely re-emergence, as well as the ability to investigate re-emergence factors of global relevance through spatial analysis and data visualization. **Conclusions:** The inability to categorically name a re-emergence event as such is due to lack of standardization and/or availability of reproducible, data-based evidence, and hinders timely and effective public health response and planning. While the tool will not explicitly call out a user scenario as categorically re-emergent or not, by providing users with context in both time and space, RED Alert aims to empower users with data and analytics in order to substantially enhance their contextual awareness; thus, better enabling them to formulate plans of action regarding re-emerging infectious disease threats at both the country and global level.

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## Abstract

**Objective:** The “ledsmanageR”, a data management platform built in R, aims to improve the timeliness and accuracy of national foodborne surveillance data submitted to the Laboratory-based Enteric Disease Surveillance (LEDS) system by automating the data processing, validating, and reporting workflow. **Introduction:** The National Surveillance Team in the Enteric Diseases Epidemiology Branch of the Centers for Disease Control and Prevention (CDC) collects electronic data from all state and regional public health laboratories on human infections caused by *Campylobacter*, *Salmonella*, Shiga toxin-producing *E. coli*, and *Shigella* in LEDS. These data inform annual estimates of the burden of illness, assessments of patterns in bacterial subtypes, and can be used to describe trends in incidence. Robust digital infrastructure is required to process, validate, and summarize data on approximately 60,000 infections annually while optimizing use of financial and personnel resources. **Methods:** We leveraged the robust and extensible programming facilities of the R programming language and the active community of R users to develop a data integration, processing, and reporting pipeline for LEDS via an internal software package we named “ledsmanageR”. We designed all data retrieval, cleaning, and provisioning algorithms using tools from RStudio software packages<sup>1–3</sup> and tracked changes to source code and data using CDC’s internal Gitlab server. We automated data validation requests to reporting partners by generating customizable emails directly from the R console<sup>4</sup>. We streamlined the data reconciliation process using OpenRefine<sup>5</sup>, a point-and-click tool for cleaning big data. We automated generation of annual reports, a process that was previously manual, using parameterized RMarkdown documents. Staff epidemiologists performed design and implementation internally, requiring no external consulting. **Results:** Developing our free and open-source software platform for national foodborne surveillance data management has saved the Enteric Diseases Epidemiology Branch thousands of dollars because we no longer depend on proprietary software requiring annual licensing fees. This transition occurred without any disruption in surveillance operations. Partial automation of email-based data validation and annual report generation processes reduced employee time requirement from one full-time position to one part-time position. The modular nature of ledsmanageR permitted LEDS to collect an expanded set of data elements with no changes to the core data processing and reporting workflow. **Conclusions:** We developed and implemented a flexible tool that helps maintain the integrity of surveillance data and reduces the need for manual data cleaning, which can be laborious and error-prone. The user-friendly design features of ledsmanageR demonstrate that data management can be optimized using programming skills that are increasingly common among epidemiologists. Our work on improving the accuracy and efficiency of enteric disease surveillance has served as a proof of concept for plans to streamline data processing for other surveillance systems.

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# Roles of Health Literacy in Relation to Social Determinants of Health and Recommendations for Informatics-Based Interventions: Systematic Review

## Abstract

**Objective:** To describe how the County of San Diego linked information from a communicable disease registry and syndromic surveillance system to further describe cases associated with a large hepatitis A outbreak. Specifically, to detail the linkage process which resulted in a longitudinal understanding of individuals' hospital visits before, during, and after the reported hepatitis A incident. **Introduction:** With increasing availability of syndromic meaningful use data, new approaches to disease surveillance utilizing linkages to other data systems are possible. Expanded communicable disease information may be valuable during outbreaks or other public health emergencies. San Diego County is experiencing a significant and protracted hepatitis A outbreak. The disease has been transmitted person-to-person through close contact or through a fecally-contaminated environment, and has been primarily affecting homeless people and injection and non-injection illicit drug users. As of August 31, 2017, there were nearly 400 cases with 15 deaths. Approximately, 70% of the cases were hospitalized. This is one of the nation's largest hepatitis A outbreaks since the introduction of the hepatitis A vaccine in 1995. Additional cases are expected over the next twelve months. The population affected by this outbreak presents some challenges for outbreak response. It is often a difficult population to reach. In addition, many have multiple comorbidities and often have health care seeking behaviors that differ from the general population. Using the medical record number (MRN) to link hepatitis A disease cases from the communicable disease registry to syndromic HL7 messages for emergency department visits and hospitalizations enabled the identification of additional hospital encounters the cases may have had before, during, or following their hepatitis A disease incident. This allowed an exploration of the ways in which this unique population interacted with the health care system in the context of a communicable disease outbreak. This presentation will highlight the steps to link information across surveillance systems, the results, the challenges, and the benefits of linked information to public health departments. **Methods:** Electronic information from a communicable disease registry system and syndromic surveillance HL7 data from participating hospitals were utilized. The patient's MRN, available in both systems, was used to link the records. The syndromic data for this project included syndromic messages from 90 days prior to the first outbreak-related hepatitis A case in November 2016 through August 31, 2017. Records with no MRN present, were unmatchable, or records with an encrypted MRN were excluded. The communicable disease registry data included outbreak-related hepatitis A cases from November 2016 through August 2017. Records were excluded if the disease incident was associated with a hospital not currently providing syndromic surveillance information. The linked dataset will continue to be updated as the outbreak progresses. Using the linked data, relevant dates and date ranges were determined for each case, including onset of hepatitis A-associated illness, hepatitis A exposure windows, infectious periods, and a 90 day post-illness period allowing for identification of possible relapsing illness patterns. Based on these dates, hepatitis A case-patients who had HL7 messages for emergency department or hospitalization visits prior to, during, and following their hepatitis A episode were identified. Interactions with the health care system were summarized and case studies were developed. **Results:** During the study time period, 396 outbreak-related hepatitis A case reports were received and documented in the communicable disease registry and nearly 18 million syndromic HL7 messages were received. After the exclusions, the MRN from 130 hepatitis A cases were linked to one or more syndromic HL7 messages associated with visits to an emergency department or inpatient hospital admissions. A total of 616 hospital encounters were documented among the 130 linked cases which reflects an overall average of 4.7 visits per case. Many of these case-patients had numerous health care visits before, during, and after their hepatitis A episode. Among the 130 linked cases, 56% (n=73) of the cases linked to one or more hospital visits other than the visit in which they were diagnosed with hepatitis A. Many of these visits were made during their infectious period prior to being treated for hepatitis A. In addition, with the available data to date, 25% (n=33) of the linked cases had additional hospital visits following their hepatitis A diagnosis. These and other findings were used to provide additional outbreak response recommendations and shape additional surveillance and case monitoring approaches. **Conclusions:** The use of MRN to link records from a communicable disease registry to syndromic HL7 data is a viable tool for public health departments looking to obtain additional information about communicable disease cases and enhance surveillance and disease control activities. In this study, the linkage yielded a more complete profile of patient outcomes and health care-seeking behaviors of individuals diagnosed with hepatitis A. The County of San Diego gained a broader understanding of a unique population's interactions with the health care system, including the identification of missed opportunities for vaccination and earlier diagnosis. The information was then leveraged to improve vaccination and other outreach and prevention efforts.

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# Roles of Health Literacy in Relation to Social Determinants of Health and Recommendations for Informatics-Based Interventions: Systematic Review

## Abstract

**Objective:** Integrate and streamline the collection and analysis of environmental, veterinary, and vector zoonotic data using a One Health approach to data system development. **Introduction:** Environmental Public Health Zoonotic Disease surveillance includes veterinary, environmental, and vector data. Surveillance systems within each sector may appear disparate from each other, although they are actually complimentary and closely allied. Consolidating and integrating data in to one application can be challenging, but there are commonalities shared by all. The goal of the One Health Integrated Data Sysytem is to standardize data collection, streamline data entry, and integrate these sectors in to one application. **Methods:** Data Assessment. An assessment of each surveillance function was carried out to evaluate data types and needs. Identify Commonalities. Common data was identified across each of the surveillance areas. Identify Unique Data. Data unique to specific surveillance efforts was identified. Build Data Structure. A back-end data structure was developed that reflected the data needs from each surveillance area. Build Data Entry Interfaces. Data entry interfaces were developed to meet the needs of each surveillance area. Build Data QC. Procedures were developed that run several quality control checks on the data. Build Data Eports. To allow users to carry out more extensive analysis of data, customized data exports were built. **Results:** This data integration project resulted in: ● Reduced time spent entering and managing data ● Improved data entry error rates ● Increased visibility through automated program metrics ● Improved access to data from data users **Conclusions:** Integrating data and building a data system that reflects the diversity of environmental, veterinary, and vector surveillance data is doable using off-the-shelf database tools. The process of integrating data and building the data structure results in a more intimate understanding of the data revealing opportunities for improving data quality.

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# Roles of Health Literacy in Relation to Social Determinants of Health and Recommendations for Informatics-Based Interventions: Systematic Review

## Abstract

**Objective:** In this paper we designed one cross-platform surveillance system to assist dengue fever surveillance, outbreak investigation and risk management of dengue fever. **Introduction:** In the 2015 dengue outbreak in Taiwan, 43,784 people were infected and 228 died, making it the nation's largest outbreak ever. Facing the increasing threat of dengue, the integration of health information for prevention and control of outbreaks becomes very important. Based on past epidemics, the areas with higher incidence of dengue fever are located in southern Taiwan. Without a smart and integrated surveillance system, the information on case distribution, high risk areas, mosquito surveillance, flooding areas and so on is fragmented. The first-line public health workers need to check all this information through different systems manually. When outbreaks occurred, paper-based outbreak investigation forms had to be prepared and filled in by public health workers. Then, they needed to enter part of this information into Taiwan CDC's system. Duplicated work occurred and cost lots of labor time during the epidemic period. Therefore, we choose one rural county, Pingtung County, with scarce financial resources, to set up a new dengue surveillance system. **Methods:** We designed a web-based cross-platform system based on an open geographical information system (GIS) framework including Openlayers, Javascript, PHP, MySQL and open data from government open data in Taiwan. There were seven epidemiological intelligence functions within the system including risk management, outbreak investigation, planning controlled areas, intelligent detection of high-risk areas, useful tools for decision making, historical epidemics, and system management. The website was developed by responsive web design which can let public health workers check information and fill in the investigation form by any devices. **Results:** The system was promptly set up in June 2016. With first-line public health workers' efforts and the help of the surveillance system, there were no indigenous dengue fever cases after the system was implemented. There were sporadic imported cases from south-east Asia. The dengue surveillance system achieved three major improvements: integration of all decision support information; digitalization and automation of outbreak investigation; and planning the control areas. The results on outbreak investigation and mosquito surveillance can directly transfer to Taiwan CDC's database by Web Application Programming Interface (API). It can avoid duplicated work for disease surveillance. **Conclusions:** Through introducing the new dengue surveillance system into local health departments, first-line public health workers can update all epidemic information at the same time. During epidemic periods, it can provide demographic, epidemiological, environmental, and entomological information for decision making. During non-epidemic periods, it can highlight the high risk areas for enhanced surveillance to reduce the risk of outbreaks.

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# Roles of Health Literacy in Relation to Social Determinants of Health and Recommendations for Informatics-Based Interventions: Systematic Review

## Abstract

**Objective:** Discuss use of syndromic surveillance as a source for the state's ILI/Influenza surveillance. Discuss reliability of syndromic data and methods to address problems caused by data outliers and inconsistencies. **Introduction:** ILINet is a CDC program that has been used for years for influenza-like illness (ILI) surveillance, using a network of outpatient providers who volunteer to track and report weekly the number of visits due to ILI and the total number of visits to their practice. Pennsylvania has a network of 95 providers and urgent care clinics that submit data to ILINet. However, ongoing challenges in recruiting and retaining providers, and inconsistent weekly reporting are barriers to receiving accurate, representative, and timely ILI surveillance data year-round. Syndromic surveillance data have been used to enhance outpatient ILI surveillance in a number of jurisdictions, including Pennsylvania. At present, 156 hospitals, or 90% of all Pennsylvania hospitals with emergency departments (EDs), send chief complaint and other information on their ED visits to the Department of Health's (PADOH) syndromic surveillance system. PADOH evaluated the consistency and reliability of ILI syndromic data as compared to ILINet data, to confirm that syndromic data were suitable for use in ILINet. **Methods:** Pennsylvania ILINet data from the past 6 influenza seasons (2011-2012 to 2016-2017, or 314 weeks of data) were downloaded from the CDC's ILINet website. The statewide weekly percent of visits due to ILI in ILINet was used as the standard for comparisons. For syndromic surveillance, PADOH uses the Epicenter platform hosted by Health Monitoring Systems (HMS); visit-level data are also stored in SAS datasets at PADOH, and HMS forwards a subset of data to the National Syndromic Surveillance System Program. Using syndromic data from the same time period, the proportion of weeks with no syndromic data available was calculated for each facility. A state-developed ILI algorithm (very similar to the 2016 algorithm developed by the ISDS Syndrome Definitions Workgroup) was applied to ED visit chief complaint data to identify visits likely to be due to ILI. The algorithm flags the ER visit as ILI if chief complaint has any combinations of words for flu or fever plus either cough and sore throat or fever and both cough or sore throat. The percent of ED visits due to ILI per the syndromic algorithm (ILIsyn) was calculated for each week by hospital and state-wide. Facility ILIsyn trends were compared to the State level percent ILI data from ILINet by visually examining plots and by calculating Pearson correlation coefficients. Facilities that had  $\geq 15$  weeks where ILIsyn differed from percent ILI in ILINet by more than 5% were considered to be poorly correlated. **Results:** A total of 156 hospitals were evaluated in the study. Twenty of the hospitals were excluded because they did not have syndromic data for at least 50% of the weeks in the study period, and an additional 20 were excluded because they had not agreed to have data forwarded to CDC. Of the remaining 116 facilities, individual facility correlation coefficients between ILIsyn and ILINet trends ranged from 0.03 to 0.82 (examples are in Figure 1). Twenty-four hospitals (20.7%) were determined to be poorly correlated. When data from the remaining 92 hospitals were combined, the state ILINet and state-wide ILIsyn trends were strongly correlated statistically and graphically ( $r=0.82$ ,  $p < 0.0001$ , Figure 2). Syndromic data from these 92 facilities were deemed acceptable for inclusion in ILINet. **Conclusions:** Syndromic surveillance data are a valuable source for ILI surveillance. However, evaluation at the hospital-specific level revealed that useful information is not obtained from all facilities. This project demonstrated that validation of data at the facility level is crucial to obtaining reliable and meaningful information. More work is needed to understand which factors distinguish well-correlated from poorly-correlated facilities, and how to improve the quality of information obtained from poorly-correlated facilities.

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# Roles of Health Literacy in Relation to Social Determinants of Health and Recommendations for Informatics-Based Interventions: Systematic Review

## Abstract

**Objective:** The Wearable Sensor Application developed by Pacific Northwest National Laboratory (PNNL) provides an early warning system for stressors to individual and group health using physiologic and environmental indicators. The application integrates health monitoring parameters from wearable sensors, e.g., temperature and heart rate, with relevant environmental parameters, e.g., weather and landscape data, and calculates the corresponding physiological strain index. The information is presented to the analyst in a group and individual view with real-time alerting of abnormal health parameters. This application is the first of its kind being developed for integration into the Defense Threat Reduction Agency's Biosurveillance Ecosystem (BSVE). **Introduction:** Wearable devices are a low cost, minimally invasive way to monitor health. Sensor data provides real-time physiological indicators of an individual's health status without the requirement of health care professionals or facilities. Information gleaned from wearable sensors can be used to better understand physiological stressors and prodromal symptoms. In addition, this data can be used to monitor individuals that are in high risk of health-related problems. However, raw data from wearable sensors can be overwhelming to process and laborious to monitor for an individual and, even more so, for a group of individuals. Often specific combination of ranges of sensor readings are indicative of changes to health status and need to be evaluated together or used to calculate specific signal parameters. In addition, the environment surrounding the individual needs to be considered when interpreting the data. To address these issues, PNNL has developed an application that collects, analyzes, and integrates wearable sensor data with geographic landscape and weather information to provide a real-time early alert and situational awareness tool for monitoring the health of groups and individuals. **Methods:** The prototype application described here was a product of PNNL's BSVE Application Development Competition. The final product that will be deployed in the BSVE is currently under development by PNNL and will vary slightly in the exact design and architecture described. **Data.** Wearable sensor data was collected from the Rim2Rim (R2R) Watch Study of individuals hiking the Grand Canyon in Arizona [1]. Weather information was obtained from nearby weather stations and mapping features were derived from Google Maps. **Calculations.** A physiological Strain Index (PSI) was calculated using core temperature estimates derived through a Kalman Filter approach and heart rate [2,3]. **Application.** The prototype backend application development was based in Python with a MongoDB. The front-end development was built using a scalable architecture and modular approach with components in React and D3. **Results:** A prototype application was developed this past summer through the PNNL BSVE App Competition (Fig 1). The application was aimed at visualizing wearable sensor data from the Grand Canyon R2R hike dataset. Simulated real-time analysis was used to calculate health status of individuals hiking based on measured physiological parameters and to alert to individuals with signs of physiologic health stress. Visualization tools were incorporated to enable sensor data for individuals and the group to be viewed simultaneously along with pertinent weather, geographic, and elevation data. Many features described in the prototype application will be incorporated into the final BSVE application. The key changes will be 1) the ability to select given time periods for viewing historical data as well as the real-time data collection, 2) environmental data and map view will come from BSVE internal data sources, and 3) the alerts will provide more information and have their own page for reviewing. **Conclusions:** The Wearable Sensor Application developed by PNNL for integration into the BSVE provides an early warning system for individual and group health using physiologic and environmental parameters. The application highlights health status from wearable sensors and relevant environmental parameters while monitoring a calculated physiological strain index. With this tool, an analyst can easily monitor the health of individuals and groups with the aid of real-time alerting tool for early detection of abnormal health parameters.

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# Roles of Health Literacy in Relation to Social Determinants of Health and Recommendations for Informatics-Based Interventions: Systematic Review

## Abstract

**Objective:** Analytics for the Investigation of Disease Outbreaks (AIDO) is a web-based tool designed to enhance a user's understanding of unfolding infectious disease events. A representative library of over 650 outbreaks across a wide selection of diseases allows similar outbreaks to be matched to the conditions entered by the user. These historic outbreaks contain detailed information on how the disease progressed as well as what measures were implemented to control its spread, allowing for a better understanding within the context of other outbreaks. **Introduction:** Situational awareness, or the understanding of elemental components of an event with respect to both time and space, is critical for public health decision-makers during an infectious disease outbreak. AIDO is a web-based tool designed to contextualize incoming infectious disease information during an unfolding event for decision-making purposes. **Methods:** Public health analysts of the Biology Division at Los Alamos National Laboratory curated a diverse library of historic disease outbreaks from publicly available official reports and peer reviewed literature to serve as a representation of the range of potential outbreak scenarios for a given disease. Available outbreak metadata are used to identify properties that relate to the magnitude and/or duration of the outbreak. Properties vary by disease, as they are related to disease-specific characteristics like transmission, disease manifestation, risk factors related to disease severity, and environmental factors specific to the given location. These properties are then incorporated into a similarity algorithm (s in Figure 1) to identify outbreaks that are similar to user inputs. **Results:** AIDO currently includes libraries for 39 diseases that are diverse across pathogen type (viral, bacterial and parasitic) as well as transmission type (vectorborne (e.g., Dengue, Malaria), foodborne (e.g., Salmonella, Campylobacteriosis), waterborne (e.g., Cholera), and person-to-person transmitted (e.g., Measles)). In addition to providing a similarity score to the user's outbreak, we provide aggregated comparisons to multiple historical outbreaks, descriptive statistics to show the distribution of property values for each disease, and extensive contextual information about each outbreak. **Conclusions:** The analytics provided by AIDO allow users to interact with a unique data set of historic outbreaks and the associated metadata to contextualize incoming information and generate hypotheses about appropriate decisions. The tool is continually updated with new functionalities and additional data.

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# Roles of Health Literacy in Relation to Social Determinants of Health and Recommendations for Informatics-Based Interventions: Systematic Review

## Abstract

**Objective:** To show how the creation of a software tool and implementation of new processes improved the efficiency of syndromic surveillance onboarding at the Tennessee Department of Health. **Introduction:** Syndromic surveillance is commonly supported by information generated from electronic health record (EHR) systems and sent to public health via standardized messaging. Before public health can receive syndromic surveillance information from an EHR, a healthcare provider must demonstrate reliable and timely generation of messages according to national standards. This process is known as onboarding. Onboarding at the Tennessee Department of Health (TDH) focused heavily on human review of HL7 messages. However, the visual inspection of messages was time-intensive and delayed efforts to provide constructive feedback to participating healthcare providers. To ease the quantity of manual review done during the onboarding process, TDH created an application to assist in the process of reviewing syndromic surveillance messages. **Methods:** The application for reviewing syndromic surveillance messages was developed in Python 3.6, a general purpose programming language. Python was selected because of the strong libraries already developed in the language for data analysis, database interaction, and interacting with healthcare related data. To support TDH onboarding efforts, the application performed three tasks : file handling, HL7 processing, and database loading. File handling was completed using Python core libraries. Healthcare facilities participating in onboarding regularly uploaded test HL7 batch files containing all emergency department (ED) visits to a secure File Transfer Protocol (sFTP) server owned by the State of Tennessee. Files are then retrieved from the sFTP server and delivered to the TDH integration engine, Rhapsody. Rhapsody processes the incoming files and makes a copy available to the Python application. The copies are then loaded by the application into a database and backed up in an archive. After the application has finished handling the received files, the raw HL7 messages within the files are processed to extract relevant information needed to validate the message. The extraction was supported by the “python-hl7” library. The application referenced a CSV file with the names and locations of all of the PHIN 2.0 guide HL7 data elements to guide data processing. Processed HL7 fields and file metadata were then extracted into a relational database using the Python library SQL Alchemy. **Conclusions:** The creation of this application has greatly assisted in the process of reviewing syndromic surveillance messages at TDH by automating data extraction and organization for all received HL7 messages. The database tables of extracted HL7 data elements allowed for easy analysis in any tool that can connect to a database (e.g., SAS, R, Python, Excel, Tableau) and faster, more manageable message validation. TDH has been able communicate better feedback to more healthcare providers because of the efficiencies gained after deploying the application.

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# Roles of Health Literacy in Relation to Social Determinants of Health and Recommendations for Informatics-Based Interventions: Systematic Review

## Abstract

**Objective:** Understand the challenges that exist in the Zimbabwe health systems, that could be addressed through the integration of a Laboratory Information Management System (LIMS). Understand key aspects for consideration when selecting and adapting a LIMS in a resource limited setting. Showcase improvements in laboratory information management processes following adoption of a LIMS. **Introduction:** Zimbabwe's National Health Laboratory Services faces multiple challenges related to inadequate financial support and skilled human resources, insufficient infrastructure, and inefficient tracking of clinical samples collected by health facilities. The slow turnaround time and poor management of the sample testing process, as well as delivery of results remain critical challenges. Compounding these problems further is a manual system for tracking large volumes of samples. This laborious and time-consuming process is inefficient for management of high amounts of incoming medical samples, frequently resulting in incomplete and inaccurate data. Additionally, health facilities are unable to monitor clinical samples and results in transit, leading to misplaced samples and missing results. Furthermore, although the laboratory service runs on a tiered network system - with lower level laboratories referring surveillance samples to higher level laboratories, processing of samples is not fulfilled promptly. The solutions to these challenges are divergent - sometimes even pointing in different directions. To this end, the Zimbabwe Ministry of Health and Child Care (MoHCC) has identified and integrated a LIMS to improve tracking of samples from the time of collection through results delivery. **Methods:** Our methods included an environmental needs assessment, user requirement analysis, followed by a LIMS customization and integration. The overarching aim has been to integrate the electronic open source BIKA LIMS into Zimbabwe's national health information systems (HIS), to improve laboratory information management. The user requirements gathering exercise, included focus group discussion meetings with potential LIMS users, and direct observations, to guide the establishment of LIMS specifications. The needs assessment focused on the system functionality. Specifically, it investigated those aspects that would improve the ability: to track clinical samples such as creating and activating an 'alerting' capability when results are not reported within the set turnaround time; for users to see lists and counts of clinical samples at various testing levels; to uniquely identify samples received in the laboratories. Guided by these requirements, an environmental scan of off-the-shelf and open source LIMS platforms was conducted to identify a few options for the Zimbabwe context. Primary factors for shortlisting included: an existing community of practice for support; interoperability; customizability and configurability; and local awareness of the platform. In a LIMS national user's meeting, involving relevant levels of the health system (Laboratories, Central, Provincial and District hospitals), a review of LIMS platform options was performed to narrow down selections. It evaluated the extent to which the user requirements (Workflow, equipment interface, result management, inter-operable, quality control, and stock management) were being met. Based on the evaluation, a single system (LIMS) was selected, adopted and adapted for use at six representative laboratories, including Zimbabwe's National Microbiology Reference Laboratory. On-Site classroom and desk-side training, for knowledge transfer to local LIMS users, characterised the implementation phase. Local champions were identified from laboratory technicians and equipped to offer first line support. Both on-site and remote support was provided to LIMS users. The monitoring phase is ongoing, using interview guides and LIMS user meetings to understand challenges and ways to improve the system. **Results:** A LIMS was successfully customized and integrated into Zimbabwe's national health information system infrastructure in six regional laboratories, to improve overall laboratory information management, timeliness of reporting and quality control. Since its full implementation between 2013 and 2017, average turnaround time for results improved significantly from 10 to 21 days in 2013 to only 3 days in 2017. Data quality improved; the number of untested clinical samples reduced from an average of 6 in 100 in 2013, to average of less or equal to 1 in 100, in 2017. Also, there have been observed improvements in Zimbabwe's laboratory information management workflow and results reporting. High user satisfaction and increased LIMS use have led to the demand for LIMS expansion to additional laboratories. The LIMS has also managed to reduce the time required to produce disease notification reports. **Conclusions:** LIMS are proving to be an effective method for tracking samples and laboratory results in low resource settings like Zimbabwe. LIMS has provided an efficient way for record, store, and track timely reporting of laboratory data, allowing for improved quality of data. Overall, LIMS has increased efficiency in laboratory workflow and introduced the ability to adequately track samples from time of collection.

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# Roles of Health Literacy in Relation to Social Determinants of Health and Recommendations for Informatics-Based Interventions: Systematic Review

## Abstract

**Objective:** To describe the process to update the Implementation Guide (IG) for Syndromic Surveillance via community and stakeholder engagement and highlight significant modifications as the IG is vetted through the formal HL7 balloting process.

**Introduction:** In 2011, the CDC released the PHIN Implementation Guide (IG) for Syndromic Surveillance v.1 under the Public Health Information Network. In the intervening years, new technological advancements, EHR capabilities as well as epidemiological and Meaningful Use requirements have led to the periodic update and revision of the IG through informal and semi-structured solicitation and collection of comments from across public health, governmental, academic, and EHR vendor stakeholders. Following the IG v.2.0 release in 2015, CDC initiated a multi-year endeavor to update the IG in a more systematic manner and released further updates via an Erratum and a technical document developed with NIST to clarify validation policies and testing parameters. These documents were consolidated into the Message Guide v.2.1 release and used to inform the development of the NIST Syndromic Surveillance Test Suite (<http://hl7v2-ss-r2-testing.nist.gov/ss-r2/#/home>), Validation Test Cases, and develop a new rules-based IG built using NIST's Implementation Guide Authoring and Management Tool (IGAMT). As part of a Cooperative Agreement initiated in 2017, CDC and ISDS built upon prior activities and renew efforts in engaging the Syndromic Surveillance Community of Practice for comment on the IG with the goal of having the final product to become an "HL7 V 2.5.1 Implementation Guide for Syndromic Surveillance Standard for Trial Use" following a formal HL7 balloting process in 2018.

**Methods:** ISDS coordinated a multi-stakeholder working group to revisit the consolidated IG, v.2.1 and began to collect structured comments via an online portal, which facilitated the documentation, tracking, and prioritization of comments for developing consensus and ultimately reconciliation and resolution when there were errors, conflicts or differing perspectives. 132 comments were received during the initial review period (April – July 2017) with 16 elements captured for each comment which included: Subject, Request Type, Clinical Venue, Name, IG Section, Priority, Working & Final Resolution (Fig. 1). The online portal also allowed for members of the Message Guide Workgroup to provide feedback directly to one another through a 'conversation tab', this has been an important feature in teasing out the underlying concerns and issues with a given comment across different local, state, and private sector partners which many have differing institutional perspectives and state or locally derived requirements (Fig. 2). Some comments were able to be fully described and resolved using this feature. Following the initial comment period, ISDS initiated a weekly webinar-based review process to delve into specific issues in an in-depth manner. In general, approximately 12 comments were addressed on a given call. Each week ISDS staff would lead the webinars structured around similar comment types (e.g. values sets, DG1 Segments, IN1 Segments, Conformance Statements, etc.). This efficiently leveraged the expertise of individuals and institutions with concerns revolving around a specific domain, messages segment, or specification described within the IG. Comments for which consensus and resolution was achieved would be "closed-out" on the portal inventory and new assignments for review would be disseminated across the Message Guide Workgroup for consideration and discussion during the subsequent review calls.

**Results:** To date this review process has identified and updated a wide-range of specification and requirements described within the IG v.2.0. These include: specifications for persistent patient ID across venues of service, inclusion of the ICD-10-CM value set for diagnosis, removal of the ICD-9-CM requirement for testing and messages, modification of values such as pregnancy status, travel history, and medication list from "O" to "RE", and the update of PHIN VADS value sets.

**Conclusions:** The results of this multi-agency comment and review process will be synthesized and compiled by ISDS. The updated version of the Message Guide (re-branded to the HL7 V 2.5.1 Implementation Guide for Syndromic Surveillance) will be made available to the Public Health community by November 2017, when a second round of review and commentary will be initiated. This systematic and structured review and documentation process has allowed for the synthesize and reconciliation of a wide range of disparate specifications, historical hold-overs, and requirements via the perspectives of a diverse range of public health partners. As we continue to move through this review process we believe that the final HL7 balloted "Standard for Trial Use" IG 2.5 will be a stronger more extensible product in supporting syndromic surveillance activities across a wider and more diverse range of clinical venues, EHR implementations, and public health authorities.

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# Roles of Health Literacy in Relation to Social Determinants of Health and Recommendations for Informatics-Based Interventions: Systematic Review

## Abstract

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**Objective:** To rebuild the software that underpins the Global Public Health Intelligence Network using modern natural language processing techniques to support recent and future improvements in situational awareness capability. **Introduction:** The Global Public Health Intelligence Network is a non-traditional all-hazards multilingual surveillance system introduced in 1997 by the Government of Canada in collaboration with the World Health Organization.<sup>1</sup> GPHIN software collects news articles, media releases, and incident reports and analyzes them for information about communicable diseases, natural disasters, product recalls, radiological events and other public health crises. Since 2016, the Public Health Agency of Canada (PHAC) and National Research Council Canada (NRC) have collaborated to replace GPHIN with a modular platform that incorporates modern natural language processing techniques to support more ambitious situational awareness goals. **Methods:** The updated GPHIN platform assembles several natural language processing tools to annotate incoming data in order to support situational awareness; broadly, GPHIN aims to extract knowledge from data. Data are collected in 10 languages and are machine translated to English. Several of the machine translation models use high performance neural networks. Language models are updated regularly and support external dictionaries for handling emerging domain-specific terms that might not yet exist in the parallel corpora used to train the models. All incoming documents are assigned a relevance score. Machine learning models estimate a score based on similarity to sets of known high-relevance and known low-relevance documents. PHAC analysts provide feedback on the scoring from time to time in the course of their work, and this feedback is used to periodically retrain scoring models. Documents are assigned keywords using two ontologies: an all-hazards multilingual taxonomy hand-compiled at PHAC, and the U.S. National Library of Medicine's Unified Medical Language System (UMLS). Categories are assigned probabilistically to incoming articles (e.g., human infectious diseases, animal infectious diseases, substance abuse, environmental hazards), largely using affinity scores that correspond to keywords. Dates and times are resolved to canonical forms, so that mentions like last Tuesday get resolved to specific dates; this makes it possible to sequence data about a single event that are released at varying frequencies and with varying timeliness. Cities, states/provinces, and countries are identified in the documents, and gaps in the hierarchical geographic relationships are filled in. Locations are disambiguated based on collocations; the system distinguishes between and correctly resolves Ottawa, KS vs. Ottawa, ON, Canada, for example. Countries are displayed with their socio-economic population statistics (Gini coefficient, human development index, median age, and so on). The system attempts to detect and reconcile near-duplicate articles in order to handle instances where one article is released on a newswire and subsequently gets lightly edited and syndicated in dozens or hundreds of local papers; this improves the signal-to-noise ratio of the data in GPHIN for better productivity. Template-based reports (where the same document may get re-issued with a new number of cases but no other changes, for example) are still a challenge, but whitelisting tools reduce the false positive rate. The system provides tools for constructing arbitrarily detailed searches, tied to colour-coded maps and graphs that update on-the-fly, and offers short extractive summaries of each search result for easy filtering. GPHIN also generates topical knowledge graphs about sets of articles that seek to reveal surprising correlations in the data; for example, graphically reconciling and highlighting cases where several neighbouring countries all have reports of a mysterious disease and where a particular mosquito is mentioned. Next steps in the ongoing rejuvenation involve collating discrete articles and documents into narrative timelines that track an ongoing event: collecting all data about the spread of an infectious disease outbreak or perhaps the aftermath of an earthquake in the developing world. Our research is focussing on how to build line lists from such a stream of news articles about an event and how to detect important change points in the ongoing narrative. **Results:** The new GPHIN platform was launched in August 2016 in order to support syndromic surveillance activities for the Rio 2016 Olympics, and has been updated incrementally since then to offer further capabilities to professional users in 30 countries. Its modular construction supports current situational awareness activities as well as further research into advanced natural language processing techniques. **Conclusions:** We improved (and continue to improve) GPHIN with modern natural language processing techniques, including better translations, relevance scoring, categorization, near-duplicate detection, and improved data visualization tools, all towards the goal of more productive and more trustworthy situational awareness.

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# Roles of Health Literacy in Relation to Social Determinants of Health and Recommendations for Informatics-Based Interventions: Systematic Review

## Abstract

**Objective:** Medical notes provide a rich source of information that can be used as additional supporting information for healthcare-associated infection (HAI) investigations. The medical notes from 10 New Jersey (NJ) emergency departments (ED) were searched to identify cases of surgical-site infections (SSI). **Introduction:** EpiCenter, NJ's statewide syndromic surveillance system, collects ED registration data. The system uses chief complaint data to classify ED visits into syndrome categories and provides alerts to state and local health departments for surveillance anomalies. After the 2014 Ebola outbreak in West Africa, the New Jersey Department of Health (NJDOH) started collecting medical notes including triage notes, which contain more specific ED visit information than chief complaint, from 10 EDs to strengthen HAI syndromic surveillance efforts. In 2017, the NJDOH was aware of one NJ resident whose surgical site was infected following a cosmetic procedure outside of the US. This event triggered an intensive data mining using medical notes collected in EpiCenter. The NJDOH staff searched one week of medical notes data in EpiCenter with a specific keyword to identify additional potential cases of surgical-site infections (SSI) that could be associated with medical tourism. **Methods:** The NJ resident whose surgical site was infected following a cosmetic procedure outside of the US was interviewed by NJDOH staff for details about their procedure. First, the patient's interview results were reviewed to prepare a set of SSI and travel related keywords to be used in performing data mining in medical notes collected in EpiCenter. The interviewed patient had tummy tuck and liposuction surgeries; therefore, it was decided to search for "tummy tuck" as a keyword in EpiCenter. The medical notes from August 31, 2017 through September 8, 2017 were reviewed to identify patients who developed SSI following a cosmetic procedure outside of the US. **Results:** The search yielded 8 ED visits, one of which was identified as possible surgical site infection. The medical notes details indicated that the ED patient, a 21-year old female who had abdominoplasty (tummy tuck) and liposuction surgeries about a month prior, presented with post-surgical complaints such as pain, surgical dehiscence, and purulent drainage at the surgery site. Chief complaint text for the same ED patient indicated the patient had headache and dizziness which were less specific than medical notes. The NJDOH staff contacted the ED to obtain additional information regarding the infection. The lab results from the ED showed that the patient was identified as having a post-surgery infection, which prompted public health to follow-up whether it was an HAI. **Conclusions:** The limitation for this project was that the keyword search was conducted only on one week of data. The timeframe was kept short to pilot testing the keyword identified. The Centers for Disease Control and Prevention suggests clinicians should consider nontuberculous mycobacteria (NTM) infections in the differential diagnosis for all people who have wound infections after surgery abroad, including surgery that has occurred weeks to months previously (1). Future studies will explore larger data sets with additional keywords (e.g. country and organism) to see if potential cases can be identified as possible HAI and/or outbreak that will lead to public health investigations.

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# Roles of Health Literacy in Relation to Social Determinants of Health and Recommendations for Informatics-Based Interventions: Systematic Review

## Abstract

**Objective:** The objective of this work is to describe the use and performance of the NSSP ESSENCE system by analyzing the structured query language (SQL) logs generated by users of the National Syndromic Surveillance Program's (NSSP) Electronic Surveillance System for the Early Notification of Community-based Epidemics (ESSENCE). **Introduction:** As system users develop queries within ESSENCE, they step through the user-interface to select data sources and parameters needed for their query. Then they select from the available output options (e.g., time series, table builder, data details). These activities execute a SQL query on the database, the majority of which are saved in a log so that system developers can troubleshoot problems. Secondly, these data can be used as a form of web analytics to describe user query choices, query volume, query execution time, and develop an understanding of ESSENCE query patterns. **Methods:** ESSENCE SQL query logs were extracted from April 1, 2016 to August 23rd, 2017. Overall query volume was assessed by summarizing volume of queries over time (e.g., by hour, day, and week), and by Site. To better understand system performance the mean, median, and maximum query execution times were summarized over time and by Site. SQL query text was parsed so that we could isolate, 1) Syndromes queried, 2) Sub-syndromes queried, 3) Keyword categories queried, and 4) Free text query terms used. Syndromes, sub-syndromes, and keyword categories were tabulated in total and by Site. Frequencies of free text query terms were analyzed using n-grams, wordclouds, and term co-occurrence relationships. Term co-occurrence network graphs were used to visualize the structure and relationships among terms. **Results:** There were a total of 354,101 SQL queries generated by users of ESSENCE between April 1, 2016 and August 23rd, 2017. Over this entire time period there was a weekly mean of 4,785 SQL queries performed by users. When looking at 2017 data through August 23rd this figure increases to a mean of 7,618 SQL queries per week for 2017, and since May 2017 the mean number of SQL queries has increased to 10,485 per week. The maximum number of user generated SQL queries in a week was 29,173. The mean, median, and maximum query execution times for all data was 0.61 minutes, 0 minutes, and 365 minutes, respectively. When looking at only queries with a free text component the mean query execution time increases slightly to 0.94 minutes, though the median is still 0 minutes. The peak usage period based on number of SQL queries performed is between 12:00pm and 3:00pm EST. **Conclusions:** The use of NSSP ESSENCE has grown since implementation. This is the first time the ESSENCE system has been used at a National level with this volume of data, and number of users. Our focus to date has been on successfully on-boarding new Sites so that they can benefit from use of the available tools, providing trainings to new users, and optimizing ESSENCE performance. Routine analysis of the ESSENCE SQL logs can assist us in understanding how the system is being used, how well it is performing, and in evaluating our system optimization efforts.

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# Roles of Health Literacy in Relation to Social Determinants of Health and Recommendations for Informatics-Based Interventions: Systematic Review

## Abstract

**Objective:** The purpose of this article was to provide static and interact mapping for the results" SaTscan with R package thereby reduce the gap between decision-makers and researchers. **Introduction:** Scan statistics is one of the most widely used method for detecting and locating the clusters of disease or health-related events through the space-time dimension. Although the Specific software of SatScan is available for free and easier to use graphical user interface (GUI) interface, the click way and the resulting text format have become obstacles in biosurveillance since automated or reproduction operation and the fast communicate information tool appeared. With the power of R software and 'rsatscan' package, we extended the visualization results to become a faster, more effective communication and motivation tool. **Methods:** All the data are from a syndromic surveillance and real-time early warning system, which established 3 counties in the Yunnan province in the China for improving the ability to handle public health emergencies events and reduce the potential risk of disease spread. To illustrate the purpose of visualization, we only use one county data from 2017/9/1 to 2017/9/30 which includes two data sources: primary schools' absentees and health clinics' records. Based on the 'rsatscan' package which makes it easy to work within SaTscan from R, we developed three ways for the results of Spatio-temporal scan: traditional tables, static maps and interactive visualize maps. Especial the last interactive visualization benefits from dynamic queries which may be an incredible tool to explore potential "clusters" data. Data are collected from web-based by smart-phone or internet including 83 health clinics and 118 primary schools for one month. All the programs are run on Rstudio. The retrospective spatio-temporal scan parameters for two data sources as follow: Analysis type=retrospective Space-Time, Analysis type=Space-Time Permutation, Model Type= High Rates (Poisson), Time precision=day, Time aggregation units=day, MaxSpatialSizeInDistanceFromCenter=10 km, MaxTemporalSize=14 day. **Results:** 76211 records in the health clinics and 6066 absenteeism in the primary schools are collected. Three ways for the spatio-temporal scan results are provided in table (Tab-1), static maps (Fig 1) and interactive visualize maps online, some of them are presented in html format. The table shows two data sources results by stack ways. The first column is the order of most likely to cluster. Follow is the code for center of the circular scan. The remaining indicators include Time Interval, Risk Value, Observed and expected value, P values from 999 Montel Carlo Simulation. See the table in more details. The static maps have the advantages of vivid communicates information for where are the potential "cluster" both in two data sources over the space. What is more, one benefit of this way can provide the possible association between medical institution information and primary school absence information through the overlap circular. The most excited is the interactive visualization with HTML format. From the click the navigate widgets on the left top, you can choose different layers. If you want to know more cluster information by the different potential cluster, clicking the map or dots or circular, and the pop-up dialogue box will show with the related clusters results of scan statistics methods. See the detail in the website: <http://rpubs.com/ynsxx/318257> **Conclusions:** These innovation ways can provide the ability to process information faster and to use that information to boost productivity and results. It is easy to help decision-makers to visualize communicates information faster than traditional reports. And the R code will more suitable for prospective analysis.

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# Roles of Health Literacy in Relation to Social Determinants of Health and Recommendations for Informatics-Based Interventions: Systematic Review

## Abstract

**Objective** Review the impact of applying regular data quality checks to assess completeness of core data elements that support syndromic surveillance. **Introduction** The National Syndromic Surveillance Program (NSSP) is a community focused collaboration among federal, state, and local public health agencies and partners for timely exchange of syndromic data. These data, captured in nearly real time, are intended to improve the nation's situational awareness and responsiveness to hazardous events and disease outbreaks. During CDC's previous implementation of a syndromic surveillance system (BioSense 2), there was a reported lack of transparency and sharing of information on the data processing applied to data feeds, encumbering the identification and resolution of data quality issues. The BioSense Governance Group Data Quality Workgroup paved the way to rethink surveillance data flow and quality. Their work and collaboration with state and local partners led to NSSP redesigning the program's data flow. The new data flow provided a ripe opportunity for NSSP analysts to study the data landscape (e.g., capturing of HL7 messages and core data elements), assess end-to-end data flow, and make adjustments to ensure all data being reported were processed, stored, and made accessible to the user community. In addition, NSSP extensively documented the new data flow, providing the transparency the community needed to better understand the disposition of facility data. Even with a new and improved data flow, data quality issues that were issues in the past, but went unreported, remained issues in the new data. However, these issues were now identified. The newly designed data flow provided opportunities to report and act on issues found in the data unlike previous versions. Therefore, an important component of the NSSP data flow was the implementation of regularly scheduled standard data quality checks, and release of standard data quality reports summarizing data quality findings. **Methods** NSSP data was assessed for the national-level completeness of chief complaint and discharge diagnosis data. Completeness is the rate of non-null values (Batini et al., 2009). It was defined as the percent of visits (e.g., emergency department, urgent care center) with a non-null value found among the one or more records associated with the visit. National completeness rates for visits in 2016 were compared with completeness rates of visits in 2017 (a partial year including visits through August 2017). In addition, facility-level progress was quantified after scoring each facility based on the percent completeness change between 2016 and 2017. Legacy data processed prior to introducing the new NSSP data flow were not included in this assessment. **Results** Nationally, the percent completeness of chief complaint for visits in 2016 was 82.06% (N=58,192,721), and the percent completeness of chief complaint for visits in 2017 was 87.15% (N=80,603,991). Of the 2,646 facilities that sent visits data in 2016 and 2017, 114 (4.31%) facilities showed an increase of at least 10% in chief complaint completeness in 2017 compared with 2016. As for discharge diagnosis, national results showed the percent completeness of discharge diagnosis for 2016 visits was 50.83% (N=36,048,334), and the percent completeness of discharge diagnosis for 2017 was 59.23% (N=54,776,310). Of the 2,646 facilities that sent data for visits in 2016 and 2017, 306 (11.56%) facilities showed more than a 10% increase in percent completeness of discharge diagnosis in 2017 compared with 2016. **Conclusions** Nationally, the percent completeness of chief complaint for visits in 2016 was 82.06% (N=58,192,721), and the percent completeness of chief complaint for visits in 2017 was 87.15% (N=80,603,991). Of the 2,646 facilities that sent visits data in 2016 and 2017, 114 (4.31%) facilities showed an increase of at least 10% in chief complaint completeness in 2017 compared with 2016. As for discharge diagnosis, national results showed the percent completeness of discharge diagnosis for 2016 visits was 50.83% (N=36,048,334), and the percent completeness of discharge diagnosis for 2017 was 59.23% (N=54,776,310). Of the 2,646 facilities that sent data for visits in 2016 and 2017, 306 (11.56%) facilities showed more than a 10% increase in percent completeness of discharge diagnosis in 2017 compared with 2016. **References** Batini, C., Cappiello, C., Francalanci, C. and Maurino, A. (2009) Methodologies for data quality assessment and improvement. *ACM Comput. Surv.*, 41(3). 1-52.

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# Roles of Health Literacy in Relation to Social Determinants of Health and Recommendations for Informatics-Based Interventions: Systematic Review

## Abstract

**Objective** To evaluate whether SAMU data could be relevant for health surveillance and proposed to be integrated into the French national syndromic surveillance SurSaUD® system. **Introduction** The syndromic surveillance SurSaUD® system developed by Santé publique France, the French National Public Health Agency collects daily data from 4 data sources: emergency departments (OSCOUR® ED network) [1], emergency general practitioners (SOS Médecins network), crude mortality (civil status data) and electronic death certification including causes of death [2]. The system aims to timely identify, follow and assess the health impact of unusual or seasonal events on emergency medical activity and mortality. However some information could be missed by the system especially for non-severe (absence of ED consultation) or, in contrast, highly severe purposes (direct access to intensive care units). The French pre-hospital emergency medical service (SAMU) [3] represents a potential valuable data source to complete the SurSaUD® surveillance system, thanks to reactive pre-hospital data collection and a large geographical coverage on the whole territory. Data are still not completely standardized and computerized but a governmental project to develop a national common IT system involving all French SAMU is in progress and will be experimented in the following years. **Methods** A pilot study was performed in the South of France PACA region, where data from the six local SAMU structures are centralized into an interconnected database. A minimal set of variables required for health monitoring (administrative and medical items) and modalities for data extraction and transmission to Santé publique France were defined. SAMU data were transmitted daily to Santé Publique France and the PACA regional team developed a Microsoft Access® application to import decrypted data, request database and analyze indicators. Retrospective part of the study was performed over a 2-year period (2013-2014) and the prospective part during 2015 was based on daily data collection. Completeness and quality of variables were analyzed. SAMU indicators including several level of specificity were built and compared to existing SurSaUD® indicators in different situations (for detection, seasonal follow-up and health impact assessment) using Spearman coefficient correlation. **Results** During the pilot study, data from five of the six SAMU structures of PACA region were structured enough to be analyzed. On the study period, almost 2,400,000 files were recorded and 89% contain medical information. Data completeness was high (87%) and stable during the whole period. The annual rate of SAMU solicitation was 16 for 100 inhabitants at the regional scale. 15% of the records were opened only for medical advice. In contrast, patients were evacuated directly in intensive care unit in 9.5% of cases without ED admission. Coding quality depended on the existence and the use of official thesauri and varied widely among SAMU structures. Despite coding variations, SAMU indicators for winter epidemics were significantly correlated with ED and SOS Médecins indicators. Respectively with ED flu, bronchiolitis and gastroenteritis indicators, the strongest correlations were found for SAMU lower respiratory infection (0.74), SAMU bronchiolitis (0.72) and SAMU gastroenteritis / diarrhea / vomiting (0.81). **Conclusions** This pilot study demonstrated the feasibility to collect daily SAMU activity data. The key strengths of SAMU data were a large geographic coverage, the subsidiarity with SurSaUD® system data sources, the follow-up of prehospital activity and for patients directly admitted into an intensive care unit. Some limitations were highlighted related to differences in coding practices especially for medical diagnosis. The generalization of this study will require the standardization of coding practices and homogenization of thesaurus. The implementation of the national SAMU information system should allow in a very next future to widely progressing on these topics. **References** [1] Fouillet A, Bousquet V, Pontais I, Gallay A and Caserio-Schönemann C. The French Emergency Department OSCOUR Network: Evaluation After a 10-year Existence. *Online Journal of Public Health Informatics* ISSN 1947-2579-7(1):e74, 2015 [2] Caserio-Schönemann C, Bousquet V, Fouillet A, Henry V. Le système de surveillance syndromique SurSaUD (R). *Bull Epidémiol Hebd* 2014;3-4:38-44. [3] Baker, D.J.. The French prehospital emergency medicine system (SAMU): An introduction (2005) *CPD Anaesthesia*, 7 (1), pp. 20-25.

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# Roles of Health Literacy in Relation to Social Determinants of Health and Recommendations for Informatics-Based Interventions: Systematic Review

## Abstract

**Objective** This analysis was undertaken to determine how the data completeness, consistency, and other attributes of our local syndromic surveillance program compared to the National Syndromic Surveillance Platform. **Introduction** In 2005, the Cook County Department of Public Health (CCDPH) began using the Electronic Surveillance System for the Early Notification of Community-based Epidemics (ESSENCE) as an emergency department (ED)-based local syndromic surveillance program (LSSP); 23 (100%) of 23 hospitals in suburban Cook County report to the LSSP. Data are transmitted in delimited ASCII text files (i.e., flat files) and contain a unique patient identifier, visit date and time, zip code, age, sex, and chief complaint. Discharge diagnosis and disposition are optional data elements. Prior to 2017, the Illinois Department of Public Health placed facilities participating in the Cook LSSP in a holding queue to transform their flat file submissions into a HL7 compliant message; however as of 2017, eligible hospitals must submit HL7 formatted production data to IDPH to fulfill Meaningful Use. The primary syndromic surveillance system for Illinois is the National Syndromic Surveillance Program (NSSP), which transitioned to an ESSENCE interface in 2016. As of December 2016, 20 (87%) of 23 hospitals reporting to the LSSP also reported to IDPH and the NSSP. As both syndromic surveillance systems aim to collect the same data, and now can be analyzed with the same interface, CCDPH sought to compare the LSSP and NSSP for data completeness, consistency, and other attributes. **Methods** Our comparison of NSSP to the LSSP focused on data completeness for key demographic and medical variables and consistency in total visit counts. Analysis of completeness utilized data from December 2016 for 20 hospitals contributing HL7 production data to IDPH at that time. Total visit counts in both systems were compared for the same 20 hospitals from February 5th-11th 2017, a randomly chosen time period. A target threshold of less than 3% difference in total visit counts was set by the CCDPH system users. Analysis was completed in Microsoft Excel 2010. Other attributes of the surveillance systems were qualitatively assessed by the primary system users at CCDPH. **Results** All variables required by the LSSP had 98-100% completeness in both the LSSP and NSSP (unique patient identifier, age, sex, zip code, visit time and date, and chief complaint). However, the LSSP optional data elements, discharge diagnosis and discharge disposition, were less complete in the LSSP, compared to the NSSP (Diagnosis: 56% versus 83%, Disposition: 66% versus 80%). Among variables required for NSSP reporting but not reported to the LSSP, completeness ranged from 100% (race, ethnicity) to 82% (county). Optional data elements within NSSP ranged in completeness from 73% (initial pulse oximetry) to 0% (initial blood pressure, insurance coverage). Of the 20 hospitals evaluated for visit counts, only one hospital had <3% difference in visit counts in the LSSP and NSSP for all 7 days assessed. Ten hospitals had >3% difference in visit counts on all seven days. Average seven day differences for hospitals ranged from 0% to 54%. Eighteen (90%) of 20 hospitals were reporting larger numbers of visits to NSSP than to the LSSP. **Conclusions** Overall completeness of data was similar between the national and our local ESSENCE systems with most required variables having over 98% completeness. NSSP had higher completeness over the LSSP for discharge diagnosis and disposition. Additional data elements required by NSSP, but unavailable in the LSSP, had similarly high completeness but optional NSSP variables of interest showed greater variability in reporting. Differences in visit counts were higher than expected. An ongoing exploration of these differences has shown they are multifaceted and require hospital-specific interventions. There are strengths and limitations to both the NSSP and LSSP. CCDPH has direct control over data sharing between jurisdictions in the LSSP and there has historically been less system “down time” in the LSSP compared to the NSSP; however, the use of flat files instead of HL7, as well as having fewer incentives for hospital participation (e.g. Meaningful Use) after 2016, results in limited data collection and stagnant growth compared to the NSSP. Jurisdictions using their own LSSPs should consider analyzing their data completeness, consistency, and quality compared to the NSSP.

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# Roles of Health Literacy in Relation to Social Determinants of Health and Recommendations for Informatics-Based Interventions: Systematic Review

## Abstract

**Objective:** To discuss data disclaimers and caveats that are fundamental to sharing syndromic surveillance (SyS) data **Introduction:** With increasing awareness of SyS systems, there has been a concurrent increase in demand for data from these systems – both from researchers and from the media. The opioid epidemic occurring in the United States has forced the SyS community to determine the best way to present these data in a way that makes sense while acknowledging the incompleteness and variability in how the data are collected at the hospital level and queried at the user level. While significant time and effort are spent discussing optimal queries, responsible presentation of the data - including data disclaimers - is rarely discussed within the SyS community. **Description:** This roundtable will provide a forum for national, state, and local users of syndromic surveillance systems to discuss these SyS data disclaimers. Over the last few months, an informal working group has crafted data disclaimer language. Members of this working group will facilitate the discussion and present their template for comment and discussion. Other members of the SyS will be encouraged to share their jurisdiction-specific data disclaimer language. The focus of this roundtable will be on effective communication of emergency department SyS data. **How the Moderator Intends to Engage the Audience in Discussions on the Topic:** This roundtable is well suited to audience participation as all jurisdictions are faced with how to communicate SyS data. Jurisdictions will likely have varying degrees of experience with disclaimers of this sort, so opportunities for sharing of work will be useful to the broader SyS community. **Sample Questions:** Does your jurisdiction have standardized language that accompanies your SyS data? How does the SyS community best share data that is often incomplete and subject to inter-hospital variability? What kinds of reporting would the SyS community like to come from the NSSP?

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# Roles of Health Literacy in Relation to Social Determinants of Health and Recommendations for Informatics-Based Interventions: Systematic Review

## Abstract

**Objective** The Regional Tourism and Health program (THP) is a novel program, comprising of a tourism surveillance system, training, standards and multisectoral partnerships. The objective was to develop regional mandate and policy to support this new program and its non-traditional surveillance system. **Introduction** In January 2016, the Caribbean Public Health Agency (CARPHA), serving 24 Member States (MS), began executing a regional Tourism and Health program (THP), recognizing that the health of Caribbean economies is closely related to the health of its tourism industry since the Caribbean is most tourism-dependent region in the world; that tourism is vulnerable to health, safety and environmental (HSE) threats; and that travel and tourism impacted on global health security. High and increasing visitors to the Caribbean can increase the health, safety and security risks by the introduction and spread of diseases, by both residents and visitors. This was exemplified by the H1N1 pandemic (2009), Chikungunya (2013), and the recent Zika epidemic. However, even though more people visit the Caribbean than reside, there is no regional visitor/tourism surveillance system. There is also no regional mandate and policy for the reporting of visitor/tourism illnesses. This coupled with inadequate training, lack of standards and collaboration between tourism health stakeholders have contributed to disease spread. The THP is an innovative, multifaceted, integrated, regional program with components of a web based real time Tourism and Health Information Surveillance and Response system (THiS), food safety and environmental sanitation training, standards and multisectoral health and tourism partnerships. It aims to promote the health, safety and security of Caribbean visitors and residents. The THP is novel in that it involves the implementation of a non-traditional, health information and surveillance system (visitor based illnesses), new data users (private sector, hotels, passenger ships, visitors), new partners (tourism sector) and at regional level. Given the novelty and the multisectoral nature of the THP, a critical factor to support its implementation and sustainability was the development of regional mandate and policy to facilitate real time surveillance and response to detect and reduce the spread of illness. **Methods** A multiprong approach was used to develop regional mandate and policy for the unique multisectoral THP program, from January 2016 to October 2017. This consisted of (i) weekly advocacy meetings with national and regional tourism and health public and private stakeholders to gain buy-in, recognition and support (ii) requesting letters of commitment from MS (iii) seeking support from the Caribbean Chief Medical Officers of Health (CMOs), who advises the Ministers of Health, at their annual meeting and convening a special CMO meeting on the THP (iv) seeking Ministers of Tourism support through the Caribbean Tourism Organization (CTO) forum (v) inclusion of tourism and health as a priority in the Caribbean Cooperation in Health (CCH4) strategy (which sets health priorities for the Caribbean region) (vi) presenting the THP to the Council for Human and Social Development (COHSOD), consisting of Caribbean Ministers of Health requesting approval to develop a regional THP policy (September 2017) and (viii) convening of a regional THP stakeholders meeting (October 2017) with high level decision makers from national, regional and international health and tourism sectors. **Results** A multiprong approach was used to develop regional mandate and policy for the unique multisectoral THP program, from January 2016 to October 2017. This consisted of (i) weekly advocacy meetings with national and regional tourism and health public and private stakeholders to gain buy-in, recognition and support (ii) requesting letters of commitment from MS (iii) seeking support from the Caribbean Chief Medical Officers of Health (CMOs), who advises the Ministers of Health, at their annual meeting and convening a special CMO meeting on the THP (iv) seeking Ministers of Tourism support through the Caribbean Tourism Organization (CTO) forum (v) inclusion of tourism and health as a priority in the Caribbean Cooperation in Health (CCH4) strategy (which sets health priorities for the Caribbean region) (vi) presenting the THP to the Council for Human and Social Development (COHSOD), consisting of Caribbean Ministers of Health requesting approval to develop a regional THP policy (September 2017) and (viii) convening of a regional THP stakeholders meeting (October 2017) with high level decision makers from national, regional and international health and tourism sectors. **Conclusions** Developing regional mandate and policy is a complex and long, but critical necessity for the implementation and the sustainability of this novel, multisectoral, non-traditional, multi-country tourism and health surveillance and response program. While the regional policy will take time to finalize, CARPHA and MS now have regional mandate to support the implementation of the THP, to strengthen capacity to prepare for, mitigate and respond to public health threats, which can transcend national boundaries.

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# Roles of Health Literacy in Relation to Social Determinants of Health and Recommendations for Informatics-Based Interventions: Systematic Review

## Abstract

**Objective** To explore the timeliness of emergency room surveillance data after the advent of federal Meaningful Use initiatives and determine potential areas for improvement. **Introduction** Timeliness of emergency room (ER) data is arguably its strongest attribute in terms of its contribution to disease surveillance. Timely data analyses may improve the efficacy of prevention and control measures. There are a number of studies that have looked at timeliness prior to the advent of Meaningful Use, and these studies note that ER data were not fast enough for them to be useful in real time<sup>2,3</sup>. However, the change in messaging practices in the Meaningful Use era potentially changes this. Other studies have shown that changes in processes and protocol can dramatically improve timeliness<sup>1,4</sup> and this motivates the current study of timeliness to identify processes that can be changed to improve timeliness. **Methods** ER data were collected from March 2017 through September 2017 from both the Georgia Department of Public Health's (GDPH) State Electronic Notifiable Disease Surveillance System (SendSS) Syndromic Surveillance Module and the Centers for Disease Control and Prevention (CDC) National Syndromic Surveillance Program's (NSSP) ESSENCE systems. Patients from hospitals missing 10 or more days of data, as well as patients with missing or invalid triage times, and all visits after August 1st were excluded in order to ensure data were representative of a "typical" time period and that a sufficient amount of time was given for visits to arrive from hospitals. The timeliness of individual records was determined in a number of different ways. All timeliness measurements were determined by subtracting the earlier time event from the later time of the event. The overall measure of timeliness is the time between the patient's triage time and the data being present in the ESSENCE data system. In between, Georgia's SendSS system receives and processes the data. This is illustrated in Figure 1. Due to the skewed nature of these measures, they were analyzed using medians and Gaussian kernel density plots. **Results** The study in total included records from 118 Georgia hospitals, 14,203 data files and 1,897,501 patient records. Overall median timeliness of data from Triage Time to being available in SendSS for analyses was 33.62 hours (IQR=28.5), and in ESSENCE was 45.08 hours (IQR=37.05). The distributions of Triage Time of Day, Time Available in SendSS Staging, and Time Available in ESSENCE Analysis can be seen in Figure 2. Additionally, lines were added for when SendSS makes data available for its own analyses and when it sends data to ESSENCE. These latter lines represent places where the SendSS system itself could improve, and potential improved times were noted based on the kernel densities. Peak triage times for Georgia hospitals were between 10 am to 11 pm, shown in black. This represents the ideal timeliness if Hospitals sent their data immediately. However, data was all batched by Georgia hospitals and sent at different times of the day. The distribution of the time patient records arrived at SendSS staging was indicated in blue. During the period of this study, Georgia processed data into its SendSS system at 6:30am and 11:30am every day and sent data to the ESSENCE system at 1pm each day. These times are highlighted on the plot in green, and red respectively. New potential improved times, based on the kernel density of data being available in SendSS staging, are shown in the lighter shades of these colors at 8:30am and 12pm every day, while being sent to ESSENCE at 9am and 12:30pm to ensure time for data to be properly processed. These were determined to be optimal times for reducing lag in the data, however, may not be optimal for daily analysis. The purple line on the plot represents the times that data were available in ESSENCE's system for analysis. This was notably delayed by a median 4.15 hours after the data was sent to ESSENCE on a typical day. **Conclusions** A data driven approach to choosing processing times could improve timeliness of data analyses in the SendSS and ESSENCE systems. By conducting this type of analysis in an ongoing periodic basis, processing lag times can be kept at a minimum. 1. Centers for Disease Control. 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# Roles of Health Literacy in Relation to Social Determinants of Health and Recommendations for Informatics-Based Interventions: Systematic Review

## Abstract

**Objective** To protect syndromic surveillance data reporting from emergency departments in Washington State beyond the cessation of Meaningful Use incentive funding in 2021. **Introduction** As syndromic surveillance reporting became an optional activity under Meaningful Use Stage 3 and incentive funds are slated to end completely in 2021, Washington State sought to protect syndromic reporting from emergency departments. As of December 2016, Washington State emergency departments had received \$765,335,529.40 in incentive funding, with facilities receiving an average of three payments of \$479,974.04 each.<sup>1</sup> Considering the public health importance of syndromic surveillance reporting and the fiscal impact of mandatory reporting, the Washington State Department of Health (WA DOH) sought a new statute to require reporting from all emergency departments within the state. **Methods** Stakeholder negotiations occurred in four distinct phases: initial outreach to gauge support for the proposed legislation and solicit comments on items for inclusion in the bill language (April to October 2016), negotiations on the proposed text (October 2016 to January 2017), sustained contact with key groups during the legislative session (January to May 2017), and targeted messaging and comment solicitation to inform the development of the administrative codes to accompany the statute (May 2017 to March 2018) (Figure 1). WA DOH secured funding from the Washington Traffic Safety Commission (WTSC) to hire a designated staff member to coordinate and lead the syndromic surveillance program's legislative agenda. **Results** During the first phase, WA DOH contacted a diverse group of stakeholders, including 7 state agencies, 5 data provider groups, 3 professional associations, 3 public health non-profits, 35 local health jurisdictions, and 29 Tribal Organizations to provide information on syndromic surveillance and gauge interest in the proposed legislation. Key partners included the WTSC, the Washington State Hospital Administration (WSHA), the Washington Poison Center (WAPC), and several large to medium-sized local health jurisdictions (LHJs). Early stakeholder negotiations indicated broad support among local health jurisdictions, state agencies, programs handling violence and injury topics, communicable disease specialists, the Department of Labor and Industries, and the Office of Financial Management; however, support from data providers was more cautious. Early relationship-building and maintaining frequent contact was key to securing support from data providers and allowed WA DOH to draft a mid-session amendment to the bill granting greater data access for providers and clarifying the foundational fee structure for data distribution. During the second phase of outreach and communication, areas of more intense negotiation included data access levels for providers, timeliness of data availability, and the proposed inclusion of a "sundown clause" which would end the effective period of the statute when federal incentive spending expired. WA DOH secured bipartisan co-sponsorship for the bill in the Washington State Senate and stakeholder negotiations continued throughout the legislative session (January-May 2017). Common concerns from stakeholders and legislators included the maintenance of patient privacy, the costs associated with participation for emergency departments, and data sharing agreements with facilities providing syndromic data. The bill passed unanimously out of the Washington State Senate and with broad bipartisan support out of the Washington State House. Governor Jay Inslee signed the bill into law on May 5, 2017 and WA DOH has continued negotiations as they develop the administrative codes to accompany the statute. **Conclusions** Broad and sustained interactions with a diverse group of stakeholders, as well as willingness to compromise on data sharing and cost issues with providers, was key to Washington State's successful effort to mandate syndromic surveillance reporting from emergency departments. **References** 1. Medicare and Medicaid Incentive Provider Payments By State, Program Type and Provider Type January 2011 to December 2016. Centers for Medicare and Medicaid. [https://www.cms.gov/Regulations-and-Guidance/Legislation/EHRIncentivePrograms/Downloads/December2016\\_PaymentsbyStateProgramandProvider.pdf](https://www.cms.gov/Regulations-and-Guidance/Legislation/EHRIncentivePrograms/Downloads/December2016_PaymentsbyStateProgramandProvider.pdf) Last accessed: 11 September 2017.

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# Roles of Health Literacy in Relation to Social Determinants of Health and Recommendations for Informatics-Based Interventions: Systematic Review

## Abstract

**Objective** An important part of the National Biosurveillance Integration Center's (NBIC) mission is collaboration with federal, state, local, tribal, and territorial governments for the purpose of enhancing early warning, shared situational awareness, and related decision support for infectious disease events. Several such collaborations occurred at multiple jurisdictional levels during the recent Zika epidemic in the Americas and the associated microcephaly and other neurological disorders Public Health Event of International Concern (PHEIC). The collaborations and their known outcomes from this major infectious disease event are described below, and NBIC stands ready to support similar efforts for future events. **Introduction** NBIC is charged with enhancing the capability of the Federal Government to enable early warning and shared situational awareness of acute biological events to support better decisions through rapid identification, characterization, localization, and tracking. A key aspect of this mission is the requirement to integrate and collaborate with federal and, state, local, tribal, and territorial (SLTT) government agencies. NBIC develops and disseminates a variety of products to its stakeholders, including daily reports, ad-hoc reports, analytic collaborations, and leadership briefings upon request. Stakeholders interact with and utilize NBIC's products in different ways, depending on the mission and jurisdiction involved. Specific collaborations with individual stakeholders are most frequent and evident during major infectious disease events, such as the recent Zika epidemic in the Americas and the associated microcephaly and other neurological disorders PHEIC. Collaborative efforts and known outcomes among varying levels of government are described in detail below in order to highlight NBIC's integration focus and capabilities in this role. **Methods** NBIC conducted a thorough review of data gathered, reports written, briefings delivered, and both direct and indirect collaborations completed during the Zika epidemic period from late April 2015 – March 2017. This review was completed with the intent to document collaborative efforts, feedback, and outcomes with multiple jurisdictions. **Results** Between April 2015 and March 2017, NBIC worked both directly and indirectly with several of its stakeholders to describe and clarify the Zika event as it unfolded in the Americas. Within the Department of Homeland Security (DHS), NBIC provided briefings for department leadership, including the DHS Secretary and Assistant Secretary of the Office of Health Affairs), and communicated with other DHS components, such as the Federal Emergency Management Agency (FEMA) and the U.S. Coast Guard, to ensure the DHS workforce received effective messaging about Zika infection risks and protections. For its federal partners, NBIC coordinated and responded to requests for information about Zika across several departments, including the Departments of Defense, State, and Health and Human Services (HHS). In addition, NBIC analysts collected, structured, and provided information about imported and locally-acquired cases described in open source reporting to the HHS Assistant Secretary for Preparedness and Response (ASPR) for inclusion as a layer on the GeoHealth Platform interactive map before Zika reporting was added to the National Notifiable Disease System. Inclusion of this map layer on ASPR's website was NBIC's first public facing collaboration effort. Finally, NBIC coordinated the incorporation of maps and diagrams from ASPR and DOD's Armed Forces Health Surveillance Branch in NBIC products to broaden the distribution of key information. Outside of the federal government, NBIC received feedback from the Texas Department of State Health Services that a September 2016 NBIC Daily Monitoring List with a map depicting Zika cases near the border of Mexico and Texas, as well as the locations of border crossings, filled a gap in its understanding of the number and distribution of cases in Mexico. State health officials used this information to help target public and clinician outreach activities in Texas. In addition to the regular reports disseminated to the SLTT community, NBIC supported monthly calls for the community to provide infectious disease event updates, including Zika updates, and responded to questions from the community regarding the event and federal government response efforts. **Conclusions** Major global or regional infectious disease events that have a direct or potential impact on the health of U.S. citizens require substantial collaboration efforts across multiple jurisdictions. These events foster communication and coordination between organizations toward the common goal of serving the American people and keeping them safe and healthy. The Zika epidemic in the Americas and the associated microcephaly/neurological disorders PHEIC is an example of such an event, and NBIC supported its partners and the multiple jurisdictions they serve, as evidenced by the results presented. NBIC continues to expand its network and support capabilities, and is available to serve as integrators for both major and lesser infectious disease events of concern to their stakeholders.

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# Roles of Health Literacy in Relation to Social Determinants of Health and Recommendations for Informatics-Based Interventions: Systematic Review

## Abstract

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**Objective** To discuss the use of poison center (PC) data for public health (PH) surveillance at the local, state, and federal levels. To generate meaningful discussion on how to facilitate greater PC and PH collaboration.

**Introduction** Since 2008, poisoning is the leading cause of injury-related death in the United States; since 1980, the poisoning-related fatality rate in the United States (U.S.) has almost tripled<sup>1</sup>. Many poison-related injuries and deaths are reported to regional PCs which receive about 2.4 million reports of human chemical and poison exposures annually<sup>2</sup>. Federal, state, and local PH agencies often collaborate with PCs and use PC data for PH surveillance to identify poisoning-related health issues. Many state and local PH agencies have partnerships with regional PCs for direct access to local PC data which help them perform this function. At the national level, the National Center for Environmental Health (NCEH) of the Centers for Disease Control and Prevention (CDC) conducts PH surveillance for exposures and illnesses of PH significance using the National Poison Data System (NPDS), the national PC reporting database and real-time surveillance system. Though most PC and PH officials agree that PC data play an important role in PH practice and surveillance, collaboration between PH agencies and PCs can be hindered by numerous challenges. To address these challenges and bolster collaboration, the PC and PH Collaborations Community of Practice (CoP) has collaborated with members to provide educational webinars; newsletters highlighting the intersection of PH and PC work; and in-person meetings at relevant national and international conferences. The CoP includes over 200 members from state and local PH departments, regional PCs, CDC, the American Association of Poison Control Centers (AAPCC), and the U.S. Environmental Protection Agency (EPA).

**Description** The panel will consist of 3 presenters and 1 moderator, who are members of the CoP. Each presenter will bring a unique perspective on the use of PC data for PH practice and surveillance. Dr. Prakash Mulay is the surveillance coordinator for chemical related illnesses and injuries in Florida. His primary focus is on carbon monoxide, pesticide, mercury, and arsenic poisoning. He also works as a liaison between the Florida Poison Information Centers and Department of Health. Dr. Mulay has a Medical Degree from India and a Masters of Public Health (MPH) in epidemiology from Florida International University, Miami. For the purpose of the panel discussion, Dr. Mulay will provide PC PH collaboration from the state perspective. Dr. Jay Schauben is the Director of the Florida/United States Virgin Islands Poison Information Center in Jacksonville, the Florida Poison Information Center Network Data Center, and the Clinical Toxicology Fellowship Program at University of Florida Health-Jacksonville Medical Center/University of Florida Health Science Center. He is board-certified in clinical toxicology and is a Fellow of the American Academy of Clinical Toxicology. In 1992, Dr. Schauben implemented the Florida Poison Information Center in Jacksonville and played a major role in crafting the Statewide Florida Poison Information Center Network. On the panel, Dr. Schauben will provide collaboration insight from the PC perspective. Dr. Royal Law is the surveillance and technical lead for the National Chemical and Radiological Surveillance Program, housed within the Health Studies Branch at the CDC. He received his PhD in Public Health from Georgia State University and his MPH at Emory University. Dr. Law will provide insight from the national level including CDC use of PC data for public health surveillance activities.

**How The Moderator Intends to Engage the Audience** After the panel members have been introduced and shared their contributions and experiences with PC PH collaboration the moderator will engage the audience by facilitating discussion of the successes and challenges to using PC data for PH practice and surveillance. Sample questions: What are your current capacities and collaborative activities between your state/local health department and your PC? What non-funding related barriers hinder the collaboration between your state/local health department and PC? If no increase in funding were available, how would you increase the level of interactivity with the PC and state/local health department? What if funding was available?

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# Roles of Health Literacy in Relation to Social Determinants of Health and Recommendations for Informatics-Based Interventions: Systematic Review

## Abstract

**Objective** We aimed to assess the effect of the amended Public Health act of 2013 on facility-based HIV testing in Princess Marina Hospital. **Introduction** HIV testing remains the mainstay of optimal HIV care and is pivotal to control and prevention of the disease, however efforts to attain optimal testing levels have been undermined by low HIV testing especially in developing countries. Botswana in response, amended its Public Health Act in September 2013 but the effect of this action on facility based HIV testing rates has not been evaluated. **Methods** We carried out an effect assessment using interrupted time-series analysis method, where we accessed electronic medical records of patients seen in Princess Marina Hospital from June 2011 to May 2015. Rates were developed from the proportion of patients that tested each month out of the number that registered, and that figure used that as our data point in the series. September 2013 served as our intervention period in the series. We ran the (i) crude and (ii) sex-stratified model regression models in stata® yielding Newey-West coefficients with their 95% confidence intervals. Graphical display of the models were also produced to visual appreciation and inspection. **Results** Two hundred and twenty-nine thousand six hundred and ninety two patients were registered between June 2011 and May 2015. Of those tested the significant majority being females (65%). From the Newey-regression output there was no significant change in the level of HIV testing immediately after the intervention however there was a change in trend( $p=0.002$ ) post the intervention. Stratification by gender, revealed no statistically significant difference between males and females, either in the levels nor the trend post intervention compared to pre-intervention. **Conclusions** The amendment of the Public Health act of 2013, has brought about trend change in HIV testing however there has not been any apparent difference in the levels nor trends on HIV testing between males and females. Nationwide health facility-based studies could assist assess the overall effect of the amended act on HIV testing rates. **References** 1. Provider Initiated HIV Testing and Counseling: One Day Training Programme, Field Test Version. WHO Guidelines Approved by the Guidelines Review Committee. Geneva 2011. 2. Donnell D, Baeten JM, Kiarie J, Thomas KK, Stevens W, Cohen CR, et al. Heterosexual HIV-1 transmission after initiation of antiretroviral therapy: a prospective cohort analysis. *The Lancet*. 2010;375(9731):2092-8. 3. Lawn SD, Harries AD, Anglaret X, Myer L, Wood R. 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# Roles of Health Literacy in Relation to Social Determinants of Health and Recommendations for Informatics-Based Interventions: Systematic Review

## Abstract

**Objective** To assess evidence for public health impact of syndromic surveillance. **Introduction** Systematic syndromic surveillance is undergoing a transition. Building on traditional roots in bioterrorism and situational awareness, proponents are demonstrating the timeliness and informative power of syndromic surveillance data to supplement other surveillance data. **Methods** We used PubMed and Google Scholar to identify articles published since 2007 using key words of interest (e.g., syndromic surveillance in combinations with emergency, evaluation, quality assurance, alerting). The following guiding questions were used to abstract impact measures of syndromic surveillance: 1) what was the public health impact; what decisions or actions occurred because of use of syndromic surveillance data?, 2) were there specific interventions or performance measures for this impact?, and 3) how, and by whom, was this information used? **Results** Thirty-five papers were included. Almost all articles (n=33) remarked on the ability of syndromic surveillance to improve public health because of timeliness and/or accuracy of data. Thirty-four articles mentioned that syndromic surveillance data was used or could be useful. However, evidence of health impact directly attributable to syndromic surveillance efforts were lacking. Two articles described how syndromic data were used for decision-making. One article measured the effect of data utilization. **Conclusions** Within the syndromic surveillance literature instances of a conceptual shift from detection to practical response are plentiful. As the field of syndromic surveillance continues to evolve and is used by public health institutions, further evaluation of data utility and impact is needed. **References** Ayala, A., Berisha, V., Goodin, K., Pogreba-Brown, K., Levy, C., McKinney, B., Koski, L., & Imholte, S. (2016). 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# Roles of Health Literacy in Relation to Social Determinants of Health and Recommendations for Informatics-Based Interventions: Systematic Review

## Abstract

**Objective** To describe an exercise to identify priority provinces to be focused in the Vietnam National HIV Sentinel Surveillance (HSS). **Introduction** The Vietnam National HSS was established in 1994. In the late 1990s and early 2000s, when the epidemic was increasing rapidly, the HSS helped with the intensive close monitoring of the HIV epidemic. In its first 10 years, the HSS was rapidly expanded from 6 to 40 provinces and in some years, it was conducted semi-annually. After two decades, the HIV epidemic situation has changed. In most provinces, HIV prevalence has reported to have declined. Compared to the peak period, the HIV prevalence among key populations (KP) in the past decade decreased from 40-60% to 20% or lower. In many provinces, HIV prevalence was less than 10% among people who inject drugs (PWID) and less than 3% among female sex workers (FSW), and among men who have sex with men (MSM) (Table 1). At the same time, the HIV programme has since been scaled up widely with various interventions and expanded to most of the 63 provinces. In 2014, the government of Vietnam and international stakeholders conducted a joint review of the health sector response to the HIV epidemic and concluded that for better monitoring of the epidemic, a more focused and higher quality surveillance system was needed(1). In 2015, surveillance stakeholders conducted a detailed review of the HSS to discuss prioritization of the surveillance activities. **Methods** The prioritization exercise followed a principle that the HSS should be conducted in locations where there is a large population of KP with a high HIV prevalence and it is feasible to implement. Criteria for prioritizing provinces for inclusion were: 1) a high estimated KP size; 2) high HIV prevalence, measured as a 5 year (2011-2015) average prevalence (P); 3) few years with low HIV prevalence, defined as  $P < 5\%$  among PWID,  $< 3\%$  among FSW and MSM; 4) few years with insufficient HSS sample size, defined as  $n < 150$  for PWID,  $n < 250$  for FSW and MSM. Steps to prioritize provinces were: - Reviewed provincial data on KP estimates; HIV prevalence and achieved HSS sample sizes in 5 years, 2011-2015. - Developed a ranking algorithm taking into account KP size estimates, HIV prevalence and achieved sample sizes. - For each survey on PWID, FSW, MSM, took top ranked provinces for which sum of KP size estimates of these provinces exceeded 50% of the national KP size estimates. - Held a consultation workshop among domestic and international surveillance stakeholders to discuss the prioritization exercise. Issues of regional representation of the HSS in the North, South, Central and Highland regions was added as a criteria to adjust the priority list of HSS provinces. The consensus reached in the workshop was the basis for proceeding a formal approval at Ministry of Health. **Results** The data review and panel discussion suggested that the number of provinces to implement HSS should be 20 for PWID, 13 for FSW, and 7 for MSM surveys. While total number of provinces reduced from 40 to 20, all 4 geographical regions of the country were covered. Even with the reduction of the geographical coverage of the HSS, large proportions of the KPs (63.9% of PWID, 58.9% of FSWs and 36% of MSM) were covered under the HSS (Table 2). In February 2017, the Ministry of Health officially approved the 20 priority provinces as a part of the new strategic direction of the Vietnam National HSS. **Conclusions** The data review and panel discussion suggested that the number of provinces to implement HSS should be 20 for PWID, 13 for FSW, and 7 for MSM surveys. While total number of provinces reduced from 40 to 20, all 4 geographical regions of the country were covered. Even with the reduction of the geographical coverage of the HSS, large proportions of the KPs (63.9% of PWID, 58.9% of FSWs and 36% of MSM) were covered under the HSS (Table 2). In February 2017, the Ministry of Health officially approved the 20 priority provinces as a part of the new strategic direction of the Vietnam National HSS. **References** 1. World Health Organization. Regional Office for the Western Pacific, 2016, Joint Review of the Health Sector Response to HIV in Viet Nam 2014.

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# Roles of Health Literacy in Relation to Social Determinants of Health and Recommendations for Informatics-Based Interventions: Systematic Review

## Abstract

**Objective** To detect the presence of brucella in serum samples of occupationally exposed human and animals by conventional screening methods. To perform epidemiosurveillance of brucella molecular based tests including genus and species specific PCR. To check the brucella prevalence in occupationally exposed human. **Introduction** Livestock sector contributes more than 58% to agriculture-based economy of Pakistan. Diseases of socio-economic importance are posing an enormous pressure to the growth of this sector. Zoonotic diseases are generally neglected in wake of epizootics having epidemic potential. One Health is a multi-sectoral approach to control zoonotic diseases at animal level to mitigate risk of transfer to the humans and environment. Despite various control programs, zoonosis is known to cause public health emergencies at various regional and national levels. OIE declared brucellosis as a model bacterial disease to control zoonosis in developing countries. Genus *Brucella* is expanding with its discovery in various amphibian species and marine mammals and demands control efforts at various levels. Reporting of zoonosis is less than actual prevalence in third world countries like Pakistan where disease is considered endemic but no official data is available. In this study, brucellosis was used as a model disease to emphasize the significance of One Health. **Methods** In total, 183 occupationally exposed human and 324 animal blood samples were collected from five different geographical areas of Punjab and one region from KP. For detection of brucella, rose bengal plate test (RBPT) and cELISA were carried out on serum samples. For molecular epidemiosurveillance genus specific PCR BCSP31 and specie specific PCR IS711 were conducted. Fifty-seven milk samples as environmental samples were also collected. For the testing of milk for the detection of brucella, Milk Ring Test (MRT) was applied. **Results** Serologically in animals 26(8%) samples were found positive by RBPT & 31(9%) by cELISA. Disease was detected in 42(13%) & 59(18%) samples by applying molecular methods using genus specific PCR BCSP31 & specie specific PCR IS711. Disease was recorded in humans as 16(8%), 24(13%), 33(18%), 56(30%) by RBPT, cELISA, PCR BCSP31 & PCR IS711, respectively. Out of 57 milk samples collected from different areas were tested by Milk Ring Test (MRT) & 12(21%) samples were found positive. **Conclusions** It is a significant finding that raw milk is a constant source of disease exposure to farmers, milking men and general users. Disease prevalence was more in people associated with milking activities possibly due to use of raw milk. This study validate the prevalence of brucellosis in Pakistan with significant presence of disease in occupationally exposed individuals emphasizing the close collaboration between veterinary and human health sectors. This study will broaden our knowledge of disease prevalence and epidemiology in Pakistan. The data produced from this study will help in future control and eradication of this important zoonosis using one health approach.

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# Roles of Health Literacy in Relation to Social Determinants of Health and Recommendations for Informatics-Based Interventions: Systematic Review

## Abstract

**Objective** To determine the sero-prevalence of FMD and indicate patterns of animal movement in Borena zone, Ethiopia. **Introduction** The Foot and mouth disease (FMD) virus is a highly contagious and economically devastating trans boundary disease of cloven-hooved domestic and wild animals<sup>1</sup>. **Methods** A cross-sectional study was carried out between April and November 2015 to investigate the sero-prevalence of foot-and-mouth disease (FMD) in cattle using serology and questionnaire survey in Borena zone. **Results** A total of 363 sera samples were collected from nine peasant associations found in three different districts. An overall seroprevalence of 42.7% (95%: CI= 37.7-47.84) was found during the study. There was statistically significant difference among the districts ( $\chi^2 = 10.43$ ,  $p=0.005$ ) and the highest prevalence was found in Dire district which accounted for 52.8% (95%: CI, 44.0-61.4). Soda peasant association of Dire district and Surupa peasant association of Yabello district accounted for highest sero-prevalence 65.5% (95%: CI, 49.4-78.5) and 65.0% (95%: CI= 40.4-78.5), respectively. Statistical significant difference in foot-and-mouth disease seroprevalence ( $\chi^2 =31.1$ ,  $p=0.000$ ) was found among the peasant associations. Similarly, there was significance difference ( $\chi^2 =17.4$ ,  $p=0.000$ ) in the prevalence of foot-and-mouth disease between age groups. Though the seroprevalence foot-and-mouth disease was higher in females than in males, there was no significant difference ( $\chi^2=1.63$ ,  $p=0.202$ ) between sex. The different risk factors analyzed during this study indicated that, peasant associations (PAs), district and age were seen to be significantly associated ( $p<0.05$ ) with the seroprevalence of foot-and-mouth disease. The questionnaire survey revealed that foot-and-mouth disease outbreak was commonly seen during June to August (Short rainy season) and December to February (Long dry season), locally called Adolessa and Bona, respectively. Younger (1-3 years) animals were most susceptible than calf and adults (>3years). Moreover, an extrinsic factor like dry season enforces pastoralist to travel a longer distance to look for grazing lands and water sources that creates suitable conditions for foot-and-mouth disease transmission between infected and susceptible animals. **Conclusions** FMD is an important transboundary animal disease that affects the livelihood of farmers and economy of the country. In pastoral areas like Borena where livestock movement is common during dry season, the disease is devastating and spreading from one area to the other. Therefore, an extensive regular serological survey, virus isolation, and characterizations of FMD virus need to be conducted for a possible development of poly-valent vaccines that contains commonly circulating serotypes of FMD virus in Ethiopia. **References** 1. Gelagay Ayelet, Mana Mahapatra, Esayas Gelaye, Berhe G. Egziabher, Tesfaye Rufeal, Mesfin Sahle, Nigel P. Ferris, Jemma Wadsworth, Geoffrey H. Hutchings, and Nick J. Knowles. Genetic Characterization of Foot-and-Mouth Disease Viruses, Ethiopia, 1981–2007. *Emerg Infect Dis.* 15(9): 1409–1417.2009

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# Roles of Health Literacy in Relation to Social Determinants of Health and Recommendations for Informatics-Based Interventions: Systematic Review

## Abstract

**Objective** Assess the legal framework establishing disease surveillance in Nigeria and identify major factors affecting the performance of the surveillance system. **Introduction** The outbreak of infectious diseases with a propensity to spread across international boundaries is on an upward rise. Such outbreaks can be devastating with significant associated morbidity and mortality. The recent Ebola Virus Disease outbreak in West Africa which spread to Nigeria is an example.(1) Nigeria like several other African countries implements the Integrated Disease Surveillance and Response (IDSR) system as its method for achieving the International Health Regulations (IHR). Yet, compliance to the IDSR is questioned. This study seeks to investigate the legal instruments in place and the factors affecting performance of the disease surveillance in the country. **Methods** The study reports the first objective of a larger study to investigate compliance to disease surveillance by private health providers.(2) An investigative search of the literature for legal instruments on disease surveillance in Nigeria was carried out. In addition, key informants were identified and interviewed at the national level and in selected states. The six states in the South-West were identified for an in-depth study. The IHR focal person and the National Health Management Information System officer were interviewed at the national level. The state epidemiologists and the state health management information system (HMIS) officers across the six states were interviewed. Each state has only one state epidemiologist and one HMIS officer as such it was a total sample. In all, 14 key informants were interviewed. **Results** Six legal instruments were identified as seen in table 1. The most recent comprehensive legal instrument on infectious disease control in Nigeria is a 2005 policy on IDSR. This is further supported by the National Health Act of 2014. However, the National Health Act is not detailed for infectious disease control. The substantive law which governs infectious diseases in Nigeria, the Quarantine Act was enacted almost a century ago during the colonial era in 1926. None of the states studied has an active law on infectious disease surveillance as noted by key informants. While all states refer to the IDSR policy, none has formally ratified the document. There are two independent overlapping data collection systems on infectious diseases: the IDSR and the National Health Management Information System (NHMIS). Data on malaria, HIV and tuberculosis are among data collected across the two systems. This was identified by key informants as a problem since the data collection forms differed across systems and almost always result in differing statistics. In addition, this duplication causes overburdening of frontline workers expected to fill the parallel data collection tools and results in inefficiency of the system. Funding of the surveillance system was identified to be inadequate with significant reliance on international partners. **Conclusions** A review of the national law on disease surveillance to address emerging global health security challenges is necessary. State legislators need to enact or ratify national laws on infectious disease monitoring and control in their states. The duplication across the NHMIS and the IDSR surveillance system requires harmonization to improve efficiency. Government needs to invest more resources in disease surveillance. **References** . Makinde OA. As Ebola winds down, Lassa Fever reemerges yet again in West Africa. *J Infect Dev Ctries* [Internet]. 2016 Feb 28;10(02):199–200. Available from: <http://www.jidc.org/index.php/journal/article/view/8148> 2. Makinde OA, Odimegwu CO. Disease Surveillance by Private Health Providers in Nigeria: A Research Proposal. *Online J Public Health Inform* [Internet]. 2016 Mar 24;8(1). Available from: <http://ojphi.org/ojs/index.php/ojphi/article/view/6554>

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# Roles of Health Literacy in Relation to Social Determinants of Health and Recommendations for Informatics-Based Interventions: Systematic Review

## Abstract

**Objective** The goal of this editorial is to shed light on the lack of transparency that exists in the sharing of Public Health data and to reverse this presumption in favour of open public health information properly vetted and openly accessible. Open public health information is a critical step to revitalize public health practice and is a human right. **Introduction** Public health practice that prevents, detects, and responds to communicable and noncommunicable disease threats is hindered by poor access to public health data and information. This includes timely sharing of case-based information, respecting patent and publication rights, and the ethical sharing of specimens. Disagreements about information shared and under what circumstances plus who has right to the data, clinical specimens, and their derivative products impede research and countermeasures. Delayed or inaction by public health authorities undermines trust and exacerbates the crisis. Evident in 2014 by the delayed Public Health Emergency of International Concern declaration of the Ebola virus outbreak in West Africa by the World Health Organization, the governing presumption is that access to public health information should be restricted, constrained, or even hoarded; this is a failed approach. This lack of transparency prevents information availability when and where it is needed and obstructs public health efforts to efficiently and ethically prevent, detect, and respond to emerging threats. A better way forward is to reverse this presumption in favour of open public health information properly vetted and openly accessible. Open public health information is a critical step to revitalize public health practice and is a human right. While there is limited global consensus among scientists and public health practitioners on best practices to guide national health authorities, researchers, NGOs, and industry as they navigate the ethical, political, technical, and economic challenges associated with the sharing of essential public health information (e.g., pathogen isolates, clinical specimens, and patient-related data), grounding this discussion on the guiding principles of open public health information can help navigate the complex privacy, security, communication, and access needs, and ensure that collaboration and sharing occur in a manner that is ethically and socially just, efficient, and equitable. Built on existing governance frameworks such as the International Health Regulations (IHRs) and the Pandemic Influenza Preparedness Framework (PIP), open public health can transform public health surveillance, allowing for the rapid sharing of data and products during outbreaks for mutual benefit and enhanced global health security. **Methods** This abstract represents a larger editorial style manuscript, thus no methods were developed in the abstract. **Results** This editorial style manuscript aims to reverse the presumption that public health data is damaging to one in favour of open public health information properly vetted and openly accessible. **Conclusions** Similar to other open movements (i.e., open data, open government, open development, and open science) that seek to address the world's greatest challenges through transparency, collaboration, reuse of and free access to ideas, open public health offers an ideal solution to overcome the challenges in the 21st century.

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# Roles of Health Literacy in Relation to Social Determinants of Health and Recommendations for Informatics-Based Interventions: Systematic Review

## Abstract

**Objective** To explore the utility of syndromic surveillance systems for detecting and monitoring the impact of air pollution incidents on health-care seeking behaviour in England between 2012 and 2017. **Introduction** The negative effect of air pollution on human health is well documented illustrating increased risk of respiratory, cardiac and other health conditions. [1] Currently, during air pollution episodes Public Health England (PHE) syndromic surveillance systems [2] provide a near real-time analysis of the health impact of poor air quality. In England, syndromic surveillance has previously been used on an ad hoc basis to monitor health impact; this has usually happened during widespread national air pollution episodes where the air pollution index has reached 'High' or 'Very High' levels on the UK Daily Air Quality Index (DAQI). [3-5] We now aim to undertake a more systematic approach to understanding the utility of syndromic surveillance for monitoring the health impact of air pollution. This would improve our understanding of the sensitivity and specificity of syndromic surveillance systems for contributing to the public health response to acute air pollution incidents; form a baseline for future interventions; assess whether syndromic surveillance systems provide a useful tool for public health alerting; enable us to explore which pollutants drive changes in health-care seeking behaviour; and add to the knowledge base. **Methods** The systematic approach will involve accessing historical data for air pollution incidents and syndromic surveillance data over the period 2012-17 across England. We will use PM10, PM2.5, ozone, NO<sub>2</sub>, SO<sub>2</sub> and DAQI data to define air pollution periods, and historical syndromic surveillance system data for respiratory syndromes (asthma, difficulty breathing, wheeze, cough, bronchitis, sore throat and allergic rhinitis), cardiac (all cardiovascular and myocardial infarction) and eye irritation/conjunctivitis syndromes. We will use regression modelling and cross-correlation analyses to determine the effects of air pollution, weather and pollen upon these syndromes and thus provide evidence of the sensitivity of these systems. Historical data on additional environmental variables including temperature and precipitation, humidity and thunderstorm activity, pollen and fungal spores will be accounted for in the regression models, as well as data on influenza and respiratory syncytial virus (RSV) laboratory reports. We will include sub-national geographies and age/gender analyses in the study depending on the data availability and suitability. **Results** Initial results presented will include the preliminary descriptive epidemiology with a focus on asthma and the impact of air pollution incidents on health-care seeking behaviour using data from the PHE national syndromic surveillance systems. **Conclusions** We aim to demonstrate an innovative use of syndromic surveillance data to explore the impact of air pollution incidents on health-care seeking behaviour in England, in turn improving our understanding of the sensitivity and specificity of these systems for detecting the impact of air pollution incidents and to contribute to the knowledge base. This understanding will improve the public health response to future incidents. **References** 1. World Health Organization (WHO). Preventing disease through healthy environments. Exposure to air pollution: A major public health concern. ([http://www.who.int/ipcs/features/air\\_pollution.pdf](http://www.who.int/ipcs/features/air_pollution.pdf)). Accessed 28/09/2017 2. Public Health England. Syndromic surveillance: systems and analyses. (<https://www.gov.uk/government/collections/syndromic-surveillance-systems-and-analyses>). Accessed 20/09/2017 3. Department for Environment Food and Rural Affairs (Defra). Daily Air Quality Index (DAQI). (<https://uk-air.defra.gov.uk/air-pollution/daq>). Accessed 28/06/2017 4. Smith GE, et al. Using real-time syndromic surveillance systems to help explore the acute impact of the air pollution incident of March/April 2014 in England. *Environ Res* 2015; 136: 500-504. 5. Elliot AJ, et al. Monitoring the effect of air pollution episodes on health care consultations and ambulance call-outs in England during March/April 2014: A retrospective observational analysis. *Environ Pollut* 2016; 214: 903-911.

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# Roles of Health Literacy in Relation to Social Determinants of Health and Recommendations for Informatics-Based Interventions: Systematic Review

## Abstract

**Objective** We will demonstrate tools that allow mechanistic constraints on disease progression and epidemic spread to play off against interventions, mitigation, and control measures. The fundamental mechanisms of disease progression and epidemic spread provide important constraints on interpreting changing epidemic cases counts with time and geography in the context of on-going interventions, mitigations, and controls. Models such as these that account for the effects of human actions can also allow evaluation of the importance of categories of epidemic and disease controls.

**Introduction** We present the EpiEarly, EpiGrid, and EpiCast tools for mechanistically-based biological decision support. The range of tools covers coarse-, medium-, and fine-grained models. The coarse-grained, aggregated time-series only data tool (EpiEarly) provides a statistic quantifying epidemic growth potential and associated uncertainties. The medium grained, geographically-resolved model (EpiGrid) is based on differential equation type simulations of disease and epidemic progression in the presence of various human interventions geared toward understanding the role of infection control, early vs. late diagnosis, vaccination, etc. in outbreak control. A fine-grained hybrid-agent epidemic model (EpiCast) with diurnal agent travel and contagion allows the analysis of the importance of contact-networks, travel, and detailed intervention strategies for the control of outbreaks and epidemics.

**Methods** We use three types of methods for simulation and analysis. They are: (1) Bayesian and regression methods allowing estimation of the basic reproductive number from case-count data; (2) ordinary-differential equation integration with modifications to account for discreteness of disease spread when case counts are small (we include space- and time-dependent effects); and (3) methods that hybridize agent-based travel, mixing, and disease progression with nested-mass action contagion (i.e. not fully agent-based). From the perspective of decision support, the crucial feature of mechanistic infectious epidemiological models is a way to capture the human interventions that determine epidemic outcome. Categorizing types of mitigation into those that change the force of infection, and those that branch disease progression allows a common framework that can be extended from medium-grained models through fine-grained. Our canonical example is our EpiGrid tool which allows for the modulation of the force of infection (i.e. contagion) with time (and potentially space), the vaccination of a susceptible population in a geographically-targeted manner, movement controls, and branching our disease progression model to account for early- vs. late-intervention during host disease progression.

**Results** We will present analysis of diseases that exemplify the various aspects of analysis in support of outbreak and epidemic control. Human and animal diseases relevant to this demonstration include rinderpest, avian influenza, and measles. We will begin with EpiEarly's estimate of epidemic potential using aggregated time-dependent case-count data. The key observation for EpiEarly is that under a wide range of situations a disease's reproductive number should be generalized to a distribution of possibilities to account for inherent randomness and other factors (including the variability of a disease contact network). We will then continue with a demonstration of EpiGrid's capabilities for understanding and modelling the role of interventions including contagion control (the force of infection), treatment (changing disease progression and infectiousness depending on treatment), vaccination, culling, and movement controls. We will briefly touch on the capabilities of EpiCast for more detailed analysis of specific intervention strategies.

**Conclusions** We will demonstrate examples where modeling either contributed or plausibly would contribute to informing epidemic and outbreak control constrained by the possibilities of the underlying epidemic and disease dynamics.

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# Roles of Health Literacy in Relation to Social Determinants of Health and Recommendations for Informatics-Based Interventions: Systematic Review

## Abstract

**Objective** To investigate whether alternative statistical approaches can improve daily aberration detection using syndromic surveillance in England. **Introduction** Syndromic surveillance involves monitoring big health datasets to provide early warning of threats to public health. Public health authorities use statistical detection algorithms to interrogate these datasets for aberrations that are indicative of emerging threats. The algorithm currently in use at Public Health England (PHE) for syndromic surveillance is the ‘rising activity, multi-level mixed effects, indicator emphasis’ (RAMMIE) method (Morbey et al, 2015), which fits a mixed model to counts of syndromes on a daily basis. This research checks whether the RAMMIE method works across a range of public health scenarios and how it compares to alternative methods. **Methods** For this purpose, we compare RAMMIE to the improved quasi-Poisson regression-based approach (Noufaily et al, 2013), currently implemented at PHE for weekly infectious disease laboratory surveillance, and to the Early Aberration Reporting System (EARS) method (Rossi et al, 1999), which is used for syndromic surveillance aberration detection in many other countries. We model syndromic datasets, capturing real data aspects such as long-term trends, seasonality, public holidays, and day-of-the-week effects, with or without added outbreaks. Then, we compute the sensitivity and specificity to compare how well each of the algorithms detects synthetic outbreaks to provide recommendations for the most suitable statistical methods to use during different public health scenarios. **Results** Preliminary results suggest all methods provide high sensitivity and specificity, with the (Noufaily et al, 2013) approach having the highest sensitivity and specificity. We showed that for syndromes with long-term increasing trends, RAMMIE required modification to prevent excess false alarms. Also, our study suggests further work is needed to fully account for public holidays and day-of-the-week effects. **Conclusions** Our study will provide recommendations for which algorithm is most effective for PHE's syndromic surveillance for a range of different syndromes. Furthermore our work to generate standardised synthetic syndromic datasets and a range of outbreaks can be used for future evaluations in England and elsewhere. **References** Noufaily, A., Enki, D. G., Farrington, C. P., Garthwaite, P., Andrews, N. and Charlett, A. (2013). An Improved Algorithm for Outbreak Detection in Multiple Surveillance Systems. *Statistics in Medicine*, 32(7), 1206-1222. Morbey, R. A., Elliot, A. J., Charlett, A., Verlander, A. Q., Andrews, N. and Smith, G. (2013). The application of a novel ‘rising activity, multi-level mixed effects, indicator emphasis’ (RAMMIE) method for syndromic surveillance in England, *Bioinformatics*, 31(22), 3660-3665. Rossi, G, Lampugnani, L, Marchi, M. (1999), An approximate CUSUM procedure for surveillance of health events. *Statistics in Medicine*, 18, 2111–2122

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# Roles of Health Literacy in Relation to Social Determinants of Health and Recommendations for Informatics-Based Interventions: Systematic Review

## Abstract

**Objective** To develop a computational model to assess the risk of epidemics in global mass gatherings and evaluate the impact of various measures of prevention and control of infectious diseases. **Introduction** Global Mass gatherings (MGs) such as Olympic Games, FIFA World Cup, and Hajj (Muslim pilgrimage to Makkah), attract millions of people from different countries. The gathering of a large population in a proximity facilitates transmission of infectious diseases [1]. Attendees arrive from different geographical areas with diverse disease history and immune responses. The associated travel patterns with global events can contribute to a further disease spread affecting a large number of people within a short period and lead to a potential pandemic. Global MGs pose serious health threats and challenges to the hosting countries and home countries of the participants [2]. Advanced planning and disease surveillance systems are required to control health risks in these events. The success of computational models in different areas of public health and epidemiology motivates using these models in MGs to study transmission of infectious diseases and assess the risk of epidemics. Computational models enable simulation and analysis of different disease transmission scenarios in global MGs. Epidemic models can be used to evaluate the impact of various measures of prevention and control of infectious diseases. **Methods** The annual event of the Hajj is selected to illustrate the main aspects of the proposed model and to address the associated challenges. Every year, more than two million pilgrims from over 186 countries arrive in Makkah to perform Hajj with the majority arriving by air. Foreign pilgrims can stay at one of the holy cities of Makkah and Madinah up to 30–35 days prior the starting date of the Hajj. The long duration of the arrival phase of the Hajj allows a potential epidemic to proceed in the population of international pilgrims. Stochastic SEIR (Susceptible–Exposed–Infected–Recovered) agent-based model is developed to simulate the disease transmission among pilgrims. The agent-based model is used to simulate pilgrims and their interactions during the various phases of the Hajj. Each agent represents a pilgrim and maintains a record of demographic data (gender, country of origin, age), health data (infectivity, susceptibility, number of days being exposed or infected), event related data (location, arrival date and time), and precautionary or health-related behaviors. Each pilgrim can be either healthy but susceptible to a disease, exposed who are infected but cannot transmit the infection, or infectious (asymptomatic or symptomatic) who are infected and can transmit the disease to other susceptibles. Exposed individuals transfer to the infectious compartment after  $1/\alpha$  days, and infectious individuals will recover and gain immunity to that disease after  $1/\gamma$  days. Where  $\alpha$  is the latent period and  $\gamma$  is the infectious period. Moving susceptible individuals to exposed compartment depends on a successful disease transmission given a contact with an infectious individual. The disease transmission rate is determined by the contact rate and the transmission probability per contact. Contact rate and mixing patterns are defined by probabilistic weights based on the features of infectious pilgrims and the duration and setting of the stage where contacts are taking place. The initial infections are seeded in the population using two scenarios (Figure 1) to measure the effects of changing, the timing for introducing a disease into the population and the likelihood that a particular flight will arrive with one or more infected individuals. **Results** The results showed that the number of initial infections is influenced by increasing the value of  $\lambda$  and selecting starting date within peak arrival days. When starting from the first day, the average size of the initial infectious ranges from 0.05% to 1% of the total arriving pilgrims. Using the SEIR agent-based model, a simulation of the H1N1 Influenza epidemic was completed for the 35-days arrival stage of the Hajj. The epidemic is initiated with one infectious pilgrim per flight resulting in infected 0.5% of the total arriving pilgrims. As pilgrims spend few hours at the airport, the results obtained from running the epidemic model showed only new cases of susceptible individuals entering the exposed state in a range of 0.20% to 0.35% of total susceptibles. The number of new cases is reduced by almost the same rate of the number of infectious individuals following precautionary behaviors. **Conclusions** A data-driven stochastic SEIR agent-based model is developed to simulate disease spread at global mass gatherings. The proposed model can provide initial indicators of infectious disease epidemic at these events and evaluate the possible effects of intervention measures and health-related behaviors. The proposed model can be generalized to model the spread of various diseases in different mass gatherings, as it allows different factors to vary and entered as parameters. **References** 1. Memish ZA, Stephens GM, Steffen R, Ahmed QA. Emergence of medicine for mass gatherings: lessons from the Hajj. *The Lancet infectious diseases*. 2012 Jan 31;12(1):56–65. 2. Chowell G, Nishiura H, Viboud C. Modeling rapidly disseminating infectious disease during mass gatherings. *BMC medicine*. 2012 Dec 7;10(1):159.

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# Roles of Health Literacy in Relation to Social Determinants of Health and Recommendations for Informatics-Based Interventions: Systematic Review

## Abstract

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**Objective** A team of data scientists from Booz Allen competed in an opioid hackathon and developed a prototype opioid surveillance system using data science methods. This presentation intends to 1) describe the positives and negatives of our data science approach, 2) demo the prototype applications built, and 3) discuss next steps for local implementation of a similar capability. **Introduction** At the Governor's Opioid Addiction Crisis Datathon in September 2017, a team of Booz Allen data scientists participated in a two-day hackathon to develop a prototype surveillance system for business users to locate areas of high risk across multiple indicators in the State of Virginia. We addressed 1) how different geographic regions experience the opioid overdose epidemic differently by clustering similar counties by socioeconomic indicators, and 2) facilitating better data sharing between health care providers and law enforcement. We believe this inexpensive, open source, surveillance approach could be applied for states across the nation, particularly those with high rates of death due to drug overdoses and those with significant increases in death. **Methods** The Datathon provided a combination of publicly available data and State of Virginia datasets consisting of crime data, treatment center data, funding data, mortality and morbidity data for opioid, prescription drugs (i.e. oxycodone, fentanyl), and heroin cases, where dates started as early as 2010. The team focused on three data sources: U.S. Census Bureau (American Community Survey), State of Virginia Opioid Mortality and Overdose Data, and State of Virginia Department of Corrections Data. All data was cleaned and mapped to county-levels using FIPS codes. The prototype system allowed users to cluster similar counties together based on socioeconomic indicators so that underlying demographic patterns like food stamp usage and poverty levels might be revealed as indicative of mortality and overdose rates. This was important because neighboring counties like Goochland and Henrico Counties, while sharing a border, do not necessarily share similar behavioral and population characteristics. As a result, counties in close proximity may require different approaches for community messaging, law enforcement, and treatment infrastructure. The prototype also ingests crime and mortality data at the county-level for dynamic data exploration across multiple time and geographic parameters, a potential vehicle for data exchange in real-time. **Results** The team wrote an agglomerative algorithm similar to k-means clustering in Python, with a Flask API back-end, and visualized using FIPS county codes in R Shiny. Users were allowed to select 2 to 5 clusters for visualization. The second part of the prototype featured two dashboards built in ElasticSearch and Kibana, open source software built on a noSQL database designed for information retrieval. Annual data on number of criminal commits and major offenses and mortality and overdose data on opioid usage were ingested and displayed using multiple descriptive charts and basic NLP. The clustering algorithm indicated that when using five clusters, counties in the east of Virginia are more dissimilar to each other, than counties in the west. The farther west, the more socioeconomically homogenous counties become, which may explain why counties in the west have greater rates of opioid overdose than in the east which involve more recreational use of non-prescription drugs. The dashboards indicated that between 2011 and 2017, the majority of crimes associated with heavy-use of drugs included Larceny/Fraud, Drug Sales, Assault, Burglary, Drug Possession, and Sexual Assault. Filtering by year, county, and offense, allowed for very focused analysis at the county level. **Conclusions** Data science methods using geospatial analytics, unsupervised machine learning, and leverage of noSQL databases for unstructured data, offer powerful and inexpensive ways for local officials to develop their own opioid surveillance system. Our approach of using clustering algorithms could be advanced by including several dozen socioeconomic features, tied to a potential risk score that the group was considering calculating. Further, as the team became more familiar with the data, they considered building a supervised machine learning to not only predict overdoses in each county, but more so, to extract from the model which features would be most predictive county-to-county. Next, because of the fast-paced nature of an overnight hackathon, a variety of open source applications were used to build solutions quickly. The team recommends generating a single architecture that would seamlessly tie together Python, R Shiny, and ElasticSearch/Kibana into one system. Ultimately, the goal of the entire prototype is to ingest and update the models with real-time data dispatched by police, public health, emergency departments, and medical examiners. **References** <https://data.virginia.gov/datathon-2017/> <https://vimeo.com/236131006?ref=tw-share> <https://vimeo.com/236131182?ref=tw-share>

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# Roles of Health Literacy in Relation to Social Determinants of Health and Recommendations for Informatics-Based Interventions: Systematic Review

## Abstract

**Objective** To utilize ED chief complaint data obtained from syndromic surveillance to quantify the effect of the Illinois smoking ban on acute myocardial infarction (AMI), acute coronary syndrome (ACS), stroke, and chronic obstructive pulmonary disease (COPD) related ED visits in adults in Cook County, IL. **Introduction** Tobacco use is the leading global cause of preventable death, killing more than five million people per year [1]. In addition, exposure to secondhand smoke is estimated to kill an additional 600,000 people globally each year [1]. In 1986, the US Surgeon General's Report declared secondhand smoke to be a cause of lung cancer in healthy nonsmokers [2]. The first law restricting smoking in public places was enacted in 1973 in Arizona that followed the 1972 Surgeon General's Report providing awareness of the negative health effects associated with the exposure to air pollution from tobacco smoke [3]. Smoke-free laws were slowly enacted after this time point with most occurring after the year 2000 [4]. In July 2007, the Smoke Free Illinois Act (SB0500, Public Act 095-0017) was passed in IL [5]. The ban went into effect on Jan 1, 2008 and Illinois joined 22 other states in prohibiting smoking in virtually all public places and workplaces including offices, theaters, museums, libraries, schools, commercial establishments, retail stores, bars, private clubs, and gaming facilities [5-6]. While many studies have examined the effect of smoking bans on hospitalizations, this study would be the first to examine the effect of the comprehensive smoking ban in IL on ED visits by utilizing chronic disease categories created with ED chief complaint data captured by syndromic surveillance [7]. The author hypothesizes that the comprehensive smoking ban in IL significantly reduced the ED visits associated with AMI, ACS, stroke, and COPD in adults in Cook County, IL. **Methods** ED visits with chief complaints consistent with categories for AMI, ACS, stroke and COPD captured by the Cook Co. Dept. of Public Health local instance of ESSENCE from Jan 1, 2006 – Dec 31, 2013 were included in the analysis. Proc Genmod with a log link and negative binomial distribution was utilized for the analysis. All data was aggregated at the monthly level. The total number of ED visits of the health effect of interest was the dependent variable. The total ED visits during the same period of time, was used as the offset variable, sub-grouped by age and gender where appropriate. A binary variable was utilized to capture the effect of the time period after the implementation of the statewide smoking ban; 0 for before the ban and 1 for after the ban. When examining the effect of the statewide ban, Cook Co. as an entirety was examined as well as ED visits stratified by zip codes that already had a smoking ban in place at that time point and those that did not, and stratifying by urban (Chicago) vs. suburban Cook Co. Seasonality was addressed by including month, month squared and month cubed in the model. Influenza was addressed by including a binary variable to indicate when influenza was occurring in the area based on percent influenza-like-illness ED visits that were occurring above the threshold for the area during that time period. Age and gender were also evaluated as confounders and effect modifiers. SAS 9.4 was utilized to perform the analyses. **Results** Results are presented in Table 1. Reductions of ED visits after the smoking ban implementation were seen in AMI and ACS disease categories for the overall adjusted model, at 3% and 3.5% respectively. Stroke associated ED visits were not affected by the smoking ban. COPD associated ED visits were not reduced immediately by the smoking ban, but did have a significant reduction 6 months after implementation of the ban at 3.6%. Stronger effects were seen in individuals 70 years and older, females, the urban population, and zip codes without a prior ban for AMI, ACS, and COPD. **Conclusions** An immediate, significant reduction in ED visits associated with AMI and ACS was associated with the IL statewide smoking ban in Cook Co., IL. COPD associated ED visits were significantly reduced 6 months after the ban implementation. The effect was greater in individuals 70 years and older, females, the urban population, and zip codes without a prior ban. **References** 1. WHO, WHO report on the global tobacco epidemic. Implementing smoke-free environments. 2009, WHO: Geneva, Switzerland. 2. 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# Roles of Health Literacy in Relation to Social Determinants of Health and Recommendations for Informatics-Based Interventions: Systematic Review

## Abstract

**Objective** LANL has built software that automatically collects global notifiable disease data, synthesizes the data, and makes it available to humans and computers within the Biosurveillance Ecosystem (BSVE) as a novel data stream. These data have many applications including improving the prediction and early warning of disease events. **Introduction** Most countries do not report national notifiable disease data in a machine-readable format. Data are often in the form of a file that contains text, tables and graphs summarizing weekly or monthly disease counts. This presents a problem when information is needed for more data intensive approaches to epidemiology, biosurveillance and public health. While most nations likely store incident data in a machine-readable format, governments are often hesitant to share data openly for a variety of reasons that include technical, political, economic, and motivational issues<sup>1</sup>. A survey conducted by LANL of notifiable disease data reporting in over fifty countries identified only a few websites that report data in a machine-readable format. The majority (>70%) produce reports as PDF files on a regular basis. The bulk of the PDF reports present data in a structured tabular format, while some report in natural language. The structure and format of PDF reports change often; this adds to the complexity of identifying and parsing the desired data. Not all websites publish in English, and it is common to find typos and clerical errors. LANL has developed a tool, Epi Archive, to collect global notifiable disease data automatically and continuously and make it uniform and readily accessible. **Methods** We conducted a survey of the national notifiable disease reporting systems notating how the data are reported and in what formats. We determined the minimal metadata that is required to contextualize incident counts properly, as well as optional metadata that is commonly found. The development of software to regularly ingest notifiable disease data and make it available involves three or four main steps: scraping, detecting, parsing and persisting. **Scraping:** we examine website design and determine reporting mechanisms for each country/website, as well as what varies across the reporting mechanisms. We then designed and wrote code to automate the downloading of the data for each country. We store all artifacts presented as files (PDF, XLSX, etc.) in their original form, along with appropriate metadata for parsing and data provenance. **Detecting:** This step is required when parsing structured non-machine-readable data such as tabular data in PDF files. We combined the Nurminen methodology of PDF table detection with in-house heuristics to find the desired data within PDF reports<sup>2</sup>. **Parsing:** We determined what to extract from each dataset and parsed these data into uniform data structures, correctly accommodating the variations in metadata (e.g., time interval definitions) and the various human languages. **Persisting:** We store the data in the Epi Archive database and make it available on the internet and through the BSVE. The data is persisted into a structured and normalized SQL database. **Results** The Epi Archive tool currently contains national and/or subnational notifiable disease data from twenty nations. When a user accesses the Epi Archive site, they are prompted with four fields: country, subregion, disease of interest, and date duration. Upon form submission, a time series is generated from the users' specifications. The generated graph can then be downloaded into a CSV file if a user is interested in performing personal analysis. Additionally, the data from Epi Archive can be reached through a REST API (Representational State Transfer Application Programming Interface). **Conclusions** LANL, as part of a currently funded DTRA effort, is automatically and continually collecting global notifiable disease data. While 20 nations are in production, more are being brought online in the near future. These data are already being utilized and will have many applications including improving the prediction and early warning of disease events. **References** [1] van Panhuis WG, Paul P, Emerson C, et al. A systematic review of barriers to data sharing in public health. *BMC Public Health*. 2014. 14:1144. doi:10.1186/1471-2458-14-1144 [2] Nurminen, Anssi. "Algorithmic extraction of data in tables in PDF documents." (2013).

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# Roles of Health Literacy in Relation to Social Determinants of Health and Recommendations for Informatics-Based Interventions: Systematic Review

## Abstract

**Objective** Epi Evident is a web based application built to empower public health analysts by providing a platform that improves monitoring, comparing, and forecasting case counts and period prevalence of notifiable diseases for any scale jurisdiction at regional, country, or global-level. This proof of concept application development addresses improving visualization, access, situational awareness, and prediction of disease behavior. **Introduction** The Epi Evident application was designed for clear and comprehensive visualization for monitoring, comparing, and forecasting notifiable diseases simultaneously across chosen countries. Epi Evident addresses the taxing analytical evaluation of how diseases behave differently across countries. This application provides a user-friendly platform with easily interpretable analytics which allows analysts to conduct biosurveillance with minimal user tasks. Developed at the Pacific Northwest National Laboratory (PNNL), Epi Evident utilizes time-series disease case count data from the Biosurveillance Ecosystem (BSVE) application Epi Archive (1). This diverse data source is filtered through the flexible Epi Evident workflow for forecast model building designed to integrate any entering combination of country and disease. The application aims to quickly inform analysts of anomalies in disease & location specific behavior and aid in evidence based decision making to help control or prevent disease outbreaks. **Methods** A workflow was constructed to define the best disease forecast model for each location based on an adjustable method approach. The differences in disease behavior across countries was achieved through a React/Python application with a user-friendly output for monitoring and comparing different combinations. The forecast model building workflow consisted of three major steps to determine the best fit model for a given disease-country pair: data type, model type, and model comparison & selection. Testing various disease-country combinations allowed for direct evaluation of the workflow efficiency, flexibility, and criteria for determining the best fit model. Data type was characterized as either seasonal, cyclic, or sporadic. Depending on data type, a specific time series forecasting model was applied. In general, seasonal or cyclic data required either an Auto-Regression Integrated Moving Average (ARIMA) model or a Seasonal Auto-Regression Integrated Moving Average (SARIMA) model while sporadic datasets employed a Poisson model. Several model candidates for a single country and disease combination were then compared to determine which was the best fit model. ARIMA and SARIMA model selection criteria included their respective order significance, residual diagnostics, and lowest possible combination of Akaike Information Criterion and Root Mean Square Error (RMSE) values. Poisson model selection criteria involved Poisson or negative binomial distribution and event probability, lag dependency of immediate past events or seasonality, and lowest possible RMSE. To enhance the user's monitoring and comparisons across multiple countries and diseases, each forecasted case counts supplied a corresponding period prevalence. This period prevalence was calculated by dividing the case counts by the population in the selected country and timeframe. Population records were obtained through the public World Health Organization database (2). **Results** A variety of visualization tools on Epi Evident allows convenient interpretation on behaviors of diseases spanning multiple countries simultaneously (Figure 1). Countries, diseases, and timeframe are selected and displayed within a matrix alongside with their corresponding forecasts for case counts and period prevalence. By providing this full representation, users can easily interpret and anticipate disease behavior while monitoring, comparing, and forecasting case counts and period prevalence across multiple countries. For future work, the Epi Evident workflow can be scaled to accommodate any disease-country combination with automated model selection to allow easier and more efficient biosurveillance. **Conclusions** Epi Evident empowers analysts to visualize, monitor, compare, and forecast disease case counts and period prevalence across countries. Epi Evident exemplifies how filtering diverse data through a flexible workflow can be scalable to output distinctive models for any given country and disease combination. Thus, providing accurate forecasting and enhanced situational awareness throughout the globe. Implementing this application's methodology helps enhance and expand biosurveillance efficacy for multiple diseases across multiple countries simultaneously. **References** 1. Generous Nicholas, Fairchild Geoffrey, Khalsa Hari, Tasseff Byron, Arnold James. Epi Archive: An automated data collection of notifiable disease data. *Online Journal of Public Health Informatics*. 2017. 9(1):e37 2. <http://apps.who.int/gho/data/view.main.POP2040?lang=en> Accessed: 6/20/2017

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# Roles of Health Literacy in Relation to Social Determinants of Health and Recommendations for Informatics-Based Interventions: Systematic Review

## Abstract

**Objective** To validate and improve the syndromic algorithm used to describe pneumonia emergency department (ED) visit trends in New York City (NYC). **Introduction** The NYC Department of Health and Mental Hygiene (DOHMH) uses ED syndromic surveillance to monitor near real-time trends in pneumonia visits. The original pneumonia algorithm was developed based on ED chief complaints, and more recently was modified following a legionella outbreak in NYC. In 2016, syndromic data was matched to New York State all payer database (SPARCS) for 2010 through 2015. We leveraged this matched dataset to validate ED visits identified by our pneumonia algorithm and suggest improvements. An effective algorithm for tracking trends in pneumonia could provide critical information to inform and facilitate public health decision-making. **Methods** The DOHMH syndromic surveillance system includes daily ED data from 53 NYC hospitals. Most syndrome algorithms rely solely on chief complaint, which has historically been reported more consistently than discharge diagnosis. For this analysis, the validation dataset was restricted to matched visits with consistent age (plus or minus two years) and sex between the syndromic and SPARCS datasets. The original pneumonia algorithm used a basic text search function to identify any mention of ICD-9-CM and ICD-10-CM diagnosis codes indicating pneumonia or key words “PNEUMON” or “MONIA” within the chief complaint only. The updated algorithm additionally searches the chief complaint for any mention of key words specific to legionella (“LEGIONA”, “LEGIONN”, “LEGIONE”) and also searches for pneumonia ICD codes in the discharge diagnosis field. Syndrome sensitivity and positive predictive value (PPV) were evaluated by comparing visits identified by each algorithm to visits identified by billing diagnosis codes. A true SPARCS pneumonia ED visit was defined to contain an admitting or principal diagnosis billing code indicating pneumonia. Alternate algorithms were created using regular expressions, which allowed for more flexible and accurate pattern matching. The algorithms were further revised based on additional inclusion and exclusion key words identified using the validation dataset. **Results** Between 2010 and 2015, there were a total of 204,101 true pneumonia visits based on the SPARCS billing records. Evaluation of the original algorithm found a sensitivity of 15.6% (31,771/204,101) and a PPV of 55.6% (31,771/57,180). Over the same time period, syndromic surveillance identified a total of 127,560 pneumonia visits using the updated algorithm; 86,590 of the 127,560 syndromic cases identified were determined to be a true visit based on the billing diagnosis codes, resulting in an algorithm sensitivity of 42.4% and PPV of 67.9%. Of the 127,560 cases identified by the updated algorithm, 19 cases were classified as a pneumonia visit solely due to the presence of legionella key words in the chief complaint. Regular expression usage as opposed to the basic text search on the updated algorithm found similar sensitivity (42.4%, 86,561/204,101) and PPV (68.0%, 86,561/127,238). Among all true pneumonia visits with a non-blank discharge diagnosis field, 65.3% (68,001/104,223) had mention of a pneumonia diagnosis code. Use of the discharge diagnosis code field in addition to the chief complaint found the algorithm to be almost three times more sensitive and 1.2 times greater in PPV than an algorithm without use of discharge diagnosis. Seasonal trends captured with and without use of discharge diagnosis were both similar to the true pneumonia trend indicated by SPARCS. Among the 117,540 pneumonia cases missed by the updated algorithm, 58.6% had fewer than three words in the chief complaint. With the most popular key words among the missed cases being highly non-specific (i.e., “fever”, “cough”, “pain”), inclusion of these key words in addition to regular expression and discharge diagnosis field usage elevated algorithm sensitivity at a severe cost to the PPV. Including “fever” in the list of pneumonia key words resulted in a sensitivity of 56.5% (115,280/204,101) and a PPV of 9.0% (115,280/1,282,342), while addition of the key word combination “fever” and “cough” led to a sensitivity of 46.7% (95,264/204,101) and a PPV of 29.8% (95,264/319,876). As we were unable to identify novel key word indicators that were good markers for pneumonia events, regular expression search functionality was the best improvement to the pneumonia syndrome algorithm. This revised, new algorithm maintained sensitivity (42.4%, 86,561/204,101) and provided slight improvements to PPV (68.0%, 86,561/127,219). However, performance of the updated algorithm varied across age groups. The algorithm was most effective in identifying younger cases (43.9% sensitivity, 80.4% PPV for those 17 years and younger), while it performed the worst among those 65 years and older (39.6% sensitivity, 58.7% PPV). **Conclusions** Based on our evaluation of the pneumonia syndromic surveillance algorithm, we found that search of the discharge diagnosis field greatly improved algorithm sensitivity and PPV and usage of regular expressions increased PPV slightly. Including additional words possibly indicating pneumonia did not substantially improve sensitivity or PPV. However, integration of the ED chief complaint triage notes which are not currently utilized could further enhance the effectiveness of the pneumonia syndrome algorithm and better characterize daily pneumonia trends in NYC.

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# Roles of Health Literacy in Relation to Social Determinants of Health and Recommendations for Informatics-Based Interventions: Systematic Review

## Abstract

**Objective** To better define and automate biosurveillance syndrome categorization using modern unsupervised vector embedding techniques. **Introduction** Comprehensive medical syndrome definitions are critical for outbreak investigation, disease trend monitoring, and public health surveillance. However, because current definitions are based on keyword string-matching, they may miss important distributional information in free text and medical codes that could be used to build a more general classifier. Here, we explore the idea that individual ICD codes can be categorized by examining their contextual relationships across all other ICD codes. We extend previous work in representation learning with medical data [1] by generating dense vector embeddings of these ICD codes found in emergency department (ED) visit records. The resulting representations capture information about disease co-occurrence that would typically require SME involvement and support the development of more robust syndrome definitions. **Methods** We evaluate our method on anonymized ED visit records obtained from the New York City Department of Health and Mental Hygiene. The data set consists of approximately 3 million records spanning January 2016 to December 2016, each containing from one to ten ICD-9 or ICD-10 codes. We use these data to embed each ICD code into a high-dimensional vector space following techniques described in Mikolov, et al. [2], colloquially known as word2vec. We define an individual code's context window as the entirety of its current health record. Final vector embeddings are generated using the gensim machine learning library in Python. We generate 300-dimensional embeddings using a skip-gram network for qualitative evaluation. We use the TensorFlow Embedding Projector to visualize the resulting embedding space. We generate a three-dimensional t-SNE visualization with a perplexity of 32 and a learning rate of 10, run for 1,000 iterations (Figure 1). Finally, we use cosine distance to measure the nearest neighbors of common ICD-10 codes to evaluate the consistency of the generated vector embeddings (Table 1). **Results** T-SNE visualization of the generated vector embeddings confirms our hypothesis that ICD codes can be contextually grouped into distinct syndrome clusters (Figure 1). Manual examination of the resulting embeddings confirms consistency across codes from the same top-level category but also reveals cross-category relationships that would be missed from a strictly hierarchical analysis (Table 1). For example, not only does the method appropriately discover the close relationship between influenza codes J10.1 and A49.2, it also reveals a link between asthma code J45.20 and obesity code E66.09. We believe these learned relationships will be useful both for refining existing syndrome categories and developing new ones. **Conclusions** The embedding structure supports the hypothesis of distinct syndrome clusters, and nearest-neighbor results expose relationships between categorically unrelated codes (appropriate upon examination). The method works automatically without the need for SME analysis and it provides an objective, data-driven baseline for the development of syndrome definitions and their refinement. **References** [1] Choi Y, Chiu CY-I, Sontag D. Learning Low-Dimensional Representations of Medical Concepts. AMIA Summits on Translational Science Proceedings. 2016;2016:41-50. [2] Mikolov T, Sutskever I, Chen K, Corrado GS, Dean J. Distributed representations of words and phrases and their compositionality. In Advances in neural information processing systems 2013 (pp. 3111-3119).

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# Roles of Health Literacy in Relation to Social Determinants of Health and Recommendations for Informatics-Based Interventions: Systematic Review

## Abstract

**Objective** To develop a forecasting model for weekly emergency department admissions due to pneumonia using information from hospital-based, community-based and laboratory-based surveillance systems. **Introduction** Pneumonia, an infection of the lung due to bacterial, viral or fungal pathogens, is a significant cause of morbidity and mortality worldwide. In the past few decades, the threat of emerging pathogens presenting as pneumonia, such as Severe Acute Respiratory Syndrome, avian influenza A(H5N1) and A(H7N9), and Middle East Respiratory Syndrome coronavirus has emphasised the importance of the surveillance of pneumonia and other severe respiratory infections. An unexpected increase in the number of hospital admissions for pneumonia or severe respiratory infections could be a signal of a change in the virulence of the influenza viruses or other respiratory pathogens circulating in the community, or an alert of an emerging pathogen which warrants further public health investigation. The purpose of this study was to develop a forecasting model to prospectively forecast the number of emergency department (ED) admissions due to pneumonia in Singapore, a tropical country. We hypothesise that there is complementary information between hospital-based and community-based surveillance systems. The clinical spectrum of many respiratory pathogens causing pneumonia ranges from asymptomatic or subclinical infection to severe or fatal pneumonia, and it is usually difficult to distinguish between the different pathogens in the absence of a laboratory test. Infected persons could present with varying degrees of severity of the infection, and seek treatment at different healthcare facilities. Hospital-based surveillance captures the more severe manifestation of the infection while community-based surveillance captures the less severe manifestation of the infection and enables earlier detection of the infection. Thus, the integration of information from the two surveillance systems should improve the prospective forecasting of ED admissions due to pneumonia. We also investigate if the inclusion of influenza data from the laboratory surveillance system would improve the forecasting model, since influenza circulates all-year round in Singapore and is a common aetiology for pneumonia. **Methods** This was a retrospective study using aggregated national surveillance data and meteorological data during the period 3 January 2011 to 1 January 2017. We compared the performance of autoregressive integrated moving average model (ARIMA) with multiple linear regression models with ARIMA errors, with and without the inclusion of influenza predictors at forecast horizons of 2, 4, 6 and 8 weeks in advance. Weekly data between the study period of 3 January 2011 and 1 January 2017 were split into training and validation sets, with the first three years of data used as the base training set. Time series cross validation was used to estimate the models' accuracy and out-of-sample forecast accuracy was based on the calculation of the mean absolute error (MAE) and mean absolute percent forecast error (MAPE). **Results** The multiple linear regression model with ARIMA errors that included influenza predictors was the best performing model while the basic ARIMA model was the worst performing model for all forecast horizons. The two multiple linear regression models with ARIMA errors had a MAPE of less than 10% for all forecast horizons. **Conclusions** Data from different multiple surveillance systems and the inclusion of influenza trends can be used to improve the forecast of ED admissions due to pneumonia in a tropical setting, despite the absence of large differences between seasons. Accurate forecasting at the national level can prepare healthcare facilities for an impending surge.

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# Roles of Health Literacy in Relation to Social Determinants of Health and Recommendations for Informatics-Based Interventions: Systematic Review

## Abstract

**Objective** We sought to use free text mining tools to improve emergency department (ED) chief complaint and discharge diagnosis data syndrome definition matching across facilities with differing robustness of data in the Electronic Surveillance System for the Early Notification of Community-based Epidemics (ESSENCE) application in Idaho's syndromic surveillance system. **Introduction** Standard syndrome definitions for ED visits in ESSENCE rely on chief complaints. Visits with more words in the chief complaint field are more likely to match syndrome definitions. While using ESSENCE, we observed geographic differences in chief complaint length, apparently related to differences in electronic health record (EHR) systems, which resulted in disparate syndrome matching across Idaho regions. We hypothesized that chief complaint and diagnosis code co-occurrence among ED visits to facilities with long chief complaints could help identify terms that would improve syndrome match among facilities with short chief complaints. **Methods** The ESSENCE-defined influenza-like illness (ILI) chief complaint syndrome was used as the base syndrome for this analysis. Syndrome-matched visits were defined as visits that match the syndrome definition. We assessed chief complaints and diagnosis code co-occurrence of syndrome-matched visits using the RCRAN TidyText package and developed a bigram network from normalized, concatenated chief complaint and diagnosis code (CCDD) fields and normalized diagnosis code (DD) fields per previously described methodologies.<sup>1</sup> Common connections were defined by a natural break in frequency of pair occurrence for CCDD pairs (30 occurrences) and DD pairs (5 occurrences). The ESSENCE syndrome was revised by adding relevant bigram network clusters and logic operators. We compared time series of the percent of ED visits matched to the ESSENCE syndrome with those matched to the revised syndrome. We stratified the time series by facilities grouped by short (average < 4 words, "Group A") and long (average ≥ 4 words, "Group B") chief complaint fields (Figure 1). Influenza season start was defined as two consecutive weeks above baseline, or the 95% upper confidence limit of percent syndrome-matched visits outside of the CDC ILI surveillance season. Season trends and influenza-related deaths in Idaho residents were compared. **Results** During August 1, 2016 through July 31, 2017, 1,587 (1.17%) of 135,789 ED visits matched the ESSENCE syndrome. Bigram networks of CCDD fields produced clusters already included by the ESSENCE syndrome. The bigram network of DD fields (Figure 2) produced six clusters. The revised syndrome definition included the ESSENCE syndrome, 3 single DD terms, and 3 two DD terms combined. The start of influenza season was identified as the same week for both ILI syndrome definitions (ESSENCE baseline 0.70%; revised baseline 2.21%). The ESSENCE syndrome indicated the season peaked during Morbidity and Mortality Weekly Report (MMWR) week 2017-05 with the season ending MMWR week 2017-14. The revised syndrome indicated 2017-20 as the season end. Multiple peaks seen with the revised syndrome during MMWR weeks 2017-02, 2017-05, and 2017-10 mirrored peaks in influenza-related deaths during MMWR weeks 2017-03, 2017-06, and 2017-11. ILI season onset was five weeks earlier with the revised syndrome compared with the ESSENCE syndrome in Group A facilities, but remained the same in Group B. The annual percentage of ED visits related to ILI was more uniform between facility groups under the revised syndrome than the ESSENCE syndrome. Unlike the trend seen with the ESSENCE syndrome, the revised syndrome shows low-level ILI activity in both groups year-round. **Conclusions** In Idaho, dramatic differences in ED visit chief complaint word counts were seen between facilities; bigram networks were found to be an important tool to identify diagnosis codes and logical operators that built more inclusive syndrome definitions when added to an existing chief complaint syndrome. Bigram networks may aid understanding the relationship between chief complaints and diagnosis codes in syndrome-matched visits. Use of trade names and commercial sources is for identification only and does not imply endorsement by the Centers for Disease Control and Prevention, the Public Health Service, or the U.S. Department of Health and Human Services. **References** 1. Silge, J., Robinson, D. (2017). "Text Mining with R". O'Reilly.

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# Roles of Health Literacy in Relation to Social Determinants of Health and Recommendations for Informatics-Based Interventions: Systematic Review

## Abstract

**Objective** This study aimed to assess the effects of urban physical environment on individual obesity using geographically aggregated health behavior surveillance data applying a geo-imputation method. **Introduction** "Where we live" affects "How we live". Information about "how one lives" collected from the public health surveillance data such as the Behavioral Risk Factor Surveillance System (BRFSS). Neighborhood environment surrounding individuals affects their health behavior or health status are influenced as well as their own traits. Meanwhile, geographical information of subjects recruited in the health behavior surveillance data is usually aggregated at administrative levels such as a county. Even if we do not know accurate addresses of individuals, we can allocate them to the random locations where is analogous to their real home within a locality using a geo-imputation method. In this study, we assess the association between obesity and built environment by applying random property allocation (1). **Methods** Data from the Korean Community Health Survey (KCHS), which is the nationwide community-based cross-sectional survey conducted by 253 community health centers in South Korea, were used (2). More than 90000 subjects recruited in the capital city Seoul from 2011 to 2014. They were selected by two-step stratified random sampling (424 administrative communities with an average area of 1.16km<sup>2</sup> and two house types) in each 25 counties. We re-allocated them randomly on the nested locality based on their community (administrative boundaries) and house type (land-use) using GIS program (Figure 1). Surrounding built environment elements such as fast-food markets, driving roads, public transit and road-crosse were measured within 500m buffer from randomly allocated locations as density or distance. Variables associating obesity are measured by : 1) self-reported obesity (self-reported body mass index(BMI)  $\geq$  25) (Figure 2), 2) perceived obesity, 3) intention to weight control. We implemented logistic regression models to estimate the effect of physical environmental factors on obesity. **Results** The person who lives in a detached house, nearer fast food markets or with higher driving road density was more likely to be obese. Who lives in a detached house was less perceived their obesity. Who lives in a detached house, nearer fast food markets or with higher driving road density was less likely to intend to control their body weights. Association between intention to weight control and accessibility to subway station showed marginal effect. **Conclusions** Urban environments influenced individual's obesity, perception, and intention to weight loss. Since we used cross-sectional survey data, we do not account cumulative environmental influence. Moreover, individuals' self-selection of more healthier places were not accounted. Even though we did not measure the environment at individuals' real address, we can measure the effects of neighborhood environment more efficiently by using random property allocation. **References** 1. Walter SR, Rose N. Random property allocation: A novel geographic imputation procedure based on a complete geocoded address file. *Spatial and spatio-temporal epidemiology*. 2013;6:7-16. Epub 2013/08/27. doi: 10.1016/j.sste.2013.04.005. PubMed PMID: 23973177. 2. Kim YT, Choi BY, Lee KO, Kim H, Chun JH, Kim SY, et al. Overview of Korean Community Health Survey. *J Korean Med Assoc*. 2012;55(1):74-83. (in Korean)

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## Abstract

**Objective** To access the potential health impact on the population during mass gathering over time using labelling procedure in emergency department (ED). **Introduction** The massive flow of people to mass gathering events, such as festivals or sports events like EURO 2016, may increase public health risks. In the particular context of several terrorist attacks that took place in France in 2015, the French national Public Health agency has decided to strengthen the population health surveillance systems using the mandatory notification disease system and the French national syndromic surveillance SurSaUD®. The objectives in terms of health surveillance of mass gathering are: 1/ the timely detection of a health event (infectious cluster, environmental exposure, collective foodborne disease...) 2/ the health impact assessment of an unexpected event such as a terrorist attack. In collaboration with the Regional Emergency Observatory (ORU), a procedure for the labeling of emergencies has been tested to identify the ED records that could be considered as linked to the event. **Methods** During summer 2016, the procedure was tested on seven major festive events throughout the region. In addition to the main medical diagnosis, a specific ICD-10 code “Y3388” was chosen to be used in associated diagnosis for records that were supposed to be linked to the event. Information on the labeling procedure was insured by the ORU to the emergency departments. All records with medical diagnoses or medical pattern beginning by Y33 have been analyzed. **Results** No significant increase in the global indicator was observed in the ED impacted by mass gathering. The ED labelling procedure identified 260 records: two thirds corresponded to young men and 17% came from abroad. Among the 250 records labeled in associated diagnosis, 39% were associated to traumatism and 31% corresponded to alcohol intake. **Conclusions** This study shows that a labelling procedure allows the identification, quantification and characterization of the population ED records associated with mass gathering. Additionally, a labelling procedure to assess a potential impact of an event as mass gathering can be implemented fairly rapidly.

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## Abstract

Objective Madagascar is one of the low-income countries with limited resources. In order to minimize the cost of the fight against malaria, the main objective of this study is to identify the priority zone for Indoor Residual Spraying (IRS). Introduction Malaria remains a major public health problem in Madagascar. Indoor Residual Spraying (IRS) is the adopted strategy for malaria control in the CHs and Fringe regions of Madagascar. Remotely sensed data analysis combined with Multi-Criteria Evaluation become crucial to target priority areas for intervention. Methods Satellite images were used to update land cover information using object based image analysis method, NOAA and MODIS for temperature and rainfall data. Multi-Criteria Evaluation was performed by weighted linear combination to obtain the gradient of malaria transmission risk. Factor weights were determined by pair-wise comparison based on literature review and expert knowledge. Fuzzy set theory was used to perform the factors weighting. To estimate a best fit risk magnitude probability per commune, we used per pixel values for inhabited locations, and chose an adjusted mean. The Jenks Natural Breaks algorithm was used to classify the obtained malaria risk gradient. All the process was compiled in a semi-automatic plugin working in an open source software. Comparison of risk magnitude between two consecutive years was performed to assess the environmental change. Results Three models of malaria risk are available for 2014, 2015 and 2016. The updated land cover map showed suitable breeding sites for mosquito responsible of malaria transmission in CHs with an accuracy of 84%. A change of 64.4% and 35.6% unchanged were obtained concerning change detection of malaria risk between 2014 and 2015. Between the years 2015 and 2016, 11.2% of the area of interest remains unchanged while 88.8% changed. Respectively 26.9% decreased and 61.9% increased. Conclusions It is crucial to focus the indoor residual spraying efforts according to the risk gradient. This allows to increase the effectiveness of the intervention targeting areas with the most need, as well as to optimize financial and logistical resource management. References 1. Rakotomanana, F, Randremanana R, Rabarijaona L, et al. Determining areas that require indoor insecticide spraying using Multi Criteria Evaluation, a decision-support tool for malaria vector control programmes in the Central Highlands of Madagascar. International Journal of Health Geographics, 2007, 6:2. 10.1186/1476-072X-6-2 2. Saaty TL: A scaling method for priorities in hierarchical structures . Journal of Mathematical Psychology. 1977, 15: 234-281. 10.1016/0022-2496(77)90033-5.

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# Roles of Health Literacy in Relation to Social Determinants of Health and Recommendations for Informatics-Based Interventions: Systematic Review

## Abstract

**Objective** To identify predictors of the risk of developing exertional heat illness (EHI) among basic training populations in the Department of Defense. **Introduction** Although effective preventive measures for heat-related illness have been recommended and mandated for military personnel, there continues to be incident cases. In 2016, there were 401 incident cases of heat stroke and 2,135 incident cases of “other heat illness” among all active component service members. Current military guidelines utilize the wet bulb globe temperature (WBGT) index to measure heat risk, guiding work/rest and hydration practices. The WBGT requires calibrated instrumentation and is based on fixed cutoff values. We propose using readily available meteorological data inputs and EHI cases to identify and validate an EHI risk prediction model. Prior studies have found that combinations of WBGT and the previous day’s WBGT and relative humidity and temperature have predictive value for EHI.<sup>1</sup> We build upon prior work by using generalized additive models (GAMs). **Methods** A case-control study was conducted among active component service members from all basic training installations from January 1, 2010 to May 31, 2017. Incident cases of EHI were identified utilizing diagnosis codes extracted from inpatient and outpatient medical encounters and confirmed reportable medical events. An equal number of random controls, matched by installation, were selected. Mean weather data during daylight hours from the Air Force Weather Squadron were provided for the closest weather station to the installation during the same time period. A GAM was used due to the non-linear association between EHI and weather predictors, to develop models for the risk of incident EHI. Training (75% of data) and test (25% of data) datasets were generated for model training and model validation. Three hundred sets of training and test datasets were randomly generated. For each set, sensitivity and specificity for EHI prediction was calculated. Four models with different combinations of predictors were compared: model 1 contains month, day of week, and installation; model 2 contains WBGT, month, day of week, and installation; model 3 contains WBGT, previous day’s WBGT, month, day of week, and installation; and model 4 contains relative humidity, temperature, month, day of week, and installation. Each predictor was significantly associated with EHI. The mean differences in sensitivity and specificity between all models and model 1 were compared and 95% confidence intervals were generated by bootstrapping. GAMs were generated using the mgcv package and odds ratios were generated using the oddsratio package in R. **Results** There were 5,258 incident cases of EHI from 2010-2017 among active component service members stationed at basic training installations. There was not a significant difference in model performance when comparing the four models. The mean differences in sensitivity and specificity of each model compared to model 1 are displayed in Table 1. The association between log odds of EHI and WBGT, controlling for month, day of week, and installation (model 2) is displayed in Figure 1. There is not a single representative odds ratio generated for GAMs due to the non-linear relationship between predictors and the log odds of EHI. As an example, the odds ratio between two arbitrary WBGT points is displayed. The odds of EHI among those exposed to a mean WBGT of 85°F is 2.55 (95% CI: 2.45, 2.64) times the odds of EHI among those exposed to a mean WBGT of 80°F. The association between the log odds of EHI and relative humidity, controlling for month, day of week, installation, and temperature (model 4) is displayed in Figure 2. The odds of EHI among those exposed to 80% relative humidity is 1.36 (95% CI: 1.33, 1.39) times the odds of EHI among those exposed to 60% relative humidity. **Conclusions** Our results provide evidence that there is no significant difference in model prediction of EHI utilizing various combinations of weather predictors. However, there is a significant non-linear association between weather predictors and EHI and examples of these relationships are given using different models. Model performance can be improved by including more granular exposure data (i.e. physical activity during EHI episode, biometric and physiological measures). **References** 1. Wallace RF, Kriebel D, Punnett L, Wegman DH, Wenger CB, Gardner JW, Gonzalez RR. The effects of continuous hot weather training on risk of exertional heat illness. *Med Sci Sports Exerc.* 2005 Jan; 37(1):84-90.

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## Abstract

**Objective** In this paper we used Boosted Regression Tree analysis coupled with environmental factors gathered from satellite data, such as temperature, elevation, and precipitation, to model the niche of Dengue Fever (DF) in Colombia. **Introduction** Dengue Fever (DF) is a vector-borne disease of the flavivirus family carried by the *Aedes aegypti* mosquito, and one of the leading causes of illness and death in tropical regions of the world. Nearly 400 million people become infected each year, while roughly one-third of the world's population live in areas of risk. Dengue fever has been endemic to Colombia since the late 1970s and is a serious health problem for the country with over 36 million people at risk. We used the Magdalena watershed of central Colombia as the site for this study due to its natural separation from other geographical regions in the country, its wide range of climatic conditions, the fact that it includes the main urban centers in Colombia, and houses 80% of the country's population. Advances in the quality and types of remote sensing (RS) satellite imagery has made it possible to enhance or replace the field collection of environmental data such as precipitation, temperature, and land use, especially in remote areas of the world such as the mountainous areas of Colombia. We modeled the cases of DF by municipality with the environmental factors derived from the satellite data using boosted regression tree analysis. Boosted regression tree analysis (BRT), has proven useful in a wide range of studies, from predicting forest productivity to other vector-borne diseases such as Leishmaniasis, and Crimean-Congo hemorrhagic fever. Using this framework, we set out to determine what are the differences between using presence/absence and case counts of DF in this type of analysis? **Methods** We combined data on Dengue fever cases downloaded from the Instituto Nacional de Salud (INS) Programa SIVIGILA INS site with population data downloaded from the 2005 General Census administered by the National Administrative Department of Statistics (Departamento Administrativo Nacional de Estadística, DANE) and projected to 2012–2014 levels. We acquired remote sensing data from the National Aeronautics and Space Administration (NASA) data servers for each day of the study period. Imagery for each environmental variable was composited to reduce the effects of cloud cover and to match the ISO Week Date format reporting of the case data. We aggregated these weekly composite images for each variable using GIS to create annual minimum, maximum, and mean for a raster cell. These data were further aggregated to the municipality level using the GIS, again for minimum, maximum, and mean. Land use and elevation were only downloaded for one period given they change very little over time. The BRT analysis was conducted twice: once using the Bernoulli family of presence/absence and again using the Poisson family of actual case counts. In the first analysis (Bernoulli), any municipality reporting one or more cases of DF in the year was coded as having disease “presence”, while all others were coded as not having disease “absence”. The BRT model was run, using a twenty-five percent hold out of the data as a testing set, for each year. In the second analysis (Poisson), the only change to the models consisted of replacing the presence/absence data with the actual cases of reported DF within the municipality. The Poisson family was chosen in the model since the count data were highly skewed. **Results** We calculated RMSE and Pearson *r* values for each of the three years. The Poisson model out-performed the Bernoulli model across all years. The RMSE values were considerably lower for the Poisson model compared to the Bernoulli model, reflecting a better model fit. The Pearson *r* values were higher for the Poisson model compared to the Bernoulli model, again across all three years. We created maps to compare Cases with the Poisson and the Bernoulli results. The maps shown in the figure reflect the results for 2012. The left panel represents the cases per 10,000 population per square kilometer for each municipality. The dark green color represents very low ratios of DF, while the red color reflects a higher incidence of DF. All maps used the same classification as the reported cases map for comparison, with an additional symbol (black) used for values outside the reported cases range. **Conclusions** Using actual reported case data and the Poisson function within the BRT functions created by Elith et al. and the *gbm* package in R, we show that the differences between using presence/absence and case counts of DF in a BRT analysis gives a clearer picture of the spatial distribution of DF. By using readily available and freely accessible data, we have shown that practitioners both within and outside of Colombia can quickly create accurate maps of annual DF incidence. The methods described here could also be extended to other regions and diseases, making it useful to a wide range of end users.

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# Roles of Health Literacy in Relation to Social Determinants of Health and Recommendations for Informatics-Based Interventions: Systematic Review

## Abstract

**Objective** Characterize the behavior of nonparametric regression models for message arrival probability as outage detection tools. **Introduction** Timely and accurate syndromic surveillance depends on continuous data feeds from healthcare facilities. Typical outlier detection methodologies in syndromic surveillance compare predictions of counts for an interval to observed event counts, either to detect increases in volume associated with public health incidents or decreases in volume associated with compromised data transmission. Accurate predictions of total facility volume need to account for significant variance associated with the time of day and week; at the extreme are facilities which are only open during limited hours and on select days. Models need to account for the cross-product of all hours and days, creating a significant data burden. Timely detection of outages may require sub-hour aggregation, increasing this burden by increasing the number of intervals for which parameters need to be estimated. Nonparametric models for the probability of message arrival offer an alternative approach to generating predictions. The data requirements are reduced by assuming some time-dependent structure in the data rather than allowing each interval to be independent of all others, allowing for predictions at sub-hour intervals. **Methods** Healthcare facility data was collected as HL7 messages via the EpiCenter syndromic surveillance system from June 1, 2017 through August 31, 2017. 713 facilities sent at least 1,000 messages during this period and were included in the analysis. Standard Poisson regression models were fit to counts of messages per quarter hour. Predictors were indicators for day of week, hour of day, and quarter of hour, along with interaction terms between them. Nonparametric logistic regression models were fit to data on the presence or absence of any message for each minute of the first two months of the study period, using the minute within the week as a predictor. The last month of data was scanned for outages at 15-minute intervals and calculating the probability of no messages since the last received message per facility as:  $P(\text{Gap from } m_{\text{last}} \text{ to } m_{\text{now}}) = \prod_t (1 - P_{\text{message}}(t))$  Four consecutive intervals with probability below 1-10 were considered outages. **Results** A total of 12,710,275 ADT A04 messages were received from 713 facilities from June 1, 2017 through August 31, 2017. Estimation of Poisson regression models averaged 1 minute, while nonparametric models averaged 1.5 minutes to estimate. Poisson models required 672 parameters to specify, whereas nonparametric models required 29. Calculating predictions from fitted models averaged 0.2 seconds for Poisson models and 2 seconds for nonparametric models. Although predictions from the two models are not on identical scales and thus not directly comparable, they did correlate well with each other with an average correlation of 0.8. The nonparametric regression method detected 175 resolved outages and 9 open outages in August, 2017. The resolved outages lasted an average of 1.5 days (1.75 hours to 15 days). The likelihood of these outages averaged 6e-13 (3e-160 to 4e-11). Figure 1 illustrates how the nonparametric models can be used in a dashboard for all 713 connections. Likelihood of an outage is available for each facility based on how long it has been since the last message was received; this can be updated every minute as needed. Figure 2 illustrates the predictions from a nonparametric model for a single facility and a detected outage. **Conclusions** Nonparametric regression models of message arrival demonstrated suitable performance for use in detecting connection outages. Compared to standard Poisson regression models, computation time for nonparametric models was longer but within acceptable ranges for operational needs and storage was significantly reduced. Further, storage and computation time for standard models will increase if greater time granularity is desired, whereas the nonparametric models require no additional storage or computation. Model predictions were sufficiently similar between both models for the two to give comparable performance in detecting outages. Given the greater time flexibility of the nonparametric models and the smaller data requirements for initial model estimation (due to fewer estimated parameters), the nonparametric approach represents a promising new option for monitoring syndromic surveillance data quality.

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# Roles of Health Literacy in Relation to Social Determinants of Health and Recommendations for Informatics-Based Interventions: Systematic Review

## Abstract

**Objective** Compare rate changes over time for Emergency Department (ED) visits due to opioid overdose in urban versus rural areas of the state of Missouri. **Introduction** Like many other states in the U.S., Missouri has experienced large increases in opioid abuse resulting in hundreds dying each year and thousands of ED visits due to overdose. Missouri has two major urban areas, St. Louis and Kansas City and a few smaller cities, while the remainder of the state is more rural in nature. The opioid epidemic has impacted all areas in the state but the magnitude of that impact varies as well as the type of opioid used. Missouri Department of Health and Senior Services (MODHSS) maintains the Patient Abstract System (PAS) which contains data from hospitals and ambulatory surgical centers throughout the state. PAS includes data from ED visits including information on diagnoses, patient demographics, and other information about the visit. MODHSS also participates in the Enhanced State Surveillance of Opioid-involved Morbidity and Mortality project (ESOOS). One major aspect of this surveillance project is the collection of data on non-fatal opioid overdoses from ED visits. Through this collection of data, MODHSS analyzed opioid overdose visits throughout the state, how rates compare across urban and rural areas, and how those rates have changed over time. **Methods** The 115 counties in Missouri were organized into the six-level urban-rural classification scheme developed by the National Center for Health Statistics (NCHS). The attached table shows the breakout of counties into the six different categories. The data years analyzed were 2012 through 2016. ED visits due to opioid overdose were identified using case definitions supplied by ESOOS. Overdoses were analyzed in three different categories—all opioids, heroin, and non-heroin opioids. The all opioid category combines heroin and non-heroin opioids. Non-heroin opioids includes prescription drugs such as oxycodone, hydrocodone, fentanyl, and fentanyl analogues. Annual rates per 10,000 were calculated for each county classification using population estimates. Confidence intervals (at 95%) were then calculated using either inverse gamma when the number of ED visits was under 500, or Poisson when the number was 500 or more. Changes over time were calculated using both a year over year method and a 5 year change method. **Results** Overall opioid rates have increased in all geographic areas during the 5 year period analyzed. Large Central Metro and Large Fringe Metro counties had the highest rates of ED visits due to opioid overdose. These two classifications also saw the largest increases in rates. The Large Central Metro counties collectively increased over 125%, while the Large Fringe Metro area increased 130%. Both areas experienced statistically significant increases year-to-year between 2014 and 2016 in addition to the overall 5 year period of 2012-2016. Analysis was also conducted for heroin and non-heroin subsets of opioid abuse. There were important differences in these two groups. For heroin ED visits, the highest rates were found in the Large Central Metro and Large Fringe Metro regions. However, the largest increase in percentage terms were found in the Medium Metropolitan, Micropolitan and Noncore regions which all saw increases of over 300%. Notably, every region experienced increases of over 150%. The Medium Metro had two consecutive years (2013/2014 and 2014/2015) where the heroin ED rate more than doubled. In contrast, non-heroin ED visits did not experience such a large increase over time. Most areas saw small fluctuations year-to-year with moderate overall increases over the 5-year time period. The exception to this trend is the Large Fringe Metro area, which saw increases every year most notably between 2014 and 2015 and had by far the largest 5 year increase at 82%. **Conclusions** The urban areas in Missouri continue to have the highest rates of opioid overdose, however all areas within the state have experienced very large increases in heroin ED visits within the past five years. The increase in heroin ED visits in the rural areas suggests the abuse of heroin has now spread throughout the state, as rates were much lower in 2012. The steady increase in non-heroin opioids unique to the Large Fringe Metro may be due to the availability of fentanyl in urban areas especially the St. Louis area. This possible finding would correspond with the increased deaths due to fentanyl experienced in and around the St. Louis urban area that has been identified through analysis of death certificate data.

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# Roles of Health Literacy in Relation to Social Determinants of Health and Recommendations for Informatics-Based Interventions: Systematic Review

## Abstract

**Objective** We present a mathematical framework for non-parametric estimation of the force of infection, together with statistical upper and lower confidence bands. The resulting estimates allow to assess how well simpler models, such as SEIR, fit the observed time series of incidence data. **Introduction** Uncertainty Quantification (UQ), the ability to quantify the impact of sample-to-sample variations and model misspecification on predictions and forecasts, is a critical aspect of disease surveillance. While quantifying the impact of stochastic uncertainty in the data is well understood, quantifying the impact of model misspecification is significantly harder. For the latter, one needs a "universal model" to which more restrictive parametric models are compared too. **Methods** This talk presents a useful modeling framework for time series of incidence data from contagious diseases that enables one to identify and quantify the impact of model form uncertainty. Specifically, we propose to focus on estimating the time dependent force of infection. The latter is a universal parameters for all contagious disease model. Using a machine learning technique for estimating monotone functions, i.e., isotonic regression and its variants, one can estimate the force of infection without additional assumptions. We note that most contagious disease model do satisfy this monotonicity assumption, due to a combination of factors: depletion of susceptibles, implementation of mitigation strategies, behavior change, etc. Comparing the resulting "non-parametric" estimate with parametric estimates, obtained by fitting an SEIR for example, can reveal model deficiencies and help quantify model form uncertainties. Finally, we discuss how ideas from "strict bound theory" can be used to develop upper and lower uncertainty bands for force of infection that acknowledge the intrinsic stochasticity in the data. **Results** We demonstrate the application of the methodology to weekly Influenza Like Illness (ILI) incidence data from France and compare the results to fitted SIR and SEIR models. This comparison can be seen as a nonparametric goodness of fit test, providing one with tools to do simple model selection. **Conclusions** We present a novel and flexible model to statistically describe the force of infection as a function of time. Comparing the fit to incidence data of that model with the fit of simpler parametric models enables the quantification of model form uncertainty and associated model selection.

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# Roles of Health Literacy in Relation to Social Determinants of Health and Recommendations for Informatics-Based Interventions: Systematic Review

## Abstract

**Objective** Standardize selection of indicator data streams and corresponding alerting algorithms for syndromic, reportable disease, and confirmed diagnostic categories derived from veterinary laboratory test order data for bovines. **Introduction** The Johns Hopkins University Applied Physics Laboratory is collaborating with epidemiologists of the US Dept. of Agriculture's Animal and Plant Health Inspection Service (APHIS) Center for Epidemiology and Animal Health (CEAH) to increase animal health surveillance capacity. CEAH monitors selected syndromic animal health indicators for stakeholder reporting. This project's goal was to extend this capacity to bovine veterinary laboratory test accession data. **Methods** Indicators for weekly monitoring were derived from bovine test records from the Colorado State University Veterinary Diagnostic Laboratory System from 27 Jun 2010 - 29 May 2016. Selected indicator types were syndromic test orders, disease-specific orders, and disease-specific positive results. Indicators were adopted if APHIS epidemiologists considered them worth monitoring and if they were represented by at least 100 lab accessions. Ten syndromes were chosen for routine monitoring based on body systems, bovine-specific concerns (e.g. mastitis), and concepts to capture novel threats. Reportable diseases were chosen from the list published by the Colorado Dept. of Agriculture [1]. Based on APHIS concerns and test order frequencies, 4 diseases were chosen for weekly monitoring: Bluetongue, Brucellosis, Epizootic Hemorrhagic Disease, and Paratuberculosis. To monitor positives, we considered both the number and the ratio of herds with at least one positive result for each disease. For included tests (excluding results quantified with antibody levels), we counted an accession as "positive" if the result field contained strings "positive", "suspect", or "detect" without negation terms. For weekly counts, we added the number of herds with any positives after deduplication. Diseases adopted for monitoring of positive results were Bovine Viral Diarrhea, Trichomoniasis, and Paratuberculosis. From experience and literature, we compared variants of 4 algorithm types, including: the C2 method of the CDC Early Aberration Reporting System, a CuSUM control chart with a sliding baseline, the temporal scan statistic Gscan applied to hospital infection counts, and the CDC Historical Limits method. We adapted a semisynthetic simulation approach for algorithm comparison in which authentic disease count data are used as baseline, and simulated signals are added to the background as detection targets. In discussions about specific diseases and veterinary testing practice, CEAH required sensitivity to one-week data spikes as well as effects of health threats with multi-week incubation periods and more gradual test ordering. For such gradual signals, we chose the lognormal signal model of Sartwell applied to incidence data for many diseases. Incubation periods vary widely by disease, and for this project, we chose lognormal parameters such that 90% of reported cases would occur within 6 weeks. We conducted separate algorithm detection trials for spike and gradual signals. Calculations of sensitivity, alert rate, and timeliness were derived with sets of 1000 repeated trials for each combination of algorithm and syndrome or disease. We applied minimum performance requirements of 95% sensitivity,  $\leq 1$  alert per 8 weeks, and mean detection delays of  $\leq 2$  weeks. The rule adopted for recommending an alerting method was to seek the method with the lowest alert rate that satisfied the sensitivity, alert rate, and delay criteria. **Results** The Table shows the syndromes with chosen algorithms and thresholds for detection of the gradual signals. The scan statistic Gscan and the historical limits method HistLim achieved consistently higher sensitivities with acceptable alert rates than the other methods applied. The presentation will extend the results to reportable disease and clinical positive indicators and to the spike signals for all indicators. **Conclusions** Among results for both signal types, the results yielded a few preferred methods covering all chosen indicator streams. Monitored indicators with median weekly counts = 0 remain a challenge requiring more background data and veterinarian judgment. From analysis of orders from the few available laboratories, manual review will be required to achieve accurate syndromic categorization for each lab. Monitoring of test positives will require combined analysis of positive herd counts and percentages (of all tested herds) due to routine variation in laboratory submissions. **References** [1] Colorado Department of Agriculture, Livestock Health: Reportable Diseases in Colorado, <https://www.colorado.gov/pacific/aganimals/livestock-health>, last accessed Aug. 23, 2017.

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## Abstract

**Objective** The application of spatial analysis to improve the awareness and use of surveillance data. **Introduction** The re-emergence of an infectious disease is dependent on social, political, behavioral, and disease-specific factors. Global disease surveillance is a requisite of early detection that facilitates coordinated interventions to these events. Novel informatics tools developed from publicly available data are constantly evolving with the incorporation of new data streams. Re-emerging Infectious Disease (RED) Alert is an open-source tool designed to help analysts develop a contextual framework when planning for future events, given what has occurred in the past. Geospatial methods assist researchers in making informed decisions by incorporating the power of place to better explain the relationships between variables. **Methods** Disease incidence and indicator data derived for the RED Alert project were analyzed for spatial associations. Using aggregate country-level data, spatial and spatiotemporal clusters were identified in ArcMap 10.5.1. The identified clusters were then used as the outcome for a series of binary logistic regression models to determine significant covariates that help explain global hotspots. These methods will continue to evolve and be incorporated into the RED Alert decision support ecosystem to provide analysts with a global perspective on potential re-emergence. **Results** Hotspots of high disease incidence in relation to neighboring countries were identified for measles, cholera, dengue, and yellow fever between 2000 and 2014. Disease-specific predictors were identified using aggregate estimates from World Bank indicator dataset. Data was imputed where possible to enhance the validity of the  $G_i^*$  statistic for clustering. In the future, as data streams become more readily available, hotspot modeling at a finer resolution will help to improve the precision of spatial epidemiology. **Conclusions** Spatial methods enhance the capability of understanding complex population and disease relationships, which in turn improves surveillance and the ability to predict re-emergence. With tools like RED Alert, public health analysts can better prepare to respond rapidly to future re-emerging disease threats.

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# Roles of Health Literacy in Relation to Social Determinants of Health and Recommendations for Informatics-Based Interventions: Systematic Review

## Abstract

**Objective** To analyze differences in utilization of Emergency Departments for primary care sensitive conditions by facility and by patient ZIP code. **Introduction** Syndromic surveillance has been widely implemented for the collection of Emergency Department (ED) data. EDs may be the only option for seeking care in underserved areas, but they do not represent population-based measures. This analysis provides insight on health-seeking behaviors within the context of the type of care sought. **Methods** The Nssp BioSense database in Adminer was queried for Illinois ED visits that occurred in August 2016, November 2016, February 2017, or May 2017. These months were chosen to account for seasonality and holidays. For each visit, as defined by the BioSense ID, the first listed diagnosis code, defined to be the primary diagnosis, and the latest valid patient ZIP code were determined. Next, an algorithm<sup>1</sup> developed by New York University (NYU) which uses diagnosis codes to classify ED visits was applied to each visit's primary diagnosis. With this algorithm, a percentage (possibly zero) of each visit was classified as primary care sensitive (PCS), where the percentage is based on the diagnosis code. The visits were tabulated to find the percentage of visits to each facility or from each ZIP code which were classified as PCS. (Visits whose diagnosis was not matched by the algorithm were excluded.) The relationships between the percentages of PCS visits in each facility or ZIP code and characteristics of the facilities or ZIP codes were then analyzed. Facilities were grouped by Critical Access Hospital (CAH) status<sup>2</sup> and by location (within, or not within, a primary care Health Professional Shortage Area (HPSA), as determined using a tool from the U.S. Department of Health and Human Services<sup>3</sup>). Percentages of PCS visits at different types of facilities were compared using t-tests. Variables reported in the Social Vulnerability Index (SVI)<sup>4</sup> at the census tract level were converted to ZIP code-level data using a crosswalk from the U.S. Department of Housing and Urban Development<sup>5</sup>. An ordinary least squares regression model in which these variables were used to predict the percentage of PCS visits in each ZIP code was fitted. The R package *geoR*<sup>6</sup> was used to fit an additional model which accounted for spatial correlation across ZIP codes. In this model, ZCTA latitude and longitude coordinates from the U.S. Census<sup>7</sup> were used as the ZIP codes' locations. Only ZIP codes for which the NYU algorithm matched diagnoses from at least 70% of visits were included in these models. **Results** The overall proportion of PCS visits across all CAHs is significantly greater than the proportion at other facilities ( $p < 0.0001$ ). Likewise, the proportion of PCS visits at facilities in primary care HPSAs is significantly greater than the proportion at other facilities ( $p < 0.0001$ ). Among facilities for which the NYU algorithm matched diagnoses from at least 70% of visits, the mean percentage of PCS visits at facilities in primary care HPSAs is significantly higher than the mean at other facilities ( $p = 0.0009$ ). The regression model for ZIP code-level data with spatial correlation was found to be better than the regression without spatial weighting. The spatial model found 3 of 16 SVI variables to be significant predictors of the percentage of ED visits which are PCS: after adjusting for all other variables, a one percentage point increase in minority makeup is associated with a 0.09 percentage point increase in PCS visits ( $p < 0.0001$ ), a one percentage point increase in persons in group quarters is associated with a 0.13 percentage point decrease in PCS visits ( $p = 0.0009$ ), and a \$1000 increase in per capita income is associated with a 0.12 percentage point decrease in PCS visits ( $p = 0.0011$ ). **Conclusions** ED-based syndromic surveillance can only provide part of the picture for monitoring health conditions across Illinois. Understanding rates of PCS ED visits can enhance the interpretation of health trends. Lower rates can inform recruiting plans for capturing data from additional sources, such as urgent or immediate care facilities, while higher rates of PCS visits at EDs may indicate areas in need of more healthcare resources. **References** 1. New York University Center for Health and Public Service Research. Algorithm for classifying ED utilization. <https://wagner.nyu.edu/faculty/billings/nyued-background>. Datasets available from: [http://wagner.nyu.edu/files/faculty/NYU\\_ED\\_Algorithm\\_-\\_ICD-9\\_Codes\\_-\\_6.23.15.xlsx](http://wagner.nyu.edu/files/faculty/NYU_ED_Algorithm_-_ICD-9_Codes_-_6.23.15.xlsx) and [http://wagner.nyu.edu/files/faculty/NYU\\_ED\\_Algorithm\\_-\\_ICD-10\\_Codes\\_-\\_6.23.15.xlsx](http://wagner.nyu.edu/files/faculty/NYU_ED_Algorithm_-_ICD-10_Codes_-_6.23.15.xlsx) 2. Illinois Health Facilities & Services Review Board. 2016 Hospital Data Spreadsheet [dataset on the Internet]. 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# Roles of Health Literacy in Relation to Social Determinants of Health and Recommendations for Informatics-Based Interventions: Systematic Review

## Abstract

**Objective** To adjust modelled baselines used for syndromic surveillance to account for public health interventions. Specifically to account for a change in the seasonality of diarrhoea and vomiting indicators following the introduction of a rotavirus vaccine in England. **Introduction** Public Health England's syndromic surveillance service monitor presentations for gastrointestinal illness to detect increases in health care seeking behaviour driven by infectious gastrointestinal disease. We use regression models to create baselines for expected activity and then identify any periods of significant increases. The introduction of a rotavirus vaccine in England during July 2013 (Bawa, Z. et al. 2015) led to a reduction in incidence of the disease, requiring a readjustment of baselines. **Methods** We identified syndromes where rates had dropped significantly following the vaccine's introduction. For these indicators, we introduced new variables into the regression models used to create baselines. Specifically we tested for a 'step-change' drop in rates and a change in the seasonality of baselines. Finally we checked the new models accuracy against actual syndromic data before and after the vaccine introduction. **Results** We were able to improve model fit post-intervention, with the best-fitting models based on a change in seasonality. All post-intervention regression models had reduced average residual square error. Reductions in residual errors ranged from <1% to 60% when a 'step-change' variable was included and 4% to 75% when accounting for seasonality. Furthermore, every syndrome showed a better model fit when a change in seasonality was included. **Conclusions** Prior to the vaccine's introduction, rotavirus caused a spring-time peak in vomiting and diarrhoea recorded by syndromic surveillance systems. Failure to account for the reduction in this peak post-vaccine would have made surveillance systems less effective. In particular, any increased activity during spring may have been undetected. Moreover, models that did not account for changes in seasonality would increase the chances of false alarms during other seasons. By adjusting our baselines for the changes in seasonality due to the vaccine we were able to maintain effective surveillance systems. **References** Bawa, Z., et al. Assessing the Likely Impact of a Rotavirus Vaccination Program in England: The Contribution of Syndromic Surveillance. *Clinical infectious diseases* : an official publication of the Infectious Diseases Society of America 2015;61(1):77-85.

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# Roles of Health Literacy in Relation to Social Determinants of Health and Recommendations for Informatics-Based Interventions: Systematic Review

## Abstract

**Objective** To utilize syndromic surveillance data timely detecting heroin overdose outbreaks in the community. **Introduction** Early detection of heroin overdose clusters is important in the current battle against the opioid crisis to effectively implement prevention and control measures. The New York State syndromic surveillance system collects hospital emergency department (ED) visit data, including visit time, chief complaint, and patient zip code. This data can be used to timely identify potential heroin overdose outbreaks by detecting spatial-temporal case clusters with scan statistic. **Methods** Heroin overdose cases (Heroin\_OD) were identified from ED visits by searching Heroin\_OD key terms in the chief complaints. Then the space-time permutation model (using the SaTScan package) was applied to detect clusters of Heroin\_OD. ED visit date served as the time variable and the case residential zip code was the spatial coordinate variable for the SaTScan analysis. A SAS program was developed to carry out the prospective scan statistics analysis weekly and produces reports of detected clusters in table and map format. Cluster detection parameters were set to detect heroin overdose aggregation in maximum geographic radius of 20 kilometer (km) and maximum time span up of 21 days at the P-value  $\leq 0.05$ . Chief complaints within the clusters are reviewed to ensure accuracy of detection. Messages have been developed and are shared with community members including law enforcement and public health identifying the cluster and offering suggestions of activities that can occur at the local level to identify and address the cause of the cluster, as well as to reduce potential harm. This includes the 23 syringe exchange programs (SEPs) regulated by the New York State Department of Health. **Results** Using ED visit data from 138 NY upstate hospitals, a total of 12 Heroin\_OD clusters were detected by the SaTScan analysis during the period of 9/1/2016 through 9/17/2017. There were 845 cases identified. The average age was 35 years and ranged from 7 to 95 years. Sixty nine percent (69%) of the cases was in 20 to 39 age group and 66% in males. A cluster was identified earlier 2017 in Suffolk County, and the local SEP was alerted. This encouraged communication between partners within the alerted county which ultimately resulted in identifying the substance endangering people who used drugs in the area. It also helped public health to partner with public safety, ensuring that the availability of the substance was interrupted. **Conclusions** As the space-time permutation scan statistic only requires disease counts, event date and disease location, the method can be easily implemented for detecting disease outbreaks using data routinely collected from disease surveillance systems. The current study showed that scan statistic is a useful tool for identifying clusters of non-fatal overdoses from specific drugs. This method also returns important information to assist outbreak investigations, such as geographic location and time-span of the potential outbreaks.

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## Abstract

**Objective** To carry out an observational study to explore what added value Google search data can provide to existing routine syndromic surveillance systems in England for a range of conditions of public health importance and summarise lessons learned for other countries. **Introduction** Globally, there have been various studies assessing trends in Google search terms in the context of public health surveillance<sup>1</sup>. However, there has been a predominant focus on individual health outcomes such as influenza, with limited evidence on the added value and practical impact on public health action for a range of diseases and conditions routinely monitored by existing surveillance programmes. A proposed advantage is improved timeliness relative to established surveillance systems. However, these studies did not compare performance against other syndromic data sources, which are often monitored daily and already offer early warning over traditional surveillance methods. Google search data could also potentially contribute to assessing the wider population health impact of public health events by supporting estimation of the proportion of the population who are symptomatic but may not present to healthcare services. **Methods** We sought to determine the added public health utility of Google search data alongside established syndromic surveillance systems in England<sup>2</sup> for a range of conditions of public health importance, including allergic rhinitis, scarlet fever, bronchitis, pertussis, measles, rotavirus and the health impact of heatwaves. Google search term selection was based on diagnostic and clinical codes underlying the syndromic indicators, with Google Trends<sup>3</sup> used to identify additional related internet search terms. Daily data was extracted from syndromic surveillance systems<sup>2</sup> and from the Google Health Trends Application Programming Interface (API) from 2012 to 2017 and a retrospective daily analysis undertaken during pre-identified public health events to identify a) whether signals were detected during these events and b) assess the correlation with analogous syndromic surveillance indicators through calculation of Spearman correlation coefficients and lag assessment to determine timeliness. **Results** We detected increases in Google search term frequency during public health events of interest. Good correlation was seen with comparable syndromic surveillance indicators on a daily timescale for several health outcomes, including the search terms hayfever, scarlet fever, bronchiolitis and heatstroke. Weaker correlation was seen for conditions which occur in small numbers and are vaccine preventable such as measles and pertussis. Lag analysis showed similar timeliness between daily syndromic and Google data, suggesting that, overall, Google data did not provide an earlier or delayed signal compared to syndromic surveillance indicators in England. **Conclusions** To the best of our knowledge this is the first time trends in Google search data have been compared against syndromic data for a range of public health conditions in England. These findings demonstrate the potential utility of internet search query data in conjunction with existing systems in England, with syndromic surveillance data found to be as timely as Google data. These findings also have important implications for countries where there are no such healthcare-based syndromic surveillance systems in place. Factors to consider with analyses of Google search trend data in the context of disease surveillance have been highlighted, including the choice of search terms and interpretation of the reasons behind searching the internet. **References** 1Nuti SV, Wayda B, Ranasinghe I, Wang S, Dreyer RP, Chen SI, Murugiah K. The use of google trends in health care research: a systematic review. PLoS One. 2014 Oct 22;9(10):e109583. 2Public Health England. Syndromic surveillance: systems and analyses. 2017. Available online: <https://www.gov.uk/government/collections/syndromic-surveillance-systems-and-analyses> 3Google. 2017. Google Trends. Available online: <https://trends.google.com/trends/>

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## Abstract

**Objective** The objective of this abstract is to illustrate how the Utah Department of Health processes a high volume of electronic data in an automated way. We do this by a series of rules engines that does not require human intervention. Introduction National initiatives, such as Meaningful Use, are automating the detection and reporting of reportable disease events to public health, which has led to more complete, timely, and accurate public health surveillance data. However, electronic reporting has also led to significant increases in the number of cases reported to public health. In order for this data to be useful to public health, it must be processed and made available to epidemiologists and investigators in a timely fashion for intervention and monitoring. To meet this challenge, the Utah Department of Health (UDOH)'s Disease Control and Prevention Informatics Program (DCPIP) has developed the Electronic Message Staging Area (EMSA). EMSA is a system capable of automatically filtering, processing, and evaluating incoming electronic laboratory reporting (ELR) messages for relevance to public health, and entering those laboratory results into Utah's integrated disease surveillance system (UT-NEDSS) without impacting the overall efficiency of UT-NEDSS or increasing the workload of epidemiologists. **Methods** After parsing and translating messages, EMSA runs the messages through a series of rules to determine if a test result should update an existing UT-NEDSS event, create a new UT-NEDSS event, be archived for possible use in future cases (e.g. to help identify seroconversion) or if the test result should be discarded. All of these rules can be configured specifically for each reportable condition. First, EMSA runs age-based rules. If the incoming message is too old for the indicated condition, EMSA does not continue processing and the message is discarded. EMSA then attempts to person match to determine if the person reported in the ELR message matches a known person in UT-NEDSS. If the person matches, EMSA will then evaluate whether the laboratory result should append to any events associated with the person, create a new event under that person, or create a new person and event. This process occurs through two different rule sets: whitelist rules, and test specific rules. Whitelist Rules are condition-specific and, when available, based on CDC's case definition guidelines to determine when a new lab test result should be considered part of an existing case or a catalyst to trigger a new event. Whitelist Rules run against all existing events found for the person matched, and once a single event is matched, then the more-specific test result-based rules come into play. Within an event matched by the whitelist rules, we have another set of rules based on the test result, collection date, accession number, and test status, to determine whether to add the laboratory report to the event, update an existing laboratory report, or if the laboratory report is a duplicate to be discarded. The message also runs through rules based on test and test result, and sometimes off organism, that determine whether that result can even be used to update the case or not. Whitelist rules also determine if too much time has passed since the matching event occurred for the incoming laboratory result to be appended to the matching event. Whitelist rules exist for both morbidity and contact events, and are based on timeframes such as onset date and treatment dates. If a particular incoming laboratory test result matches a known person in UT-NEDSS, and the whitelist rules determine that the laboratory result matches that person's disease condition and can "update an existing event", the laboratory result is run through another set of rules, called "test specific rules". Test specific rules match incoming laboratory tests results to a UT-NEDSS disease condition, and determine whether each unique test type and test result combination can "create a new event" and/or "update an existing event". All tests that do not meet the criteria for inclusion into UT-NEDSS, either by updating an event or creating a new event, are held in EMSA, in what is termed the "graylist" for a period of 18 months. When EMSA creates a new event, it queries the graylist to determine if a previous reported lab should be pulled and added to the new event. Graylist rules determine how far back EMSA is allowed to search for previous test results. **Results** From 10/10/2016 to 9/30/2017, the Utah Department of Health has received a total of 995,486 electronic messages that required processing. Of those 995,486 messages, 23,787 (2.4%) were deleted, 17,839 (1.8%) were identified as duplicates and subsequently deleted, 853,853 (85.8%) were sent to graylist, and 99,657 (10%) were added to UT-NEDSS. Of the 99,657 messages, 85,705 (86%) were processed from raw electronic messages to assignment into UT-NEDSS without any human intervention. **Conclusions** ELR improves the timeliness, completeness, and accuracy of laboratory reporting to public health, but often results in a significant increase in laboratory reporting to public health agencies. This increase in volume can overwhelm epidemiologists and investigators if manual processes for reviewing all incoming ELR messages are needed for processing laboratory results and entering data into surveillance systems. In order to fully leverage the benefits of ELR for public health surveillance, we knew we needed a highly automated process for receiving, parsing, translating, and entering data into UT-NEDSS that would mitigate the challenges associated with the increased volume. We developed EMSA and its series of rule sets to meet this challenge.

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## Abstract

**Objective** To share practical, user-friendly data validation methods in R that result in shorter validation time and simpler code. **Introduction** There are currently 123 healthcare facilities sending data to the Washington (WA) State syndromic surveillance program. Of these facilities, 30 are sending to the National Syndromic Surveillance Program's (NSSP) production environment. The remainder are undergoing validation or in queue for validation. Given the large number of WA healthcare facilities awaiting validation, staff within the state syndromic surveillance program developed methods in R to reduce the amount of time required to validate data from an individual facility. **Methods** The dplyr package and R Markdown file format were used to more rapidly conduct syndromic data validation. Dplyr, written by Hadley Wickham, was created for easy data manipulation. The syntax of this package is user-friendly, providing a function for almost every common data manipulation task and utilizing the piping operator from the magrittr package. Data fields of interest for syndromic surveillance are classified as required (R), required but may be empty (RE), or optional (O). For R or RE data fields, dplyr can be used to check for patterns of missingness as well as verify that the correct value sets are being used for code fields. For character fields, dplyr can be used to pull samples of free-text, calculate word or character counts, or search for string patterns of interest. **Results** The amount of time spent validating any single facility has decreased significantly. This has allowed the number of facilities undergoing data validation at one time to increase from 12 to 22. However, the length of time between beginning and completing data validation per facility has not decreased. While reporting data issues to facilities takes less time, the lag in the validation process still occurs while waiting for facilities to correct these issues at the feed origination. **Conclusions** In order to increase the number of healthcare facilities that are sending production quality data more quickly, more resources need to be directed at providing facilities with support on how to correct data issues rather than solely reporting the problems. **References** 1. Anderson, S. dplyr and pipes: the basics [Internet]. 2014 [cited 2017 Oct 10]. Available from: <http://seananderson.ca/2014/09/13/dplyr-intro.html> 2. Broman, K. Knitr with R Markdown [Internet]. [cited 2017 Oct 10]. Available from: [http://kbroman.org/knitr\\_knutshell/pages/Rmarkdown.html](http://kbroman.org/knitr_knutshell/pages/Rmarkdown.html).

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# Roles of Health Literacy in Relation to Social Determinants of Health and Recommendations for Informatics-Based Interventions: Systematic Review

## Abstract

**Objective:** We have conducted this study to characterise the movement and contact patterns of poultry in Bangladesh that could be associated with transmission of newly-introduced subtypes of avian influenza virus in two districts of Bangladesh as well as to summarise the patterns arising from the network analysis in a way that can inform the parameterisation of spatially explicit stochastic models of transmission of newly-introduced subtypes of avian influenza virus in the two types of areas. **Introduction:** Bangladesh is a South Asian country with large human and poultry populations which is highly affected with frequent outbreaks of both high and low pathogenic avian influenza since 2007. Very few studies have been carried out to reveal the farm biosecurity at backyard poultry that might have contributed to the spread of avian influenza in Bangladesh, specially rural areas. Therefore, we aimed to characterize biosecurity practices of poultry farm including the movement of live birds which is a well-known risk factor for the geographic dissemination of the virus among poultry flocks and personnel hygiene of poultry workers for rapid detection and effective risk management of incursion of HPAI and LPAI viruses. **Methods:** This cross sectional survey was carried out using pretested questionnaire in backyard Poultry holdings of Kalkini Upazila of Madaripur district in Dhaka division which has a relatively low proportion of commercial poultry farms and high proportion of backyard poultry holdings. 1-mode and 2-mode social network analysis was also carried out to show the farm to farm movements. From each primarily selected farm, details of the last 2 movements of live poultry along with source/destination details was collected with pre-tested questionnaire. Later, data was stored in Epi-Info, analysed with STATA 14 and UCINET. 315 backyard HH from 2 villages of Kalkini Upazila, Madaripur District were randomly selected. **Results:** The study revealed that majority backyard farm owners do not maintain the standard biosecurity measures whereas a significant amount of the study included farms rear multiple poultry species. No poultry workers found to use any personal protective equipments (PPEs) while cleaning the litter/mats (Figure 2). The farms with multiple poultry species feed them in same container and keep them in same shed which is a major risk factor for disease transmission. Movement patterns differed in a number of aspects (Table 1) and this information is useful for the establishment of the movement parameter settings in a simulation model of avian influenza incursion. **Conclusions:** The findings on farm biosecurity practices and movement pattern from this study will support to develop risk-based surveillance and contingency policies as well as to minimize the spread between poultry units and also from poultry to people for novel AI viruses in Bangladesh.

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# Roles of Health Literacy in Relation to Social Determinants of Health and Recommendations for Informatics-Based Interventions: Systematic Review

## Abstract

**Objective:** To explore the use of ED syndromic surveillance data to retrospectively identify individuals who died from suicide and visited an ED before death in order to improve suicide surveillance and inform planning and prevention efforts in Salt Lake County, Utah. **Introduction:** In 2015, suicide was the 8th leading cause of death in Salt Lake County, Utah, and has recently been identified as a priority public health issue. For suicide, suicide ideation and suicide attempts surveillance, Salt Lake County Health Department staff use National Violent Death Reporting System (NVDRS) mortality data to monitor historical trends and vital records mortality data and ESSENCE ED encounter morbidity data to monitor trends and populations in real time. To improve surveillance and better identify populations at higher risk of suicide, we tested whether we could retrospectively identify residents who died from suicide and visited an ED in the year before death. **Methods:** Data for all ESSENCE ED encounters from January 1, 2016, through June 30, 2017, were downloaded from the National Syndromic Surveillance Program BioSense platform. Salt Lake County residents who died from suicide from January 1, 2017, through June 30, 2017, were linked to this ESSENCE dataset using date of birth and zip code. We performed chart reviews of the matched patients' ED encounters and collected sociodemographic (name, residence, race, ethnicity, marital status, military service, sexual orientation), socioeconomic status (education, occupation) and suicide risk factor data (social isolation, addiction, physical health, relationship, financial, job, school, criminal, civil legal problems, eviction or housing problem, recent suicide or other death of family/friend, current depressed mood, current or recent mental health diagnosis and/or treatment, current alcohol or other substance use disorder, perpetrator or victim of interpersonal violence, history of abuse, and history of suicide ideation, plan and attempt). We used descriptive epidemiology to describe risk factors and circumstances. **Results:** Fifteen Salt Lake County residents who died from suicide from January 1, 2017, through June 30, 2017, matched individuals in the ESSENCE ED dataset by date of birth and zip code. Upon chart review, 14/15 matched by medical record number; the remaining patient was excluded due to medical record number mismatch. Ultimately, 13% (14/105) of Salt Lake County residents who died from suicide from January 1, 2017, through June 30, 2017, were identified in ESSENCE as having visited an ED in the year before death. Among them, they visited an ED a total of 30 times. Based on chart review of 13/14 of these individuals, the most common suicide risk factors or circumstances were physical health problem (62%), current mental health diagnosis (62%), history of suicidal thoughts (54%) and current depressed mood (54%). The correlation between risk factors identified from ESSENCE and those identified from NVDRS was moderate ( $r=0.57$ ). **Conclusions:** It is possible to identify individuals who died from suicide and visited an ED before death. We are encouraged by the result that common risk factors found via chart review are similar to those we have found in our historical analyses of NVDRS suicide data. This risk factor information adds valuable context to real-time surveillance of suicide, suicide ideation and suicide attempts. Next steps in this pilot are to complete the final chart review and develop and test triage note search queries to monitor suicide and suicidal thoughts and behavior and identify populations who have these common risk factors and may be at higher risk for suicide. It should be noted that during this work, several facilities' data feeds dropped and the quantity of data decreased dramatically. That we were still able to identify 13% of our residents who died from suicide in ESSENCE despite the large loss of data suggests the true percentage is likely to be much higher once facilities are re-onboarded. This gives us confidence that we will be able to develop a reliable ESSENCE query for suicide risk factors specific to our residents.

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# Roles of Health Literacy in Relation to Social Determinants of Health and Recommendations for Informatics-Based Interventions: Systematic Review

## Abstract

**Objective:** The objective is to develop a standard opioid overdose case definition that could be generalized nationally. **Introduction:** Opioid ODs have been rising globally and nationally. The death rate from ODs in the United States has increased 137% since 2000, including a 200% increase of OD deaths involving opioids<sup>1</sup>. The pilot project, a collaboration across 3 states, allowed information sharing with Syndromic surveillance (SyS) partners across jurisdictions, such as sharing a standard SyS case definition and verifying its applicability in each jurisdiction. This is a continuation of the work from an initial pilot project presented during the ISDS Opioid OD Webinar series. **Methods:** Three regions (Colorado North Central Region [CO-NCR]), State of Nebraska [NE], and Marion County, Indiana) participated in the development and evaluation of the opioid OD case definition. Data sources included ESSENCE and 2015 hospital discharge data (HDD) for the first two jurisdictions. Work was conducted in 3 stages. Stage I and II consisted of the development and validation of an opioid misuse definition. In stage I, the percent of completeness of admission date, chief complaint (CC), and discharge diagnosis (DD) was assessed from January 2015 to August 2016 SyS emergency department (ED) data from each of the 3 participating jurisdictions. Data selected for the time period with the best completeness among all jurisdictions was utilized to develop a case definition. Completeness of ESSENCE data submission was assessed at all jurisdictions. The threshold for best data quality was 80% of completeness. SyS ED data was analyzed for the selection of CC search terms and ICD9/ICD102 DD codes, and the reported Chief Complaint-Discharge Diagnosis (CCDD) were validated by analyzing consistency between CC and DD. In stage II, the consistency of DD reporting corresponding to the opioid case definition was assessed for CO-NCR and NE data by performing Pearson Correlation analysis to compare the weekly counts of opioid misuse cases in 2015 SyS ED data to those obtained in HDD. Stage III consisted of the development of an opioid OD case definition that meets the DD code reporting requirements of the Centers for Disease Control and Prevention (CDC), Prescription Drug Overdose Prevention for States awardees. This definition consisted of an ESSENCE query containing CC, and CCDD components. For Stage III, SyS ED data was analyzed for the August 2016 to August 2017 time period. The case definition was evaluated by assessing the consistency between the CC and DD reported for each identified opioid OD possible case. Triage notes were used for case validation. **Results:** Stage I: Mean percent of completeness of DD codes for CO-NCR, NE and Marion County, IN, 2015 ED SyS data was  $\geq 85\%$ . In the CO-NCR, of 963 cases detected by the CC definition, 99.4% had an opioid misuse diagnostic code in the DD, while of 1,445 cases detected by the DD, 66.2 % had an associated opioid misuse in the CC search terms. In NE, of 6 cases detected by the CC definition, 33% identified opioid misuse DD. However, of 42 cases detected by the DD definition, only 5% identified opioid misuse CC search terms. In Marion County, IN, of 95 cases detected by the CC definition, 70% identified opioid related diagnosis codes. Of 191 cases detected by the DD definition, only 20% identified opioid-related CC search terms. Stage II: Results of the Pearson correlation analysis indicate statistically significant correlations between 2015 SyS and HDD data for the DD code based opioid definition for both CO ( $r = 0.92$ ,  $p < 0.0001$ ), and NE ( $r = 0.63$ ,  $p < 0.0001$ ). Stage III: In NE, 56% of the cases detected by the CC component, identified opioid OD DD codes, and only 8% of the cases detected by the DD component identified opioid OD search terms in the CC. Triage notes were consistent with opioid OD in 55% of the cases detected by the DD component. However, for CO-NCR, of 235 cases detected by the CC component, 215 identified opioid OD DD codes. Of 465 cases detected by the DD component, 46% identified opioid OD search terms in the CC field. Triage notes values were consistent with opioid OD reported DD codes in 80% of the cases. **Conclusions:** Results suggest that DD codes reported in SyS ED data correlated with HDD data. Indicators of opioid OD signs and symptoms were observed in CCDD. Therefore, the SyS case definition proposed through this pilot project may be applied by other states to support real-time monitoring of opioid OD related hospital ED visits, and consequences of opioid OD. Further study includes exploring how triage notes search terms may improve the identification of opioid OD related ED visits.

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# Roles of Health Literacy in Relation to Social Determinants of Health and Recommendations for Informatics-Based Interventions: Systematic Review

## Abstract

**Objective:** The objectives are to introduce a provincial level surveillance system, which has been initiated in response to the MERS-CoV outbreak of South Korea, and describe findings from systematic investigation of individual admissions attributed to acute febrile illness for the first year. **Introduction:** In May 2015, the MERS-CoV outbreaks in South Korea was sparked from a hospital of Gyeonggi-do province (1). In response to this outbreak, the provincial government and infectious disease control center (GIDCC) initiated an emergency department (ED) based Gyeonggi-do provincial acute febrile illness (AFI) surveillance network (GAFINet) to monitor for a subsequent outbreak of emerging or imported infectious diseases since September 2016. Gyeonggi-do province is located in the North-West of South Korea, surrounds the capital city Seoul, and borders North Korea (Figure 1). Considering the geographical coverage, GAFINet Initiative involves ten hospitals, consisted of four university-affiliated hospitals and six provincial medical centers in Gyeonggi-do province. These hospitals participated in this network voluntarily, and most staffs including five infectious diseases specialists had direct or indirect experiences in dealing with MERS-CoV patients. **Methods:** Periodic surveillance for finding AFI patients in ED of participating hospitals was performed prospectively (Figure 2). AFI was defined as 1) fever: body temperature  $\geq 38$  °C at admission, or 2) chief complaint of febrile or chilling sensation. Demography of patients and chief complaints were investigated in this first step (CRF #1). Cases were classified into six categories based on their clinical diagnoses: 1) respiratory AFI [AFRI], 2) gastroenteric AFI [AFGI], 3) exanthematic AFI [AFEI], 4) other infectious AFI, 5) non-infectious AFI, and 6) unclassified AFI. Participating infectious diseases specialists regularly reviewed and reformed this classification. Because the aim of GAFINet is primarily monitoring community- or aboard-acquired infection, nosocomial AFI cases or the patients transferred from another hospital were excluded. When a patient had a history of international travel or he/she were undiagnosed in three days after ED admission, more comprehensive information (CRF#2 & #3) including history and final diagnosis were obtained. For a baseline data, age- and sex-stratified ED visits were also gathered weekly. The proportion of AFI cases per 1000 visits was determined for one week period and analyzed by febrile diseases categories with age-stratification. Characteristics of cases with international travel histories or undiagnosed cases were also described separately. **Results:** Between 30 September and 3 December 2016, about 6,000 of patients visited ED of ten hospitals a week, and 10% of them were AFI cases. The proportion of AFRI was the largest, 33.64 to 71.96 per 1000 visits/week, and the second-largest was the other infectious AFI. The proportion of AFRI showed the highest rate at the age 1-9 years, while those of AFGI and AFEI were the highest at the age under 19 year and 70-79 years, respectively. 31 cases with international travel history were reported, and the majority of them traveled China and South East Asian countries. Some of them were suspected cases of Zika viral infection, MERS-CoV, or viral hemorrhagic fever. 3 cases undiagnosed until discharge were also reported. **Conclusions:** Gyeonggi-do province was the most affected region in the 2015 MERS-CoV outbreak, 67 of 185 cases were residents of this province. GAFINet Initiative is a meaningful step for rapid detection of emerging or overseas imported infectious diseases at the provincial level. To validate data and co-analysis with pre-existing surveillance data, we need a more long-term of continuous operation of GAFINet. As a next step, we are preparing the additional lab-based surveillance system to detect new or re-emerging pathogens.

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# Roles of Health Literacy in Relation to Social Determinants of Health and Recommendations for Informatics-Based Interventions: Systematic Review

## Abstract

**Objective:** To create a scoping review on enterovirus D-68 (EV-D68) that will serve as a useful tool to guide future research with the aim of filling critical information gaps and supporting the development of public health preparedness activities. **Introduction:** EV-D68 is a non-polio enterovirus, primarily resulting in respiratory illness, with clinical symptoms ranging from mild to severe. Infection has also been associated with severe neurological conditions like acute flaccid myelitis (AFM). EV-D68 was first discovered in 1962, with infrequent case reports until 2014 at which point a widespread multi-national outbreak mostly affecting the pediatric population occurred across North America, Europe, Southeast Asia and Africa. This outbreak was associated with an increase in AFM, with cases being reported in Canada, the United States, Norway, and France. With this new and emerging threat, public health and other organizations were called upon to implement response measures such as establishment of case definitions, surveillance mechanisms, and recommendations for clinical and public health management. The response to the 2014 outbreak in Canada highlighted several important EV-D68 evidence gaps including a lack of risk factor and clinical information available for non-severe cases, and uncertainty around seasonal, cyclical and secular trends. Given the increased reporting of EV-D68 cases associated with severe outcomes, it's critical that public health establishes what is known about EV-D68 in order to support decision-making, education and other preparedness activities and to highlight priority areas for future research to fill critical knowledge gaps. Scoping reviews provide a reproducible and updateable synthesis research methodology to identify and characterise all the literature on a broad topic as a means to highlight where evidence exists and where there are knowledge gaps. In order to systematically characterise the EV-D68 knowledge base, a scoping review was conducted to map the current body of evidence. **Methods:** A literature search of published and grey literature on EV-D68 was conducted on May 1, 2017. A standardized search algorithm was implemented in four bibliographic databases: Medline, Embase, Global Health and Scopus. Relevant grey literature was sought from a priori identified sources: the World Health Organization, United States Centers for Disease Control and Prevention, the Public Health Agency of Canada, the European Centre for Disease Prevention and Control, and thesis registries. Two-level relevance screening (title/abstract followed by full-text) was performed in duplicate by two independent reviewers using pretested screening forms. Conflicts between the reviewers were reconciled following group discussion with the study team. English and French articles were included if they reported on EV-D68 as an outcome. There were no limitations by date, publication type, geography or study design. Conference abstracts were excluded if they did not provide sufficient outcome information to characterize. The articles were then characterized by two independent reviewers using a pretested study characterization form. The descriptive characteristics of each article were extracted and categorized into one of the following broad topic categories: 1) Epidemiology and Public Health, 2) Clinical and Infection Prevention and Control (IPC), 3) Guidance Products, 4) Public Health Surveillance, 5) Laboratory, and 6) Impact. The Epidemiology and Public Health category contained citations describing prevalence, epidemiological distribution, outbreak data and public health mitigation strategies. Clinical and IPC citations included details regarding symptoms of EV-D68 infection, patient outcomes, clinical investigation processes, treatment options and infection prevention and control strategies. The Guidance category included citations that assess risk, provide knowledge translation or provide practice guidelines. Public Health Surveillance citations provided details on surveillance systems. Citations in the laboratory category included studies that assessed the genetic characteristics of circulating EV-D68 (phylogeny, taxonomy) and viral characteristics (proteins, viral properties). Lastly, the Impact category contained citations describing the social, economic and resource burden of EV-D68 infection. Each broad topic category was subsequently characterised further into subtopics. **Results:** The search yielded a total of 384 citations, of which 300 met the inclusion criteria. Twenty-six of forty-three potentially relevant grey literature sources were also included. Preliminary literature characterization suggests that the majority of the published literature fell under the topic categories of Epidemiology, Clinical, and Laboratory. There were limited published articles on public health guidance, IPC, surveillance systems and the impact of EV-D68. The grey literature primarily consisted of webpages directed towards the public (what EV-D68 is, how to prevent it, what to do if ill, etc.). This scoping review work is presently underway and a summary of the full results will be presented at the 2018 Annual Conference. **Conclusions:** The body of literature on EV-D68 has increased since the 2014 outbreak, but overall remains small and contains knowledge gaps in some areas. To our knowledge, this scoping review is the first to classify the entirety of literature relating to EV-D68. It will serve as a useful tool to guide future research with the aim of filling critical information gaps, and supporting development of public health preparedness activities.

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# Roles of Health Literacy in Relation to Social Determinants of Health and Recommendations for Informatics-Based Interventions: Systematic Review

## Abstract

**Objective:** Study of the structure of lethal cases in patients diagnosed with leptospirosis in the Lviv Region. **Introduction:** Mortality rate of leptospirosis in Ukraine remains high year after year. The study of the peculiarities of lethal cases over a long period enables researchers to specify possible mechanisms of infection which cause the development of the severest cases of leptospirosis and to prevent disease emergence by applying adequate preventive measures. **Methods:** We have analyzed case reports of patients diagnosed with leptospirosis, who were treated and died in Lviv Regional Clinical Hospital of Infectious Diseases from 1987-2016. **Results:** Over the last 30 years, 942 patients with leptospirosis were treated in Lviv Regional Clinical Hospital of Infectious Diseases, and 125 of them died. The mortality rate was 13.27%. Men died twice as often as women – 83 (66.4%) and 42 (33.6%), respectively,  $p < 0.001$ . The average age at death was  $56.5 \pm 11.98$  years old. Women died at older age ( $59.62 \pm 9.6$ ) as compared to men ( $54.93 \pm 12.78$ ),  $p < 0.05$ . Patients who died from leptospirosis were admitted into the hospital on the  $5.81 \pm 2.31$  day, which is considered to be a late admission. The average length of stay in the inpatient department was  $6.21 \pm 6.54$  days. Rural residents died much more often, 78 cases (62.4%) compared with city residents, 47 cases (37.6%),  $p < 0.01$ . The mortality from leptospirosis was lowest during the summer months (6.79%) compared to winter (19.85%,  $p < 0.001$ ), spring (23.81%,  $p < 0.001$ ) and autumn (13.78%,  $p < 0.01$ ) months. It should be noted that the mortality during the autumn-summer period was significantly lower (10%) than during the spring-winter period (21.76%,  $p < 0.001$ ). The causative agent was verified by microscopic agglutination test and lysis in 66 (52.8%) of the deceased patients, and in 59 individuals (47.2%) the agent could not be identified due to early period of serological investigation, when no anti-leptospirosis antibodies had been produced so far. In these cases the diagnosis of leptospirosis was based on typical clinical signs and epidemiological anamnesis. The main serogroups of leptospirae, which caused lethal cases, were *L. icterohaemorrhagiae* – 51 (40.8%), *L. grippityphosa* – 5 (4%), *L. kabura* – 3 (2.4%), mixed *L. Icterohaemorrhagiae* plus *L. Grippityphosa* – 3 (2.4%), *L. Cynopteri* and *L. Hebdomadis* – 2 (1.6%) patients each. Epidemiological anamnesis could be determined in 84 (67.2%) patients. Most often, patients associated the disease with the following factors: 45 (36%) – with the presence of rats or mice-like rodents in a house, yard or workplace, 26 (20.8%) – with agricultural work, where contact with rodents' feces was also possible, 5 (4%) – with professional activity, 4 (3.2%) – with fishing, and 4 (3.2%) – with swimming in water pools. In 41 (32.8%) patients, leptospirosis could not be associated with any factor. **Conclusions:** *L. icterohaemorrhagiae* still remains the most common cause of mortality of leptospirosis – 51 (40.8%). In 56.8% of the cases, the disease was caused by contact with rodents. Over the last 30 years, men died more often of leptospirosis in the Lviv region than women ( $p < 0.001$ ), whereas, the deceased women were considerably older than men ( $p < 0.05$ ). Rural residents died much more often than city residents ( $p < 0.01$ ). The highest mortality rate was recorded in the spring – 23.81%, the lowest was recorded in summer – 6.79% ( $p < 0.001$ ). Active deratization measures help to reduce morbidity and mortality of leptospirosis. We believe that the question regarding the accuracy of the final diagnosis of "leptospirosis" in 59 (47.2%) dead patients is still under discussion, as the diagnosis was established based on clinical symptoms only, while PMA result was negative. After all, the clinical picture of the severe forms of leptospirosis is similar to the typical symptoms of hemorrhagic fever with renal syndrome and Crimean hemorrhagic fever.

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# Roles of Health Literacy in Relation to Social Determinants of Health and Recommendations for Informatics-Based Interventions: Systematic Review

## Abstract

**Objective** To strengthen public health surveillance to monitor neglected tropical diseases (NTDs) like leprosy as a control measure to avert disabilities in the Kingdom of Swaziland. **Introduction** Leprosy is a chronic infectious disease caused by *Mycobacterium leprae*. It is a contagious disease that affects the skin, mucous membrane, and nerves causing discoloration and lumps on the skin and in severe cases disfigurement and deformities. The mode of transmission remains uncertain, but is believed that *M.leprae* is spread from person to person primarily as a nasal droplet infection. The incubation period for a bacterial disease generally is 5 – 7 years. Progress in the fight against leprosy has been one of the greatest public health success and in the country, was eliminated in the mid-1990s. However on the 22nd August 2017 a confirmed leprosy cases was reported by the National Referral Hospital. **Methods** Following the confirmed case an investigation was conducted to fully understand the possible source of the case and identify further cases. The assessment was done in three parts that is, hospital visit to follow up on the index case; conducting home visits to collect data for leprosy and their contact and a file review of all clients who were once diagnosed as having leprosy. **Results** The index case was identified and his condition is improving as he has been initiated on MDT which he will be taking for a minimum of six months. Eleven clients were visited in their homes. Their age range was 31 to 91 years but the majority were above 60 years with a median age of 70 years. There were 7 females and 4 males. The clients presented with permanent nerve damage either from the face, upper or lower limbs. The common disabilities and deformities post treatment were sagging of face, nasal collapse, blindness and clawing of fingers and feet. Other patients had plantar-palmar ulcers and abscesses from trauma, injuries or burns sustained due to nerve damage and inadequate protection. They reported to be experiencing stigma and are being discriminated. None of the clients presented with clinical signs and symptoms suggestive of leprosy. There were 18 files that were reviewed out of 58 who are known to exist. Six of the 18 files belonged to clients who were seen during home visits. One of the clients was epidemiologically linked to the index case as they used to live together in 1994. **Conclusions** The country seem to be experiencing the re-emerging of leprosy. Since the index case is epidemiologically linked to one of the old cases this therefore confirms the incubation period of leprosy being from 15 to 20 years. There is need to strengthen leprosy prevention and control measures as well as strengthening of leprosy surveillance in the context of IDSR. There is an urgent need to raise public awareness and provide clients with protective clothing. Furthermore, there is need to strengthen the Bilharzia and Worms Control Program to incorporate leprosy as it is one of the NTDs targeted for elimination in Swaziland. **References** 1. Heymann D.L 2008, Control of Communicable Diseases Manual, 18th Edition, American Public Health Association, Geneva, Switzerland.

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# Roles of Health Literacy in Relation to Social Determinants of Health and Recommendations for Informatics-Based Interventions: Systematic Review

## Abstract

**Objective:** To study the trends of GBS and dengue in Hong Kong, the ecological associations between GBS, dengue, and local meteorological factors. To examine the non-stationary oscillating association among these factors. **Introduction:** Guillain-Barre Syndrome (GBS) is a severe paralytic neuropathy associated with virus infections such as Zika virus and Chikungunya virus. There were also case reports of dengue fever preceding GBS. With the aim to understand the mechanisms of GBS and dengue outbreaks, this ecological study investigates the relationships between GBS, dengue, meteorological factors in Hong Kong and global climatic factors from January 2000 to June 2016. **Methods:** The correlations between GBS, dengue, Multivariate El Nino Southern Oscillation Index (MEI) and local meteorological data were explored by Spearman's Rank correlations and cross-correlations. Three Poisson regression models were fitted to identify non-linear associations among GBS, dengue and MEI. Cross wavelet analyses were applied to infer potential non-stationary oscillating associations among GBS, dengue and MEI. **Results:** We found a substantial increasing of local GBS and dengue cases (mainly imported) in recent year in Hong Kong. The seasonalities of GBS and dengue are different, in particular, GBS is low while dengue is high in the summer. We observed weak but significant correlations between GBS and local meteorological factors. MEI could explain over 17% of dengue's variations based on Poisson regression analyses. We report a possible non-stationary oscillating association between dengue fever and GBS cases in Hong Kong. **Conclusions:** We report increasing patterns of both local GBS cases and imported dengue cases in Hong Kong, and investigate the possible mechanism behind these patterns. This study has led to an improved understanding about the timing and ecological relationships between MEI, GBS and dengue.

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# Roles of Health Literacy in Relation to Social Determinants of Health and Recommendations for Informatics-Based Interventions: Systematic Review

## Abstract

**Objective:** The objective of this study was to determine the species composition of mammals and parasites involved in the epizootic process of plague in Armenia and their geographic distribution. **Introduction:** Plague was first identified in Armenia in 1958 when *Y. pestis* was isolated and cultured from the flea species *Ct. teres* collected from the burrows of common voles in the northwestern part of the country. In the process of digitalizing archived data, a statistical and spatial analysis of the species composition of mammals and parasites involved in the epizootic process of plague between 1958 and 2016 was performed. **Methods:** The plague archives of the NCDPC were exploited. The geographic addresses from which strains of *Y. pestis* were isolated from mammals and their parasite species were analyzed and grouped into 38 administrative regions (Fig.1). For geostatistical analysis, databases were created using Microsoft Excel and converted into a ESRI Geodatabase (Fig.2). **Results:** Data from the especially dangerous pathogen laboratories indicate that 9329 *Y. pestis* strains were isolated in 27 of the 38 regions of the country with 7022 (75%) of the strains found in just four regions: Abovyan 2597 (28%), Sisian 1953 (21%), Martuni 1416 (15%) and Ashotsk 1056 (11%) (Fig.3). During this period, plague bacteria were isolated from 17 mammal species including 15 rodents, *Mustela nivalis* (weasel), and *Neomys fodiens* (shrew) (Fig.4). *Y. pestis* was isolated from 22 species of fleas belonging to 11 genera along with two families of ticks. Of the 9329 bacterial isolates, 6540 (70.2%) came from fleas, 2646 (28.3%) came from mammals and 143 (1.5%) were from ticks (Fig.5). **Conclusions:** In Armenia, the primary mammalian host for *Y. pestis* is the common vole *Microtus arvalis* from which 2600 isolates (27.9%) were taken. Flea species from which large numbers of plague bacteria have been isolated include *Ct. teres*-3758 (40.3%), *Ct. wladimiri*-1262 (13.5%) and *C. caspia*-667 (7.1%).

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# Roles of Health Literacy in Relation to Social Determinants of Health and Recommendations for Informatics-Based Interventions: Systematic Review

## Abstract

**Objective:** Study the advantages of using the PCR method for monitoring of natural foci within the EDP surveillance system. **Introduction:** Natural foci of especially dangerous pathogens (EDP) (tularemia, leptospirosis, anthrax, tick-borne infections) are known in Lviv oblast for more than 50 years. An integral part of the epidemiological surveillance of these infections is the monitoring of environmental objects that can detect the circulation of pathogens in natural biotopes. Identification and studying of the activity of natural foci of EDP in the territory of Lviv oblast in previous years was conducted using classical laboratory and epidemiological methods. **Methods:** Since 2015 in the EDP laboratory are conducted investigations of field materials (mouse-like rodents, ixodic ticks, gray rats, surface water bodies, wild birds dung, soil) during the monitoring process of the EDP natural foci. From 2015 to 2017 samples of field materials were investigated in order to identify specific DNA regions of causative agents of tularemia, anthrax, leptospirosis, Q-fever, Lyme borreliosis, etc., using the «Primer design™ genesis», «GENEKAM Biotechnology AG», «MO BIO Laboratories, Inc», «Analytic Jena AG» kits, which were provided within the Cooperative Biological Engagement Program (CBEP), and «Amplisens» kits. During this period samples were analyzed from 299 mouse-like rodents, 7325 ixodic ticks, 128 open water reservoirs, 51 wild birds dung, 92 soil samples and 17 gray rats. In addition, enzyme-linked immunosorbent assay (ELISA) was used. For immunoserological monitoring selected serum samples of 80 people living in enzootic territories were used. Currently, 40 human samples were investigated for the presence of IgM and IgG antibodies using the “Serion ELISA classic Francisella tularensis IgG/IgM”. **Results:** According to the results of the research that was conducted in previous years it was revealed that in the territory of Lviv oblast there are stable natural foci of tularemia, leptospirosis, tick-borne infections (Lyme borreliosis, tick-borne encephalitis) present. The main reservoirs of pathogens are 5-6 species of small mouse-like rodents and gray rats who are carriers of two dominant species of ixodic ticks. Live cultures of tularemia and leptospirosis were isolated from these types of reservoirs and carriers and positive results of immunoserological analysis were found. Tularemia antigen was detected in 29.2% of ticks samples (*D. reticulatus* mainly), causative agents of Lyme borreliosis *D. reticulatus* was detected in 17.3% of ticks and *I. ricinus* was present in 8.0% of ticks. During the serological investigation of mouse-like rodents antibodies against *F. tularensis* were detected in 6.5% of samples, antibodies against *Leptospira* in 6.7%, and antibodies against *Borrelia* from 14.6% to 27.7%. During the monitoring period of burial places of animals killed from anthrax on the territory of the oblast where classical laboratory methods were used, *B. anthracis* was not detected. However, due to the ability of the pathogen to maintain its pathogenic properties for a long time, monitoring of such areas will be relevant in the future. According to analysis of mouse-like rodents, ticks, samples of surface water bodies, wild birds dung, soil and gray rats were received 3.18% positive samples that confirmed the presence of *F. tularensis*, 9.74% positive samples of pathogenic *Leptospira* spp, 20.75% positive samples of *B. burgdorferi* s.l.. Results of DNA detection of tularemia, leptospirosis and Lyme borreliosis were obtained on already known enzootic territories as well as on new ones. During the investigation of soil samples collected from burial places of animals, DNA of *B. anthracis* were not detected. Also, results of PCR-tested samples of ticks and rodents were negative and did not confirm the presence of *C. burnetii*. Based on data received from PCR analysis, anti-epidemic measures were carried out in places where positive results were found: additional acaricidal treatment of areas of ticks breeding, deratization measures and educational work with the population. The investigation of 40 serum samples collected from people living in the enzootic territory gave negative results, but the work continues. **Conclusions:** PCR methodology provides a possibility to monitor the natural foci of EDP at a fundamentally new level. Its requires less time for getting results if compared to classical methods, the level of biorisks during the work is lower, and it is possible to conduct samples at the same time to detect several pathogens.

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# Roles of Health Literacy in Relation to Social Determinants of Health and Recommendations for Informatics-Based Interventions: Systematic Review

## Abstract

**Objective:** To describe 5 years of binational infectious disease surveillance using the binational variable in the medical electronic surveillance system in Arizona. **Introduction:** Infectious diseases can spread across borders. (1) The Arizona Department of Health Services (ADHS) collects information on binational infectious disease cases and shares it with Mexico. Infectious disease investigation in Arizona is enhanced by using an electronic surveillance platform known as the Medical Electronic Disease Surveillance Intelligence System (MEDSIS), and in 2010 a specific variable for binational cases with Mexico was added to the platform. ADHS also maintains a binational case definition in the state reportable communicable morbidities manual. Arizona partners with the US Centers for Disease Control and Prevention (CDC)'s Division of Global Migration and Quarantine (DGMQ), US Mexico Unit (USMU), in a monthly binational case reporting project, and shares information with the Ministry of Health of the State of Sonora, Mexico, (SON MOH) to reinforce ongoing communication, to establish baseline disease patterns, and to help detect binational outbreaks. In 2007, the Ministry of Health of the State of Sonora began to use the MEDSIS system for real-time secure case notification, and secure file sharing, using the Arizona's Health Services Portal and secure e-mail accounts for confidential communication between both states. **Methods:** From 2011 to 2015, the ADHS Binational Border Infectious Disease Surveillance (BIDS) program maintained a database to collect information on binational cases with Mexico, and coordinated regularly with SON MOH to investigate and respond to binational cases and outbreaks. In addition, a SAS program was created to search for possible binational cases not designated as binational using variables such as an address in Mexico and Mexican citizenship. The ADHS BIDS program investigated all suspected binational cases with Mexico and classified them as binational according to the case definition established by the Council of State and Territorial Epidemiologists (CSTE). The ADHS BIDS program also shared binational cases from Mexico with CDC DGMQ USMU through an Epi-X Forum and with SON MOH through MEDSIS or secure e-mail. **Results:** Between 2011 and 2015, the ADHS BIDS program investigated 2,158 possible binational cases with Mexico. From those, 70.44% (n=1520) were classified as binational with Mexico according with the CSTE case definition. The majority of cases were classified as binational because of travel to Mexico (n =1089, 71.6%), with 59% traveling to Sonora (n =641). The majority of cases during those 5 years were enteric diseases (n=1086, 71.4%), followed by vector borne diseases (n =131, 8.6%). Most of the binational cases reported had symptom onset between June and August, following the seasonality of both southbound travel and enteric diseases. Regular communication with Sonora facilitated detection of an average of three binational outbreaks per year. All confirmed binational cases were reported to CDC DGMQ USMU and SON MOH. **Conclusions:** Continuous sharing of infectious disease surveillance information between both states is essential in understanding the magnitude and types of reportable diseases in the Arizona/Sonora border region. Proper use of the binational MEDSIS variable enables a quicker identification of binational status, allowing for the prompt investigation of possible binational cases and detection of binational outbreaks. Binational outbreaks led to collaborative Arizona/Sonora investigations on several occasions, strengthening our relationship, coordination, collaborations, and understanding of the surveillance system used by SON MOH. Real-time exchange of information using the same secure surveillance system enables better situational awareness, more timely and accurate binational communication, and binational collaborations.

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# Roles of Health Literacy in Relation to Social Determinants of Health and Recommendations for Informatics-Based Interventions: Systematic Review

## Abstract

**Objective:** The aim of this project was to assess the face validity of surveillance case definitions for heroin overdose in emergency medical services (EMS) and emergency department syndromic surveillance (SyS) data systems by comparing case counts to those found in a statewide emergency department (ED) hospital administrative billing data system. **Introduction:** In 2016, the Centers for Disease Control and Prevention funded 12 states, under the Enhanced State Opioid Overdose Surveillance (ESOOS) program, to utilize state Emergency Medical Services (EMS) and emergency department syndromic surveillance (SyS) data systems to increase timeliness of state data on drug overdose events. An important component of the ESOOS program is the development and validation of case definitions for drug overdoses for EMS and ED SyS data systems with a focus on small area anomaly detection. In fiscal year one of the grant Kentucky collaborated with CDC to develop case definitions for heroin and opioid overdoses for both SyS and EMS data. These drug overdose case definitions are compared between these two rapid surveillance systems, and further compared to emergency department (ED) hospital administrative claims billing data, to assess their face validity. **Methods:** The most recent available data were pulled from multiple hospitals in a large healthcare system serving an urban region of Kentucky. Definitions for acute heroin overdose were applied to all three sources. For SyS and ED data, definitions were queried against the same hospitals within this geographic region and aggregated to week-level totals. SyS and ED data are similar with the exception of additional textual information available in SyS (such as chief complaint). Our EMS definition of heroin overdose was loosely based on a draft definition that was produced by the Massachusetts Department of Public Health, and relies more on textual analysis versus ICD10 codes used in SyS and ED data systems. While SyS and ED used the same hospitals as the frame of selection, EMS used incidents that occurred in the approximate catchment area served by those hospitals. Weekly totals from all three data sources were plotted in R studio with LOESS-smoothed trend lines. Unsmoothed times series plots also demonstrate highly correlated trends, but the smoothed trend lines are less cluttered and easier to interpret. **Results:** Visual interpretation of the LOESS-smoothed trend lines shows very similar trajectories among all three sources [Fig 1]. The resultant graph demonstrates that individually, the time courses described by SyS and EMS data track closely with the one observed in ED data. The absolute counts between the three sources showed some differences, as expected. The EMS system captures a slightly different cohort that may include people that do not go to the ED (observation patients, refused transport, etc.) and SyS/ED have slightly different definitions (as ED does not include a free-text chief complaint. These types of limitations are better explored through data linkage that may or may not include medical record review to establish ground truth. **Conclusions:** Public health surveillance of drug overdoses has traditionally relied on ED billing data. In most states, however, there is a lag of at least several months before this data becomes available for analysis. In some jurisdictions the delay may be considerably longer. Rapid surveillance data sources may allow for more timely identification of changes in overdose patterns at the local level. In addition, SyS/EMS can be used together to confirm that a spike seen in one rapid system is confirmed within the other, with relative ease. Though the comparison is a rather simple or crude visual analysis of three data systems at a common geographic level, there is still appears to be a common pattern among the three systems. While this does not carry the validity of cross-data matched analysis, it does provide some of the utility of looking at these system collective without match; and therefore may be of use to surveillance users that may be limited by de-identified data.

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# Roles of Health Literacy in Relation to Social Determinants of Health and Recommendations for Informatics-Based Interventions: Systematic Review

## Abstract

**Objective:** Identifying text features of emergency department visits associated with risk of future drug overdose. **Introduction:** Opioid overdoses are a growing cause of mortality in the United States.<sup>1</sup> Medical prescriptions for opioids are a risk factor for overdose.<sup>2</sup> This observation raises concerns that patients may seek multiple opioid prescriptions, possibly increasing their overdose risk. One route for obtaining those prescriptions is visiting the emergency department (ED) for pain-related complaints. Here, two hypotheses related to prescription seeking and overdoses are tested. (1) Overdose patients have a larger number of prior ED visits than matched controls. (2) Overdose patients have distinct patterns of pain-related complaints compared to matched controls. **Methods:** ED registrations were collected via the EpiCenter syndromic surveillance system. Regular expression searches on chief complaints identified overdose visits. Overdose visits were matched with control visits from the same facility with maximal similarity of gender, age, home location and arrival time. A year of prior ED visits for cases and controls were matched using facility-specific patient identifiers or birthdate, gender and home location. Patient history chief complaints were sanitized to standardize spelling, expand abbreviations and consolidate phrases. Word frequency comparisons between groups identified candidate terms for modeling. Odds ratios of patient history terms were calculated with univariate logistic regression. Multivariate lasso logistic regression selected covariates for prediction. These models were fit to data from one quarter and cutoffs for covariate inclusion were validated on the following quarter's data. Model predictions were validated on a 1% sample of ED registrations from the next quarter. **Results:** Quarter three of 2016 yielded 23,769 overdose ED visits and matching controls; quarter four yielded 21,957 pairs; and 15,824 ED visits were sampled from the first quarter of 2017 including 130 overdose visits. Contrary to expectations, patients in the control group averaged 0.7 additional ED visits in the prior year relative to controls; this pattern was consistent across quarters and regardless of how prior visits were matched (Fig 1). Prior visits for various pain categories were also more common among control patients than overdose patients (e.g. odds ratio for "back pain": 0.78). Terms associated with drug use (e.g. "detox" odds ratio: 2.66) and mental health concerns (e.g. "psychological" odds ratio: 4.28) were most consistently overrepresented in the history of overdose patients (Table 1). Terms associated with chronic disease were most overrepresented in the history of control patients (Table 2). The best predictive model achieved a sensitivity of 57% and a specificity of 86% on test data (Fig 2). **Conclusions:** While a history of more overall ED visits and more ED visits related to pain were not associated with overdose ED visits, vocabulary of prior ED visits did predict future overdose ED visits. Performance of predictive models exceeded expectations, given the relative scarcity of overdoses among ED visits and the simplicity of chief complaints used for prediction. The correlation between past and future overdose visits highlights the need for targeted intervention to break addiction cycles.

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# Roles of Health Literacy in Relation to Social Determinants of Health and Recommendations for Informatics-Based Interventions: Systematic Review

## Abstract

**Objective:** This study examined the epidemiology of scarlet fever in Hong Kong based on notifiable disease surveillance data, in a period where a 10-fold upsurge in scarlet fever incidence occurred. High risk groups and important factors associated with scarlet fever transmission were identified. **Introduction:** Scarlet fever is a notifiable disease in Hong Kong for over 40 years. There was relatively low activity of scarlet fever until an outbreak in mid-2011 which resulted in two deaths and more than 1,500 cases. Scarlet fever incidence remained elevated since then with >10-fold increase comparing to that before the upsurge (1, 2). Reemergence of scarlet fever was also reported in China in 2011 and the United Kingdom in 2014 (3). We analyzed the patterns in scarlet fever incidence in Hong Kong using the notifiable disease surveillance data from 2005–2015. **Methods:** We analyzed 7,266 scarlet fever cases aged 14y or younger from 2005-2015, who were notified to the Department of Health. Hierarchical multivariable negative binomial models were fitted to the data to study the effects of age, sex, school holidays, and other meteorological parameters, accounting for autocorrelation, seasonal and long-term trend. Separate models were fitted to the data before and after the upsurge in 2011, excluding data in 2011 to allow for a 1-year window period. **Results:** We observed seasonal pattern throughout the study period (Figure). Among children aged ≤5y, the average scarlet fever incidence was 3.3 per 10,000 children in 2005-2010, which increased substantially to 18.1 per 10,000 children in 2012-2015. The final model included age, sex, school holidays in the preceding week, temperature, relative humidity, rainfall, long-term and bimodal seasonal trend. Based on the model, we identified no significant long-term trend before the upsurge in 2011, but there was a mild decreasing trend of about 8% (95% CI=6-11%) per year after the upsurge. A major peak was identified in December to January, with a milder peak in May to June. We found that the most affected groups were kindergarten students (3-5y), followed by primary school students (6-11y). Comparing to girls aged 0-2y, boys had significantly higher risk than girls except for the 0-2y age group, and boys aged 3-5y had the highest risk (adjusted incidence rate ratio (IRR)=1.47, 95% CI=1.32-1.65). School holidays were significantly associated with lower incidence of scarlet fever, with an adjusted IRR of 0.58 (95% CI=0.51–0.65) after the upsurge in 2011. Temperature was found to be negatively associated with scarlet fever incidence (adjusted IRR=0.963, 95% CI=0.940-0.987) after the upsurge. **Conclusions:** Our study showed that elevated activity of scarlet fever was sustained for more than 5 years after the upsurge in 2011. We found that younger children who started schools, especially for boys aged 3-5 years, had a higher risk of scarlet fever, and there was significant effect of school holidays in reducing scarlet fever incidence. Combining these findings, school-based control strategy is likely to be effective. Sustained and consistent surveillance of scarlet fever allows continued monitoring of potential change in high risk group to drive updated and effective control strategy.

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# Roles of Health Literacy in Relation to Social Determinants of Health and Recommendations for Informatics-Based Interventions: Systematic Review

## Abstract

**Objective** To better understand the barriers and facilitators to reporting and assessing what improvements would increase participation. **Introduction** Traditional surveillance methods have a major challenge to estimating the burden of disease due to underreporting [1]. Participatory surveillance techniques can help supplement to monitor and detect foodborne outbreaks while reducing the impact of underreporting [2]. As there is a low participation rate in Singapore, this study aims to better understand the barriers and facilitators to reporting and assesses what improvements can increase participation. **Methods** A total of 14 individuals participated in the study; 8 had informed health authorities of a possible foodborne outbreak while 6 patients were diagnosed with gastroenteritis at general practitioner (GP) clinics but did not report their illness to health authorities. We examined the barriers and facilitators to reporting foodborne illnesses to health authorities through semi-structured in-depth interviews and thematic analysis. **Results** The median age of participants was 28 (Interquartile Range = 23-37). The majority were Singaporeans and had or were pursuing university qualifications. The combination of perceived severity of illness and degree of certainty of the cause of illness are key reasons that are both barrier and facilitator to reporting foodborne illness to the authorities. The informants expected government intervention and hoped that their actions would prevent others from being affected as well. However, reporting to health authorities was usually delayed by the participants' severity of illness. Those who did not report were unaware of reporting channels and were concerned their actions would negatively affect food establishments. Participants also shared what they would like to see in a reporting system. Firstly, contact information should be easily accessible with a user-friendly system. Secondly, a human touch and live acknowledgement was desirable when reporting the issue instead of being met with recorded voice machine messages. This would also reduce the number of subsequent follow up calls from the authorities to gather information. **Conclusions** It is crucial for the public to be informed of easily accessible and user-friendly avenues to report foodborne incidences to the authorities. Being able to communicate directly to relevant authorities immediately would help relay issues with the assurance that the matter would be looked into and acted upon. In trying to understand the barriers and facilitators to reporting, the study hopes to see a higher motivation of the public to report, so that necessary actions can be taken to reduce foodborne incidences. **References** 1. Fletcher SM, Lewis-Fuller E, Williams H, et al. Magnitude, distribution, and estimated level of underreporting of acute gastroenteritis in Jamaica. *J Heal Popul Nutr.* 2013;31(4 SUPPL.1):69-80. <http://www.ncbi.nlm.nih.gov/pubmed/24992813>. Accessed October 4, 2017. 2. Quade P, Nsoesie EO. A Platform for Crowdsourced Foodborne Illness Surveillance: Description of Users and Reports. *JMIR Public Heal Surveill.* 2017;3(3):e42. doi:10.2196/publichealth.7076.

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# Roles of Health Literacy in Relation to Social Determinants of Health and Recommendations for Informatics-Based Interventions: Systematic Review

## Abstract

**Objective** To describe violent injuries treated in North Carolina (NC) emergency departments (EDs) and compare to deaths reported by the NC Violent Death Reporting System (NC-VDRS). **Introduction** Violence-related injuries are a major source of morbidity and mortality in NC. From 2005-2014, suicide and homicide ranked as NC's 11th and 16th causes of death, respectively. In 2014, there were 1,932 total violent deaths, of which 1,303 were due to suicide (67%), 536 due to homicide (28%), and 93 due to another mechanism of violent injury (5%). These deaths represent a fraction of the total number of violence-related injuries in NC.<sup>1</sup> This study examined ED visit data captured by NC DETECT to identify and describe violent injuries treated in NC EDs and compare/contrast with fatalities reported by NC-VDRS. **Methods** This descriptive epidemiologic study included all NC ED visits made to a 24/7, acute-care, civilian, hospital-affiliated ED from January 1, 2012 – September 30, 2015 reported to NC DETECT with an injury mechanism code indicating a violent injury due to one of the following injury types: self-harm, assault, legal intervention, or unintentional firearm. In addition, ED visits of an undetermined intent were separately examined. Violence-related NC ED visits were classified according to definitions developed by the National Center for Injury Prevention and Control for WISQARS™.<sup>2</sup> Descriptive analyses consisted of counts, percentages, and incidence rates. **Results** From January 1, 2012-September 30, 2015, there were 182,385 violence-related NC ED visits captured by NC DETECT (492.1/100,000 person-years). The most common type of violent injury treated in NC EDs was assault, with 132,550 visits (357.6/100,000 person-years), followed by self-inflicted injury (41,455 visits; 111.8/100,000 person-years), unintentional firearm-related injury (5,940 visits; 15.9/100,000 person-years), and legal intervention (2,440 visits; 6.6/100,000 person-years). Twelve percent of all violence-related NC ED visits were made by children 0-17 years of age (21,876 ED visits). There were an additional 20,867 NC ED visits for injuries of an undetermined intent. Males visited a NC ED for treatment of violent injuries more often than females (550.3 versus 436.2 visits/100,000 person-years, respectively). Young adults 20-24 years of age had the highest rate of violence-related NC ED visits (1,242.9), followed by individuals aged 25-34 (997.4), 15-19 (935.3), 35-44 (635.6) and 45-54 (461.3) (visits/100,000 person-years in parentheses). Among violence-related NC ED visits, the most common mechanism of injury was struck by/against an object or person (35.0%), the most common mode of transport to the ED was private transportation (37.7%), the most common discharge disposition was discharged home from the ED (77.7%), the most common expected source of payment was self-pay (37.5%), and the most common time of visit was the evening hours of 6-11 PM (33.6%). Violence-related ED visits differed from violence-related deaths reported by the NC-VDRS. On average, there were 25 times more annual violence-related ED visits than deaths. Table 1 displays the average annual number of violence-related ED visits and deaths stratified by type of violent injury. The proportion of ED visits due to assault was greater than the proportion of deaths due to homicide, while the proportion of injuries/deaths attributable to self-inflicted injury/suicide was higher among fatalities. A comparison of the self-inflicted injury and suicide data shows that women have a higher rate of ED visits for self-harm while men have a higher rate of suicide (data not shown). **Conclusions** Violence-related injuries are a common source of morbidity and mortality in NC. The annual number of violence-related ED visits exceeds the number of violence-related deaths, 25 to 1. Because there are important differences between violent injury leading to ED visits and fatalities, comparing NC DETECT surveillance with NC-VDRS fatality data expands our understanding of violent injury in NC and better informs prevention efforts. **References** 1. Injury and Violence Prevention Branch (IVPB). North Carolina Violent Death Reporting System Annual Report 2014. Raleigh: NC. IVPB, NC DPH, NC DHHS, 2017. Available at: [www.injuryfreenc.ncdhhs.gov/DataSurveillance/VDRS/2014-NC-VDRS-AnnualReport-Final.pdf](http://www.injuryfreenc.ncdhhs.gov/DataSurveillance/VDRS/2014-NC-VDRS-AnnualReport-Final.pdf). 2. National Center for Injury Prevention and Control (NCIPC). Definitions of Web-based Injury Statistics Query and Reporting System (WISQARS™) Nonfatal website. NCIPC, CDC. [www.cdc.gov/ncipc/wisqars/nonfatal/definitions.htm](http://www.cdc.gov/ncipc/wisqars/nonfatal/definitions.htm). Last updated March 21, 2007. Accessed June 21, 2017.

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# Roles of Health Literacy in Relation to Social Determinants of Health and Recommendations for Informatics-Based Interventions: Systematic Review

## Abstract

**Objective** We reviewed measles specific Integrated Disease Surveillance and Response (IDSR) data from Nigeria over a five-year period to highlight its burden and trends, and make recommendations for improvements. **Introduction** Measles is a vaccine preventable, highly transmissible viral infection that affects mostly under-five year children. The disease is caused by a Morbillivirus; member of the Paramyxovirus family. **Methods** We conducted a secondary data analysis of measles specific IDSR records of all States in Nigeria from January 2012 to September 2016. The record had reported measles cases with laboratory outcomes from all the States. IDSR weekly epidemiological data were obtained from Surveillance Unit, Nigerian Centre for Disease Control (NCDC). **Results** A total of 131,732 cases were recorded within the period. Highest number of cases 57,892(43.95%) were recorded in 2013 while the least number of cases 11,061(8.4%) were recorded in 2012. A total of 817 deaths were recorded, given a case fatality rate (CFR) of 0.62%. The CFR showed a decreasing trend over the years with the highest CFR (1.43%) recorded in 2012 and the least CFR (0.44%) recorded in 2016. Only 8,916 (6.7%) cases were confirmed by laboratory investigation. The Northwest region recorded the highest attack rate (AR) of 149.7 cases per 100,000 population, followed by the Northeast region with 140.2 cases per 100,000 population, while the South-south region recorded the least AR of 15.8 cases per 100,000 population. Case Fatality Rate per region followed similar pattern, with the Northcentral region having the highest CFR of 4.38%. The trend of measles cases followed the same pattern. Cases peaked at March, then gradually reduced to lowest level at June. **Conclusions** Measles infection remains a burden especially in the northern region of Nigeria. Though measles fatalities were on decline over the years, laboratory diagnosis of cases has been suboptimal. We recommended improvement on routine immunization and measles case management, and strengthening of regional laboratories capacity for measles diagnosis. **References** 1. WHO | Measles. WHO [Internet]. World Health Organization; 2017 [cited 2017 Apr 10]; Available from: <http://www.who.int/mediacentre/factsheets/fs286/en/> 2. Akande TM. A review of measles vaccine failure in developing countries. Niger. Med. Pract. SAME Ventures; 2007;52:112–6. 3. Ibrahim BS, Gana GJ, Mohammed Y, Bajoga UA, Olufemi AA, Umar AS, et al. Outbreak of measles in Sokoto State North-Western Nigeria, three months after a supplementary immunization campaign: An investigation report 2016. Australas. Med. J. AUSTRALASIAN MEDICAL JOURNAL PTY LTD HILLARYS, GPO BOX 367, PERTH, WA 6923, AUSTRALIA; 2016;9:324–35.

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## Abstract

**Objective** The Oregon Child Absenteeism due to Respiratory Disease Study (ORCHARDS) was implemented to assess the relationships between cause-specific absenteeism within a school district and medically attended influenza visits within the same community. Introduction Transmission and amplification of influenza within schools has been purported as a driving mechanism for subsequent outbreaks in surrounding communities. However, the number of studies assessing the utility of monitoring school absenteeism as an indicator of influenza in the community is limited. ORCHARDS was initiated to evaluate the relationships between all-cause (a-Tot), illness-related (a-I), and influenza-like illness (ILI)-related absenteeism (a-ILI) within a school district and medically attended influenza A or B visits within the same community. **Methods** ORCHARDS was based at the Oregon School District (OSD), which enrolls 3,640 students at six schools in south-central Wisconsin. Parents reported influenza-like symptoms on an existing phone-based absenteeism reporting system. Attendance staff identified ILI using a simple case definition. Absenteeism was logged into the OSD's existing electronic information system (Infinite Campus), and an automated process extracted counts of a-Tot, a-I, and a-ILI each school day from 9/02/14 through 6/08/17. Parents of students with acute respiratory infections (ARI) were invited to contact study staff who assessed the students' eligibility for the study based on presence of ILI symptoms. From 1/05/15 through 6/08/17, data and nasal swabs were collected from eligible OSD students whose parents volunteered to have a study home visit within 7 days of ILI onset. Specimens were tested for influenza A and B at the Wisconsin State Laboratory of Hygiene using the CDC Human Influenza Virus Real-time RT-PCR Diagnostic Panel. For community influenza, we used data from the Wisconsin Influenza Incidence Surveillance Project (WIISP) that monitors medically attended influenza using RT-PCR at five primary care clinics surrounding the OSD. **Data analysis:** Over-dispersed Poisson generalized additive log-linear regression models were fit to the daily number of medically attended influenza cases and daily absenteeism counts from three sources (a-Tot, a-I, and a-ILI) with year and season (calendar day within year) as smooth functions (thin plate regression splines). Two subgroups of a-ILI representing kindergarten through 4th grade (K-4) and 5th-12th grade (5-12) were also evaluated. **Results** During the study period, 168,859 total absentee days (8.57% of student days), 36,104 illness days (1.83%), and 4,232 ILI days (0.21%) were recorded. Home visits were completed on 700 children [mean age = 10.0 ± 3.5 (sd) years]. Influenza RT-PCR results were available for 695 (99.3%) children: influenza A was identified in 54 (13.3%) and influenza B in 51 (12.6%) specimens. There were one large and early outbreak of influenza A (H3N2) followed by B in 2014/15, an extremely late combined outbreak of influenza A (H1N1) and B in 2015/16, and a combined outbreak of influenza A/(H3N2) and B in 2016/17. PCR detection of influenza A or B, as compared to no influenza, was strongly associated with a child with a-ILI-positive status (OR=4.74; 95% CI: 2.78-8.18; P<0.001). Nearly 2,400 medically attended ARI visits were reported during the study period. Of these, 514 patients were positive for influenza (21.5%): 371 (15.5%) influenza A and 143 (6.0%) influenza B. The temporal patterns of medically attended influenza were very similar to influenza cases in OSD students. Comparisons of the regression models demonstrated the highest correlation between absenteeism and medically attended influenza for 5th-12th grade students absent with ILI with a -1 day time lag and for all students with a-ILI with a -1 day lag (Table); a-I also had moderate correlation with a -15 day lag period. **Conclusions** Cause-specific absenteeism measures (a-I and a-ILI) are moderately correlated with medically attended influenza in the community and are better predictors than all-cause absenteeism. In addition, a-I preceded community influenza cases by 15 days. The monitoring system was easily implemented: a-I surveillance was fully automated and a-ILI required only minor review by attendance staff. The resulting correlations were likely lowered by the presence of other viruses that resulted in a-ILI (e.g., adenovirus) and by breaks in the school year during which absenteeism data did not accrue. Automated systems that report cause-specific absenteeism data may provide a reliable method for the early identification of influenza outbreaks in communities. From a preparedness perspective, 15-day advance warning is significant. The addition of a laboratory component could increase usefulness of the cause-specific student absenteeism monitoring as an early-warning system during influenza pandemics.

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## Abstract

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**Objective** The Outbreak Observatory (OO) aims to: ●Strengthen outbreak/epidemic preparedness and response activities through real-time, one-the-ground observations and analyses ●Identify best practices based on operational experience that are broadly applicable across outbreak response agencies ●Serve as an independent voice to advocate for policies that support preparedness and response activities based on expert assessment of the resources required to build and maintain necessary outbreak response capabilities ●Support local practitioners' efforts to publish their experiences Sharing the firsthand experience of responders is critical for building outbreak preparedness and response capacity, and OO will serve as a dedicated mechanism to collect, analyze and disseminate this information

**Introduction** Each significant outbreak and epidemic raises questions that must be answered in order to better inform future preparedness and response efforts, such as: ●What are the systems and resources needed to characterize an outbreak? ●What systems and resources are needed to bring an outbreak to a close? While we can anticipate these types of questions, the absence of dedicated mechanisms to record operational experiences and challenges can result in valuable, ephemeral data that are crucial for improving outbreak response not being consistently collected or analyzed. Participation in outbreaks by external experts can be instrumental in ensuring that this important operational information is documented, analyzed and shared with the broader public health community. There is a particular need for observers external to the response who can capture and analyze applied data about the operational response to outbreaks—eg, the systems and strategies involved in responding to the such events—in order to improve our understanding of best practices for detecting and responding to these events. These can then be shared so that the entire public health community can access and incorporate lessons learned into their own preparedness and response plans. External observers can also help describe the important work performed by local responders during outbreaks and advocate for necessary preparedness and response program resources. The Outbreak Observatory is currently in a pilot phase and is looking for international and US partners who may be interested in collaborating with members of our team during their next outbreak response.

**Methods** When an outbreak occurs, OO will reach out to our partners to assess their interest in having project team member(s) travel to their location to observe the ongoing outbreak for the purpose of collaborating on a joint analysis of the response. The team member(s) would engage with local officials to identify operational challenges and best practices to better understand their perspectives and experiences. Prior to the OO team's arrival, they will provide local responders a list of sample questions that the team is interested in exploring for the purpose of potential future written analysis, with the goal of focusing on those questions that are most relevant to both the local and broader public health communities. Once a preliminary list of study questions is developed, team members will engage with local responders to discuss their experiences. Once on location, the OO team member(s) will regularly report their findings back to the Project Director. The OO team will work with the Project Director and local partners to compose and submit the findings to a peer-reviewed journal, ensuring that local practitioners receive appropriate authorship credit.

**Results** OO aims to fill gaps in existing health security literature by sharing the experiences of practitioners involved in outbreak responses and co-authoring peer-reviewed publications with those responders. We envision that these publications will be available more quickly than existing outbreak reports. We will disseminate our findings to pertinent policymakers, members of the broader biosecurity and public health communities and the public to ensure that important lessons reach all appropriate audiences, especially those responsible for planning and resource allocation decisions for outbreak and epidemic response. In support of this, we have created a communication platform ([www.outbreakobservatory.org](http://www.outbreakobservatory.org)) to publish interim observations via rapid communication channels (eg, communications with policymakers, social media, blog posts, video logs). All publications will be developed in partnership with local practitioners.

**Conclusions** The lessons learned from previous epidemic and outbreak responses are critical to informing future response efforts. However, this data is often lost in the midst of an outbreak, when responders are too busy with the situation at hand to collect and analyze operational data. Outbreak Observatory endeavors to bridge this research gap, helping to capture and analyze this data and making it available to the broader public health community.

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## Abstract

**Objective** To determine if social media data can be used as a surveillance tool for influenza at the local level. **Introduction** The use of social media as a syndromic sentinel for diseases is an emerging field of growing relevance as the public begins to share more online, particularly in the area of influenza. Several applications have been developed to predict or monitor influenza activity using publicly posted or self-reported online data; however, few have prioritized accuracy at the local level. In 2016, the Cook County Department of Public Health (CCDPH) collected localized Twitter information to evaluate its utility as a potential influenza sentinel data source. Tweets from MMWR week 40 through MMWR week 20 indicating influenza-like illness (ILI) in our jurisdiction were collected and analyzed for correlation with traditional surveillance indicators. Social media has the potential to join other sentinels, such as emergency room and outpatient provider data, to create a more accurate and complete picture of influenza in Cook County. **Methods** We developed a JAVA program which included a customized geofence around suburban Cook County to collect tweets from Twitter's STREAM application programming interface (API) (available at <https://github.com/FoodSafeCookCo/TwitterStream-Program>). The JAVA program looked for tweets within the geofence or for tweets with a profile location naming a suburban Cook County municipality and copied them to a text file if the tweet contained "flu" or "influenza". Captured data included the user's Twitter handle, Tweet text, Tweet time and date, x and y coordinates (if available), and profile location. Tweets were then manually reviewed to determine if they met the following criteria: 1) language indicated the user was recently ill with influenza; 2) user appeared to reside in CCDPH jurisdiction. Tweets meeting these criteria were included in the analysis. Tweets were aggregated by MMWR week and analyzed for correlation, using Pearson methods (data were normal), with two traditional surveillance sources: 1) the percent of visits to all suburban Cook County emergency departments for ILI as reported to the Cook County Electronic Surveillance System for the Early Notification of Community-based Epidemics (ESSENCE), and 2) the percent of laboratory specimens testing positive for influenza at seven local sentinel laboratories. **Analysis** was performed in Excel 2013 and SAS 9.4. **Results** From MMWR week 40-20, 113 tweets indicating influenza-like illness were collected within Cook County's jurisdiction. Due to technical issues with the program, data were not collected for weeks 52, 2, and 17-19. Correlations were compared for the percent of laboratory specimens testing positive for influenza (LSL) and percent of visits to emergency departments for ILI (EDILI) to the total number of tweets per MMWR week. A strong correlation exists between LSL and EDILI  $r=0.92$  ( $p\text{-value}\leq 0.0001$ ) indicating the traditional sentinels have a strong positive relationship. The correlation between number of tweets and LSL was 0.46 ( $p\text{-value}=0.0138$ ), indicating a moderate positive relationship. Correlation between number of tweets and EDILI was similarly moderate,  $r=0.52$  ( $p\text{-value}=0.0049$ ). Correlations to EDILI stratified by age (0-4, 5-17, 18-64, 65+) also showed a moderate positive relationship (range 0.50 to 0.55, all  $p\text{-values}\leq 0.01$ ). Twitter use peaked one week before the recorded peak of other surveillance indicators. When Twitter counts were shifted one week to align the peak in tweets with the peak of the influenza season, the correlations were 0.54 for LSL and 0.61 for EDILI ( $p\text{-value}=0.0034$  and 0.0007, respectively). **Conclusions** Overall, the tweets collected had a moderately positive relationship with the severity of influenza activity in Cook County. When the data were transitioned to match peaks, there was an increase in the correlations' strength for both LSL and EDILI. This data indicates that publicly shared social media data may be an underutilized source of syndromic data at the local level, potentially capable of predicting seasonal influenza peaks before traditional data sources. Other jurisdictions may consider using the open source program created by CCDPH to determine the relationship of influenza related social media to their own local influenza surveillance data. For the 2017-2018 influenza season, we established a redundant system for tweet collection in case one of the systems goes down. Exploring machine learning (in place of manual review) to detect tweets indicating illness is also a promising avenue to simplify data collection and cleaning. Data will be collected using the same system for the 2017-2018 influenza season and correlations re-evaluated with more complete data.

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## Abstract

**Objective** Describe cross-jurisdictional data sharing practices using ESSENCE and facilitated by the BioSense Platform for a national mass gathering event, and the dashboard views created to enhance local data for greater situational awareness. **Introduction** In 2016, the BioSense Platform for national syndromic surveillance made substantial enhancements including data processing changes, a national ESSENCE instance, and management tools to support diverse data sharing needs. On August 21, 2017, a total solar eclipse occurred over much of the United States. The event resulted in large gatherings over multiple days to areas in the Path of Totality (PoT). In the days leading up to the event, public health and emergency preparedness included syndromic surveillance in their monitoring plans. To support this effort, Illinois (IL), Kentucky (KY), and Tennessee (TN) established inter-jurisdictional aggregate data sharing to get a more inclusive view of cause-specific illness or injury in Emergency Department (ED) visits before, during, and after the eclipse. **Methods** Following best practices outlined by colleagues at Oregon Health Authority, in their July 2017 guidelines “Using ESSENCE for Mass Gathering Surveillance”, the tristate collaboration between IL, KY, and TN provided participating state-level epidemiologists access to aggregate data in all three states. Dashboards for each state were created to include hospital ED visits in counties that fell in the PoT and shared to view trends in syndromes such as gastrointestinal illness (GI), Influenza-like Illness, heat-related illness (HRI), and substance abuse. Counts from event-specific keyword queries related to the eclipse were also shared. **Results** Shared dashboards included data from 64 facilities (31 IL, 10 KY, and 23 TN) and monitoring was performed from August 16 – August 23. During the monitoring period, 41,507 ED visits were reported from the shared facilities (10,610 IL; 7,740 KY; 23,157 TN). Out of state residents accounted between 3% to 8.6% of reported visits. There was a sharp increase in ED visits referencing the eclipse across all three states during the monitoring period. A total of 71 visits were identified as eclipse-related (19 IL, 44 KY, and 8 TN). KY requested one hospital to identify patient encounters related to the eclipse by including the term “eclipse” in the patient chief complaint, IL and TN did not. Minor fluctuations in syndrome trends were observed across all three states. **Conclusions** Mass gatherings may cause a sudden increase of healthcare resource utilization in the municipalities where they occur. In IL and KY, the PoT occurred over a rural part of each state, whereas in TN the path went through a major metropolitan area. ED coverage and completeness varied across all three states. Expanded data access and visualization of syndromes in nearby states allowed IL, KY, and TN to enhance their surveillance efforts and verify observed syndromic trends across jurisdictional boundaries. The ESSENCE instance in the BioSense platform fostered a collaborative environment that quickly enabled the sharing of limited data across multiple jurisdictions during the August 21, 2017 total solar eclipse.

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## Abstract

**Objective** Our goal is to develop deployable strategies for infectious disease diagnosis at the point-of-care that are applicable to multiple hosts of infection - conforming to the global One Health Strategy for diagnostics. We aim to develop methods that do not require prior knowledge of the pathogen in question, and can facilitate rapid and effective decision-making and situational awareness. **Introduction** There is an urgent need for diagnostic strategies for infections which are host-independent, so as to effectively track zoonotic spread, monitor animal carriers of pathogens, and evaluate transmission dynamics. Infection of a host - pathogen or human- by an animal results in recognition by the immune response, which consequently causes release of inflammatory mediators. Many scientists have explored the use of cytokines as diagnostic indicators of disease, but the conserved nature of the immune response in humans and animals results in cross-reactivity among many pathogens, making evaluation of the results difficult, especially in high disease burden populations. Measuring the pathogen-specific signature, however, is advantageous - as it offers discrete identification of active infection, and discrimination from exposure. It also offers a universal strategy that can be applied to human and animal hosts of infection - allowing for One Health Biosurveillance. Achieving this, however, requires the development of a) tailored strategies for the measurement of biochemically disparate pathogen signatures in clinical samples and b) ultra-sensitive detection of such signatures in the host. The sensor team at Los Alamos National Laboratory is working on both of these aspects, and the development of One Health Diagnostic platforms, the focus of the work presented here. **Methods** Many of the biomarkers secreted by bacterial pathogens and recognized by innate immune receptors elicit host cytokine responses that are amphiphilic (largely glycolipids, lipoproteins or lipoglycans). Based on such, our team has developed tailored methods - membrane insertion and lipoprotein capture for the capture and detection of these greasy and stealthy molecules in infected blood. Sensitivity and specificity, assay optimization, alinearity associated with lipidic molecules and assay parameter development for biomarkers associated with bacterial pathogens will be presented. Considerations for clinical sampling for amphiphile detection in blood, and clinical study design will be demonstrated. Our team has developed an ultra-sensitive biosensor for detection of biomarkers in complex matrices based on the evanescent field properties of single mode planar optical waveguides. Detection of amphiphilic biomarkers in clinical samples, using the waveguide-based biosensor and tailored methods for the detection of such molecules has allowed for the diagnosis of infection in both human and animals hosts. Herein, we present two examples of the same; 1) diagnosis of tuberculosis in humans, cattle and badgers using pathogen-based diagnostic strategies; and 2) detection of Gram-negative Lipopolysaccharides in beef and in patients with Salmonella-induced sepsis. **Results** We have developed tailored ultra-sensitive waveguide-biosensor assays for the detection of Lipoarabinomannan (and other biomarkers) from Mycobacteria and demonstrated feasibility in blinded clinical studies in humans and cattle, demonstrating one-health compatibility. We have also demonstrated detection of lipopolysaccharides from eight different serotypes of Shiga-toxin carrying E. coli in beef, and Salmonella Typhimurium in pediatric patients using the same approach. **Conclusions** We have demonstrated clinical feasibility of a One Health Strategy for point-of-care diagnostics of bacterial infections in blood for tuberculosis and Gram-negative pathogens in clinical samples. The results will be demonstrated with several discussion points on the consideration of unconventional biochemistry of pathogens for diagnostics, factors influencing point-of-care deployment and integration of diagnostic platforms for biosurveillance. One Health Considerations and challenges therein will also merit discussion. **References** Sakamuri, R; et al. Accurate Tracking of Bovine Tuberculosis Biomarkers in Infected Cattle using a Novel Biomarker Capture Strategy, *Analytical Sciences*, 33(4): 457-460, 2017. Noormohammed A et al. 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# Roles of Health Literacy in Relation to Social Determinants of Health and Recommendations for Informatics-Based Interventions: Systematic Review

## Abstract

**Objective** Identify surveillance priorities for emergency department (ED) and Oregon Poison Center (OPC) data ahead of the 2017 Great American Solar Eclipse gatherings in Oregon and create a suite of queries for use in the Health Intelligence Section of the Oregon Public Health Division (OPHD) Incident Management Team (IMT). **Introduction** Oregon's statewide syndromic surveillance system (Oregon ESSENCE) has been operational since 2012. Non-federal emergency department data (and several of their associated urgent care centers) are the primary source for the system, although other data sources have been added, including de-identified call data from OPC in 2016 (1). OPHD epidemiologists have experience monitoring mass gatherings (2) and have a strong relationship with OPC, collaborating on a regular basis for routine and heightened public health surveillance. Nevertheless, surveillance for the Great American Solar Eclipse (August 2017) presented a challenge due to the 107 reported simultaneous statewide eclipse-watching events planned for the day of the eclipse (some with estimated attendance of greater than 30,000 people and most in rural or frontier regions of the state). Scientific literature is limited on mass gathering surveillance in the developed world (3), particularly in rural settings (4), so OPC and OPHD worked together to develop a list of health conditions of interest, including some that would warrant both an ED visit and a call to OPC (e.g., snake bites). Monitoring visits in both data sources would allow for assessment of total burden on the healthcare system, especially in the case of snake bites where only specific bites require administration of anti-venom. **Methods** Ahead of the planned mass gatherings, OPHD Health Intelligence and OPC compiled a list of expected risks from the literature (4,5) and input from members of the IMT including the Public Information Officer, who monitored media for stories about health. Priority health conditions presented a clear risk to public health (e.g., limited supply of snake anti-venom warranted surveillance of snake bites) or were the subject of substantial media coverage. Query development focused on risks that had specific, well-defined health effects and that would be captured by syndromic ED and OPC data. During an enhanced surveillance period (8/18-8/24), OPHD Health Intelligence reviewed and interpreted trends in common queries with OPC and disseminated a daily statewide surveillance report. **Results** OPHD and OPC created four new queries for both ED and OPC data streams: snake bites, psychedelic mushrooms, 2nd and 3rd degree body burns and eye-related calls and visits. ED queries used chief complaint, discharge diagnosis, or triage note. OPC queries used generic code, therapy and clinical effect. From 8/18-8/22, OPHD Health Intelligence distributed daily surveillance reports to the OPHD IMT and external partners. An increase in eye-related injuries was identified on the day after the eclipse, prompting OPHD Health Intelligence to consult with OPC. ED surveillance data indicated that the increase in eye-related visits was likely a seasonal trend. OPC staff reviewed the charts of patient calls captured by the query and concluded the calls were not related to retinal issues from looking at the sun. No other trends were noted in the joint OPHD/OPC queries. **Conclusions** OPHD Health Intelligence piloted four new queries for surveillance during this mass gathering event and exercised the process for disseminating trend information from OPC and ED data. The eclipse event was fairly quiet and very few trends of note were captured by surveillance. Prior to this event, OPC data had not been a part of the Health Intelligence surveillance plan. However, assessing trends in OPC data provides an opportunity to better understand trends seen in ED data (e.g., whether or not a surge in ED visits for snake bites is accompanied by a surge in OPC calls for anti-venom is meaningful). By building a process to review disparate data in tandem, OPHD and OPC strengthened regional surveillance for this event. Applicable queries will continue to be used for planned event surveillance and several additional queries are currently under development. **References** 1. Laing R, Powell M. Integrating Poison Center Data into Oregon ESSENCE using a Low-Cost Solution. 2017;9(1):2579. 2. Jagger MA, Jaramillo S, Boyd L, Johnson B, Reed KR, Powell M. Mass Gathering Surveillance : New ESSENCE Report and Collaboration Win Gold in OR. 2017;9(1):2579. 3. Steffen R, Bouchama A, Johansson A, Dvorak J, Isla N, Smallwood C, et al. Non-communicable health risks during mass gatherings. *Lancet Infect Dis*. 2012;12(2):142–9. 4. Polkinghorne BG, Massey PD, Durrheim DN, Byrnes T, MacIntyre CR. Prevention and surveillance of public health risks during extended mass gatherings in rural areas: The experience of the Tamworth Country Music Festival, Australia. *Public Health [Internet]*. 2013;127(1):32–8. Available from: <http://dx.doi.org/10.1016/j.puhe.2012.09.014> 5. 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# Roles of Health Literacy in Relation to Social Determinants of Health and Recommendations for Informatics-Based Interventions: Systematic Review

## Abstract

**Objective** To describe the differences in patient populations between those who seek care for heat exposure during the work week and those who seek care during the weekend. **Introduction** As global temperatures increase, so too does interest in the effect of climate change on the population's health. 2016 represented the hottest year on record globally and well above the 20th century average in Virginia.<sup>1,2</sup> With large-scale climate change comes an increase in severe weather patterns, including heat waves.<sup>3</sup> Heat waves can have immense health impacts on a community, including heat stroke, heat exhaustion, and dehydration. Previous analyses of emergency department (ED) data indicate that certain populations – specifically males and rural residents – are more at risk for heat-related illness.<sup>4,5</sup> None of these studies, however, looked for temporal relationships between the population seeking care and the day of the week. Syndromic surveillance data can be used to further describe those communities affected by heat exposure as well as identify any temporal patterns in visits. **Methods** The Virginia Department of Health (VDH) receives data from 148 EDs and urgent care centers (UCCs) as part of its syndromic surveillance program. During regular surveillance of a heat wave, it was observed that males made up a larger proportion of heat-related visits during the week than they did over the weekend. Data received on visits between January 1, 2015 and July 31, 2017 were used for a retrospective, cross-sectional analysis of demographic risk factors for heat-related illness. During this time frame, 6,739 visits were identified using the September 2016 Council for State and Territorial Epidemiologists (CSTE) syndrome definition for heat-related illness.<sup>6</sup> The effect of various demographics and visit factors on weekday heat exposure was measured using chi-squared tests. The variables in question included sex, race, ethnicity, rural vs. urban residence, and age group. Odds ratios, 95% confidence intervals, and p-values were reported for these analyses. Analyses were conducted using SAS 9.3 with a significance level of 0.05. **Results** Of the total 6,739 visits identified for heat-related illness, 4,782 (71.0%) occurred during the work week and 1,957 (29.0%) occurred on the weekend. The odds of seeking care for heat-related illness on a weekday were 1.84 times higher for males than for females,  $p < 0.001$ , 95% CI [1.65, 2.06]. Blacks or African Americans were more likely to seek care than whites during the work week with an odds ratio of 1.38,  $p < 0.001$ , 95% CI [1.20, 1.57]. Adults aged 18-64 years were more likely to seek care during the work week than both children aged 0-17 years (OR = 1.61,  $p < 0.001$ , 95% CI [1.37, 1.89]) and adults aged 65 years or older (OR = 1.36,  $p < 0.001$ , 95% CI [1.17, 1.58]). No significant relationship between ethnicity or rural vs. urban residence and work week visits for heat-related illness was observed. **Conclusions** The patient population that seeks care for heat-related illness differs between the work week and the weekend. These data suggest the presence of potential mediators or confounders that make males, blacks or African Americans, and adults aged 18-64 more likely to suffer from heat-related illness during the week. Collecting data on patients' health behaviors, risk factors, and occupation could further elucidate this relationship. Syndromic surveillance, however, does not include the level of detail needed to investigate anything beyond basic demographics. With an increase in the intensity and frequency of heat waves on the horizon, the issue of heat-related illness is one of growing public health concern. Syndromic surveillance data can be used to describe patterns in the patient population most at risk. Public health action is then needed to protect these communities while further research explores the relationships in greater depth. **References** 1 Nuccitelli, D. (2017, July 31). 2017 is so far the second-hottest year on record thanks to global warming. *The Guardian*. Retrieved from <http://bit.ly/2vkPZpg> 2 Boyer, J. (2017, January 18). 2016 was the planet's warmest year in modern records, but it wasn't for Richmond or even Va. *Richmond Times-Dispatch*. Retrieved from <http://bit.ly/2jptCKg> 3 Duffy, P. B. (2012, January 21). Increasing prevalence of extreme summer temperatures in the U.S. *Climate Change*, 111(2), 487-495. <https://doi.org/10.1007/s10584-012-0396-6> 4 Hess, J. J., Saha, S., & Lubber, G. (2014 November). Summertime Acute Heat Illness in U.S. Emergency Departments from 2006 through 2010: Analysis of a Nationally Representative Sample. *Environmental Health Perspectives* 122(11), 1209. <http://dx.doi.org.proxy.library.vcu.edu/10.1289/ehp.1306796> 5 Sanchez, C. 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# Roles of Health Literacy in Relation to Social Determinants of Health and Recommendations for Informatics-Based Interventions: Systematic Review

## Abstract

**Objective** Using a syndromic surveillance system to understand the magnitude and risk factors related to heat-related illness (HRI) in Pinal County, AZ. **Introduction** Extreme heat is a major cause of weather-related morbidity and mortality in the United States (US).<sup>1</sup> HRI is the most frequent cause of environmental exposure-related injury treated in US emergency departments.<sup>2</sup> More than 65,000 emergency room visits occur for acute HRI each summer nationwide.<sup>3</sup> In Arizona, HRI accounts for an estimated 2,000 emergency room patients and 118 deaths each year.<sup>4</sup> As heat-related illness becomes increasingly recognized as a public health issue, local health departments are tasked with building capacity to conduct enhanced surveillance of HRI in order to inform public health preparedness and response efforts. In Pinal County, understanding the magnitude and risk factors of HRI is important for informing prevention efforts as well as developing strategies to respond to extreme heat. **Methods** To gain a better understanding of the magnitude of HRI in Pinal County, historical cases were reviewed from hospital discharge data (HDD) from 2010-2016. Cases were included if the discharge record included any ICD codes consistent with HRI (ICD-9 codes 992 or ICD-10 codes T67 or X30) and if the patient's county of residence was Pinal County. Recent HRI cases during the summer of 2017 were identified using the National Syndromic Surveillance Program BioSense Platform. The ESSENCE syndromic surveillance tool within the BioSense Platform includes data reported by local hospitals. This data can be used to detect abnormal activity for public health investigation. HRI cases were identified in ESSENCE based on ICD-10 codes and chief complaint terms according to a standardized algorithm developed by the Council of State and Territorial Epidemiologists.<sup>1</sup> Both emergency department and admitted patients with a HRI were abstracted from HDD and ESSENCE. To assess HRI risk factors for the summer of 2017, a survey instrument was developed. Survey questions included the nature and location of the HRI incident, potential risk factors, and knowledge and awareness of HRI. Cases were identified in ESSENCE on a weekly basis from May 1, 2017-September 12, 2017, and follow up phone interviews were conducted with eligible cases. For HRI cases eligible for interview, three attempts were made to contact the patient by phone. Cases were excluded if the patient was incarcerated, deceased, or did not have a HRI upon medical record review. An exploratory analysis was performed for the data from HDD, ESSENCE, and interviews. **Results** Pinal County Public Health Services District identified 1,321 HRI cases from 2010-2016, an average of 189 per year. Hospital discharge data suggest HRI cases are more likely to occur in males between the ages of 20-44 years old (27%). It is also notable that a sharp increase in HRI cases is observed each year in mid-to-late June, with an estimated 14% of annual cases occurring during the third week of June. Further analysis of HDD showed 31% of cases received medical treatment in Casa Grande in central Pinal County. Between May 1st and September 12th of 2017, 161 HRI cases were detected using ESSENCE. Of which 149 cases were determined to be HRI; 22 cases did not have contact information, and 4 cases were ineligible due to incarceration or death. A total of 31 HRI cases were interviewed out of the eligible 123 ESSENCE cases (25% response rate). Interview data indicated occupational exposure to extreme heat as a major risk factor for HRI. Additional risk factors reported during interviews included exposure to extreme heat while at home or traveling, although interview results are not representative due to a small sample size (n=31). **Conclusions** Syndromic surveillance combined with interviews and a review of HDD provides an informative approach for monitoring and responding to HRI. Data suggest Pinal County should expect an increase in HRI cases by mid-June each year, typically coinciding with the first National Weather Service Extreme Heat Warning of the season. Preliminary results suggest that cases occur more frequently in working males ages 20-44 years old in occupations that expose workers to extreme heat conditions. Additional information is needed to assess risk factors for HRI among vulnerable populations in Pinal County who were not represented in this study, including individuals who are homeless, undocumented, elderly, or in correctional facilities. Future areas for improvement include improving the phone interview script to include English and Spanish language versions and performing medical record abstractions on all HRI cases. Enhanced syndromic surveillance is recommended to provide information on risk factors for HRI to inform prevention efforts in Pinal County. **References** 1. Heat-Related Illness Syndrome Query: A Guidance Document For Implementing Heat-Related Illness Syndromic Surveillance in Public Health Practice. In: Epidemiologists CoSaT, ed. Vol 1.02016:1-12. 2. Pillai SK, Noe RS, Murphy MW, et al. Heat illness: predictors of hospital admissions among emergency department visits-Georgia, 2002-2008. *J Community Health*. 2014;39(1):90-98. 3. 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## Abstract

**Objective** To describe the use of multiple data sources to monitor overdoses in near real-time in order to evaluate response to the provincial overdose emergency. Introduction On April 14, 2016, British Columbia (BC)'s Provincial Health Officer declared a public health emergency due to a significant increase in drug-related overdoses and deaths in the Province. Despite the declaration, 161 suspected drug overdose deaths were reported across the Province in December 2016, a 137% increase over the number of deaths occurring in the same month of 2015 [1]. In response to the surge overdoses, Vancouver Coastal Health Authority (VCH), one of 5 health regions within BC, rapidly implemented a number of novel harm reduction initiatives. Overdose Prevention Sites (OPS) were opened on December 8, 2016. At these sites, people using illicit drugs are supervised by peers who can provide rapid intervention if an overdose occurs. The Mobile Medical Unit (MMU), a temporary state-of-art medical facility, was deployed on December 13, 2016 to reduce the congestion for the BC Ambulance Service (BCAS) and a major urban emergency department (ED) [2]. Following deployment of the MMU, services were transitioned to a permanent program at the Downtown Eastside Connections Clinic (DTES Connections) in the spring of 2017. DTES Connections was created to provide rapid access to addiction treatment [3]. In order to keep pace with the rapidly increasing number of novel harm reduction initiatives, enhanced surveillance programs were implemented at VCH to monitor and evaluate these innovative harm reduction activities, including development of new surveillance programs for the MMU, OPS and DTES Connections, along with existing routine surveillance system from EDs and a Supervised Injection Site (Insite). **Methods** Since 2011, after a spike of heroin-related deaths was reported in the Vancouver region, VCH started weekly monitoring of overdoses at nine EDs and Insite. Daily data extracts from EDs are automatically transferred to a secure driver by secure file transfer protocols. Groups of ICD 9/10 codes and keywords were refined to identify overdoses from EDs. A formal epidemiological evaluation was conducted to measure the algorithm's accuracy in 2013. A live connection with Insite database was set up in 2011. Overdose events at Insite are clinically determined by clinical staff. Substance injected, characteristics of overdose event and emergency interventions are entered in the database. With the implementation of MMU, OPS and DTES Connections, a series of protocols were developed to monitor visitors' information and overdose events from each site. Demographic information, visit information, clinical presentations and substance used are collected from MMU and DTES Connections. A subset of data fields, including client handle, visit information, substance involved, overdose occurrence, naloxone intervention and ED transfer, are collected from OPS to minimize impact on peers and community partners who run the sites. **Results** Between November 2016 and January 2017, a sharp increase in overdoses was identified from EDs and Insite. Opioids, especially fentanyl and analogs, most likely contributed to the sudden increase. Weeks with government income assistance payment showed an even greater increase in overdoses. Since December 2016, six OPS opened in Vancouver. Four of them are still operating and one received federal approval to become a supervised consumption site. By September 2017, there were 184,760 visits to the OPS. 1,017 overdoses were reversed. A total of 2,798 patients visited the MMU during the whole operation period. 589 (21%) presented from treatment of overdose. The highest number of overdose visits occurred on December 21, 2016 after that month's income assistance payment. Since then, the number of visits fluctuated with most visits driven by non-overdose related reasons. 89% of overdose visits arrived by BCAS and 79% of overdoses needed emergent and urgent care. 108 patients were transferred to DTES Connections by BCAS for treatment of overdoses by September 2017. All patients presented with opioid addiction issues. As of the end of September 2017, no deaths were reported from OPS, MMU and DTES Connections since operations. **Conclusions** As VCH continues responding to the drug overdose emergency in face of increasing drug overdoses, enhanced surveillance data have been widely used by the VCH Emergency Overdose Response Committee for decision making on harm reduction activities, such as expanding operation hours at OPS and Insite on income assistance payment days; examining the impact on EDs of opening the MMU; encouraging users to avoid using alone; opening new supervised injection service and women's only OPS; and referring ED patients with non-fatal overdose to rapid access opioid agonist treatment and outreach follow-up.

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# Roles of Health Literacy in Relation to Social Determinants of Health and Recommendations for Informatics-Based Interventions: Systematic Review

## Abstract

**Objective** This paper presents an investigation using early notification methods to enhancing epidemic detection in syndromic surveillance data from royal Thai army in Thailand. **Introduction** Early Notification Detection Systems have taken a critical role in providing early notice of disease outbreaks. To improve the detection methods for disease outbreaks, many detection methods have been created and implemented. However, there is limited information on the effectively of syndromic surveillance in Thailand. Knowing the performance, strengths and weakness of these surveillance systems in providing early warning for outbreaks will increase disease outbreak detection capacity in Thailand. **Methods** This study describes and compares the capabilities of various outbreak detection algorithms using 37,043 unique syndromic daily reports based on medical information from both civilian and military personnel from the Unit Base Surveillance of Royal Thai Army (RTA) along the Thai-Myanmar and Thai-Cambodia boarder areas. Traditional epidemic detection method: mean plus two SD were compared with algorithms for early notification methods and which included regression, regression/EWMA/Poisson, CDC-C1, CDC-C2 and CDC-C3. Early notification and epidemic detection methods were compared according to their ability to generate alert notifications. Sensitivity, specificity, positive predictive value (PPV), negative predictive value and overall accuracy to detect or predict disease outbreaks were estimated. **Results** This study shows that the preliminary results are promising for epidemic detection by early notification methods in syndromic surveillance in Thailand. The majority of syndromic records were categorized into 12 symptoms. The three most common symptoms were respiratory, fever and gastrointestinal illness (11,501; 9,549 and 4,498 respectively). The results from the early notification systems were analyzed and their performances were compared with traditional epidemic detection method according to their ability to generate early warning alerts for the 3 symptoms. In our study regression/EWMA/Poisson method had higher specificity across the 3 symptoms (94.5%, 94.7% and 95.9% respectively), but generated lower sensitivity (22.6%, 40.4% and 23.1%). CDC-C1, CDC-C2 and CDC-C3 algorithms are easy to understand and are widely used. CDC-C3 had higher sensitivity to detect gradual disease outbreak effects (64.2%, 70.2% and 57.7%), but it is known to produce higher alarm rates/false positive signals. **Conclusions** Within the syndromic surveillance data of RTA, the CDC algorithm is the best chosen to use in the syndromic system due to being easy to understand and implement in a system with high sensitivity. CDC-C2 is the best early notification detection method due to its high sensitivity and PPV. However, CDC-C3 is shows the highest sensitivity, but exhibits the lowest specificity and PPV for all symptoms including a high alarm rates. To be useful, early notification detection methods must have acceptable operating characteristics. Consequently, we should select the most appropriate algorithm method to explain the data well and in order to improve detection of outbreaks. The comparison methods used in this study may be useful for testing other proposed alert threshold methods and may have further applications for other populations and other diseases. **References** 1. Chretien JP, Burkom HS, Sedyaningsih ER, Larasati RP, et al. Syndromic Surveillance: Adapting Innovations to Developing Settings. *PLoS Medicine* 2008; vol 5: page 1-6. 2. Burkom HS, Elbert Y, Magruder SF, Najmi AH, Peter W, Thompson MW. Developments in the roles, features, and evaluation of alerting algorithms for disease outbreak monitoring. *Johns Hopkins APL Technical Digest* 2008; vol 27: page 313.

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# Roles of Health Literacy in Relation to Social Determinants of Health and Recommendations for Informatics-Based Interventions: Systematic Review

## Abstract

**Objective** To demonstrate the demographic and clinical distribution of reported Cryptosporidiosis cases in Houston, Texas, from 2013-2016

**Introduction** Cryptosporidiosis is a diarrheal disease caused by microscopic parasite *Cryptosporidium*. Modes of transmission include eating undercooked food contaminated with the parasite, swallowing something that has come into contact with human or animal feces, or swallowing pool water contaminated with the parasite. The disease is clinically manifested usually with chronic diarrhea and abdominal cramps. It is found to be more prevalent in immunocompromised patients like HIV and AIDS. Cryptosporidiosis usually causes potentially life-threatening disease in people with AIDS.

**Methods** Data were extracted from the Houston Electronic Disease Surveillance System (HEDSS) from January 1, 2013 to December 31, 2016. A total of 170 confirmed cases received during the study period were analyzed and cross checked against national Enhanced HIV/AIDS Reporting System (eHARS) database to examine epidemiological distribution. SAS 9.4 was used to analyze demographics, clinical characteristics as well as transmission factors.

**Results** Approximately, 72% of the cases were males and 28% were females. The 35-44 year old age group (37%) had the highest prevalence. African Americans (49%) and Hispanics (30%) had the highest number of confirmed Cryptosporidiosis cases. 133 of the 170 cases, 78% were previously reported to the eHARS national database as HIV/AIDS cases. Among the cases reported to eHARS, 90% had AIDS. 10% of the reported cases were found to be deceased in eHARS database. Among the 170 reported cases, 30% were hospitalized. Clinical presentations were diarrhea (44%), followed by abdominal cramps (23%), and nausea and vomiting (18%). Most common transmission factors among cryptosporidiosis cases were found to be men who have sex with men (MSM) (34%), followed by heterosexual contact with HIV/AIDS patients (14%), and MSM with Intravenous/Injection drug user (IDU) (5%). Among the reported cases, 70% were receiving ongoing medical services for their HIV/AIDS status.

**Conclusions** Cryptosporidiosis in patients with HIV/AIDS diagnosis is mostly prevalent in males, African American adults and those between 35-44 years of age, with common clinical presentations of diarrhea and abdominal cramps. The prevalence of cryptosporidiosis is found to be more common in AIDS patients. Prevention strategies should be focused on raising awareness among immunocompromised patients with HIV and symptoms of cryptosporidiosis so they get evaluated and treated quickly to prevent conversion to AIDS disease.

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# Roles of Health Literacy in Relation to Social Determinants of Health and Recommendations for Informatics-Based Interventions: Systematic Review

## Abstract

**Objective** This study characterizes the epidemiology of suspected pesticide poisoning in livestock in the United States (U.S.) and Canada using data from calls to the American Society for the Prevention of Cruelty to Animals (ASPCA) Animal Poison Control Center (APCC). **Introduction** Pesticides are used in agriculture and in the home to control pests such as insects, weeds, fungi and rodents. Pesticide poisoning in animals is usually due to misuse or accidental exposure<sup>1</sup>. Information on poisonings in livestock in North America is largely lacking<sup>2</sup>. Examples of hotlines in the U.S. for animal poisoning consultations include the APCC (\$65.00 fee) and the Pet Poison Helpline (PPH) (\$59.00 fee). The APCC fields calls 24 hours/day, 7 days/week about animal poisonings from the U.S., its territories and Canada. Using data from almost 4 years of APCC calls we describe the occurrence, category and class of pesticides involved, and outcomes of suspected pesticide exposures in livestock. This information is useful to raise awareness, encourage the proper use of pesticides and identify specific pesticides with negative impact on livestock health. **Methods** APHIS contracts with the APCC to receive de-identified data weekly on livestock calls for the purpose of conducting surveillance. This retrospective study used data from all calls concerning bovine, camelid, caprine, equine, ovine, porcine and poultry species from 10/1/2013 to 9/2/2017, where the caller reported suspected pesticide exposure. There were 1,025 calls regarding 3,028 animals meeting this criteria, representing 52% of all livestock calls with any type of toxic exposure. Caller type was 80% animal owners, 10% veterinarian or veterinary staff, and 10% other types. Most callers (92%) provided their zip code, with 96% of calls from the U.S. and 4% from Canada. Variables used for descriptive analysis were: species; APCC staff assessment that illness was due to pesticide exposure; severity of illness; clinical signs; first, second and third ingredients of the pesticide, and pesticide ingredient class (e.g. pyrethrin). Pesticides were grouped based on the first active ingredient into fungicide, herbicide, insecticide, and rodenticide categories. **Results** The proportion of calls by species was equine (33%), poultry (26%), bovine (25%), caprine (8%), porcine (6%), ovine (2%), and camelid (0.5%). Some animals were exposed to >1 pesticide product and some pesticide products had >1 ingredient class. The pesticide category with the highest number of exposed animals was insecticides (2,151), followed by herbicides (839), rodenticides (765) and fungicides (286). The treemap below illustrates the number and proportions of animals exposed to the 4 pesticide categories and the top 3 pesticide classes within each category based on the first active ingredient. For all pesticide exposures in all species, no illness was reported in 68% of animals. According to assessment by APCC staff, only 35% (333) of animals showing clinical signs were considered with confidence (medium or high likelihood) to be due to pesticide exposure. For these 333 animals, severity of illness was mild for 80% (266 animals), moderate for 18% (61 animals), major for 1% (3 animals) and caused death in 1% (3 animals). Among animals with confidence that clinical signs were due to pesticide exposure the most frequent syndrome was dermatologic. **Conclusions** Suspected pesticide exposure was the most frequent reason a call concerning livestock was made to the APCC. Callers reported that most animals showed no illness, and major illness or death was rare. Livestock were most frequently exposed to the insecticide category, and 46% of the animals with exposure to insecticides were exposed to the pyrethrin class. This is consistent with the phasing out of organophosphate insecticides for residential use since 2000 and the increasing use of pyrethrin insecticides<sup>3</sup>, which are considered less toxic. **Limitations** of this study include: 1) data from only one major animal poison control hotline was available for analysis and people may call their veterinarian directly or use the internet 2) calls regarding specific ingredients may be over represented due to corporate client relationships with the APCC 3) illness may have occurred after the call was made, therefore the proportion of animals with illness following suspected exposure may be an underestimate. **References** 1. Wang Y, Kruzik P, Helsber A, Helsberg I, Rausch W. 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## Abstract

**Objective** The goal of this study was to characterize the epidemiological, geographic, and historical characteristics of erysipeloid outbreaks in the Republic of Armenia. **Introduction** Erysipeloid is a zoonotic bacterial infection transmitted to humans from animals. Symptoms include inflamed joints and skin; there is also a generalized type of the infection in which bacteria spread through the lymphatic and blood vessels, leading to the emergence of widespread skin lesions and the formation of secondary foci of infection in internal organs. Morbidity has no age or gender specifics; there is summer and autumn seasonality. The agent of the infection - *Erysipelothrix rhusiopathiae* can be found in many domestic and wild animals. Wild rodents and ectoparasites play an essential role in spreading the disease and serve as a source of infection contaminating the environment. **Methods** Tests are conducted on both national and Marz levels in Reference Laboratory Center of NCDC SNCO and Marz branch laboratories of Especially Dangerous, Zoonotic and Natural Foci Infections respectively. Tests for detection of *E. rhusiopathiae* and confirmation of epizootics are conducted on rodents and ectoparasites collected from their hair and nests from 373 sectors of Armenia. Tests include smear microscopy and a bioassay in which cultures from a suspension of rodent organs or an emulsion of ticks and fleas are injected into white mice to assess the presence of agent in the organs or parasites. **Results** Ten years of monitoring indicates that erysipeloid epizootics have been recorded annually in Armenia with a total number of 119 cases. The most outbreaks were recorded in 2011 when 26 cases were recorded while in 2009 there were 20. The lowest number of cases recorded was five in 2008. Kotayk, Aragatsotn and Lori Marzes have the least number of cases with only 1-3 recorded epizootics, while Vayk, Gegharkunik and Shirak Marzes are considered active foci with 5-7 cases reported. Microbiological analyses indicates that 80% of cultures were isolated from field mice, 13.3% from gamasid ticks, 4.2% from fleas and 2.5% from ixodid ticks. **Conclusions** The presence of *E. rhusiopathiae* is stable in Armenia. It is found among rodents, where the epidemiological situation remains unfavorable. Constant regular tests/analyses are required to prevent human and animal infection. There is a need to enhance the area of test sites and apply most up-to-date methods of analysis i.e. ELISA, PCR so that the live bioassays in mice can be halted.

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# Roles of Health Literacy in Relation to Social Determinants of Health and Recommendations for Informatics-Based Interventions: Systematic Review

## Abstract

**Objective** The objective of this study was to analyze the epizootic potential of four areas of Tavush Marz. **Introduction** Tavush Marz, in northeastern Armenia, occupies 9,1% of its territory. In recent years in this area either no surveys were conducted or they were incomplete. Tavush Marz is a tourism center as well as a border Marz with strategic importance. The presence of tularemia was first confirmed in 1949 in Noyemberyan. Natural foci of tularemia are located in forest zones where *Sylvemus uralensis* and its flea vectors are the source of infection. **Methods** Tavush Marz, in northeastern Armenia, occupies 9,1% of its territory. In recent years in this area either no surveys were conducted or they were incomplete. Tavush Marz is a tourism center as well as a border Marz with strategic importance. The presence of tularemia was first confirmed in 1949 in Noyemberyan. Natural foci of tularemia are located in forest zones where *Sylvemus uralensis* and its flea vectors are the source of infection. **Results** The first detection of the *Aedes albopictus* species of Culicoidea subfamily in Armenia was on the border between Noyemberyan and Georgia in 2016; this is a vector of especially dangerous infections and arboviruses. The presence of the mosquito was confirmed in 2017 and it makes up 13.5% of the mosquitoes collected in the northeast. It is capable of transmitting the chikungunya, Dengue, and West Nile viruses. Since the end of 2015, we have recorded a significant increase in carriers and vectors, mainly *S. uralensis*, *Microtus socialis*, and ectoparasites specific to them. In October 2016 six cases of infection with tularemia were recorded in the village of Tsakhkavan in Tavush region and in Bagratashen Village of Noyemberyan region in 2017. **Conclusions** Analysis of the density of rodents and vectors, as well as their typical ectoparasites leads us to conclude that there are favorable conditions for the spread of not only tularemia but also other natural foci infections and that a comprehensive and regular epizootological survey is required to control this situation.

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# Roles of Health Literacy in Relation to Social Determinants of Health and Recommendations for Informatics-Based Interventions: Systematic Review

## Abstract

**Objective** To understand the disease burden, we studied the epidemiological and clinical characteristics and associated costs for brucellosis patients hospitalized in Nork hospital in 2016. **Introduction** Brucellosis, endemic in Armenia, is recognized as a significant public health challenge with a major economic burden. To address the regional threat of brucellosis for both animal health and public health, the “One Health Surveillance of Brucellosis in Armenia” was initiated in December 2016. The project aims to develop scientifically sound strategies and policies for sustainable control of the disease. **Methods** In 2016, 265 patients diagnosed with brucellosis were hospitalized at “Nork” hospital, of whom 16 were 0-14 years old and 94% were males. Diagnosis was confirmed using agglutination test and ELISA. The SPSS program was used to analyze the data. **Results** Distribution of the disease by marz revealed that the most cases came from Ararat (53), followed by Kotayk (49), Armavir (38), Aragatsotn (36), Yerevan (28), Gegharkunik (26), Vayots Dzor (24), Syunik (8), and Lori (3). Clinical data indicated that 71% of patients had acute brucellosis with fever, arthralgia and night sweating while 29% suffered chronic brucellosis with damage of organ systems. The primary complaints included arthralgia (80%), sweating (60%) and fever (40%). Joint pain was mainly located in knee, elbow, and sacroiliac regions. Average grade of fever was  $37,9\pm 0,95^{\circ}\text{C}$ . Total days spent in hospital were 1798, economic losses for the hospital were estimated at AMD 36 million per year. **Conclusions** Those at the highest risk for brucellosis were males living in Ararat and Kotayk marzes who work with livestock.

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# Roles of Health Literacy in Relation to Social Determinants of Health and Recommendations for Informatics-Based Interventions: Systematic Review

## Abstract

**Objective** To evaluate the difference in sensitivity between passive and active diarrheal and malnutrition disease surveillance system post-drought period in Swaziland **Introduction** Over the past decade Swaziland has experienced recurring drought episodes. In 2016 the country experienced challenges regarding water supplies in both urban and rural areas due to the drought impact. A rapid health and Nutrition Assessment was conducted in 2016 revealed an increase in number of cases of acute watery diarrhea of all age groups. While there is a high demand for epidemiological data in the country a passive system through Health Management Information System (HMIS) and Immediate Disease Notification System (IDNS) has been used to monitor acute watery diarrhea and a set of priority notifiable diseases in the country. **Methods** An active sentinel surveillance system was set up in four regional hospitals for monitoring of all diarrheal cases of the under-fives. A data abstraction form was developed and used to extract data from outpatient registers and inpatient mainly from the children's ward over a period of 15 weeks. Two surveillance officers trained on Integrated Disease Surveillance and Response (IDSR) collected and analyzed on weekly basis and further compared with data from a passive surveillance system that included the HMIS and IDNS. **Results** While acute gastroenteritis was the most prevalent type of diarrheal disease (93%), about 35.5% (1788 in active surveillance vs 1147 passive surveillance) of the cases of diarrheal cases are being underreported in the passive surveillance. Similar observation was made on malnutrition with more than 51% of the cases not reported in passive surveillance (186 cases vs 91 cases). **Conclusions** The process exposed gaps in data collected for passive surveillance and also differing data standards indicating inconsistency and under reporting which may be misleading for public health purposes. Low sensitivity in terms missing cases within the passive surveillance was observed when comparing within the active surveillance sentinel sites. It was also noted that having multiple data sources poses challenges in the country as they provide varying diseases trends and burden estimate. **References** 1. WHO. Integrated Disease Surveillance and Response

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# Roles of Health Literacy in Relation to Social Determinants of Health and Recommendations for Informatics-Based Interventions: Systematic Review

## Abstract

**Objective** To create a hepatitis A virus (HAV) syndrome category with which to monitor emergency department (ED) visits for situational awareness during a currently emerging Hepatitis A community outbreak in Los Angeles County (LAC), and to evaluate its usefulness. **Introduction** In early 2017, HAV outbreaks were identified in San Diego County (490 cases)<sup>1</sup> and Santa Cruz County (73 cases)<sup>2</sup> in California, affecting primarily the homeless and/or illicit drug users. As of October 10, 2017, LAC had identified 12 outbreak-related HAV cases. Due to LAC's proximity to San Diego County, and its own large homeless population, the syndromic surveillance team of the LAC Department of Public Health created a syndrome category and began querying its ED data to monitor for any increase in HAV-related visits. **Methods** ED data from 1/1/2017 to 10/10/2017 (CDC weeks 1-41) from all participating syndromic EDs in LAC were queried for patients who reported symptoms and signs of HAV. For comparison, ED data from calendar year 2016 was also queried. The query consisted of key word searches primarily within the chief complaint field, and, if available, the diagnosis and triage note fields. Based on the Centers for Disease Control and Prevention (CDC) clinical description of hepatitis A<sup>3</sup>, the HAV syndrome category was defined as: Jaundice (or elevated liver function tests) AND nausea or vomiting. Any ED visit that mentioned a diagnosis of hepatitis A also met the syndrome criteria. The resulting line lists were reviewed, and the query was periodically refined to exclude visits unrelated to hepatitis A (e.g., previous history of or vaccination for hepatitis A, other forms of hepatitis, and neonatal jaundice). The syndromic system was also queried for records that matched the 12 LAC cases by hospital and admission date. In addition, the chief complaint, diagnosis, and triage note fields were reviewed for any mention of homelessness or intravenous drug use. **Results** The syndromic system detected 158 ED patients meeting the HAV syndrome category criteria. Of these, 12.7% had a diagnosis of HAV, 53.8% had jaundice, 36.7% had elevated liver enzymes, 65.2% had nausea, and 65.8% had vomiting. In 2016, 170 ED patients who met the syndrome criteria were detected: 8.2% had a diagnosis of HAV, 64.1% had jaundice, 32.4% had elevated liver enzymes, 63.5% had nausea, and 71.2% had vomiting. In both years, no indications of homelessness or IDU were found. Of the 12 LAC confirmed HAV outbreak-related cases, three did not go to a hospital, and thus did not have any syndromic data. Two went to non-participating syndromic EDs, but medical chart review showed that they would not have met the syndrome criteria. Of the remaining seven, all went to a participating syndromic ED, and three met the syndrome criteria, but none had any mention of homelessness or IDU. **Conclusions** No major change was seen in the trend of HAV syndrome visits in 2017 compared to 2016 (Figure 1). One of the challenges in monitoring HAV incidence is that the clinical signs and symptoms are very general, and may be shared with many other conditions. An emerging outbreak may not be detected above background levels unless the increase in ED patients with HAV is large, or consolidated over time. Variability in data quality in the free text fields such as chief complaint and triage notes may be problematic. Cases will be missed if data fields are not fully and accurately documented, and also if patients didn't go to a participating syndromic hospital, or to a hospital at all. Though many syndromic hospitals now report diagnosis information, such information may be delayed, waiting for lab results. Using a stricter syndrome definition, such as requiring a specific diagnosis of HAV, may result in underreporting, but may provide a more accurate baseline for detecting increases and monitoring trends. While the query relied primarily on ED chief complaint, diagnosis and triage notes also proved useful in detecting HAV syndrome visits. None of the confirmed HAV cases that were known to be homeless had any mention of homelessness. The lack of any records indicating homelessness or IDU may indicate that these conditions are not currently reliably captured in the syndromic extract of ED patient records. LAC will continue to monitor for increases in HAV syndrome ED visits as a surrogate measure of HAV spread in the community. Syndromic surveillance, despite its limitations, remains a valuable complement to electronic lab reporting and other traditional reporting mechanisms. **References** 1. San Diego Hepatitis A Outbreak, 2017 [Internet]. San Diego, CA: San Diego County Health & Human Services Agency [cited 2017 Sep 21]. Available from: [http://www.sandiegocounty.gov/content/sdc/hhsa/programs/phs/community\\_epidemiology/dc/Hepatitis\\_A.html](http://www.sandiegocounty.gov/content/sdc/hhsa/programs/phs/community_epidemiology/dc/Hepatitis_A.html) 2. Santa Cruz Hepatitis A, 2017 [Internet]. Santa Cruz, CA: County of Santa Cruz Health Services Agency [cited 2017 Sep 21]. Available from: <http://www.santacruzhealth.org/HSAHome/HSADivisions/PublicHealth/CommunicableDiseaseControl/HepatitisA.aspx> 3. Hepatitis A, Acute 2012 Case Definition [Internet]. 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# Roles of Health Literacy in Relation to Social Determinants of Health and Recommendations for Informatics-Based Interventions: Systematic Review

## Abstract

**Objective** To incorporate data from Twitter into the New York City Department of Health and Mental Hygiene foodborne illness surveillance system and evaluate its utility and impact on foodborne illness complaint and outbreak detection. **Introduction** An estimated one in six Americans experience illness from the consumption of contaminated food (foodborne illness) annually; most are neither diagnosed nor reported to health departments<sup>1</sup>. Eating food prepared outside of the home is an established risk factor for foodborne illness<sup>2</sup>. New York City (NYC) has approximately 24,000 restaurants and >8.5 million residents, of whom 78% report eating food prepared outside of the home at least once per week<sup>3</sup>. Residents and visitors can report incidents of restaurant-associated foodborne illness to a citywide non-emergency information service, 311. In 2012, the NYC Department of Health and Mental Hygiene (DOHMH) began collaborating with Columbia University to improve the detection of restaurant-associated foodborne illness complaints using a machine learning algorithm and a daily feed of Yelp reviews to identify reports of foodborne illness<sup>4</sup>. Annually, DOHMH manages over 4,000 restaurant-associated foodborne illness reports received via 311 and identified on Yelp which lead to the detection of about 30 outbreaks associated with a restaurant in NYC. Given the small number of foodborne illness outbreaks identified, it is probable that many restaurant-associated foodborne illness incidents remain unreported. DOHMH sought to incorporate and evaluate an additional data source, Twitter, to enhance foodborne illness complaint and outbreak detection efforts in NYC. **Methods** DOHMH epidemiologists continue to collaborate with computer scientists at Columbia University who developed a text mining algorithm that identifies tweets indicating foodborne illness. Twitter data are received via a targeted application program interface query that searches for foodborne illness key words and uses metadata to select for tweets with a possible NYC location. Each tweet is assigned a sick score between 0–1; those meeting a threshold value of 0.5 are manually reviewed by an epidemiologist, and a survey link is tweeted to users who have tweeted about foodborne illness, requesting more information regarding the date and time of the foodborne illness event, restaurant details, and user contact information. Survey data are used to validate complaints and are incorporated in a daily analysis using all sources of complaint data to identify restaurants with multiple foodborne illness complaints within a 30-day period. This system was launched on November 29, 2016. **Results** During November 29, 2016–September 27, 2017, 12,015 tweets qualified for review (39/day on average); 2,288 (19.0%) indicated foodborne illness in NYC, and 1,778 (14.8%) were tweeted a survey link (510 foodborne illness tweets were either deleted by the Twitter user or were tweets from a user who was already sent a survey for the same foodborne illness incident). The survey tweets resulted in 92 likes, 12 retweets, 65 replies, 232 profile views and 348 survey link clicks. Of the 1,778 surveys sent, 27 were completed (response rate 1.5%), of which 20 (74.7%) confirmed foodborne illness associated with a NYC restaurant; none had been reported via 311/Yelp. Of those, 11 (55%) provided a phone number, of which 10 (90.9%) completed phone interviews. The completed surveys contributed to the identification of two restaurants with multiple foodborne illness complaints within a 30-day period. **Conclusions** The utility of Twitter for foodborne illness outbreak detection continues to be evaluated. While the survey response rate has been low, the identification of new complaints not otherwise reported to 311 and Yelp suggests this will be a useful tool. Future plans include using feedback data collected by DOHMH epidemiologist review to increase the sensitivity and specificity of the text mining algorithm and improve the location detection for Twitter users. In addition, we plan to implement enhancements to the survey and create a web page to promote survey responses. Furthermore, we intend to share this system with other health departments so that they might incorporate Twitter in their outbreak detection and public health surveillance activities. **References** 1. Scallan E, Griffin PM, Angulo FJ, Tauxe RV, Hoekstra RM. Foodborne illness acquired in the United States--unspecified agents. *Emerg Infect Dis*. 2011 Jan;17(1):16-22. 2. Jones TF, Angulo FJ. Eating in restaurants: a risk factor for foodborne disease? *Clin Infect Dis*. 2006 Nov 15;43(10):1324-8. 3. New York City Health and Nutrition Examination Survey, 2013-2014 [Internet]. New York: New York City Department of Health and Mental Hygiene and The City University of New York; 2017 [cited 2017 Aug 28]. Available from: <http://nychanes.org/data/> 4. Harrison C, Jorder M, Stern H, Stavinsky F, Reddy V, Hanson H, Waechter H, Lowe L, Gravano L, Balter S; Centers for Disease Control and Prevention (CDC).. 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## Abstract

**Objective** The objective of this session is to discuss syndromic surveillance evaluation activities. Panel participants will describe contexts and importance of selected evaluation and performance measurement activities in NSSP. Discussions will explore ways to strengthen evaluation in syndromic surveillance activities in the future. **Introduction** Syndromic surveillance uses near-real-time Emergency Department healthcare and other data to improve situational awareness and inform activities implemented in response to public health concerns. The National Syndromic Surveillance Program (NSSP) is a collaboration among state and local health departments, the Centers for Disease Control and Prevention (CDC), other federal organizations, and other entities, to strengthen the means for and the practice of syndromic surveillance. NSSP thus strives to strengthen syndromic surveillance at the national and the state, and local levels through the coordinated activities of the involved partners and the development and use of advanced technologies, such as the BioSense platform. Evaluation and performance measurement are crucial to ensure that the various strategies and activities implemented to strengthen syndromic surveillance capacity and practice are effective. Evaluation activities will be discussed at this session and feedback from audience will be sought with the goal to further strengthen evaluation activities in the future. **Description** Syndromic surveillance practice among NSSP grant recipients: findings from a telephone based survey – S. Romano This presentation will highlight the development and implementation of a survey among the NSSP grant recipients about their syndromic surveillance practice. The objectives of the survey was to develop knowledge and understanding about: a) characteristics of syndromic surveillance practice at the state and local level among jurisdictions that are NSSP grant recipients; b) challenges encountered by these jurisdictions in conducting syndromic surveillance; and c) strategies that may help address these challenges. The objectives and methods of the survey will be described in detail. The survey is expected to be implemented before the end of this year. Preliminary findings will be presented if available. Lessons learned and strategies to consider for strengthening syndromic surveillance practice will be discussed. **Defining a sustainable approach to syndromic surveillance through the AZ BioSense Workgroup Charter** – K. Collier, S. Johnston The Arizona BioSense Workgroup has developed a five year charter outlining the method and measures used for implementation and adoption of syndromic surveillance in Arizona. Membership consists of clinicians, IT and public health. The mission and vision help to establish a foundation for building capacity and quality of the syndromic surveillance data, improved population health and emergency response through timely and effective use of the data. Cross-cutting topics resulted in a process for assessing training needs, establishing protocols and evaluation of use cases, shared plans for situational awareness and making public health decisions. This talk will discuss the collaborative approach and how lessons learned will inform future activities. **User Acceptance Testing to inform development and enhancement of the BioSense Platform** – C. Davis Between June, 2016 and January, 2017, NSSP operationalized an updated BioSense Platform for conducting syndromic surveillance. The platform included ESSENCE, a software that enables analysis and visualization of syndromic surveillance data and the Access Management Center, a tool that enables jurisdictions to manage access to data. The development of and transition to the updated platform was informed by a User Acceptance Testing (UAT) that examined the functionality and usability of the platform and associated tools After webinar based orientation UAT, participants were requested to carry out specific tasks using the updated platform and tools in development. This presentation will discuss the objectives and methods of implementation of the UAT, findings from the UAT, and how these guided transition activities and the refinement of the platform applications. A quantitative and qualitative assessment of user support provided by the NSSP Service Desk – H. Tesfamichael, S. Romano A principal component of NSSP is the BioSense platform that includes health care visits related information, particularly related to emergency department visits, from across the U.S. BioSense and its associated tools, including ESSENCE, the Access Management Center, and Adminer, enable state and local health departments, and other, as appropriate, to use syndromic surveillance data to implement surveillance and assessment activities. The NSSP Service Desk provides technical support to BioSense users to assist with the use of the BioSense platform and its tools Users submit support request tickets through an online application. An analysis of information related to these tickets, including the context of the requests and their resolution status, was conducted to better understand the support needs of users and how well these were being addressed. This presentation will discuss the assessment, findings, and conclusions. **How the Moderator Intends to Engage the Audience in Discussions on the Topic**The moderator will introduce the session and the panelists. The moderator will also invite questions and comments from the audience, and will facilitate the discussions.

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# Roles of Health Literacy in Relation to Social Determinants of Health and Recommendations for Informatics-Based Interventions: Systematic Review

## Abstract

**Objective** To evaluate Arizona's arboviral syndromic surveillance protocol in Maricopa County. **Introduction** Timely identification of arboviral disease is key to prevent transmission in the community, but traditional surveillance may take up to 14 days between specimen collection and health department notification. Arizona state and county health agencies began monitoring National Syndromic Surveillance Program BioSense 2.0 data for patients infected with West Nile virus (WNV), St. Louis encephalitis virus (SLEV), chikungunya, or dengue virus in August 2015. Zika virus was added in April 2016. Our novel methods were presented at the International Society for Disease Surveillance 2015 Annual Conference. [1] Twice per week, we queried patient records from 15 Maricopa County BioSense-enrolled emergency department and inpatient hospitals for chief complaint keywords and discharge diagnosis codes. Our "Case Investigation Decision Tree" helped us determine whether records had a high or low degree of evidence for arboviral disease and necessitated further investigation. This study evaluated how Arizona's protocol for conducting syndromic surveillance compared to traditional arboviral surveillance in terms of accuracy and timeliness in Maricopa County from August 2015 through December 2016. **Methods** We followed guidelines from the Centers for Disease Control and Prevention (CDC) to evaluate two major attributes of the protocol: accuracy [measured as positive predictive value (PPV) and sensitivity] and timeliness. [2] Arizona's Medical Electronic Disease Surveillance Intelligence System (MEDSIS) was considered the "gold standard" system and BioSense was the test system. PPV was calculated as the proportion of records identified by BioSense that were reported to MEDSIS, regardless of final case classification. Sensitivity was the proportion of confirmed or probable cases in MEDSIS identified by BioSense. Though not all MEDSIS cases were seen at BioSense-reporting facilities, the sensitivity demonstrates how each query contributed to arboviral surveillance overall. We assessed timeliness in two ways: (1) the difference between the date when keywords or diagnosis codes were first identified by BioSense and the date the same patient was first reported to MEDSIS; and (2) the difference between the date the BioSense record was first reviewed by the Maricopa County Department of Public Health (MCDPH) syndromic surveillance team and the date the same patient was first investigated through MEDSIS by the MCDPH disease investigators. We assessed whether timeliness was affected by the method in which a record was identified in BioSense (i.e., chief complaint keyword or discharge diagnosis code). **Results** The arboviral syndromic surveillance queries identified 62 records during the evaluation period (Table). For each arboviral query, the proportion of BioSense records that were also reported through MEDSIS ranged from 25.0% to 32.4%, except chikungunya, which had a PPV of 0%. BioSense records that had a high degree of evidence for arboviral disease tended to have a higher PPV compared to those with low evidence. BioSense records that were not already reported to MEDSIS met neither clinical nor exposure criteria for the arboviral diseases and were not deemed a public health risk. The sensitivities of the WNV and Zika queries to detect confirmed or probable cases in MEDSIS were 8.2% and 5.6%, respectively, while SLEV, chikungunya, and dengue queries were 0%. On average, patients were reported to MEDSIS 7 days prior to BioSense identifying keywords or diagnosis codes. In addition, MEDSIS cases were investigated by MCDPH disease investigators 10 days prior to MCDPH syndromic surveillance team review of BioSense records, on average. The average time between MEDSIS report date and BioSense identification date was shorter for BioSense records identified by chief complaint keywords than by diagnosis codes (4 and 8 days after MEDSIS, respectively). **Conclusions** Arizona's arboviral syndromic surveillance protocol provided MCDPH with situational awareness, but BioSense data were not available more quickly than traditional mandated reporting. Through this process, we reviewed patient records that mentioned arboviral diseases and confirmed that these reportable conditions were captured in our traditional surveillance system. The decision tree was effective at prioritizing records for further investigation. Timeliness may be improved by updating the queries to include more chief complaint keywords and reviewing BioSense more than twice per week. MCDPH plans to evaluate Arizona's updated arboviral syndromic surveillance protocol, which was adapted for BioSense Platform's Electronic Surveillance System for Early Notification of Community-based Epidemics (ESSENCE). **References** 1. White, J. R., Imholte, S., & Collier, K. (2016). Using Syndromic Surveillance to Enhance Arboviral Surveillance in Arizona. *Online J Public Health Inform*, 8(1), e81. 2. German, R. R., et al. (2001). Updated guidelines for evaluating public health surveillance systems: recommendations from the Guidelines Working Group. *MMWR Recomm Rep*, 50(RR-13), 1-35.

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# Roles of Health Literacy in Relation to Social Determinants of Health and Recommendations for Informatics-Based Interventions: Systematic Review

## Abstract

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**Objective** Demonstrate the utility of a One Health collaboration during a leptospirosis outbreak to expand outreach in human, environmental and animal health arenas. **Introduction** The One Health paradigm emphasizes cooperation and interdisciplinary collaboration to promote health and well-being among people, animals and the environment. Though the concept of One Health has been around since the 1800's, the phrase "One Health" was more recently coined, and projects are being developed globally under its sponsorship. Maricopa County Department of Public Health (MCDPH) has been working at a local level to enhance its One Health surveillance efforts and partnerships. This One Health partnership, comprised of representatives from the Arizona Department of Agriculture (ADA), Arizona Department of Health Services (ADHS), Arizona Game and Fish Department (AzGFD), Arizona Veterinary Medicine Association (AzVMA), Centers for Disease Control & Prevention (CDC), MCDPH, Midwestern University (MWU) Veterinary School, and local veterinarians, was employed during a response to the recent emergence of leptospirosis in Maricopa County, Arizona. Leptospirosis is a zoonotic bacterial disease typically prevalent in tropical regions, especially island countries or low-lying areas that flood. In the United States, CDC reports 100-200 human cases annually. Within the last five years, there have been two confirmed travel-associated human cases reported in Maricopa County. However, no locally acquired human or canine leptospirosis cases were reported. Two separate clusters of canine leptospirosis were reported in Maricopa County in 2016; the first was detected in February among canines within a household. To increase awareness in the veterinary community, the AzVMA published an article summarizing the cluster. This article might have aided in the identification of a second larger cluster in November that involved multiple veterinary and boarding facilities throughout Maricopa County. Following both clusters, capacity increased for canine and human surveillance, laboratory testing, and environmental remediation, and discussions were initiated regarding wildlife testing through the efforts of the One Health team. **Methods** A coordinated review of canine medical records verified suspicion of leptospirosis within the exposed canine population. A CDC questionnaire was modified by the One Health team and facilities were visited to identify possible sources of canine infection. A Knowledge, Attitudes and Practice (KAP) survey was distributed through the AzVMA to guide veterinary education efforts. Lecture series, educational materials, and health alerts were created with input from One Health agencies for physicians, veterinarians, dog boarding facilities, and owners. CDC subject matter experts assisted in the implementation of a serosurvey of both dog owners and veterinary staff to determine if zoonotic transmission had occurred at the home, veterinary clinic or boarding facility. CDC laboratory testing provided leptospirosis speciation of canine urine specimens. **Results** Medical records were abstracted for 79 suspect leptospirosis canine cases and 48 owners were interviewed to assess their risk and exposure factors for their dogs. Prior to the visit, some facilities had already implemented self-directed infection control activities. No procedural gaps were identified at the four canine boarding facilities and veterinary clinics visited. The KAP survey was completed by 216 Arizona veterinarians and technicians. Educational outreach included three AzVMA newsletter articles distributed to approximately 1,100 registered veterinarians, one fact sheet regarding the leptospirosis vaccine, and three factsheets targeting prevention and infection control messages for boarding facilities, veterinary clinics and the home. A three-part lecture series presented jointly by ADHS, ADA, MCDPH, and MWU was attended by approximately 150 veterinarians. A health alert about the possibility of leptospirosis human cases was distributed by MCDPH to healthcare providers. Eighty-five dogs with either compatible symptoms or exposure were tested through the CDC laboratory, 68 (80%) were positive. Canine testing revealed different leptospirosis species between the two clusters, suggesting it was unlikely that they had a common source of exposure. No zoonotic transmission was identified among the 118 people tested in the serosurvey. **Conclusions** Pre-existing connections between public health and animal health partners helped facilitate and expand laboratory testing, diagnosis, reporting, outbreak tracking and prevention. The serosurvey provided a novel opportunity to identify cases amongst exposed people and provided insight into zoonotic transmission. Information gained from the KAP survey provided a gap analysis in veterinary services and guided education efforts. Since July 2017, no new canine cases have been reported to public health. However, further studies to identify sources of transmission in wildlife are being developed. The collaborative efforts of multiple agencies culminated in a robust outbreak response and the strengthened processes and relationships can be leveraged for future emerging diseases.

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# Roles of Health Literacy in Relation to Social Determinants of Health and Recommendations for Informatics-Based Interventions: Systematic Review

## Abstract

**Objective** The main aim of this work is to estimate the projected risks based on the incidence rate of natural foci infections and to expand the list of criteria for the characterization of natural foci of tick-borne infections. **Introduction** The epidemiological situation of natural foci of tick-borne infections (TBI) in Ukraine, as well as globally, is characterized by significant activation of processes due to global climate change, growing human-induced factor and shortcomings in the organization and running of epidemiological surveillance [1]. For the Western region of Ukraine, among all tick-borne zoonoses the most important are tick-borne viral encephalitis (TBVE), Lyme disease (LD), human granulocytic anaplasmosis (HGA) and some others [2-4]. Taking into account the increased incidence rate for these infections, we have developed baseline criteria (indicators of natural contamination of the main carriers and levels of the serum layer among the population in relation to the TBI pathogens in the endemic areas) to identify areas with different risk of contamination through GIS-technologies [5]. **Methods** Epi Info 7.1.1.14 software was used to analyze patient questionnaires with tick-borne infections (TBI) for 2010-2015. Prevalence maps of vector-borne infections were created by means of GIS technology using the QGIS 2.0.1. software to assess the risks of infection. Maps demonstrating the distribution of TBVE, LD and HGA were also developed based on contamination risk assessment criteria. **Results** Retrospective epidemiological analysis of incidence rates for TBVE, LD and HGA was conducted based on laboratory tests that were performed in the laboratory of vector-borne viral infections of the State Institution Lviv Research Institute of Epidemiology and Hygiene of the Ministry of Health of Ukraine. A direct correlation between the infection of *I. ricinus*, *B. burgdorferi* and LB ( $P < 0.05$ ) and infections of *I. ricinus* ticks, anaplasma and incidence of HGA ( $P < 0.05$ ) was established. However, this connection has not been confirmed for indicators with TBE. Data was obtained during the assessment of possible risks of tick-borne infections. For TBVE, the indicator of predicted risks based on the basic criteria was 60.3%, taking into account the cases of the disease. This was based on indicators of natural infection of the main carriers and the level of the serum layer among the population on the TBI activators in the endemic areas. The data obtained can be explained by the low level of morbidity and the detection of TBVE cases. The predicted risk for LD according to these criteria is 88.9%, due to the high level of clinical and laboratory diagnosis. As for the HGA, the predicted risk indicator reaches 66.7% due to the fact that the study of human anaplasmosis in Ukraine is at the initial level (the incidence rate and incidence are not included in the official reporting system). Taking into account the results obtained, it is advisable to supplement the list of criteria for determining the degree of activity of natural foci of tick-borne infections and the identification of areas with high risk of morbidity. These calculations were made by grouping statistical data (indicators) [5]. The reliability of the difference between the same indicators for individual zones was 95% (Table 1). **Conclusions** Tick-borne zoonoses are a serious problem for the public health system of the Western region of Ukraine. Extending the list of criteria for the characterization of natural foci of tick-borne infections will improve epidemiological surveillance and focus on key measures in high and medium-risk areas for the rational use of funds. **References** 1. Nordberg M. Tick-Borne Infections in Humans. Aspects of immunopathogenesis, diagnosis and co-infections with *Borrelia burgdorferi* and *Anaplasma phagocytophilum*. Linköping University Medical Dissertations No.1315. Linköping, Sweden 2012. 2. Morochkovsky R. Clinical characteristic of tick-borne encephalitis in Volhynia and optimization of treatment. Ternopil State Medical Academy I. Gorbachevsky Dissertations. Ternopil, Ukraine 2003. 3. Zinchuk O. Lime borreliosis: Clinical and immunopathogenetic features and emergency preventive treatment. Lviv National Medical University D. Galitsky Dissertations. Lviv, Ukraine 2010. 4. Ben I., Biletska H. Epidemiologic aspects of human granulocytic anaplasmosis in the Western region of Ukraine. *Lik Sprava*. 2015 Oct-Dec;(7-8). 5. Ben I., Lozynsky I. Application of GIS-technologies for risk assessment of areas with tick-borne infections. Materials of the Regional Scientific Symposium within the framework of the concept of "Unified Health" and a review and Selection of scientific works with the support of CCDD in Ukraine. 2017 April 24-28, Kyiv.

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# Roles of Health Literacy in Relation to Social Determinants of Health and Recommendations for Informatics-Based Interventions: Systematic Review

## Abstract

**Objective** To study the factors associated with streptococcal infection that led to hospitalization in Houston, Texas for years 2015-2016 **Introduction** Different studies have shown that Streptococcal infections in adults are more common among older age, blacks, and underlying chronic medical conditions like diabetes, cardiovascular and kidney diseases. In specific, other studies have demonstrated that streptococcal pyogenes can cause severe illnesses and dramatic hospital outbreaks. Furthermore, community-acquired pneumonia studies had also suggested that cardiovascular disease, severe renal disease, chronic lung disease and diabetes were associated with increased odds of hospitalization. **Methods** Data were extracted from Houston Electronic Disease Surveillance System (HEDSS) beginning January 1, 2015 to December 31, 2016. A total of 512 confirmed cases were investigated and analyzed during the study period. Frequencies and percentages were calculated and chi square test was used to examine the association between hospitalization and other risk factors. Odds ratio was calculated using unconditional logistic regression to determine the association of risk factors with hospitalization in streptococcal patients. **Results** A total of 414 patients (81 %) of the confirmed cases were hospitalized. Age, race, fever, sepsis, diabetes, cardiovascular and kidney diseases were significantly associated with hospitalization in the bivariate analysis. Logistic regression analysis adjusted for confounding factors demonstrated that among clinical characteristics, fever (OR 2.9; 95% CI 1.66-5.38) was three times more prevalent among hospitalized patients with streptococcal infection. Patients with diabetes (OR 7.92; 95% CI 3.08-20.36) were almost eight times more likely to be hospitalized than patients without diabetes among streptococcal patients, followed by cardiovascular disease (OR 2.84; CI 1.32-6.10) which was three times more likely to be present. **Conclusions** Common clinical sign like fever was associated with hospitalization among streptococcal patient. Similarly, risk factors like diabetes and cardiovascular diseases were significantly associated with hospitalization in streptococcal patients. Prevention strategies need to be focused on streptococcal patients with chronic risk factors like diabetes, and cardiovascular disease. **References** Parks t, Barret L, Jones N. Invasive streptococcal disease: a review for clinicians. British Med Bulletin, 2015; 115 (7): 77-89. Skoff TH, Farley MM, Petit S, et al. Increasing Burden of Invasive Group B Streptococcal Disease in Nonpregnant Adults, 1990-2007. CID 2009; 49 (7): 85-92.

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# Roles of Health Literacy in Relation to Social Determinants of Health and Recommendations for Informatics-Based Interventions: Systematic Review

## Abstract

**Objective** To describe and present results of field-based near-real time syndromic surveillance conducted at first aid stations during the 2017 National Collegiate Athletic Association Division I Men's College Basketball Championship (Final Four) events, and the use of field team data to improve situational awareness for Mass Gathering events. **Introduction** Final Four-associated events culminated in four days of intense activity from 3/31/17-4/3/17, which attracted an estimated 400,000 visitors to Maricopa County (population 4.2 million). Field teams of staff and volunteers were deployed to three days of Music Fest, four days of Fan Fest, and three Final Four games (Games) as part of an enhanced epidemiologic surveillance system. **Methods** Attendees presenting to first aid stations were requested to complete an electronic questionnaire which captured illness and injury syndromes (after needed care was given). Emergency Medical Services technicians and nurses (EMS) conducted patient care. These were submitted and epidemiologically assessed in near-real-time to rapidly identify threats. Syndrome-specific data were mapped during events to identify spatial clustering. Field Teams were provided with case contact log sheets, suspicious substance investigation and exposure registry forms to allow rapid investigation of significant public health events. Patient Presentation Rates (PPR) and Transport to Hospital Rates (TTHR) were calculated per 10,000 attendees. Patients presenting per hour of event and transports per hour of event were calculated. Field reports were included in daily reports to inter-disciplinary partners, and shared during regular Multi-Agency Coordination Center briefings. **Results** 301 field questionnaires were completed, including 146 from Final Four games (Games), 127 from the Music Fest, and 28 from the Fan Fest (see Figure). Among the 153,780 attendees of the three Games, there were 146 cases who presented to one of five first aid stations (over 12 hours). There were 27 illness cases who sought care (18.5% of Games cases), among whom 21 (78%) were assessed by EMS. Illness cases not assessed by EMS (n=6) included mostly allergy symptoms/medication needs. There were 50 injury cases who sought care (34.2% of Games cases), among whom 10 (20%) were assessed by EMS. Sixty (41.1%) persons presented seeking a pain reliever, and 9 (6.2%) presented seeking an antacid. Games experienced a PPR of 9.5, and a TTHR of 0.52. Patients presented at 12.2 per hour on average and there were eight transports to medical facilities (0.66 per hour). There were 127 cases among an estimated 135,000 Music Fest attendees who presented to one of two first aid stations (and at times 2 roving teams) over 3 days (22.5 hours) from 3/31 to 4/2. Illnesses accounted for 29 cases (22.8% of Music Fest cases) and 28 of 29 were assessed by EMS. There were 68 injury cases who sought care (53.5% of Music Fest cases), among whom 22 (32.4%) were assessed by EMS. Twenty-seven persons (21.3%) presented seeking a pain reliever and 2 (1.6%) sought an antacid. Music Fest results included a PPR of 9.4, and a TTHR of 0.15. There were 5.6 patients presenting per hour on average, and there were two transports to the hospital (0.09 per hour). At the Fan Fest there were 28 cases among an estimated 50,803 attendees presenting to the first aid station (or roving teams) from 3/31-4/3 (over 37 hours). Most cases sought care for an injury (n=22, 78.6% of cases). Four persons sought care for an illness (14.3%), all with relatively minor complaints. For the Fan Fest, there was a PPR of 5.5, and a TTHR of 0 (there were no transports to the hospital). There were 0.76 patient presentations per hour on average. No geographic clustering or public health threats requiring investigation were identified at any of the three sites. Interdisciplinary partners requested additional field data during the response. **Conclusions** Injuries were more common than illnesses at all three sites. Visits requiring pain relievers only were more common at Games (41.1%) than at Music Fest (21.3%) or Fan Fest (3.6%). A greater percentage of visits requiring EMS assessment were seen at the Fan Fest (78.6%) than at the Music Fest (40.2%) or the Games (21.2%). The PPRs per 10,000 attendees were highest at the Games (9.5) and Music Fest (9.4), compared to the Fan Fest (5.5). The TTHR per 10,000 attendees was highest at the Games (0.52), compared to the Music Fest (0.15) and Fan Fest (0.0). The Music Fest field team reported greater effectiveness at fixed first aid stations compared to traveling with roving EMS teams. Field reports enhanced health and medical situational awareness and information sharing as evidenced by requests from interdisciplinary partners for additional field data.

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# Roles of Health Literacy in Relation to Social Determinants of Health and Recommendations for Informatics-Based Interventions: Systematic Review

## Abstract

**Objective** The goal was to determine the impact of flea number variation on the epizootic situation in the Jermuk region. **Introduction** The Jermuk region of the Zangezur mezofocus is part of the transcaucasian highland focus of plague. This enzootic area is polyvectorial. The mezofocus has rich fauna with approximately eight species of fleas: *Callopsylla caspia*, *Ctenophthalmus wladimiri*, *Frontopsylla elata*, *Amphipsylla rossica*, *Leptopsylla taschenbergi*, *Nosopsyllus consimilis*, *Palaeopsylla vartanovi*, and *Doratopsylla dampfi*. *Ct. wladimiri* is the most abundant. However, special attention should be paid to *C. caspia* and *N. consimilis* as they are the only vectors specific for *Yersinia pestis*. In these fleas, the bacteria form a plug that blocks digestion and induces starvation. Afflicted fleas bite frenziedly in an effort to feed and the pressure that results releases bacteria from the plug, infecting a new host. Fleas infected with plague during an epizootic are a serious threat to humans, especially when in contact with synanthropic rodents. A survey was conducted to catalog fleas in the foci. **Methods** From 2010-2016 different species of fleas were collected in Jermuk region of Vayots Dzor by combing the hair of captured rodents and processing their nests with heat and light. Flea species, and their egg-laying status, were identified by microscopic examination. **Results** From 2010-2015 the density of *C. caspia* averaged 23 per hectare. Fleas that were laying eggs were quantified via microscopy. In 2016 a drastic increase in *C. caspia* density was recorded; flea numbers averaged 225 per hectare. Half of these were actively reproducing (Table 1). These changes in flea numbers occurred with a stable rodent population of 60 per hectare. **Conclusions** Because of the drastic increase in flea density of 2016 compared to the period of 2010-2015, it is likely that diseases that depend on fleas to spread will increase in the near future in Jermuk. So, it is necessary to monitor the epizootic situation of Jermuk, as it is a popular resort in Armenia.

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# Roles of Health Literacy in Relation to Social Determinants of Health and Recommendations for Informatics-Based Interventions: Systematic Review

## Abstract

**Objective** To introduce the method of molecular genotyping (MLVA) to determine the genotype of field isolates of leptospira. **Introduction** Leptospirosis (icterohemoglobinuria, Leptospirosis biliousness) is a natural focal and zoonotic infectious disease dangerous for humans and farm animals. It is important to identify specific leptospira strains isolated from rodents or sick and suspicious animals by the serotype or genotype. In comparison with serotyping using micro agglutination test (MAT), molecular genotyping makes it possible to accurately identify a specific pathogen strain. The genetic classification now becomes more significant than the phenotypic classification. **Methods** Specific oligonucleotide primers, which flank fragments of the genome locus of pathogenic leptospira varies in terms of the number of tandem repeats VNTR-4, -7, -10 specific for *L.interrogans*, *L.kirschneri*, and *L.borgpetersenii* were used. The amplification products were detected using agar gel electrophoresis with the following identification of the fragment length with a molecular weight marker and comparison with the collection of VNTR profiles of the strains described in the literature. **Results** It was established that the method of leptospira molecular genotyping by determining the number of variable tandem repeats of a locus (VNTR-variable number tandem repeats analysis) is suitable for molecular epizootology studies in Ukraine. The advantages of the method are the simplicity of performance and availability for diagnostic and research laboratories in Ukraine compared to other pathogen genome sequencing based genotyping methods, in particular Multilocus sequence typing (MLST) or Multispacer Sequence Typing (MST), which require complex equipment and operating conditions. The reference strain of *Leptospira* M20 serotype Copengageni serogroup Icterohaemorrhagiae from the NAAS IVM collection of was studied and its VNTR profile was identified with the genotype of the strain Fiocruz L1-130 that is described in the literature as a serotype of Copengageni serogroup Icterohaemorrhagiae. The genotype of the leptospira field isolate obtained from a rat in Lviv Oblast of Ukraine was specified and its identity was established in the aforementioned genotype. The obtained data support the prospects of using MLVA genotyping method to study the distribution of different genotypes of leptospira. The research will continue to study the specificities of molecular epizootology of leptospirosis in Ukraine. **Conclusions** The method of leptospira molecular genotyping by multilocus analysis of the number of variable tandem repeats has been tested in the Leptospirosis Research Laboratory in collaboration with the Museum of Microorganisms at the National Academy of Sciences, the Ukraine Institute of Veterinary Medicine, the ELISA and PCR Research Laboratory, and the Bila Tserkva National Agrarian University. The genotype of the reference strain has been correlated with its serological profile; identification of the genotype of the field isolate pathogenic leptospira has been completed. The tested method is planned to be implemented in surveillance and control over leptospirosis spreading in Ukraine, and aimed to help in development and improvement of leptospirosis vaccine formulations. Additionally, method of Multiple-Locus Variable number tandem repeat Analysis will be used for molecular epidemiology research in Ukraine. **References** Salaün L, Mérien F, Gurianova S, Baranton G, Picardeau M. Application of multilocus variable-number tandem-repeat analysis for molecular typing of the agent of leptospirosis. *J Clin Microbiol.* 2006;44(11):3954-3962. doi:10.1128/JCM.00336-06. Caimi K, Repetto SA, Varni V, Ruybal P. Infection , Genetics and Evolution *Leptospira* species molecular epidemiology in the genomic era. *Infect Genet Evol.* 2017;54(July):478-485. doi:10.1016/j.meegid.2017.08.013. Ayral F, Zilber AL, Bicout DJ, Kodjo A, Artois M, Djelouadji Z. Distribution of leptospira interrogans by multispacer sequence typing in urban Norway rats (*Rattus norvegicus*): A survey in France in 2011-2013. *PLoS One.* 2015;10(10):1-14. doi:10.1371/journal.pone.0139604.

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# Roles of Health Literacy in Relation to Social Determinants of Health and Recommendations for Informatics-Based Interventions: Systematic Review

## Abstract

**Objective** In this panel, attendees will learn about how disaster surveillance was conducted in response to Hurricanes Irma and Harvey, as well as the role of CDC at the federal level in supporting local response efforts. By hearing and discussing the challenges faced and solutions identified, attendees will be better able to respond in the event of a low-frequency/high-consequence disaster occurring within their jurisdiction. **Introduction** In this panel, the presenters will discuss their perspective in responding to Hurricanes Harvey and Irma. Hurricane Harvey made landfall on August 25th and over the course of 4 days dropped approximately 27 trillion gallons of water on Texas and Louisiana.<sup>1</sup> The flooding that ensued was unprecedented and forced over 13,000 people into shelters.<sup>2</sup> These individuals needed to have their basic needs -food, shelter, clothing, sanitation- met as well as their physical and mental health needs. The George R Brown Conference Center (GRB) and NRG Stadium Center were set up as mega-shelters to house shelterees. Hurricane Irma made landfall on September 10th in the Florida Keys as a Category 4 Hurricane. The Hurricane caused 72 deaths<sup>3</sup> and forced thousands of people into shelters.<sup>4</sup> These weather events created novel challenges for local response efforts. Decision makers needed timely and actionable data, including surveillance data. **Description** At the federal level, Aaron Kite-Powell will discuss his experiences in supporting local efforts to acquire timely and actionable data collected by on-site federally deployed disaster medical assistance teams (DMAT). DMAT provided clinical services to residents who were staying in a mega-shelter. Data collected from DMAT was electronically sent to CDC through the National Syndromic Surveillance Program (NSSP) where it could be accessed in CDC's instance of ESSENCE. Additionally, in Houston, 3 area hospitals submitted their data to NSSP. The City of Houston Health Department (HHD) was given access to DMAT and hospital syndromic data through ESSENCE. Once access was established, just in time training was conducted for HHD. David Atrubin will discuss how Florida's syndromic surveillance system was utilized during Hurricane Irma in September 2017. ESSENCE-FL provided critical near real-time surveillance data before, during, and after the storm. Multiple data sources, within the ESSENCE-FL, were utilized including emergency department, poison control, death record, and DMAT data. In addition to the anticipated increases in animal bites, injuries, medication refills, dialysis visits, and carbon monoxide exposures, some unexpected increases were observed as well. Eric Bakota will describe his experience in coordinating the remote shelter surveillance team for the City of Houston Health Department. In the immediate aftermath of the flooding, several organizations opened shelters for people who were forced to leave their homes. Many of these facilities were not officially connected to the City. An ad hoc process was used to identify and connect with these facilities. Once identified as a shelter, a team of 6 epidemiologists conducted daily check-ins to determine the census and status of shelterees. Several tools to coordinate activities and record the data collected were used, including Dropbox, Googlesheets, and MAVEN. Each tool had its own strengths and limitations that will be discussed. **How the Moderator Intends to Engage the Audience in Discussions on the Topic**The moderator should engage the panelists by asking questions the following questions: ● How did each panelist work with their Federal/State/Local partners ● How did each panelist integrate into the larger response framework (e.g., ICS) ● How did each panelist use technology to address any novel surveillance barriers during the disaster **References** 1. Sanchez R, Yan H, Simon D. Harvey aftermath: Houston "open for business"; other cities suffering. CNN. 2017 Sep 1. 2. Sullivan K, Hernandez A, Fahrenthold D. Harvey leaving record rainfall, at least 22 deaths behind in Houston. Chicago Tribune. 2017 Aug 29. 3. Impact of Hurricane Irma. Boston Globe. Accessed 2017 Oct 10. <https://www.bostonglobe.com/news/bigpicture/2017/09/11/impact-hurricane-irma/W6WBN9K2IXd4gPmtu26auN/story.html> 4. Smith A. After Hurricane Irma, Many Ask: How Safe Are Shelters? Tampa Bay Times. 2017 September 21.

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# Roles of Health Literacy in Relation to Social Determinants of Health and Recommendations for Informatics-Based Interventions: Systematic Review

## Abstract

**Objective** To estimate and compare influenza attack rates (AR) in the United States (US) using different approaches to adjust for reporting biases in participatory syndromic surveillance data. **Introduction** Because the dynamics and severity of influenza in the US vary each season, yearly estimates of disease burden in the population are essential to evaluate interventions and allocate resources. The CDC uses data from a national health-care based surveillance system and mathematical models to estimate the overall burden of disease in the general population. Over the past decade, crowd-sourced syndromic surveillance systems have emerged as a digital data source that collects health-related information in near real-time. These systems complement traditional surveillance systems by capturing individuals who do not seek medical care and allowing for a longitudinal view of illness burden. However, because not all participants report every week and participants are more likely to report when ill, the number of weekly reports is temporally and spatially inconsistent and the estimates of disease burden and incidence may be biased. In this study, we use data from Flu Near You (FNY), a participatory surveillance system based in the US and Canada<sup>1</sup>, to estimate and compare Influenza-like Illness (ILI) ARs using different approaches to adjust for reporting biases in participatory surveillance data. **Methods** This analysis uses FNY data from the 2015-16 influenza season. Four different approaches of bias adjustment were assessed. The first approach includes all FNY participants, defined as users and household members, who submitted at least one symptom report, whereas the second approach only includes FNY participants who submitted at least 10 symptom reports. The third approach includes all FNY participants who submitted at least one symptom report, but drops the first symptom report for all participants. For the first three approaches, all missing reports were assumed to be non-ILI when estimating attack rates. Finally, the fourth approach includes FNY participants who submitted at least 10 symptom reports and uses multiple imputation to account for missing reports. Age-stratified and overall estimates of ILI ARs were calculated for each of the four approaches to bias adjustment by dividing the sum of the weekly incident cases of ILI, defined as the first report of fever with cough and/or sore throat, by the population at risk at the beginning of the period. **Results** During the 2016-2017 influenza season, FNY received an average of 10,723 unique symptom reports per week from 46,390 registered users and their household members. For FNY, the youngest age group assessed, 5-17, had the largest ILI AR, and the ILI ARs decreased as the age group increased for all approaches. Overall, the approach that drops all first reports had the smallest ARs, whereas the approach that selects a cohort of users who submit at least 10 reports during the season and imputes the missing reports had the largest ARs. Although the influenza ARs estimated by the CDC were less than the ILI ARs estimated using FNY data for all age-groups, a similar pattern was observed across age groups, except for the 50-64 age group, which had the largest influenza AR. **Conclusions** As expected, the ARs estimated using FNY data were greater than the CDC's influenza ARs because FNY estimates ARs of ILI and does not adjust for the probability of reporting ILI when experiencing non-flu illness. The approach of dropping the first report had the smallest ARs because during the 2015-16 influenza season the weekly percent of ILI cases that were first time reports ranged from 18-59%. This approach was developed to adjust for the potential correlation between symptom presence and willingness to join the platform. However, important information about the dynamics of disease may be lost when using this approach. The multiple imputation method was used only for individuals who submitted at least 10 reports to maintain a missing data rate below 30%. The imputation model also assumed that data were missing at random, which may not be appropriate in this case, because approximately 30% of FNY users have reported that they are more likely to report when ill. As shown in Table 1, the AR estimate depends on the bias adjustment approach. Simulation-based studies should be performed to further evaluate these methods. **References** 1. Smolinski MS, Crawley AW, Baltrusaitis K, Chunara R, Olsen JM, Wójcik O, et al. Flu Near You: Crowdsourced Symptom Reporting Spanning 2 Influenza Seasons. *Am J Public Health*. 2015 2. Rolfes MA, Foppa IM, Garg S, Flannery B, Brammer L, Singleton JA, et al. Estimated Influenza Illnesses, Medical Visits, Hospitalizations, and Deaths Averted by Vaccination in the United States. 2016 Dec 9 [2017 Sept 25]; <https://www.cdc.gov/flu/about/disease/2015-16.htm>

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## Abstract

Objective Asthma is one of the most common chronic childhood diseases in the United States [2, 3]. In addition to its pervasiveness, pediatric asthma shows high sensitivity to the environment. Combining medical-social dataset with machine learning methods we demonstrate how socio-markers play an important role in identifying patients at risk of hospital revisits due to pediatric asthma within a year. Introduction A socio-marker is a measurable indicator of social conditions where a patient is embedded in and exposed to, being analogous with a biomarker indicating the severity or presence of some disease state. Social factors are one of the most clinical health determinants [1], which play a critical role in explaining health outcomes. Socio-markers can help medical practitioners and researchers to reliably identify high-risk individuals in a timely manner. Methods We collected data from three different sources: pediatric asthma encounter records from Jan 1st, 2016 to Dec 31st, 2016 at a children's hospital, the 2010 U.S census data and neighborhood quality survey data by Memphis Property Hub. After merging these datasets we examine the effect of social features in identifying the patients who visited the hospital more than once during the observation period. We only use the first time visit (3,678 cases) to avoid over-counting of the same patients. In addition to demographic features (age, gender, insurance type, and race (African American and White)), we incorporate the social features such as the proportion of individuals living below the federal poverty level, blight prevalence, neighborhood quality, neighborhood quality inequality, trash dumping presence, the broken window pervasiveness within the zip code area of patients' residence are included. We then implemented a Support Vector Machine (SVM) based classification model using abovementioned 11 social features. The classification outcome is either patient visits the hospital only one-time (class 0) or revisits the hospital within a year (class 1). Among 3,678 unique patients in the dataset, only 823 pediatric patients revisited hospital with asthma. So, to overcome the class imbalance issue, we have used 823 patients' data (randomly selected in 1,000 iterations) from each class. Further, to avoid overfitting and ensure generalizability, we divided the dataset as training, test, and validation with a proportion of 60%, 20%, and 20%, respectively. The reported test (5-folds cross-validation using training and testing data) and validation accuracy of the SVM method are averaged over 1,000 iterations to avoid sampling error and bias. Results The proposed socio-marker model resulted in an average classification accuracy of 63.70% for the test set and 63.67 % for the validation set. Further, the average specificity (the total true negative cases divided by the sum of true negative and false positive) and sensitivity (the total number of true positive cases divided by the sum of positive predicted cases) is found to be 62.79% and 64.77%, respectively for the test set and 62.79% and 64.83%, respectively for the validation set. Results of this study suggest that socio-marker features that are not directly related to a patient's medical conditions can still predict whether the patient will come back to the hospital within a year or not with approximately 64% accuracy. Conclusions Bringing the socio-marker features in the surveillance system may ease the burden of detecting the patients at risk of revisiting the hospital. The results should be interpreted with caution because we only used 12-month period of observation and the visit beyond the observation window is not considered. Also the patients may have visited different hospitals which are not captured in the data. References 1. Booske BC, Athens JK, Kindig DA, Park H, Remington PL: Different perspectives for assigning weights to determinants of health. University of Wisconsin: Population Health Institute 2010. 2. Subbarao P, Mandhane PJ, Sears MR: Asthma: epidemiology, etiology and risk factors. Canadian Medical Association Journal 2009, 181(9):E181-E190. 3. Gold DR, Wright R: Population disparities in asthma. Annu Rev Public Health 2005, 26:89-113.

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# Roles of Health Literacy in Relation to Social Determinants of Health and Recommendations for Informatics-Based Interventions: Systematic Review

## Abstract

**Objective** To evaluate the use of commercial laboratory data for monitoring trends in HAV infections over time and identifying geographic and demographic characteristics of HAV case clusters for the purpose of targeting interventions. **Introduction** Hepatitis A virus (HAV) infections have persisted in the United States despite the availability of an effective vaccine. Recent outbreaks of HAV infections among unvaccinated adults attributed to consumption of HAV-contaminated food, or person-to-person contact in certain populations (e.g., men who have sex with men) or settings (e.g., homeless shelters) have emphasized the importance of targeted vaccination of at-risk adults. **Methods** We used commercial laboratory data from Quest Diagnostics (Quest) and Laboratory Corporation of America (LabCorp) to identify unique individuals within each database who tested positive for HAV IgM antibody (indicative of acute HAV infection) from January 2011 through June 2017. Though de-duplication across the two laboratories was not possible, comparison of case characteristics indicated limited possible overlap of cases (<0.5%) and thus data from the two laboratories were combined. Demographic characteristics associated with the first positive test were used to classify cases by age, gender, state of residence, insurance type, and provider specialty. Persons co-infected with hepatitis B and/or hepatitis C were identified based on positive test results for hepatitis B surface antigen and hepatitis C RNA, respectively. **Results** A total of 6,702,256 HAV IgM test results from Quest and 7,043,555 HAV IgM test results from LabCorp were processed. Of those, 24,697 (0.4%) and 13,785 (0.2%) tests, respectively, had a 'Reactive', or positive result, indicating acute HAV infection. From these test results, we identified 15,415 unique individuals from Quest and 10,622 unique individuals from LabCorp with an acute HAV infection between January 2011 and June 2017. Among the 26,037 acute cases, the majority were female (14,056; 54.0%), were aged 50 or older (13,940; 53.5%), resided in large central or fringe metropolitan areas (17,842; 68.5%), and had tests ordered by family or internal medicine providers (12,358; 47.5%; Table). We identified 330 cases (1.3%) among incarcerated persons. Although data could not be de-duplicated across labs, we estimated a minimum of 630 persons (2.4%) were co-infected with hepatitis B and 852 persons (3.3%) were co-infected with hepatitis C. From 2011 to 2015, there were 7,370 cases of acute HAV reported to CDC, whereas Quest and LabCorp test results indicated 19,822 cases over the same time period. Trends in cases by month revealed seasonal increases in cases in late summer and early fall months (Figure 1). Mapping of acutely-infected individuals demonstrated a range of cases from 0 to 1,119 cases by county over the study period (Figure 2). **Conclusions** HAV IgM test results over a 6-year period from two commercial laboratories serving the United States suggest continuing hepatitis A transmission. Most cases occur among older adults, and appear to cluster geographically in metropolitan areas. Commercial laboratory data is a useful tool for supplementing case-based surveillance and informing prevention efforts.

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# Roles of Health Literacy in Relation to Social Determinants of Health and Recommendations for Informatics-Based Interventions: Systematic Review

## Abstract

**Objective** We used hospitalization rates for mental disorders to determine utilization patterns and the need for community-based mental health services. **Introduction** Hospitalization rates for mental health disorders provide important information to help us prioritize community needs for mental health and urgent care plantation. In Saint Louis County, there were over 13,000 hospitalizations for mental disorders between 2010 and 2014. For all age groups, depressive disorders, including major depression and mood disorder not-otherwise-specified, were the most common primary diagnostic grouping for hospitalizations among mental disorders, followed by bipolar disorder. In 2012, The Saint Louis County Department of Planning defined 5 geographic areas (Inner North, Outer North, South, West and Central) within and crossing Saint Louis County's borders. Among them, the Inner North has the greatest poverty, as opposed to the West which has the least. These geographic areas, along with neighborhood poverty level, were analyzed to better understand the demographics of Saint Louis County residents experiencing mental disorders. **Methods** Hospitalization for a mental disorder—that is, a principal diagnosis of International Classification of Disease, Ninth Revision, code 290 – 319—among Saint Louis County residents from 2010 to 2014 were obtained from the Missouri Department of Health and Senior Services (DHSS), Bureau of Health Care Analysis and Data Dissemination. Hospitalization rate was calculated by age, gender/sex, race/ethnicity, neighborhood poverty and geographic area using SAS 9.4. The five geographic areas were created by the Saint Louis County Department of Planning for the 2012 Citizen Survey, which were defined based on the 49 ZIP codes within and crossing Saint Louis County's borders. ESRI ArcGIS was used to assign each census tract to one of the five survey areas based on having greater than 50 percent of its area falling within a particular survey area. The maps were created using ESRI ArcMap version 10.3. The maps compare geographic and social economic patterns of rates of hospitalization of a mental disorder in Saint Louis County by census tract. **Results** The greatest burden of mental health-related hospitalizations was among children ages 15-17, Black/African Americans, and neighborhoods with “high” poverty. Hospitalization rates of mental disorders among children (age 0 - 17) increased from 67.3 to 81.1 per 10,000 from 2010 to 2014; among adults (18+), rates increased from 124.7 to 134.8 per 10,000 from 2010 to 2014. From 2010 to 2014, children living in the Inner North area were more than twice as likely to be hospitalized for a mental disorder as children who were living in the West. Similarly, hospitalization rates for mental disorders among adults living in the Inner North area were nearly three times greater than adults living in the West. **Conclusions** As illustrated by the maps, there is an obvious, positive association between poverty level and mental health-related hospitalizations among residents of Saint Louis County. Thus, although a likely overlooked policy concern, heightened focus on community-based mental health care facilities in certain areas, specifically the Outer and Inner North regions, may be both ethical and cost-effective. Furthermore, early prevention should be developed and introduced to children at the transition age period (15-17). **References** Wojas E, Meausoone V, Norman C. Adult Psychiatric Hospitalizations in New York City. Department of Health and Mental Hygiene: Epi Data Brief (71); June 2016.

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# Roles of Health Literacy in Relation to Social Determinants of Health and Recommendations for Informatics-Based Interventions: Systematic Review

## Abstract

**Objective** To identify surveillance coverage gaps in emergency department (ED) and urgent care facility data due to missing discharge diagnoses. **Introduction** Indiana utilizes the Electronic Surveillance System for the Early Notification of Community-Based Epidemics (ESSENCE) to collect and analyze data from participating hospital emergency departments. This real-time collection of health related data is used to identify disease clusters and unusual disease occurrences. By Administrative Code, the Indiana State Department of Health (ISDH) requires electronic submission of chief complaints from patient visits to EDs. Submission of discharge diagnosis is not required by Indiana Administrative Code, leaving coverage gaps. Our goal was to identify which areas in the state may see under reporting or incomplete surveillance due to the lack of the discharge diagnosis field. **Methods** Emergency department data were collected from Indiana hospitals and urgent care clinics via ESSENCE. Discharge diagnosis was analyzed by submitting facility to determine percent completeness of visits. A descriptive analysis was conducted to identify the distribution of facilities that provide discharge diagnosis. A random sample of 20 days of data were extracted from visits that occurred between January 1, 2017 and September 6, 2017. **Results** A random sample of 179,039 (8%) ED entries from a total of 2,220,021 were analyzed from 121 reporting facilities. Of the sample entries, 102,483 (57.24%) were missing the discharge diagnosis field. Over 40 (36%) facilities were missing more than 90% of discharge diagnosis data. Facilities are more likely to be missing >90% or <19% of discharge diagnoses, rather than between those points. Comparing the percent of syndromic surveillance entries missing discharge diagnosis across facilities reveals large variability. For example, some facilities provide no discharge diagnoses while other facilities provide 100%. The number of facilities missing 100% of discharge diagnoses (n = 19) is 6.3 times that of the facilities that are missing 0% (n = 3). The largest coverage gap was identified in Public Health Preparedness District (PHPD)1 three (93.16%), with districts five (64.97%), seven (61.94%), and four (61.34%) making up the lowest reporting districts. See Table 2 and Figure 12 for percent missing by district and geographic distribution. PHPD three and five contain a large proportion (38%) of the sample population ED visits which results in a coverage gap in the most populated areas of the state. **Conclusions** Querying ESSENCE via chief complaint data is useful for real-time surveillance, but is more informative when discharge diagnoses are available. Indiana does not require facilities to report discharge diagnosis, but regulatory changes are being proposed that would require submission of discharge diagnosis data to ISDH. The addition of discharge diagnose is aimed to improve the completeness of disease clusters and unusual disease occurrence surveillance data. **References** 1. Preparedness Districts [Internet]. Indianapolis (IN): Indiana State Department of Health, Public Health Preparedness; 2017 [Cited 2017 Sept 20]. Available from: <https://www.in.gov/isdh/17944.htm>.

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## Abstract

**Objective** The Florida Department of Health in Hillsborough County (DOH-Hillsborough) routinely reviews the ESSENCE-FL system to assess syndromic trends in emergency department (ED) and urgent care data (UCC). Collection of this type of symptom data from long term care facilities (LTCFs) and child care centers is of interest in order to better understand how these illness patterns present in vulnerable populations outside of the EDs. Introduction Surveillance in nursing homes (Enserink et al., 2011) and day care facilities (Enserink et al., 2012) has been conducted in the Netherlands, but is not commonly practiced in the United States (Buehler et al., 2008). Outbreaks of illnesses within these facilities are required to be reported to the Epidemiology Program, however a small fraction of outbreaks reported come from LTCFs. Without regular communication between LTCFs and the Epidemiology Program, it is likely that many outbreaks are going unreported due to lack of awareness of the reporting requirements by facility staff. To better understand the prevalence of illness in LTCFs and improve communication between LTCFs and DOH-Hillsborough a weekly surveillance survey was created using Epi Info web survey. **Methods** The online facility search tool from the Agency for Healthcare Administration (AHCA) was used to query assisted living facilities and nursing homes in Hillsborough County in July 2017. The information provided included the number of beds a facility is licensed to have. Interest in participation was solicited from larger LTCFs within the county in August 2017 and 23 facilities volunteered to receive weekly surveys, with a total volume of 3,276 beds. A form was created in Epi Info to capture weekly information per facility of the number of residents and staff with new onset of various symptoms. Symptom groups include GI, rash, respiratory, and those with respiratory symptoms who also have a fever (to assess influenza-like illness); number of positive flu tests for the week is also asked. Starting with week 38, an email has been sent once a week to participating facilities with a link to the Epi Info web survey (Figure 1) and instructions to fill out the information for the previous week. **Results** To date, 12 weeks of information has successfully been captured in Epi Info and transferred to Microsoft Excel for graphical visualization of percentage of residents/staff reported each week in the county with new onset of the above symptoms. Low levels of illness (<6%/week of total reported residents/staff) have been reported for various syndromes each week. Over the 12 week period an average of 3.9 facilities submit data per week, with a total of 10 of 23 facilities participating at least once. In week 42 phone calls were made to facilities that had not submitted any responses in an attempt to elicit more participation and troubleshoot any problems facilities may have encountered. Prior to week 42, an average of 3.2 facilities reported per week. After reminder phone calls were conducted, the average number of responses for weeks 42-48 was 4.4 with the highest in week 42 (6 responses). Starting in week 42 the survey has also been implemented for 15 child care facilities, with four participating over the seven weeks with an average of 2.1 responses per week. **Conclusions** Since implementation, the main limitation with the data collection is lack of regular participation from facilities. The current goal of the project is to increase the number of regular responses from both LTCFs and child care facilities. The phone calls made in week 42 increased the response rate for LTCFs, particularly for that week. Preliminary results from the first 12 weeks of data indicate that using Epi Info web survey as a syndromic surveillance tool for local facilities has potential if regular participation can be achieved. **References** Buehler, J., Sonricker, A., Paladini, M., Soper, P., Mostashari, F. (2008), Syndromic Surveillance Practice in the United States: Findings from a Survey of State, Territorial, and Selected Local Health Departments. *Advances in Disease Surveillance*, 6:3. Enserink, R., Meijer, A., Dijkstra, F., van Benthem, B., van der Steen, J. T., Haenen, A., van Delden, H., Cools, H., van der Sande, M., Veldman-Ariesen, M.-J. and on behalf of the Sentinel Surveillance Network on Infectious Diseases in Nursing Homes Study Group (2011), Absence of Influenza A(H1N1) During Seasonal and Pandemic Seasons in a Sentinel Nursing Home Surveillance Network in the Netherlands. *J Am Geriatr Soc*, 59: 2301-2305. doi:10.1111/j.1532-5415.2011.03715.x Enserink, R., Noel, H., Friesema, I., de Jager, C., Kooistra-Smid, A., Kortbeek, L., Duizer, E., van der Sande, M., Smit, H., van Pelt, W. (2012), The KIzSS network, a sentinel surveillance system for infectious diseases in day care centers: study protocol. *BMC Infectious Diseases*, 12:259. doi:10.1186/1471-2334-12-259

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# Roles of Health Literacy in Relation to Social Determinants of Health and Recommendations for Informatics-Based Interventions: Systematic Review

## Abstract

**Objective:** To strengthen public health surveillance and monitor implementation of Integrated Disease Surveillance and Response in the Kingdom of Swaziland. **Introduction:** Swaziland adopted the Integrated Disease Surveillance and Response (IDSR) strategy in 2010 to strengthen Public Health Surveillance (PHS) that fulfills International Health Regulations (2005) and the Global Health Security Agenda (GHSA). This strategy allows the Ministry of Health (MoH), Epidemiology and Disease Control Unit (EDCU) to monitor, prevent and control priority diseases in the country. We used a health systems strengthening approach to pilot an intervention model for IDSR implementation at five hospitals in Swaziland over a pilot phase of three months. **Methods:** Our intervention included cross-country IDSR trainings, sensitizations and onsite trainings targeting national and regional health teams for over 250 health workers. The EDCU developed and disseminated standardized case definitions for health facilities (HFs) to detect, confirm and report priority conditions. Trained health care workers were tasked to cascade knowledge sharing and sensitization about IDSR with their HFs during in-service trainings. The facilities were to use IDSR standard case definition as guidelines for diagnosing and reporting cases; submit monthly reports on all priority conditions to Health Management Information System (HMIS) and intensify reporting through immediate disease notification system (IDNS) for all notifiable conditions. Indicators and monitoring tools for disease surveillance and response as recommended by the technical guidelines for IDSR in the African region were developed. The intervention was evaluated at five purposively selected high-volume referral hospitals (attending to  $\geq 1500$  to 15000 outpatient visits per month), which also have maternity services. Structured questionnaires in the form of a monitoring tool, checklists and observations were used to collect data. Quantitatively, monthly reports submitted by the five facilities to HMIS were reviewed and analyzed for completeness and timeliness. Clinic supervisors were identified from outpatient, inpatient, maternity and laboratory departments as key informants to explore successes and challenges of IDSR implementation. Additionally, IDSR officers visited health facilities and observed the registers and reporting forms used to report IDSR priority conditions and the availability of IDSR guidelines. **Results:** The five HFs submitted monthly reports from June to August 2017 with a calculated completeness of 80% in June 2017, 60% in July and 40% in August. Timeliness was calculated as at 20% in June, 20% in July and 40% in August. IDSR officers observed that all five HFs document cases of priority diseases in registers during consultations and use daily tally sheets. However, it was observed that diseases reported through the immediate diseases notification system were not all documented in the morbidity registers and vice versa. Health workers reported to be unaware about all diseases that require immediate notification to trigger investigation, hence some disease like perinatal deaths were never notified through the IDNS system during the period of evaluation. All five hospitals reported not utilizing the standard cases definitions provided to identify and report IDSR priority diseases. **Conclusions:** The proportion of completeness and timeliness from the five HFs during the evaluation period was low compared to WHO recommended standards of  $\geq 80\%$  from all HFs. This therefore, poses challenges in monitoring and responding to the priority conditions as per IDSR standards and recommendations. All five hospitals reported not utilizing the standard cases definitions to identify and report IDSR priority diseases and this poses challenges in comparison of data across sites, monitoring priority diseases, conditions and events and also identifying the alert or epidemic thresholds. There is need to capacitate more health workers on IDSR for Swaziland to strengthen PHS and be able to prevent and control public health threats timely.

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# Roles of Health Literacy in Relation to Social Determinants of Health and Recommendations for Informatics-Based Interventions: Systematic Review

## Abstract

**Objective:** We describe the Bangkok Dusit Medical Services Surveillance System (BDMS-SS) and use of surveillance efforts for influenza as an example of surveillance capability in near real-time among a network of 20 hospitals in the Bangkok Dusit Medical Services group (BDMS). **Introduction:** Influenza is one of the significant causes of morbidity and mortality globally. Previous studies have demonstrated the benefit of laboratory surveillance and its capability to accurately detect influenza outbreaks earlier than syndromic surveillance.<sup>1-3</sup> Current laboratory surveillance has an approximately 4-week lag due to laboratory test turn-around time, data collection and data analysis. As part of strengthening influenza virus surveillance in response to the 2009 influenza A (H1N1) pandemic, the real-time laboratory-based influenza surveillance system, the Bangkok Dusit Medical Services Surveillance System (BDMS-SS), was developed in 2010 by the Bangkok Health Research Center (BHRC). The primary objective of the BDMS-SS is to alert relevant stakeholders on the incidence trends of the influenza virus. Type-specific results along with patient demographic and geographic information were available to physicians and uploaded for public health awareness within 24 hours after patient nasopharyngeal swab was collected. This system advances early warning and supports better decision making during infectious disease events.<sup>2</sup> The BDMS-SS operates all year round collecting results of all routinely tested respiratory clinical samples from participating hospitals from the largest group of private hospitals in Thailand. **Methods:** The BDMS has a comprehensive network of laboratory, epidemiologic, and early warning surveillance systems which represents the largest body of information from private hospitals across Thailand. Hospitals and clinical laboratories have deployed automatic reporting mechanisms since 2010 and have effectively improved timeliness of laboratory data reporting. In April 2017, the capacity of near real-time influenza surveillance in BDMS was found to have a demonstrated and sustainable capability. **Results:** From October 2010 to April 2017, a total of 482,789 subjects were tested and 86,110 (17.8%) cases of influenza were identified. Of those who tested positive for influenza they were aged <2 years old (4.6%), 2-4 year old (10.9%), 5-14 years old (29.8%), 15-49 years old (41.9%), 50-64 years old (8.3%) and >65 years old (3.7%). Approximately 50% of subjects were male and female. Of these, 40,552 (47.0%) were influenza type B, 31,412 (36.4%) were influenza A unspecified subtype, 6,181 (7.2%) were influenza A H1N1, 4,001 (4.6%) were influenza A H3N2, 3,835 (4.4%) were influenza A seasonal and 196 (0.4%) were respiratory syncytial virus (RSV). The number of influenza-positive specimens reported by the real-time influenza surveillance system were from week 40, 2015 to week 39, 2016. A total of 117,867 subjects were tested and 17,572 (14.91%) cases tested positive for the influenza virus (Figure 1). Based on the long-term monitoring of collected information, this system can delineate the epidemiologic pattern of circulating viruses in near real-time manner, which clearly shows annual peaks in winter dominated by influenza subtype B in 2015-1016 season. This surveillance system helps to provide near real-time reporting, enabling rapid implementation of control measures for influenza outbreaks. **Conclusions:** This surveillance system was the first real-time, daily reporting surveillance system to report on the largest data base of private hospitals in Thailand and provides timely reports and feedback to all stakeholders. It provides an important supplement to the routine influenza surveillance system in Thailand. This illustrates a high level of awareness and willingness among the BDMS hospital network to report emerging infectious diseases, and highlights the robust and sensitive nature of BDMS's surveillance system. This system demonstrates the flexibility of the surveillance systems in BDMS to evaluate to emerging infectious disease and major communicable diseases. Through participation in the Thailand influenza surveillance network, BDMS can more actively collaborate with national counterparts and use its expertise to strengthen global and regional surveillance capacity in Southeast Asia, in order to secure advances for a world safe and secure from infectious disease. Furthermore, this system can be quickly adapted and used to monitor future influenzas pandemics and other major outbreaks of respiratory infectious disease, including novel pathogens.

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## Abstract

**Objective:** In August, 2017, we conducted a peer review evaluation of the reported high stool adequacy and Non-polio Acute Flaccid Paralysis (AFP) rates of the World Health Organisation (WHO) verified AFP cases, in order to estimate and establish concordance for both surveillance core indicators in Lafia and Nasarawa Egon LGAs in Nasarawa State. **Introduction:** Nigeria is the only polio endemic country in Africa. Four (4) WPV1 cases were confirmed in 2013 after two years of silence. Nigeria has a strong polio programme characterized by innovative and forward driven strategies, despite several challenges of which surveillance is one of the driving forces. Near perfect surveillance core indicators reported over the past twelve (12) months across certain states and Local Government Areas (LGAs) were issues of concern, given security challenges among others. In August, 2017, we conducted a peer review evaluation of the reported high stool adequacy and Non-polio Acute Flaccid Paralysis (AFP) rates of the World Health Organisation (WHO) verified AFP cases, in order to estimate and establish concordance for both surveillance core indicators in Lafia and Nasarawa Egon LGAs in Nasarawa State. **Methods:** The LGAs to be visited and AFP cases reported within ninety (90) days and verified to be true and adequate prior to peer review were selected. Any person with strong surveillance knowledge and skill, working in Nigeria with the government or partner agencies and involved in surveillance was identified as a peer reviewer, trained and deployed to the LGAs. Reviewers were not deployed to their geo-political zones where they work under routine conditions. Data was collected by visiting the residence of the respective AFP cases and eliciting responses, using a structured interviewer-administered peer review checklist. Data was collated, analysed using Microsoft Excel 2010 and interpreted accordingly. The causes of incoherence were identified and presented to the LGA Disease Surveillance and Notification Officers (DSNOs) and State authority. An improvement plan which would be monitored and evaluated was elaborated. The AFP surveillance data base for discordant AFP cases was updated with the data generated from the peer review. **Results:** Of the nineteen (19) AFP cases reviewed, 63.2% (12/19) were females. The mean Age of the total AFP case patients was 3 years (SD 3.4). In Lafia LGA, eight (8) AFP cases were verified and all were true AFP cases and adequate. In Nasarawa Egon LGA, eleven (11) cases were verified, 54.5% (6/11) were true AFP cases and 90.9% (10/11) were found to be adequate. The major causes of the gaps identified include mothers/caregivers dividing collected stool specimen sample to make for two (2) stool samples meant to be collected 24 hours apart for case investigation. This was due to failure on the part of the LGA DSNOs to either inform the mothers/caregivers or underscore the importance of appropriate stool collection. The inability of the surveillance focal officers to adequately identify/differentiate other disease conditions that mimic AFP and persistence of residual paralysis (in Non-polio AFP cases) in 5 (45.5%) cases were also identified in Nasarawa Egon LGA. This was as a result of the lack of referral to the next level for physiotherapy care. **Conclusions:** In Nasarawa Egon LGA, they were discordances in the reported AFP performance core indicators. They include inadequate stool sample, wrong classification of AFP cases and persistence of residual paralysis in Non-polio AFP cases. We therefore, recommend that the WHO State team should re-orient the LGA DSNOs on proper stool specimen collection for case investigation. Also, the LGA DSNOs should sensitize parents/caregivers on appropriate protocol of stool specimen collection and advise them on referral to the next level of care.

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# Roles of Health Literacy in Relation to Social Determinants of Health and Recommendations for Informatics-Based Interventions: Systematic Review

## Abstract

**Objective:** Describe a case study of validation of a scarlet fever outbreak using syndromic surveillance data sources. **Introduction:** Since 2004, the French syndromic surveillance system SurSaUD® [1] coordinated by the French Public Health Agency (Santé publique France) daily collects morbidity data from two data sources: the emergency departments (ED) network Oscour® and the emergency general practitioners' associations SOS Médecins. Almost 92% of the French ED attendances are recorded by the system. SOS Médecins network is a group of 62 associations of general practitioners, dispatched all over the territory. Santé publique France received data from 61 out of 62 associations. Both data sources collect medical diagnosis, using ICD10 codes in the ED network and specific medical thesaurus in SOS Médecins associations. These data are routinely analyzed to detect and follow-up various expected or unusual public health events all over the territory [2]. The system is also used for reassurance of decision makers. In that framework, in March 2017, the French Ministry of Health requested Santé publique France to validate a potential scarlet fever outbreak in France. **Methods:** ED attendances for scarlet fever were identified using the ICD10 code "A38". SOS Médecins visits with the specific code corresponding to "scarlet fever" were considered. The weekly numbers of ED attendances and SOS Médecins visits for scarlet fever were analyzed from 02/01/2017 (week 5) to 03/31/2017 (week 13) by age group (all ages and less than 15 years old, scarlet fever affecting mainly children) and were compared to the numbers of attendances and visits registered during the same period of the two previous years. Analysis was conducted both at national and regional levels. In order to take into account the improvement of data quality during the study period, we also calculated proportion of attendances and visits for scarlet fever among the overall attendances (respectively visits) with medical coded information. **Results:** The number of SOS Médecins visits for scarlet fever started to increase in week 9 of 2017. Almost 95% of visits concerned children aged less than 15 years old. SOS Médecins visits for scarlet fever represented 0.24% of the overall visits for the 2 age groups for weeks 11, 13 and 14. This proportion was never reached in 2015 and was observed twice in 2016, but later in the year (weeks 25 and 26). The regional analysis showed that all French metropolitan regions contributed to the increase, even if Paris region was the most impacted. More specifically, cases were mainly located in the east part of the Paris region (in Seine-et-Marne). In the OSCOUR® network, the analysis of the number of attendances for scarlet fever at the national level shows a limited increase from week 9 to week 12. Weekly proportion of ED attendances for scarlet fever among the total coded attendances remained comparable to those observed the two previous years on the same period. The regional analysis also showed that 35% of attendances for scarlet fever during this period were observed in Paris area. But, number of attendances for scarlet fever in this region was comparable during this period to numbers observed the two previous years. **Conclusions:** The analysis of emergency syndromic data sources enables to confirm an increase of consultations for scarlet fever in SOS Médecins associations from weeks 9 to 14, mainly for children less than 15 years old. The large implementation of the SOS Médecins associations on the whole territory allowed us to provide a geographical location of the outbreak: mainly in the east part of Paris area. The temporal pattern of scarlet fever visits in this region may be in favor of a small cluster of cases. The availability of data collected routinely during a long period of time by the syndromic surveillance system enables to evaluate that the outbreak occurred earlier than the previous years, but the intensity of the outbreak was similar to those observed previously. Scarlet outbreak was not confirmed through the ED network, even if a limited increase was observed during the same period of time. The investigation of this outbreak in ED network revealed a miscoding practice in one ED structure, resulting locally in a larger number of attendances than in the other ED of Paris area. Finally, this case study led to improve data quality and highlighted the importance of the validation step of alarms by epidemiologists, even in an automatized system.

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# Roles of Health Literacy in Relation to Social Determinants of Health and Recommendations for Informatics-Based Interventions: Systematic Review

## Abstract

**Objective** The goal of this study was to identify gaps in the severe acute respiratory infection sentinel surveillance system at Surb Astvatsamayr Medical Center. Introduction Influenza is a priority in Armenia. There are two influenza surveillance systems in Armenia: population and sentinel. The medical center (MC) has been included in sentinel surveillance since 2012. In 2015 a study was undertaken to identify gaps in severe acute respiratory infection (SARI) sentinel surveillance system in Surb Astvatsamayr MC. **Methods** Medical records and reporting forms of SARI cases were generated for individuals meeting the case definition and analyzed for age groups, risk factors, sentinel surveillance detection methods, laboratory conformation, number of days hospitalized and reporting. **Results** In 2014, 3016 patients were admitted in the hospital with ARI, of whom 2982 were younger than 18 years. During the 2014-2015 influenza season (week 40, 2014-week 20, 2015), 77 swabs have been taken in total, of which five were influenza positive (4 B and 1 AH1N1). Also in the 2013-2014 influenza season, five samples tested positive (all influenza A). Sixty-one (48%) patients with respiratory disease met the WHO SARI case definition (2011), 84 (66%) of all reviewed patients would have met the SARI case definition. The numbers for the ICU (25 records reviewed) do not reflect the actual percentage of patients admitted with respiratory symptoms. The 33 additional cases taken from the sampling logbook were mainly hospitalized in the ICU. Influenza tests were performed on 34 patients (mainly ICU), five were positive for influenza (four B--all adults—and one AH1N1), and four tested positives for other respiratory pathogens (two RSV, one RV, one BV). All influenza positives had fever or a history of fever and 80% met the WHO SARI case definition (2011). Non-sampled cases generally have fewer reported symptoms, but still 44% of cases fits the WHO SARI case definition (2011). **Conclusions** The percentages of patients meeting the WHO SARI 2011 case definition and the WHO SARI 2014 definition shows that mainly caused by the absence of shortness of breath in the SARI 2014 definition 52% (2011) vs 66% (2014) in Surb Asvatsamayr. A large number of children from Neonatal and Children's departments fulfil the SARI case definition and could potentially be swabbed in addition to ICU patients. There are gaps in WHO SARI case definitions. The sentinel surveillance system should be improved.

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# Roles of Health Literacy in Relation to Social Determinants of Health and Recommendations for Informatics-Based Interventions: Systematic Review

## Abstract

**Objective** To describe how a successful partnership between state public health and a university organization has used epidemiologic data, such as mortality, hospital discharge, and emergency department (ED) visit data, to inform falls prevention activities in North Carolina (NC). **Introduction** Falls are a leading cause of fatal and nonfatal injury in NC. As the size of the older adult population is predicted to increase over the next few decades, it is likely that the incidence of falls-related morbidity and mortality will increase in tandem.<sup>1</sup> In order to address this public health emergency, the Injury and Violence Prevention Branch (IVPB) of the NC Division of Public Health has partnered with the Carolina Center for Health Informatics (CCHI) in the Department of Emergency Medicine at the University of North Carolina at Chapel Hill to perform falls surveillance activities. This abstract describes some of the specific research and surveillance activities currently ongoing in NC. **Methods** IVPB developed the Special Emphasis Report (SER) on Fall Injuries among Older Adults, 2005-2014 to describe the demographic characteristics and trends of falls-related mortality and hospitalization among adults 65 and older, associated costs of falls-related injury, and current falls prevention activities in NC. The NC SER was based on the Centers for Disease Control and Prevention's Injury SER template, a tool designed to facilitate the dissemination of injury data for public health action. While the SER focused primarily on falls among adults >65 years of age, CCHI was interested in using ED visit data to identify the age at which falls morbidity begins to increase as a means of informing prevention activities to be implemented before the advent of an injurious fall. Therefore, CCHI performed a descriptive epidemiologic study using ED visit data collected by NC DETECT. CCHI identified all NC ED visits from January 1, 2010 – December 31, 2014 that met the National Center for Injury Prevention and Control definition of a fall of unintentional intent.<sup>2</sup> During 2010-2014, NC DETECT captured ED visit data from all 125 24/7, acute care, hospital-affiliated, civilian EDs and over 99% of all ED visits in the state.<sup>3</sup> **Results** Analysis for the SER found that falls-related death rates increased by 43.1% from 2005 (47.0 per 100,000) to 2014 (67.3 per 100,000), with the greatest increase among males (61.3%) and adults 85 and older (74.4%). Conversely, rates of non-fatal hospitalization remained relatively stable and were 1.6 times higher among females than males in 2014 (84.0 and 56.8 per 100,000 respectively). Projected lifetime costs associated with falls among NC older adults was approximately \$1.4 billion in 2014. NC DETECT captured 986,024 ED visits during the period 2010-2014 among adults >20 years of age (27.4 ED visits/1,000 person-years; 95% CI: 27.4-27.5). Throughout the adult lifespan, fall incidence rates in women (33.0 ED visits/1,000 person-years; 95% CI: 32.9-33.1) exceeded those in men (21.3 ED visits/1,000 person-years; 95% CI: 21.3-21.4). Starting at age 45, fall rates in women continued to exceed fall rates in men, climbing each year, while rates in men remained stable until after age 65. These results suggest that the risk of having an injurious fall may increase before age 65, particularly among women. Due to the public health implications of the results obtained by IVPB and CCHI, both organizations are working closely to ensure that relevant information reaches a wide net of potential partners in the effort to reduce falls morbidity and mortality. To date, IVPB and CCHI have collaborated on generating fact sheets and short reports available to the public, syndromic surveillance custom event reports available to authorized users, and presenting information to local, state, and national partners. **Conclusions** Falls morbidity and mortality are major concerns for the state of NC and the country as a whole. Falls surveillance benefits from the collaboration of governmental and university organizations with community partners. For example, when CCHI identified an increase in falls incidence in middle age, and, therefore, the potential need to begin falls risk assessment activities at ages < 65, particularly among women, NC DPH had the resources to communicate these results to relevant local and state programs and organizations. **References** 1. R Tippett. Population Growth in the Carolinas: Projected vs. Observed Trends. 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## Abstract

**Objective** To assess healthcare facilities' level of readiness to respond to an HAI outbreak, the Florida Department of Health in Pinellas County (DOH-Pinellas) conducted an HAI outbreak tabletop exercise (TTX) on June 6, 2017. Other benefits of this TTX were to provide opportunities for collaborative learning, building community partnerships and evaluation of HAI preparedness activities in Pinellas County healthcare facilities. **Introduction** One in twenty-five patients in acute care hospitals develop at least one health care associated infection (HAI); this resulted in approximately 75,000 preventable deaths in 2011. Risk factors associated with developing HAIs include older patients, serviced at a large hospital, central catheter placement, receiving medical ventilation, and placement in a critical care unit. In Pinellas County, individuals 65 years of age and older comprise approximately 24% of the total population. **Methods** A line list of contact information for all long-term care facilities in Pinellas County was obtained from the DOH-Pinellas Environmental Health Program. An invitation to the TTX was sent to 234 health care and assisted living facilities. Of those invited, 35 individuals attended the TTX on June 6, 2017. The methods used to facilitate discussion included the four scenarios that addressed different stages of an outbreak investigation and a "force decision-making" framework. Following the course, a twelve-question evaluation was distributed. The first seven questions were based on a five-point Likert scale assessing the course's impact on knowledge and tabletop learning environment. The other five were open-ended and asked participants to elaborate on what they learned and provide feedback regarding the strengths and areas for improvement of the TTX. **Results** Exercise participants included infection control practitioners, safety officers, nursing supervisors, facility managers and epidemiologists from hospitals, assisted living and skilled nursing facilities, hospice, rehabilitation centers and health departments. Of the 35 participants, 30 completed the course evaluation for a completion rate of 86%. For questions addressing HAI knowledge, participants strongly agreed that the tabletop exercise enhanced their understanding of infection control guidelines for HAIs. The question that received the lowest score of 4.3 was the perception that "I was able to develop tools for my agency's infection control guidelines." In the open-ended questions, themes regarding HAI knowledge, resources, response and policies were frequently mentioned, in addition to confusion over the health department's role and available resources during an HAI outbreak. **Conclusions** Participation and feedback during the TTX substantiated the importance of increased collaboration across organizations and opportunities for training on HAI outbreak response. Participants identified a need for an open forum to discuss best practices for HAI control and surveillance methods to help guide preparedness and response efforts. To address this need, DOH-Pinellas will create a HAI coalition which would aim to improve understanding of each facility's role in responding to an HAI outbreak.

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# Roles of Health Literacy in Relation to Social Determinants of Health and Recommendations for Informatics-Based Interventions: Systematic Review

## Abstract

**Objective** To match fatal overdose information across city data sources to understand which systems overdose decedents may have interacted with prior to their death **Introduction** Philadelphia is in the midst of a drug epidemic that killed 702 Philadelphians in 2015, 907 in 2016, and is on trajectory to kill 1,200 in 2017. Opioids are involved in the majority of fatal overdoses, contributing to 80% of overdose deaths in 2016. In 2016, the age-adjusted death rate for opioid-involved overdoses was 40.4 deaths per 100,000 residents, up from 17.9 deaths per 100,000 residents in 2010. Despite the epidemiologic work accomplished to date, gaps in knowledge still exist, especially for vulnerable populations such as those with serious mental illness or those who were ever incarcerated, homeless, or within the juvenile justice system. Matching individuals who died of an overdose across city systems could provide insight into missed opportunities for interventions. Findings will help inform policy for those systems that serve clients at highest risk for overdose. **Methods** Individuals who succumbed to fatal overdoses involving opioids between January 1, 2012 and June 30, 2016 were matched to other city data systems going back to January 1, 2000. Descriptions of city systems that were matched to fatal overdose data is provided in Table 1. Frequencies were calculated to determine the number of individuals who received services or received services in the three years prior to death, as indicated by one of the city systems. **Results** Between January 1, 2012 and June 30, 2016, 2,163 individuals died from an opioid-involved overdose. Overdose decedents were predominately male (69.1%), between the ages of 25-34 (28.0%), and white, non-Hispanic (63.5%). Heroin was the most common opioid detected in the system found in 67.1% of overdose decedents. In the years prior to death, 75.4% of individuals had received a service provided by a city agency and 61.6% had received a service within the three years immediately prior to death. Overdose decedents utilized the most services from Community Behavioral Health (CBH), a managed care organization providing behavioral health services for Philadelphia's Medicaid population, both ever (59.5%) and in the three years prior to death (46.2%). Many decedents were also incarcerated within the Department of Prisons with 50.4% ever incarcerated and 27.9% incarcerated in the three years prior to death (Table 2). Additionally, 20.9% and 17.5% of overdose decedents had a positive STD or hepatitis C test, respectively, ever reported to the Department of Public Health (Table 3). **Conclusions** This match of overdose decedents to other city systems highlights missed opportunities to help individuals who struggle with opioid dependence. Historically, Philadelphia has taken a recovery oriented approach to drug use, which focuses on drug treatment, and these data suggest that this approach is not sufficient for preventing subsequent fatal overdose. A harm reduction approach, which seeks to reduce the harms of drug use through interventions such as overdose reversal training and naloxone distribution, needle and syringe exchange, and education on safe injection practices, needs to be prioritized in this epidemic alongside recovery oriented practices.

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## Abstract

**Objective** To demonstrate the utility of the National Syndromic Surveillance Program's (NSSP) version of the Electronic Surveillance System for Early Notification of Community-based Epidemics (ESSENCE) for case detection during a 2017 outbreak of hepatitis A virus (HAV) infection among persons experiencing homelessness in Maricopa County, Arizona. **Introduction** On 3/29/2017, the Maricopa County Department of Public Health (MCDPH) received three reports of confirmed HAV infection from an onsite clinic at Campus A that assists individuals experiencing homelessness, a population at risk for HAV transmission. To identify the scope of the problem, the department initiated rapid HAV infection case detection using NSSP ESSENCE. **Methods** MCDPH created a myESSENCE dashboard that searched for chief complaint keywords and discharge diagnosis codes from 15 Maricopa County emergency department and inpatient hospital records using three separate queries: (1) HAV infection; (2) hepatitis virus infection; and (3) HAV infection symptoms combined with terms for homelessness. The dashboard was reviewed retrospectively for the 90 days prior to the initial report of the cluster (12/28/2016 – 3/29/2017). Based on this review, MCDPH epidemiologists decided to use the first query (HAV infection-specific) only, because reviewing the line list for all three queries was resource-intensive and resulted in duplicate cases. The query was monitored every weekday morning from 3/30/2017 to the close of the outbreak on 7/22/2017. **Results** From 3/30/2017 – 7/22/2017, MCDPH identified 37 potential HAV infection cases in ESSENCE. Eleven cases were classified as outbreak cases, while the other 26 patients lacked recent HAV infection symptoms, laboratory confirmation, or association with Campus A. All 11 outbreak cases' records included the ICD-CM-10 code B15.9 (Hepatitis A without hepatic coma), and 3 records included the code Z59 (Problems related to housing and economic circumstances). The HAV infection-specific query in ESSENCE identified 11 (73%) of the 15 total outbreak cases; however, all cases were reported in MEDSIS prior to a being flagged in ESSENCE. On average, cases were reported to MEDSIS 9 days earlier than identified in ESSENCE (range, 0 - 21 days). Of note, ESSENCE helped identify the outbreak index case, previously lost to follow-up, as an individual experiencing homelessness. This information helped MCDPH perform additional follow-up, which revealed that the individual had arrived from San Diego, CA, a city with an ongoing outbreak of HAV infection in their homeless and drug-using population. This epidemiologic link was identified on 3/30/2017, over a month before the Centers for Disease Control and Prevention confirmed a match by genome sequencing between the index case and the neighboring outbreak on 5/5/2017. **Conclusions** Use of ESSENCE identified most of the HAV infection cases from this outbreak among individuals experiencing homelessness but no sooner than traditional surveillance methods. However, use of ESSENCE allowed for identification of the outbreak index case, leading to epidemiological linkage to outbreak origin approximately one month prior to molecular laboratory confirmation.

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# Roles of Health Literacy in Relation to Social Determinants of Health and Recommendations for Informatics-Based Interventions: Systematic Review

## Abstract

**Objective** To assess the use of Medicaid claims data to conduct surveillance for cases of Zika-related birth defects identified after birth among infants born in New York City (NYC). **Introduction** As a part of the Zika Birth Defects Surveillance, a national effort coordinated by the Centers for Disease Control and Prevention (CDC), NYC is conducting enhanced surveillance of all births with defects included in the congenital Zika syndrome (CZS) phenotype among infants born in NYC beginning in 2016. The intent of the project is to provide background on the prevalence of these conditions, regardless of cause. The surveillance project builds on the New York State (NYS) Congenital Malformations Registry, a passive, mandatory reporting system that relies on reporting from hospitals and providers. For the Surveillance project, potential cases of Zika-related birth defects (ZBD) are identified by hospital and administrative data of birth records with one or more of the International Classification of Diseases, 10th Revision (ICD-10) diagnostic codes associated with CZS.<sup>1</sup> The list of included diagnostic codes was specified by the NYS registry following guidance established by CDC. Full medical record chart abstraction of the birth hospital visit of potential cases is then conducted applying further inclusion guidelines to identify ZBD cases. Recent reports of late presentation of birth defects consistent with CZS suggest that some cases are being missed due to identification and diagnosis of the condition after birth.<sup>2</sup> As one component of a broader strategy to obtain a more accurate surveillance count, we seek to identify potential ZBD cases first diagnosed in the 6-month postpartum period using Medicaid claims data. **Methods** We will obtain Medicaid records for all infants born in NYC in 2016 from Jan 1, 2016 through June 30, 2017 using Salient, a data mining system of Medicaid data (Salient Interactive Miner, Version 5.70.079). The 85 ICD-10 diagnostic codes currently being used to identify potential ZBD cases will be applied to birth records and all outpatient and inpatient visits to a medical provider for the 6-month period after birth. All visits containing one or more of the codes from either primary or secondary diagnosis will be identified. A unique list of infants receiving one or more included diagnoses within the 6-month postpartum period will be obtained and cross-referenced with the current case list using a matching algorithm based on child's name, date of birth, and other identifying variables. **Results** Preliminary results Surveillance measures to-date have identified 380 cases of infants born in NYC in 2016 with birth defects that could be due to Zika virus; it is anticipated that a majority have Medicaid. (In 2015, 59% of all births in NYC were to mothers with Medicaid.) Analysis will determine (a) the extent of overlap of cases identified from surveillance activities and Medicaid claims data, and (b) the extent of ZBD potential cases missing from surveillance but found with Medicaid data of in- and out-patient visits. Descriptive statistics will include age and class of earliest diagnosis of infants. Those identified by Medicaid analysis will be considered potential ZBD cases pending full abstraction of record. Full results pending. **Conclusions** If results indicate missed potential ZBD cases, medical chart abstraction of such cases will be warranted. Further, as CZS is a relatively new syndrome, findings may provide support in the determination of accurate follow-up time for future surveillance projects.<sup>3</sup> Full conclusion pending. **References** 1. Moore CA, Staples JE, Dobyns WB, et al. Characterizing the Pattern of Anomalies in Congenital Zika Syndrome for Pediatric Clinicians. *JAMA Pediatrics*. 2017;171(3):288-295. doi:10.1001/jamapediatrics.2016.3982. 2. Cragan JD, Mai CT, Petersen EE, et al. Baseline Prevalence of Birth Defects Associated with Congenital Zika Virus Infection — Massachusetts, North Carolina, and Atlanta, Georgia, 2013–2014. *MMWR Morb Mortal Wkly Rep*. 2017;66:219–222. DOI: <http://dx.doi.org/10.15585/mmwr.mm6608a4>. 3. Shapiro-Mendoza CK, Rice ME, Galang RR, et al. Pregnancy Outcomes After Maternal Zika Virus Infection During Pregnancy — U.S. Territories, January 1, 2016–April 25, 2017. *MMWR Morb Mortal Wkly Rep*. 2017;66:615-621. DOI: <http://dx.doi.org/10.15585/mmwr.mm6623e1>.

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## Abstract

**Objective** To model the transmission dynamics of varicella among school children in Shenzhen, to determine the effect of the school-based vaccination intervention. **Introduction** Varicella (chickenpox) is a highly transmissible childhood disease. Between 2010 and 2015, it displayed two epidemic waves annually among school populations in Shenzhen, China. However, their transmission dynamics remain unclear and there is no school-based vaccination programme in Shenzhen to-date. In this study, we developed a mathematical model to compare a school-based vaccination intervention scenario with a baseline (i.e. no intervention) scenario. **Methods** Data on varicella reported cases were downloaded from the Infectious Disease Reporting Information Management System. We obtained the population size, age structure of children aged 15 or under, the class and school distribution from Shenzhen Education Bureau. We developed an Agent-Based Susceptible-Exposed-Infectious-Recovered (ABM-SEIR) Model that considered within-class, class-to-class and out-of-school transmission modes. The intervention scenario was that school-wide vaccination intervention occurred when an outbreak threshold was reached within a school. We varied this threshold level from five to ten cases. We compared the reduction of disease outbreak size and estimated the key epidemiological parameters under the intervention strategy. **Results** Our ABM-SEIR model provided a good model fit to the two annual varicella epidemic waves from 2013 to 2015. The transmission dynamics displayed strong seasonality. Our results suggested that a school-based vaccination strategy could effectively prevent large outbreaks at different thresholds. **Conclusions** There was a considerable increase in reported varicella cases from 2013 to 2015 in Shenzhen. Our modelling study provided important theoretical support for disease control decision making during school outbreaks and the development of a school-based vaccination programme.

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# Roles of Health Literacy in Relation to Social Determinants of Health and Recommendations for Informatics-Based Interventions: Systematic Review

## Abstract

**Objective** Determine the AMR phenotypes and genotypes of Salmonella isolates recovered from cattle and poultry farms in the Wakiso District of Uganda. **Introduction** Antimicrobial resistance (AMR) is a major concern in developing countries. Uganda is one of many developing countries that are beginning to implement a surveillance program countrywide to monitor AMR within the animal, environmental, and human sectors. Not only is there a concern for AMR, but the emergence of multidrug resistance (MDR) of Salmonella is also becoming a major One Health problem. Few new drugs are being produced. When current treatments fail, new antimicrobials for treatment of these microorganisms are limited (5). In Salmonella, AMR genes are usually found on plasmids that are transferable. Most plasmids that carry resistance are conjugative plasmids, promoting the transfer of DNA from cell to cell (1). Class I Integrons are located on transposable plasmids and are known to transfer AMR through an assortment of gene cassettes (3). Extended-spectrum  $\beta$ -lactamases (ESBLs) are also known to encode genes located on integrons and transposons (2). ESBLs confer resistance to third generation cephalosporins, a drug of choice for treatment of Salmonella infections. ESBLs are now reported in Enterobacteriaceae all over the world. Examples of common ESBLs include blaCTX-M, blaOXA, blaTEM, blaCMY, and blaSHV (2). It has been reported that ESBLs evolved from the Kluverya species chromosome by mutation and gene transposition (4). In our previous study, we phenotypically characterized Salmonella from cattle and poultry farms within the Wakiso District of Uganda. Based on the high prevalence of MDR in the isolates collected we continued investigating at the molecular level. For the Salmonella isolates, we wanted to characterize genotypes by first analyzing the relatedness of the isolates with pulse field gel electrophoresis (PFGE). Next, we wanted to look to see which DNA plasmids were present. We looked at 28 replicon plasmids and the Class 1 Integron, Int1. The Salmonella isolates were also screened for ESBL genes based on their resistant profiles. **Methods** Fecal and environmental samples from cattle and poultry farms were cultured using standard laboratory methods. AMR profiles were identified among all poultry and cattle Salmonella using the Sensitire™ system per manufacturer's directions. Fifty-six Salmonella isolates were screened for 28 replicon type plasmids, ESBL genes, and Class I integrons by PCR. The 56 isolates were subjected to PFGE to determine relatedness. **Results** Salmonella was recovered from 51/379 (13.5%) and 5/400 (1.3%) of poultry and cattle samples, respectively. Salmonella Enteritidis 16/51 (31.7%) and Kentucky 11/51 (21.6%) were most often recovered on poultry farms. Salmonella was most often resistant to Tetracycline and Sulfisoxazole. All Salmonella Kentucky isolates were resistant to Ciprofloxacin. Five replicon plasmids were identified among all poultry and cattle Salmonella: IncFIIS 18/56 (32.1%), IncI1 $\alpha$  12/56 (21.4%), IncP 8/56 (14.3%), IncX1 8/56 (14.3%), and IncX2 1/56 (1.8%). The Class I integron, Int1, was positive in one poultry isolate presenting MDR. PFGE cluster analysis of the 56 isolates showed 17 distinctive cluster types and displayed distinct clusters by replicon types IncP, IncX, IncFIIS, and IncI1 $\alpha$ . No isolates displayed the ESBL genes that were screened. **Conclusions** In conclusion, we observed some degree of association between the AMR and plasmids. These plasmids also have an association with the PFGE cluster types and the Salmonella serotypes presented in this study. These Salmonella serotypes may be harboring these particular plasmids which confer resistance to select antimicrobials. Future work with these isolates will include whole genome sequence screening to detect differences between AMR phenotypes and genotypes. **References** 1. Bennett, P. M. (2008). Plasmid-encoded antibiotic resistance: acquisition and transfer of antibiotic resistance genes in bacteria. *Br J Pharmacol*, 153 Suppl 1, S347-357. doi:10.1038/sj.bjp.0707607 2. Bradford, P. A. (2001). Extended-spectrum beta-lactamases in the 21st century: characterization, epidemiology, and detection of this important resistance threat. *Clin Microbiol Rev*, 14(4), 933-951, table of contents. doi:10.1128/cmr.14.4.933-951.2001 3. Fluit, A. C., & Schmitz, F. J. (2004). Resistance integrons and super-integrons. *Clin Microbiol Infect*, 10(4), 272-288. doi:10.1111/j.1198-743X.2004.00858.x 4. Humeniuk, C., Arlet, G., Gautier, V., Grimont, P., Labia, R., & Philippon, A. (2002). 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## Abstract

**Objective** To investigate Q fever pathogen distribution among ixodic ticks, myomorph rodents, febrile patients, residents of enzootic areas with Q fever and persons in contact with Q fever, specifically infected persons in the Southern and Western regions of Ukraine. **Introduction** Improvement of the Q fever epizootic and epidemiological surveillance system remains an urgent veterinary service and healthcare problem in Ukraine. The grounds for this should be laid by the results of monitoring studies of persons with a professional infection risk (livestock farms, animal processing enterprises, veterinary specialists, etc.) and living in enzootic territories, as well as research of Q fever pathogen possible sources reservoirs. **Methods** Real-time PCR - detection of specific DNA segments of *Coxiella burnetii* with application of commercial reagent kits. Immunofluorescence microscopy - detection of antigens/antibodies of studied rickettsia in biological substrates using luminescent immune sera labeled with fluorescein-5-isothiocyanate. **Epidemiological methods** - analysis of infectious diseases foci epidemiological maps. **Statistical methods** - data analysis using such software as Excel and Quantum GIS (1.6.0). **Results** Primarily, Q fever endemic areas are formed because of the circulation of *Coxiella burnetii* in warm-blooded animal populations and their blood-sucking ectoparasites, which are the main source of the infection in humans. Based on the aggregated data received from multi-year research projects in Ukraine, Q fever enzootic territories were found in 18 administrative regions, Crimea and the city of Sevastopol. Currently we know of 257 areas where the pathogen was detected. The epidemic process in these territories is manifested by sporadic human diseases and the detection of the pathogen in natural carriers. The possibility of the natural foci epidemic potential increase in these territories is confirmed by the higher titers of Q fever pathogen specific antibodies detected in the local population. The results of the research of the infected material that was collected in Southern Ukraine during 2014-2016, showed the preservation of the Q fever causative agent in natural foci both in Danube-Dniester interfluvial area of Odesa region and in Trans-Dniestr areas, and its significantly less prevalent in the area adjacent to Odessa. In addition, the signs of natural foci formation have been revealed in other areas, which is indicative of current epidemic activity of natural foci of the infection. The results of serological studies and clinical and epidemiological surveys indicate that in the immunological structure of the population of the Danube-Dniester interfluvial areas of Odesa region, Q fever is most common in rural population of working age, especially those constantly contact with farm animals. In the Ivano-Frankivsk region, serological studies in 2014-2016, detected no Q fever seropositive people, indicating the pathogen being in the reserve stage, which corresponds to the inter-epidemic period. At the same time, the detection of *C. burnetii* in ticks in the enzootic territories indicates the possibility of the pre-epidemic process being formed. Since by pathogen range and transmission mechanisms Q fever in Ukraine is associated with many natural-focal zoonotic infections, it is advisable to monitor endemic areas using a modern observation algorithm using the introduction of geoinformation systems and the molecular genetic characteristics of circulating strains. This will increase the effectiveness of the detection of current natural and anthropogenic foci of such infections, will contribute to their detailed characterization and systematization, improve epidemiological surveillance and prevent the emergence of epidemic outbreaks among the population. The results of the research will contribute to the improvement of differential diagnosis of febrile states with an unclear etiologic agent. **Conclusions** The results of the Q fever pathogen detection in the material collected in Southern and Western regions of Ukraine showed that the area of prevalence of this agent has been expanded to the areas and settlements that are not included in the list of enzootic territories. Involvement in the ecological cycles of ixodic ticks and mouse-like rodents was observed. The presence of polyvectoral and polyhostal natural foci of this infection was found. The circulation of the causative agent of Q fever in the territories of Odesa and Ivano-Frankivsk regions where epidemic outbreaks and sporadic disease in people were also observed. **References** 1. Surveillance Atlas of Infectious Diseases // <http://atlas.ecdc.europa.eu/public/index.aspx>. 2. UCDCM Information Sheet as of 07/21/2010 No. 04.4-31/40/868 On Epidemic and Epizootic Situation with Zoonotic Infections Common for Humans and Animals and Methods of their Prevention in Ukraine.

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## Abstract

**Objective** To demonstrate the use of ESSENCE in the BioSense Platform to monitor out-of-State patients seeking emergency healthcare in Tennessee during Hurricanes Harvey and Irma. **Introduction** Syndromic surveillance is the monitoring of symptom combinations (i.e., syndromes) or other indicators within a population to inform public health actions. The Tennessee Department of Health (TDH) collects emergency department (ED) data from more than 70 hospitals across Tennessee to support statewide syndromic surveillance activities. Hospitals in Tennessee typically provide data within 48 hours of a patient encounter. While syndromic surveillance often supplements disease- or condition-specific surveillance, it can also provide general situational awareness about emergency department patients during an event or response. During Hurricanes Harvey (continental US landfall on August 25, 2017) and Irma (continental US landfall on September 10, 2017), TDH supported all hazards situational awareness using the Electronic Surveillance System for the Early Notification of Community-based Epidemics (ESSENCE) in the BioSense Platform supported by the National Syndromic Surveillance Program (NSSP). The volume of out-of-state patients in Tennessee was monitored to assess the impact on the healthcare system and any geographic- or hospital-specific clustering of out-of-state patients within Tennessee. Results were included in daily State Health Operations Center (SHOC) situation reports and shared with agency response partners such as the Tennessee Emergency Management Agency (TEMA). **Methods** Data were monitored from August 18, 2017 through September 24, 2017. A simple query was established in ESSENCE using the Patient Location (Full Details) dataset. Data were limited to hospital ED visits reported by Tennessee (Site = "Tennessee"). To monitor ED visits among residents of Texas before, during, and after Major Hurricane Harvey, data were queried for a patient zip code within Texas (State = "Texas"). ED visits among Florida residents were monitored similarly (State = "Florida") before, during, and after Major Hurricane Irma. Additionally, a free text chief complaint search was implemented for the terms "Harvey", "Irma", "hurricane", "evacuee", "evacuate", "Florida", and "Texas". Chief complaint search results were then filtered to remove encounters with patient zip codes within Tennessee. **Results** From August 18, 2017 through September 24, 2017, Tennessee hospital EDs reported 277 patient encounters among Texas residents and 1,041 patient encounters among Florida residents. The number of encounters among patients from Texas remained stable throughout the monitoring period. In contrast, the number of encounters among patients from Florida exceeded the expected value on September 7, peaked September 10 at 116 patient encounters, and returned to expected levels on September 16 (Figure 1). The increase in patients from Florida was evenly distributed across most of Tennessee, with some clustering around a popular tourism area in East Tennessee. No concerning trends in reported syndromes or chief complaints were identified among Texas or Florida patients. The free text chief complaint query first exceeded the expected value on September 9, peaked on September 11 with 5 patient encounters, and returned to expected levels on September 14. From August 18 through September 24, 21 of 30 visits captured by the query were among Florida residents. One Tennessee hospital appeared to be intentionally using the term "Irma" in their chief complaint field to indicate patients from Florida impacted by the hurricane. **Conclusions** The ESSENCE instance in the BioSense platform provided TDH the opportunity to easily locate and monitor out-of-state patients seen in Tennessee hospital EDs. While TDH was unable to validate whether all patients identified as residents of Florida were displaced because of Major Hurricane Irma, the timing of the rise and fall of patient encounters was highly suggestive. Likewise, seeing no substantial increase ED patients with residence in Texas reassured TDH that the effects of Hurricane Harvey were not impacting hospital emergency departments in Tennessee. TDH used information and charts from ESSENCE to support situational awareness in our SHOC and at TEMA. Use of patient zip code to identify out-of-state residents was more sensitive than chief complaint searches by keyword during this event. ESSENCE allowed TDH to see where out-of-state patients appeared to be concentrating in Tennessee and monitor the need for targeting messaging and resources to heavily affected areas. Additionally, close surveillance of chief complaints among out-of-state patients provided assurance that no unusual patterns in illness or injury were occurring. ESSENCE is the only TDH information source capable of rapidly collecting health information on out-of-state patients. ESSENCE allowed TDH to quickly identify a change within the patient population seen at Tennessee emergency departments and monitor the situation until the patient population returned to baseline levels.

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## Abstract

**Objective** To establish morbidity patterns of influenza A/H1N1 in Swaziland from 10th July to 15th August 2017. **Introduction** Influenza infection is caused by the influenza virus, a single-stranded RNA virus belonging to the Orthomyxoviridae family. Influenza viruses are classified as types A, B and C. Influenza A and B viruses can cause epidemic disease in humans and type C viruses usually cause a mild, cold-like illness. The influenza virus spreads rapidly around the world in seasonal epidemics, resulting in significant morbidity and mortality. On the 10th of July 2017, a case of confirmed Influenza A/H1N1 was reported through the immediate disease notification system from a private hospital in the Hhohho region. A 49 year old female was diagnosed of Influenza A/H1N1 after presenting with flu-like symptoms. Contacts of the index case were followed and further positive cases were identified. **Methods** Upon identification of the index case, the rapid response teams conducted further investigations. Two nasal swaps from each sample were taken and sent to a private laboratory in South Africa for the detection of the virus RNA using RT-PCR to assess for the presence Influenza A, B and Influenza A/H1N1. Further laboratory results were sourced from a private laboratory to monitor trends of influenza. Data was captured and analyzed in STATA version 12 from STATA cooperation. Descriptive statistics were carried out using means and standard deviations. The Pearson Chi square test and student t test were used to test for any possible association between influenza A/H1N1 and the explanatory variables (age and sex). **Results** Surveillance data captured between 10th July 2017 and 15th August 2017 indicated that a total of 87 patients had their samples taken for laboratory confirmation. There were 45 females and 42 males and the mean age was 27 years (SD= 17). At least 25 of the 87 patients tested positive for influenza A while only 1 tested positive for influenza B. The prevalence of influenza A/H1N1 was 16%. The prevalence of influenza A/H1N1 among males was 19% compared to 13% in females; however the difference was not statistically significant ( $p=0.469$ ). There was no association noted between age and influenza A/H1N1 ( $p=427$ ). Upon further sub-typing results indicated that the circulating strain was influenza A/H1N1 pdm 09 strain which is a seasonal influenza. The epidemic task forces held weekly and ad-hoc meetings to provide feedback to principals and health messaging to the general population to allay anxiety. **Conclusions** Though WHO has classified the influenza A/H1N1 strain pdm 0029 as a seasonal influenza, surveillance remains important for early detection and management. There is therefore an urgent need to set up sentinel sites to monitor and understand the circulating influenza strains. Health promotion remains crucial to dispel anxiety as the general public still link any influenza to the 2009 pandemic influenza. Finally the Ministry of Health should consider introducing influenza vaccines into the routine immunization schedule especially for children. **References** 1. Global Epidemiological Surveillance Standards for Influenza. 2014 [cited 2015 15 April]; Available from: [http://www.who.int/influenza/resources/documents/influenza\\_surveillance\\_manual/en/](http://www.who.int/influenza/resources/documents/influenza_surveillance_manual/en/). 2. Human cases of influenza at the human-animal interface, 2013. *Wkly Epidemiol Rec*, 2014. 89(28): p. 309-20. 3. WHO Global Influenza Surveillance Network. Manual for the laboratory diagnosis and virological surveillance of influenza. 2011 [cited 2015 April27]; Available from: [http://www.who.int/influenza/gisrs\\_laboratory/manual\\_diagnosis\\_surveillance\\_influenza/en/](http://www.who.int/influenza/gisrs_laboratory/manual_diagnosis_surveillance_influenza/en/).

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## Abstract

**Objective** Describe the common work of Donetsk State Phthisiological Service and non-governmental organizations that has been conducted since 2014 in order to achieve the global goal for tuberculosis elimination. **Introduction** The global strategy for eliminating tuberculosis (TB) epidemic "End TB" has been implemented in the world since 2016. Its main goal is to reduce the 2015 TB incidence rate by 90% and 2015 TB mortality rate by 95% by 2035. In Ukraine, in 2016, the incidence rate of new cases of tuberculosis among the general population was 54.7 per 100 thousand of population (2015 - 55.9), the rate of decrease was  $2.1 \pm 0.1\%$ . In Donetsk Oblast (that is under control of Ukrainian authorities), the incidence rate increased by 2.4% and was 56.4 per 100 thousand of population. The mortality rates were  $19 \pm 0.6\%$  in the country and  $29 \pm 2.5\%$  in Donetsk Oblast. However, according to the World Health Organization (WHO) estimates, we need to enhance the annual incidence rate reduction by 10% by 2025, and TB mortality rate should be reduced to 6.5% in order to achieve the strategy-targeted values. In Ukraine, as well as globally, there is a crisis of multidrug-resistant tuberculosis (MDR-TB). According to WHO estimates, Ukraine belongs to five European countries where 2/3 of MDR-TB cases were registered; the proportion of MDR-TB cases among newly diagnosed TB cases was 16%, and 48% of repeated cases. In Ukraine, this rate is equal to 24.3% and 58.2% in Donetsk Oblast, respectively. Such results in the Donetsk region may be related to the beginning of hostilities in eastern Ukraine in 2014, which lead to the active migration of population and breakdown of the supply of anti-TB drugs. According to monitoring data, 20% of with MDR-TB on the territory of the Donetsk region controlled by Ukraine were lost and did not seek medical assistance. **Methods** This work describes a retrospective cohort study of MDR-TB patients' treatment efficacy. The MDR-TB diagnosis was confirmed by the BSL3 laboratory by molecular genetic testing of sputum using Gene Expert and bacteriological methods to determine resistance to rifampicin and isoniazid. All MDR-TB patients were divided into 3 cohorts. The first cohort of 86 patients received outpatient treatment within the project "Outpatient Home Treatment Model Using Mobile Response Team" supported by the Foundation for Development of Ukraine in Kramatorsk, Donetsk Oblast, during one year (2014-2015). The response team consisting of a nurse, a driver and a doctor (if necessary) delivered drugs to patients with TB six times a week. The second cohort of 477 MDR-TB patients has received outpatient treatment via the Red Cross Society since 2015. A nurse visited patients every day and controlled drugs administration. In addition to the treatment, patients were given food kits twice a month. The third cohort of 391 MDR-TB patients received outpatient treatment in healthcare institutions without any support of non-governmental organizations. Before the beginning of the controlled treatment, psychologists worked with patients from risk groups. **Results** Surveillance data in Donetsk Oblast showed the increase of the MDR-TB morbidity rate from 15.0 to 20.1 per 100 thousand of population. According to the analysis results, MDR-TB is found in 31% of cases among all newly diagnosed TB cases. The successful treatment rate of all TB cases in Donetsk Oblast in 2015 was  $61.9 \pm 5.4\%$ , which is lower than the average rate in Ukraine, which is  $11.1 \pm 1.0\%$  (WHO indicator is 75%). The number of MDR-TB cases with "treatment failure" (treatment was completed, but bacterial secretion continued) -  $9.3 \pm 2.6\%$  and "interrupted treatment" -  $13.3 \pm 2, 6\%$  is very high in Donetsk Oblast. Results analysis of the controlled treatment showed that the treatment efficacy for MDR-TB patients in the first cohort was 75%. In the second cohort, 205 out of 477 patients completed their treatment. The treatment efficacy was 78.5%. In the third cohort 45.0% of patients were cured, which corresponds to general rates in this oblast. However, the treatment efficacy for MDR-TB patients, who received the support of non-governmental organizations, was 30,0-33.5% higher than among patients who did not receive such support (Table 1). **Conclusions** The cooperation of the State Phthisiatrician Service with non-governmental organizations concerning patients at the outpatient stage of treatment and development of treatment adherence increased the treatment efficacy for MDR-TB patients by almost 30%, which is important to control the spread of dangerous sources of tuberculosis agents in order to improve the epidemic situation. Cohort analysis of treatment results and clinical MDR-TB monitoring reflects the peculiarities of the epidemic situation and reveals errors in the work of the State Phthisiatrician Service in Donetsk Oblast. Nevertheless, the results show that common work of healthcare institutions, non-governmental organizations and volunteers can bring significant results in strengthening TB patients care.

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# Roles of Health Literacy in Relation to Social Determinants of Health and Recommendations for Informatics-Based Interventions: Systematic Review

## Abstract

**Objective** Weekly numbers of deaths are monitored to increase the capacity to deal with both expected and unusual (disease) events such as pandemic influenza, other infections and non-infectious incidents. The monitoring information can potentially be used to detect, track and estimate the impact of an outbreak or incident on all-cause mortality. **Introduction** The mortality monitoring system (initiated in 2009 during the influenza A(H1N1) pandemic) is a collaboration between the Centre for Infectious Disease Control (CIb) of National Institute for Public Health and the Environment (RIVM) and Statistics Netherlands. The system monitors nation-wide reported number of deaths (population size 2017: 17 million) from all causes, as cause of death information is not available real-time. Data is received from Statistics Netherlands by weekly emails. **Methods** Once a week the number of reported deaths is checked for excess above expected levels at 2 different time-lags: within 1 and 2 weeks after date of death (covering a median 43% and 96% of all deaths respectively). A weekly email bulletin reporting the findings is sent to the Infectious Disease Early Warning Unit (at CIb) and a summary of results is posted on the RIVM website. Any known concurrent and possibly related events are also reported. When excess deaths coincide with hot temperatures, the bulletin is sent to the Heat Plan Team (also at RIVM). Data are also sent to EuroMOMO which monitors excess mortality at a European level. For the Dutch system baselines and prediction limits are calculated using a 5 year historical period (updated each July). A serfling-like algorithm based on regression analysis is used to produce baselines which includes cyclical seasonal trends (models based on historical data in which weeks with extreme underreporting have been removed. Also periods with high excess mortality in winter and summer were removed so as not to influence the baseline with previous outbreaks). **Results** Increased mortality started two weeks after the influenza epidemic started and remained increased during the remainder of the influenza epidemic except for a drop in week 52 (coinciding with Christmas holidays) (Figure 1). Excess mortality was primarily observed in persons 75 years or older. Cumulative excess mortality was estimated at 7,503 deaths occurring during the 15 weeks of the 2016/2017 influenza epidemic (week 48 of 2016 through week 10 of 2017) and at 8,890 during the total winter season (44 weeks running from week 40 up to week 20 of the next year). **Conclusions** In terms of number of deaths during the winter season (weeks 40-20 the next year) and during the influenza epidemic (weeks 48-10), the 2016/2017 season in the Netherlands was of high severity compared with the previous five seasons. Mortality was only higher in the 2014/2015 season when the longest influenza epidemic was recorded of 21 weeks.

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# Roles of Health Literacy in Relation to Social Determinants of Health and Recommendations for Informatics-Based Interventions: Systematic Review

## Abstract

**Objective** The National Biosurveillance Integration Center (NBIC) is deploying a scalable, flexible open source data collection, analysis, and dissemination tool to support biosurveillance operations by the U.S. Department of Homeland Security (DHS) and its federal interagency partners. **Introduction** NBIC integrates, analyzes, and distributes key information about health and disease events to help ensure the nation's responses are well-informed, save lives, and minimize economic impact. To meet its mission objectives, NBIC utilizes a variety of data sets, including open source information, to provide comprehensive coverage of biological events occurring across the globe. NBIC Biofeeds is a digital tool designed to improve the efficiency of analyzing large volumes of open source reporting and increase the number of relevant insights gleaned from this dataset. Moreover, the tool provides a mechanism to disseminate tailored, electronic message notifications in near-real time so that NBIC can share specific information of interest to its interagency partners in a timely manner. **Methods** NBIC intends to implement operational use of the capability in FY 2018. The core components of the system are data collection, curation, and dissemination of information deemed important by NBIC subject matter experts. NBIC Biofeeds has captured information from more than 70,000 unique sources published from around the globe and presents, on average, 9,000 new biosurveillance-relevant articles to users each day. NBIC leverages a variety of data feeds, including third party aggregators like Google and subscription-based feeds such as HealthMap, as well as Really Simple Syndication (RSS) feeds and web-scraping of highly relevant sources. The NBIC biosurveillance taxonomy imbedded in the tool consists of more than 600 metadata targets that cover key information for understanding the significance of an active biological event, including etiologic agents, impact to humans and animals (e.g., infection severity, healthcare workers involved, type of host), social disruption, infrastructure strain, countermeasures engaged, and 'red flag' characteristics (e.g., pathogen appearance in a new geographic area, unusual clinical signs). This taxonomy serves as a foundation for data curation and can be tailored by NBIC partners to more directly meet their own mission objectives. At this time, metadata is predominately captured by NBIC analysts, who manually tag information, which triggers the population of three automatically-disseminated products from the tool: 1) the NBIC Daily Biosurveillance Review, 2) immediate and daily summary email notifications, and 3) custom-designed RSS feeds. These products are meant for individual recipients in the federal interagency and for consumption by other biosurveillance information technology systems, such as the Department of Defense, Defense Threat Reduction Agency (DTRA) Biosurveillance Ecosystem (BSVE). NBIC is working in partnership with DTRA to integrate NBIC Biofeeds as an application directly into the BSVE and further develop the BSVE as an all-in-one platform for biosurveillance data analytics. To improve the efficiency and effectiveness of gaining insights using NBIC Biofeeds, developers of the tool at the Pacific Northwest National Laboratory (PNNL) are researching and testing a variety of advanced analytics techniques focused on: 1) article relevancy ratings to improve the review of queried data, 2) significance ratings to elucidate the perceived severity of an event based on reported characteristics, 3) full-text article retrieval and storage for improved machine-tagging, and 4) anomaly detection for emerging threats. Testing and implementation of new analytic capabilities in NBIC Biofeeds is planned for this fiscal year. **Results** NBIC Biofeeds was developed to serve as a sophisticated and powerful open source biosurveillance technology of value to the federal government by providing information to stakeholders conducting open source biosurveillance as well as those consuming biosurveillance information. In FY 2018, NBIC Biofeeds will begin operational use by NBIC and an initial set of users in various federal agencies. User accounts for testing purposes will be available to other federal partners, and a broad scope of federal stakeholders can receive products directly from NBIC Biofeeds based on their interests. **Conclusions** NBIC Biofeeds is expected to enable more rapid recognition and enhanced analysis of emerging biological events by NBIC analysts. NBIC anticipates other federal agencies with biosurveillance missions will find this technology of value and intends to offer use of the platform to those federal partners that can benefit from access to the tool and information generated from NBIC Biofeeds.

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# Roles of Health Literacy in Relation to Social Determinants of Health and Recommendations for Informatics-Based Interventions: Systematic Review

## Abstract

**Objective** Demonstrate performance of the Virena Global Wireless Surveillance System, an automated platform utilized in conjunction with the Sofia FIA Analyzer, for near real-time transmission of infectious disease test results to public health and other healthcare organizations. **Introduction** Public health agencies worldwide all enjoy the same mission—providing healthcare warnings, guidance, and support to the public and healthcare professionals they represent. A critical element in achieving this mission is accessing timely and comprehensive surveillance information about disease in their regions of responsibility. Advances in diagnostic technologies for infectious disease and in the wireless conveyance of information hold great promise for advancing the quality of surveillance information and in facilitating the delivery of timely, accurate, and impactful public health information. Quidel Corporation has developed a cloud-based, wireless communications system that is fully integrated with its Sofia fluorescence immunoassay (FIA) platform for rapid, point-of-care diagnosis of infectious disease. The system, called the Virena Global Wireless Surveillance System (hereinafter, Virena) provides test results to public health organizations and other appropriate entities in near-real time. Currently, more than 4,000 Sofia instruments are transmitting results automatically by Virena. This presentation describes the use of Virena in surveilling influenza in the U.S. in the 2016-2017 influenza season, when over 700,000 influenza-like-illness (ILI) patient results were transmitted. The methods employed, results, and the promise of this innovative system will be discussed. **Methods** The Sofia Fluorescent Immunoassay Analyzer (FIA) is a small FDA-cleared, CLIA-waived bench top device that uses immunofluorescence-based, lateral-flow technology for rapid analyte detection within 15 minutes for influenza. With Sofia2, a recent upgrade, positive influenza test results can be obtained in as few as 3 minutes, depending on virus levels. The results are encrypted, and automatically transmitted by Virena—often within 5 seconds—to a dual cloud system for further encryption and formatting. The test results (also including location, date, and patient age) are subsequently pushed to participating public health and healthcare organizations for daily collection and analysis. Healthcare providers utilizing the Virena system may also access their own data and facility-de-identified regional and national data, using a password-enabled internet application called MyVirena.com. **Results** Between August 1, 2016 and October 6, 2017, 706,654 ILI patient results were transmitted by Virena from over 3,000 clinical sites in the United States. The influenza positivity rate (influenza A and B combined) peaked on February 9th at 33% and maintained this level for two weeks (Figure 1). During this period, as many as 7,048 results were transmitted by Virena per day. Influenza A activity peaked on the same day at 26%, and influenza B peaked at 18% nearly 6.5 weeks later. In the six months from December 15th to June 15th, the influenza positivity rate for patients with ILI was 10% or greater in the United States. Data analysis for individual states revealed significant differences in time of onset of influenza and in the peak positivity rates. For example, the state of Arizona experienced peak positivity rates for influenza activity (42%) as late as mid-May, driven largely by influenza B. In California, influenza A peaked at 43% on January 16th and maintained a positivity rate greater than 15% for nearly three months, while influenza B averaged below 4% for the entire period. Age-specific analysis showed that children in the 2 to 18 year old group had the highest positivity rate (44%, n=251,756) and the longest incidence period. Virena data demonstrated similar influenza activity trends on national and regional levels as that depicted by the clinical laboratory and NREVSS data collected by the CDC; however, the Virena data were collected and reported sooner (Figure 2). **Conclusions** The Virena system represents a major stride for disease surveillance, providing clinical testing data in near real-time time, with local, national, and global scope. This first substantial evaluation of the Virena system, with over 4,000 transmitting Sofia Analyzers, demonstrates capabilities for near real-time assessment of disease onset, regionally varying positivity rates, durations of outbreaks, differential assessment of influenza A and B prevalence, and dynamic mapping throughout the year. With expanding regional and metropolitan coverage, the Virena system holds promise as both a powerful surveillance tool, and as a valuable resource for healthcare quality initiatives, epidemiological research, and the development of new mathematical models for influenza forecasting .

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# Roles of Health Literacy in Relation to Social Determinants of Health and Recommendations for Informatics-Based Interventions: Systematic Review

## Abstract

**Objective** The present study aims to operationalize one health approach through local urban governance system in a rapidly urbanized Indian city, Ahmedabad, India. In Ahmedabad (proposed Smart city), Gujarat, India: 1. To understand the pattern of zoonotic diseases in reference to urban governance system 2. To develop a conceptual One Health Governance framework with reference to zoonotic diseases 3. To assess the key indicators for convergence for inter-sectorial professional collaborations in One Health

**Introduction** Smart governance refers to the emergence of joint action by the health and non-health sectors, public and private actors and citizens. Although, there are growing literature on governance and its potential impact on health, major challenges on collective action across sectors have been witnessed in developing countries like India. In the same line, the current forms of Global Health Governance façades operational issues and does not sufficiently meet the needs at local levels. In light of these perceived shortcomings, the local governance becomes subject of interest and should be debated especially with reference to global urbanization. Rapid and unplanned urbanization followed by the combination of high population density, poverty and lack of infrastructure have more side effects and fostering conditions for communicable diseases to flourish. Evidence suggests that new megacities could be incubators for new epidemic and zoonotic diseases, which can spread more rapidly and become worldwide threats. In India, Ministry of Urban Development initiated the concept of converting few major cities into “Smart City” in 2015-16. However, one of the major critiques of available smart city guideline is that it has no such focus on prevention of emerging and/or re-emerging zoonotic diseases. The emergence and/or re-emergence of zoonotic diseases should be considered as potential threats for these upcoming Smart Cities and hence, should be addressed by one health approach (health and non-health sectors, public and private actors) through an appropriate local governance strategy. With rapid urbanization and healthcare transformation in India, the operationalization of one health approach might become a major challenge, because of, the absence of the systematic effect at the national level and urban cities are riven between central, state and municipal authorities in terms of health policy, planning, health needs etc. There is also lack of information sharing or collaborations between the health and non-health sectors, public and private actors at the city level. Understanding these challenges can offer important lessons for strengthening both local urban governance and One Health.

**Methods** For Objective-1: To understand the pattern of zoonotic diseases in reference to urban governance system 1. Is there existing literature indicates the importance of governance system in prevention of zoonotic diseases in urban settings Urban Governance System & Zoonotic diseases (Systematic Review) 2. Is prevalence of zoonotic disease vary in accordance with change of local urban governance (Outcome: Prevalence of Zoonotic diseases & Exposure: Governance Index for last 10 years) For Objective-2: To develop a conceptual One Health Governance framework with reference to zoonotic diseases 1. Is there evidence of existing One Health Governance framework exists One Health Governance Framework (Systematic Review & SWOT Analysis) 2. To map the urban agencies working for zoonotic diseases Institutions for zoonotic diseases (Mapping) 3. Is convergence possible for One Health in prevention of Zoonotic diseases (Policy Maker, System-level professionals Qualitative Key Informant Interviews) For Objective-3: To assess the key indicators for convergence for inter-sectorial professional collaborations in One Health 1. Is developed governance framework operational at field level- KAP among Healthcare providers, Veterinarians, Environmental specialists 2. Is there possibilities of convergence at field level for One health in prevention of zoonotic diseases (Qualitative Key Informant Interviews)

**Results** This is first of kind unique study to come up with a local urban governance convergence approach for “One Health” for the upcoming Smart city Ahmedabad, which may further be scaled up to other smart cities of India.

**Conclusions** Urban Health governance framework for a smart city to develop an one health approach.

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# Roles of Health Literacy in Relation to Social Determinants of Health and Recommendations for Informatics-Based Interventions: Systematic Review

## Abstract

**Objective** To confirm and to characterize the increase in emergency department (ED) visits related to the use of synthetic cannabinoids (SC) Introduction On October 2016, the Indian Ocean Regional Health Agency was alerted about an increase in ED visits related to adverse reactions associated with use of SC on Mayotte Island. In this context, an investigation based on a syndromic surveillance system was implemented by the regional unit of the French national public health agency. **Methods** An extraction of anonymized records routinely collected by the syndromic surveillance system (1) was carried out from January 1st, 2012 to October 30, 2016. ED visits related to the consumption of SC were identified from ICD-10 codes of the principal diagnostic according to two levels of confidence: - a probable case was defined as ED visit coded X69 (Intentional self-poisoning by and exposure to other and unspecified chemicals and noxious substances). This code has been implemented specifically by ED physicians since august 2015; - a suspect case was defined as ED visit coded: F11 (Mental and behavioral disorders due to use of opioids), F12 (Mental and behavioral disorders due to use of cannabinoids), F16 (Mental and behavioral disorders due to use of hallucinogens), F18 (Mental and behavioral disorders due to use of volatile solvents), F19 (Mental and behavioral disorders due to multiple drug use and use of other psychoactive substances). Based on these data, an epidemic curve and a descriptive analysis of ED visits were carried out. **Results** In total, 146 ED visits related to adverse events associated with use of SC were registered from January 1st, 2012 to October 30, 2016. The epidemic curve shows two waves between 2015 and 2016 with a particularly high peak in August 2015 (Figure 1). In total, 49% (n=72/146) of these ED visits were probably related to adverse reactions associated to use SC and 51% (n=74/146) meet to the suspect case definition. On the surveillance period, men represented 84% of the patients (n=122) and median age (min – max) was 23 (8-62) years old. When the severity score variable was filled (n = 138), a vital emergency was reported for 4% (n = 5) of patients and 19% of patients were hospitalized. **Conclusions** Data from syndromic surveillance system allowed to confirm an increase in ED visits related to adverse reactions associated with use of SC in Mayotte Island. To our knowledge, it's the first time that an outbreak related to use SC is described in the Ocean Indian area. This phenomenon was particularly marked in 2015 with a peak of ED visits on August 2016. After this outbreak, the regional unit of the French national public health agency recommended the pursuit of the coding X69 in principal diagnosis with the following case definition: any patient with an adverse reaction attributed to synthetic cannabinoid use whether suspected by the medical team or declared by the patient himself or if the patient is in possession of the substance; and to raise awareness ED physicians to the notification of these poisonings to the Regional Addictive Surveillance Center. In conclusion, the young population, weakened by a precarious socio-economic situation, is a target for new synthetic drugs and a threat to public health. This emerging risk in Mayotte must be taken into account and must be actively monitored. In this context, collaborative work with the emergency services must continue in parallel with targeted prevention measures. **References** 1. Vilain P, Maillard O, Raslan-Loubatie J, Abdou MA, Lernout T, Filleul L. Usefulness of Syndromic Surveillance for Early Outbreak Detection in Small Islands: The Case of Mayotte. *Online Journal of Public Health Informatics*. 2013;5(1):e149.

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# Roles of Health Literacy in Relation to Social Determinants of Health and Recommendations for Informatics-Based Interventions: Systematic Review

## Abstract

**Objective** As part of CDC's Global Disease Detection work, in conjunction with Zhambyl Region Department of Health, we conducted a tick survey and human seroprevalence Knowledge, Attitudes, and Practices (KAP) survey of livestock-owning households in Zhambyl to assess CCHF seroprevalence and risk factors. **Introduction** Crimean Congo Hemorrhagic Fever (CCHF) virus is a tick-borne pathogen that causes severe disease in people, with a distribution that extends from central Asia to southern Africa. In addition to tick bites, contact with bodily fluids from viremic livestock or from symptomatic humans are risk factors for infection. From 2000 to 2013, 73 cases of CCHF were reported in Zhambyl Region, Kazakhstan. CCHF virus is categorized as an "especially dangerous pathogen" in Kazakhstan and CCHF is prioritized for surveillance and treatment. Little is known about the seroprevalence of infection by CCHF virus in Zhambyl in ticks or people, and knowledge of risk factors for transmission of CCHF virus among at-risk populations is believed to be low. **Methods** Rural villages were classified as "endemic" or "non-endemic", where endemic areas reported  $\geq 1$  CCHF case or a CCHF virus-positive tick in the past 5 years. In each group, 15 villages were chosen by population proportional to livestock population size. Livestock-owning households ( $n=969$ ) were selected randomly from veterinary registries. One adult was randomly selected per house and ticks were collected from one randomly selected sheep or cow over 1 year of age per house. Data were weighted accounting for design and analyzed in R. **Results** KAP surveys were completed for 950 people (98%); of those, 923 (97%) submitted blood for ELISA testing using Vector-Best Kits. Median age of human respondents was 46 years (range: 19 – 90); 54% were male. Three individuals were anti-CCHF IgM positive, 12 anti-CCHF IgG positive and two positive for both. Weighted seroprevalence of CCHF in Zhambyl was 1.6% (95% CI: 0.9, 3.0). In endemic villages, seroprevalence was 1.8% (95% CI: 1.0, 3.0), compared to 1.2% (95% CI: 0.4, 4.0) in non-endemic villages. Of the 17 seropositive for CCHF, median age was 54 years; 58% were male. None reported previous CCHF diagnosis or illness with fever and hemorrhaging in the past five years. None reported high-risk tick exposure in the past four months. Controlling for age and sex, milking animals, an activity in which 40.3% of the population had engaged, was associated with infection in Poisson regression (OR: 2.53, 95% CI: 1.27, 4.81). Of respondents who had heard of CCHF ( $n=791$ ), 99.8% knew transmission was caused by a tick bite; few identified contact with animal blood (8.2%) or tick crushing (20.8%) as potential causes. Of the five seropositive by IgM, four participated in at least one of the following activities in the last four months: milking ( $n=3$ ), birthing ( $n=2$ ), shearing and slaughtering ( $n=1$ ). One reported experiencing an illness with joint pain within the past four months. Three were from non-endemic villages. Entomologists inspected 465 cows and 528 sheep for ticks. Ticks were found on 61.5% (95% CI: 48.1, 73.2) of cows ( $n=254$ ) and 46.3% (95% CI: 24.3, 69.8) of sheep ( $n=264$ ). Ticks were grouped into pools by animal source and species. Over ninety-seven percent of the tick pools were from the family Ixodidae, with the remaining from family Argasidae. The genus *Hyalomma* accounted for 65.8% of tick pools, *Rhipicephalus* for 31.8%, *Ornithodoros* for 2.4%, and *Argas* for 0.5%. Pools contained an average of 4.5 ticks (range: 1 – 26). Ticks were stored live at 4°C for up to 24 hours before being crushed and extracts tested for CCHF virus by PCR and Antigen testing. Of the 155 pools tested, seven (2.4%, 95% CI: 1.1, 5.0) were positive for CCHF virus by either PCR ( $n=5$ ) and/or antigen testing ( $n=4$ ). A CCHF virus-positive tick was found on 1.4% (95% CI: 0.4, 4.8) of all sheep and 4.8% (95% CI: 2.3, 10.0) of all cows. All CCHF virus-positive ticks were hard ticks of family Ixodidae, belonging to either genus *Hyalomma* ( $n=5$ ) or *Rhipicephalus* ( $n=2$ ). Two pools were from non-endemic villages. **Conclusions** Presence of CCHF virus-positive ticks and CCHF-seropositive humans in non-endemic areas may suggest a wider range of virus circulation. These findings will be used to inform and target public health messaging.

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# Roles of Health Literacy in Relation to Social Determinants of Health and Recommendations for Informatics-Based Interventions: Systematic Review

## Abstract

**Objective** To define the problems of epidemiological surveillance of West Nile fever (WNF) in Ukraine. Introduction Flaviviridae are one of the most widespread arboviruses in Ukraine. Mosquitoes are vectors of WNF in a majority of cases due to bites during swimming, fishing, work in suburban areas and outdoor recreation without use of individual protection from mosquitoes. A study of the species composition of bloodsucking mosquitoes is conducted in Ukraine. Existence of natural foci of WNF viruses has been well-proven all over the territory of Ukraine by testing IgG antibodies in different groups of population, including children [1]. Also, infection of mosquitoes (RNA found in *Culex pipiens* (including *Culex pipiens f. molestus*, *Culiseta annulata*)) was registered. Infection of *I. ricinus* and *D. reticulatus* was also determined, and it acts as a factor for circulation of virus in the wild too [2]. **Methods** Statistical, serological and epidemiological methods were used during the study. Serological tests included reactions with IgM and IgG antibody in human serum performed using immunofluorescent and ELISA methods. **Results** In Ukraine, the causative agent of WNF is detected in all landscapes. It is the main arboviral infection in the forest-steppe zone (53.1 % among all arboviral infections). Enzootic territories are located in 18 regions, 47 administrative districts, and 63 settlements. The majority of natural foci of WNF is located in the Dnieper left-bank steppes, and also in North-Western and Western forest-steppes. The enzootic territories are located on the East of steppe zone and on the East of forest-steppes. The smallest number of natural foci is registered in the Dnieper right-bank part of the steppes. Enzootic territories are absent in Chernivtsi, Chernihiv, Sumy, Ternopil, Luhansk, Kirovohrad Oblasts and Kyiv. Most of them are located in Zaporizhzhia with 9 administrative districts and 16 settlements; in Rivno Oblast - 7 and 9; in Kherson - 5 and 4, and in Poltava Oblasts - 2 and 4 respectively [3]. During the period from 2007 to 2016, 86 cases of WNF were registered. WNF was registered in 7 oblasts (Zaporizhzhya - 40 cases, Poltava - 24, Donetsk - 16, Mykolaiv- 3, Kherson, Kharkiv, Zhytomyr Oblasts - one case in each) [4]. Registration of WNF cases separately from other viral hemorrhagic fevers has been conducted in the country since 2010 (official registration of total amount of viral hemorrhagic fevers has been performed since 2005). In enzootic territories, 2 cases of the diseases were registered and were associated with ticks bites. The strains of WNV were detected in bloodsucking mosquitoes in Rivne and Zaporizhzhia Oblasts and in tick samples of *Ixodes* genus collected in Lviv Oblast (probably may be found in other species of tick (*Argasidae* and *Gamazoidea*) where the causative agent is kept in natural foci under unfavorable conditions). Laboratory diagnostics was conducted (mainly retrospectively) in Zaporizhzhia, Poltava, Donetsk Oblasts. All diagnoses (exception Mykolaiv Oblast in 2011, data is absent) were laboratory confirmed, including 10 cases confirmed in the State Institution Lviv Research Institute of Epidemiology and Hygiene of the Ministry of Health of Ukraine, and 3 more cases were confirmed by a private laboratory [2]. In total, 129 samples of blood sera collected from patients with clinical manifestations of a fever of unknown origin were delivered to the Laboratory of Virology of Ukrainian Center for Diseases Control and Monitoring during 2016-2017. Samples were investigated using the immunofluorescent and enzyme immunoassay methods including immunoblot. West Nile virus markers such as IgM/IgG antibodies have been detected in 4 cases (Poltava oblast) [4]. **Conclusions** Mainly, single cases were registered. It is caused by insufficient level of diagnostics in most of the regions, as a result, diseases pass under other diagnoses. Migratory birds (3 flyways of migratory birds pass through Ukraine) and local animals (crows, jackdaws, doves and other) may be the possible reservoirs of causative agent of WNF. Laboratory diagnostics need to be improved and more attention should be paid to testing of samples of blood serum from patients with suspected WNF. **References** [1] Rusev I.T., Zakusilo V.M., Vinnuk V.D. Bloodsucking mosquitoes of urbanized biocenosis and their role are in circulation of viruses of West Nile fever. Series are "Biology, chemistry". issue 24 (63). 2011. No. 2. p. 240-248. [2] Lozinskyi I.M., Beletska G.V., Drul O.S., Fedoruck V.I., Kozlovskyi M.M., Rogochiy E.G., Sholomey M.V., Ben I.I., Shulgan A.M./Epidemic situation of Western Nile fever in Ukraine. Magazine of infectology, issue 6, No. 2, 2014 Appendix 66-65. [3] Official data of state statistic form of the Ministry of Health. [4] Data of the State Institution Ukrainian center for Diseases Control and Monitoring of the Ministry of Health of Ukraine.

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## Abstract

**Objective** The mandate of establishing this DSS is to provide a research platform for both observational and interventional studies, with focus on maternal and child health, which could influence decision-making and planning for health strategies at local, national and international levels. **Introduction** The Karachi Health and Demographic Surveillance System was set up in year 2003 by the Department of Pediatrics and Child Health of the Aga Khan University, Karachi, Pakistan, in four peri-urban low socioeconomic communities of Karachi and covers an area of 17.6 square kilometers.(Figure 1) **Methods** Total population currently under surveillance is 299,009 for which a record of births, deaths, pregnancies and migration events is maintained by two monthly household visits. At each re-enumeration, Community Health Workers move through the area using GIS-derived maps and collect the information from households and conduct verbal autopsies for stillbirths and deaths of children under the age of five and adult female. Primary Health Care centre at each site provide free care to children under 5. **Results** The demographic characteristics for the year 2016 are summarized in Table 1. The main demographic indicators for a period of five years enable us to study the trends of population dynamics and reasons for the change in the rates of stillbirth, under 5 children mortality and maternal mortality (Table 2). Under 5 mortality rates peaked in 2013 and 2016 due to measles epidemic. Within the time period of five years, a reduction in neonatal mortality rates is observed (Table 2). For over a decade, the KHDSS has been a platform for a variety of studies. At the outset, various epidemiological studies were conducted in the area of infectious diseases of children, identifying signs and symptoms in young infant requiring urgent referral, vaccine coverage and the impact of multiple interventions. The focus was on measuring burden of relevant and common childhood illnesses. Some of these projects include: calculation of the incidence of various infectious diseases like typhoid bacteremia, pneumonia and diarrhea, evaluation of effectiveness of various treatment regimens for neonatal sepsis, assessment of the acceptance of hospitalized care, determining etiology of moderate to severe diarrhea, assessment of burden and etiology of neonatal sepsis and a multi-center cohort measuring the burden of stillbirths, neonatal and maternal deaths. (1-5) **Conclusions** All the studies aim for improvement of public health policies and informed decision making at local and national levels. We have also established a bio-repository of a well-defined maternal and newborn cohort. **References** 1. Group YICSS. Clinical signs that predict severe illness in children under age 2 months: a multicentre study. *The Lancet*. 2008;371(9607):135-42. 2. Kotloff KL, Nataro JP, Blackwelder WC, Nasrin D, Farag TH, Panchalingam S, et al. Burden and aetiology of diarrhoeal disease in infants and young children in developing countries (the Global Enteric Multicenter Study, GEMS): a prospective, case-control study. *The Lancet*. 2013;382(9888):209-22. 3. Mir F, Nisar I, Tikmani SS, Baloch B, Shakoor S, Jehan F, et al. Simplified antibiotic regimens for treatment of clinical severe infection in the outpatient setting when referral is not possible for young infants in Pakistan (Simplified Antibiotic Therapy Trial [SATT]): a randomised, open-label, equivalence trial. *The Lancet Global Health*. 2016. 4. Shafiq Y, Nisar MI, Kazi AM, Ali M, Jamal S, Ilyas M, et al. Implementation of the ANISA Study in Karachi, Pakistan: Challenges and Solutions. *The Pediatric infectious disease journal*. 2016;35(5):S60-S4. 5. group As. Burden, timing and causes of maternal and neonatal deaths and stillbirths in sub-Saharan Africa and South Asia: protocol for a prospective cohort study. *Journal of Global Health*. 2016;6(2).

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## Abstract

**Objective** Develop a public health surveillance plan for the Oregon Public Health Division (OPHD) in anticipation of the expected influx of visitors for the 2017 Great American Solar Eclipse. **Introduction** The Great American Solar Eclipse of 2017 provided a rare opportunity to view a complete solar eclipse on the American mainland. Much of Oregon was in the path of totality and forecasted to have clear skies. Ahead of the event, OPHD aggregated a list of 107 known gatherings in mostly rural areas across the state, some with estimated attendance of up to 30,000 attendees. Temporary food vendors and a range of sanitation solutions (including open latrines) were planned. International travelers were expected, along with large numbers of visitors traveling by car on the day of the eclipse. The potential for multiple simultaneous mass gatherings across the state prompted OPHD to activate an incident management team (IMT) and to create a Health Intelligence Section to design a mass gathering surveillance strategy. Statewide syndromic surveillance (Oregon ESSENCE) has been used to monitor previous mass gatherings (1) and captures statewide emergency department (ED), urgent care, Oregon Poison Center, and reportable disease data. **Methods** The OPHD Health Intelligence Section identified five categories of public health effects associated with large outdoor gatherings based on literature review (2–5) and an internal risk assessment. These included health system status (total visit or call counts), communicable disease (fever, bloody diarrhea and reportable disease counts), injuries and substance abuse (including motor vehicle accidents), and outdoor exposure (heat-related illness, snake bites and asthma-related visits). An event-related category monitored trends in eclipse-related visits or eye-related injuries (looking directly at the sun). Where possible, syndromic trends were assessed in multiple data sources. These categories were used to create dashboards within Oregon ESSENCE and shared in a guidance document for local health departments and hospitals. Health Intelligence monitored syndromes of interest during a period of enhanced surveillance (9/18-9/22), and met daily with members of the OPHD IMT to share surveillance summaries, which were also sent to OPHD leadership and external partners. **Results** During the enhance surveillance period, the OPHD Health Intelligence Section did not identify statewide increases in healthcare utilization (total ED visits and calls to the Oregon Poison Center), but did observe increases in visits at select emergency departments in the state. Visits by out-of-state residents (as determined by patient zip code at time of registration) increased during the surveillance period. Fever-related visits increased as well but were not accompanied by reports of illnesses clusters. Increases were noted for motor vehicle accidents, eye-related injuries, and “eclipse”-related visits. Increases in eye-related injuries appeared to be an annual seasonal trend and not related to the eclipse. There were no increases of note in the other queries monitored. Development of new queries (West Nile Virus) was begun based upon mosquito pool surveillance findings. Surveillance highlights were posted publicly in a special edition of the biweekly Oregon ESSENCE Hazard Report (see Image 1). **Conclusions** Statewide public health surveillance during the 2017 Great American Solar Eclipse in Oregon did not identify clusters of infectious disease or other opportunities for real-time public health intervention. Nevertheless, surveillance identified increases in motor vehicle accidents, especially among out-of-state residents, due perhaps to increased road travel for the event. Preparations for this event increased capacity of state health department staff to conduct this type of surveillance in the future. Tools created for the eclipse have been used in several IMT activations since the eclipse. **References** 1. Jagger MA, Jaramillo S, Boyd L, Johnson B, Reed KR, Powell M. Mass Gathering Surveillance : New ESSENCE Report and Collaboration Win Gold in OR. 2017;9(1):2579. 2. WHO. Public Health for Mass Gatherings: Key Considerations. World Health Organization. 2015. 3. Lombardo JS, Sniegowski CA, Loschen WA, Westercamp M, Wade M, Dearth S, et al. Public health surveillance for mass gatherings. Johns Hopkins APL Tech Dig (Applied Phys Lab. 2008;27(4):347–55. 4. Polkinghorne BG, Massey PD, Durrheim DN, Byrnes T, MacIntyre CR. Prevention and surveillance of public health risks during extended mass gatherings in rural areas: The experience of the Tamworth Country Music Festival, Australia. Public Health. 2013;127(1):32–8. 5. Burdick TE. Wilderness event medicine: Planning for mass gatherings in remote areas. Vol. 3, Travel Medicine and Infectious Disease. 2005. p. 249–58.

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# Roles of Health Literacy in Relation to Social Determinants of Health and Recommendations for Informatics-Based Interventions: Systematic Review

## Abstract

**Objective** 1) Describe HCPH's disease surveillance and prevention activities within the NRG Center mega-shelter; 2) Present surveillance findings with an emphasis on sharing tools that were developed and may be utilized for future disaster response efforts; 3) Discuss successes achieved, challenges encountered, and lessons learned from this emergency response. **Introduction** Hurricane Harvey made landfall along the Texas coast on August 25th, 2017 as a Category 4 storm. It is estimated that the ensuing rainfall caused record flooding of at least 18 inches in 70% of Harris County. Over 30,000 residents were displaced and 50 deaths occurred due to the devastation. At least 53 temporary refuge shelters opened in various parts of Harris County to accommodate displaced residents. On the evening of August 29th, Harris County and community partners set up a 10,000 bed mega-shelter at NRG Center, in efforts to centralize refuge efforts. Harris County Public Health (HCPH) was responsible for round-the-clock surveillance to monitor resident health status and prevent communicable disease outbreaks within the mega-shelter. This was accomplished through direct and indirect resident health assessments, along with coordinated prevention and disease control efforts. Despite HCPH's 20-day active response, and identification of two relatively small but potentially worrisome communicable disease outbreaks, no large-scale disease outbreaks occurred within the NRG Center mega-shelter. **Methods** Active surveillance was conducted in the NRG shelter to rapidly detect communicable and high-consequence illness and to prevent disease transmission. An online survey tool and novel epidemiology consulting method were developed to aid in this surveillance. Surveillance included daily review of onsite medical, mental health, pharmacy, and vaccination activities, as well as nightly cot-to-cot resident health surveys. Symptoms of infectious disease, exacerbation of chronic disease, and mental health issues among evacuees were closely monitored. Rapid epidemiology consultations were performed for shelter residents displaying symptoms consistent with communicable illness or other signs of distress during nightly cot surveys. Onsite rapid assay tests and public health laboratory testing were used to confirm disease diagnoses. When indicated, disease control measures were implemented and residents referred for further evaluation. Frequencies and percentages were used in the descriptive analysis. **Results** Harris County's NRG Center mega-shelter housed 3,365 evacuees at its peak. 3,606 household health surveys were completed during 20 days of active surveillance, representing 7,152 individual resident evaluations, and 395 epidemiology consultations. Multifaceted surveillance uncovered influenza-like illness and gastrointestinal (GI) complaints, revealing an Influenza A outbreak of 20 cases, 3 isolated cases of strep throat, and a Norovirus cluster of 5 cases. Disease control activities included creation of respiratory and GI isolation rooms, provision of over 771 influenza vaccinations, generous distribution of hand sanitizer throughout the shelter, placement of hygiene signage, and frequent bilingual public health public service announcements in the dormitory areas. No widespread outbreaks of communicable disease occurred. Additionally, a number of shelter residents were referred to the clinic after reporting exacerbation of chronic conditions or mental health concerns, including one individual with suicidal ideations. **Conclusions** Effective public health surveillance and implementation of disease control measures in disaster shelters are critical to detecting and preventing communicable illness. HCPH's rigorous surveillance and response system in the NRG Center mega-shelter, including online survey tool and novel consultation method, resulted in timely identification and isolation of patients with gastrointestinal and influenza-like illness. These were likely key factors in the successful prevention of widespread disease transmission. Additional success factors included successful partnerships with onsite clinical and pharmacy teams, cooperative and engaged shelter leadership, synergistic internal surveillance team dynamics, availability of student volunteers, sufficient quantities of influenza vaccine, and access to mobile survey technology. Challenges, mostly related to scope and magnitude of response, included lack of pre-designed survey tools, relatively new staff without significant disaster experience, and simultaneous management of multiple surveillance activities within the community. Personal hurricane-related losses experienced by HCPH staff also impacted response efforts. HCPH's rich disaster response experiences at the NRG mega-shelter and developed surveillance tools can serve as a planning guide for future public health emergencies in Harris County and other jurisdictions.

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## Abstract

**Objective** The goal of this study was to identify the periodicity of seven zoonooses in humans, and set epidemic thresholds for future occurrences. **Introduction** The frequency of disease outbreaks varies as a result of complex biological processes. Analysis of these frequencies can reveal patterns that can serve as a basis for predictions. **Methods** A 40 year regression analysis of the following infectious diseases was performed using Arc-GIS10.1—anthrax, brucellosis, erysipeloid, leptospirosis, plague, tularemia and yersiniosis. **Results** The analyses covered many years and revealed the dynamics of epidemics for infections. Yearly periodicities of (3.1 + 2.8) - (3.8 + 2.2) - 5 - 4.6 - 2.2 - 5.1 - 2.1 - 2.6 were determined for theoretically calculated zoonooses. These coincide with the recorded activity of (6 - 6 - 5 - 5 - 2 - 5 - 3 - 2) that correspond to (1977-1983-1989-1994-1999-2001-2006-2009-2011 (2017-2023-2028)). These years had more cases of disease than other years. The predicted years (2017, 2023, 2028) are those of potential risk, when 0.7-0.9% of the total disease burden will consist of epidemiologically associated cases. Disease severity was correlated with natural factors including air temperature, humidity, number of annual heat days, geographical factors, type of landscape, number of carriers, and the contact intensity between disease carrier and transmitter. Partial control indicators (PCIs) were determined to characterize the epidemic situation. These are determined from the perennial average characteristic of the given area from which the mean square deviation is removed. The detection indicator is the normal size of a given disease, with minimal and maximal deviation of the range. It can be compared to the epidemic threshold and helps yield short- and long-term quantitative predictions with high reliability indicators (96.5% p < 0.035). **Conclusions** A 3-5 year periodicity for zoonooses was identified. Conditions contributing to the occurrence of these epidemics differ by region. In Shirak Marz, the PCIs for the different diseases are: brucellosis-47, anthrax-12, plague-8, tularemia-6, leptospirosis-175, erysipeloid-12, yersiniosis-18. These numbers represent years of positive points as a maximum threshold. The stability index was identified, for instance, for brucellosis S = 1.2, amplitude - 5.2, perennial average - 28.8, orientation month - January, seasonal morbidity ratio - 18-42 cases. Our predictions indicate that 2017 will be a peak year with 95% probability; intensive index: 16.8 (per 100,000 population), seasonal illness cases: 42 ± 3.5 between March and November. The application of numerical thresholds in predictive epidemiological surveillance provide clear triggers that make public health responses more targeted and rational.

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# Roles of Health Literacy in Relation to Social Determinants of Health and Recommendations for Informatics-Based Interventions: Systematic Review

## Abstract

**Objective** Use ESSENCE to create a sustainable process for identifying ED and urgent care visits that may be related to harmful algal bloom exposure in Oregon. **Introduction** Harmful algal blooms (HABs) consist of colonies of prokaryotic photosynthetic bacteria algae that can produce harmful toxins. The toxins produced by HABs are considered a One Health issue. HABs can occur in all types of water (fresh, brackish, and salt water) and are composed of cyanobacteria or microalgae. As the climate changes, so do many of the factors that contribute to the growth of HABs, which in turn, can increase the incidence of HAB-related illness in humans. There are three main pathways that HAB toxins can affect human health: dermal, gastrointestinal (GI), and neurological. Swimming in or consuming contaminated water and eating contaminated shellfish are ways to develop HAB-related illnesses. Contact with cells from a bloom while recreating can cause a rash on the body. Most commonly, HAB-related illnesses present with GI symptoms that resemble food poisoning and can affect the liver. Rarely, HABs that produce cyanotoxins can present with neurological symptoms. Issuing and lifting freshwater HAB advisories is within the preview of the Environmental Public Health section at the Oregon Public Health Division. However, most water bodies in the state are not monitored. Because of this, syndromic surveillance was considered as a potentially useful source of HAB exposure information, and the Oregon ESSENCE team was asked to develop a query to help monitor HAB-related complaints. **Methods** Preliminary research was done on HABs and the associated health issues, and past advisories were examined to identify locations of interest. Next, keywords and symptoms were evaluated. Initially, the objective was to create a single query for HAB syndromic surveillance, but it became evident that multiple queries would have to be developed to fully encompass the various types of HAB-related illnesses: GI, neurological, and rash. Most commonly Oregon ESSENCE uses chief complaint and discharge diagnosis (CCDD) queries. However, the ICD-10 codes relating to HABs are not widely used, with only two occurrences since June 2015. It was determined that using the already established ESSENCE syndromes of Neuro, GI, and Rash would be most useful. To make the queries HAB-specific, an additional exposure element needed to be added. Exposures to HABs that are of interest occur in recreational freshwater sources. After running this query in the CCDD field, it was determined that the triage note field would yield better results. This is because this field often includes the patient's verbatim complaints. This produced higher quality results, and a seasonal curve of cases could be seen in the historic data. Since the microcystin threshold for illness is significantly lower for pets; and a permanent HAB alert in southern Oregon was established after several dogs died from drinking contaminated water, tracking neurological cases that followed canine illness was investigated. A free-text triage note query was developed for patients mentioning dogs, and it was combined with the ESSENCE Neuro syndrome. After several attempts, it was clear that this would not be helpful for surveillance of HAB-related illnesses. Ultimately, four query configurations were developed to monitor HAB-related illness. Most importantly, a free-text recreational water query was developed to stand alone and then be paired with three distinct ESSENCE syndromes. Recreational water query text: ( ( , ^lake^ ,andnot ( , ^road^ ,or, ^rd^ ,or, ^sky^ ,or, ^oswego^ ,or, ^view^ , ) , ) ,or, ^swim^ ,or, ( , ^river^ ,andnot ( , ^driver^ ,or, ^hood^ ,or, ^rd^ ,or, ^road^ ,or, ^three^ , ) , ) ,or, ^boat^ , ) ,andnot, ^feels like^ All queries were compiled into a myESSENCE page that could be shared for easy monitoring by all members of the team (Figure 1). **Results** The ESSENCE team monitored the HAB myESSENCE page. The monitoring period for this project stretched from May to early August (MMWR weeks 19-31). Monitoring was often informed by HAB alerts and required looking closely at individual visits. Over this time, the number of recreational water related visits varied, but the average was approximately 110 visits a week. This techniques also helped identify cases possibly related to unreported blooms. The months of June and July saw 15 specific cases that were potentially due to HAB exposure. These cases were highlighted and forwarded to Environmental Public Health for investigation. **Conclusions** This process helped refine the use of the triage note field when constructing keyword queries. While not all Oregon facilities provide triage notes, using specific terms allows ESSENCE users to search for words that may not be included in chief complaints. This is most be useful when searching for specific places or events. With further analysis, users can see what chief complaints are most likely to occur in conjunction with specific exposures. Moving forward, the development of a recreational water query has proven to be useful beyond the scope of this HAB project. Alternative versions of this query have been used in other contexts. **References** Harmful Algal Bloom (HAB)-Associated Illness. (2017, June 01). Retrieved August 01, 2017, from <https://www.cdc.gov/habs/index.html>

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# Roles of Health Literacy in Relation to Social Determinants of Health and Recommendations for Informatics-Based Interventions: Systematic Review

## Abstract

**Objective** To better understand the importance of monitoring responders during public health emergencies and to learn how the Georgia Department of Public Health (DPH) developed and deployed an electronic responder monitoring tool. **Introduction** During an emergency, the state of Georgia depends on public health staff and volunteers to respond. It is imperative that staff are safe before, during and after deployment. Emergency response workers must be protected from the hazardous conditions that disasters and other emergencies create<sup>1</sup>. In October 2016 and September 2017, Hurricanes Matthew and Irma caused widespread evacuation of Georgia residents, initiating a tremendous sheltering effort. Hundreds of public health responders were deployed to assist with sheltering and other aspects of the response. DPH rapidly developed a novel electronic Responder Safety, Tracking and Resilience module, which was used to track public health responders and monitor their health and safety while deployed. **Methods** DPH rapidly developed a novel electronic Responder Safety, Tracking, and Resilience module (R-STaR), within the existing State Electronic Notifiable Disease Surveillance System to monitor the health and safety of responders. R-STaR was originally used during Hurricane Matthew, where it was launched the day of the storm, and was launched again four days before Hurricane Irma made landfall. Responders were emailed a web-based link to register, indicating demographic information, contact information, work location, subject area, vaccination status, and whether they considered themselves mentally and physically fit to deploy. Responders then received a daily email with a link to document their daily deployment location, duties, and whether they had any hazardous exposures, illness, or injuries while deployed. A post-deployment survey was sent to responders after Hurricane Matthew to solicit feedback about the responder safety module. **Results** During Hurricane Matthew, 128 responders representing 11 Georgia Public Health Districts registered in R-STaR. Seven responders reported illness or injury and were contacted to determine if medical services were needed; all remained healthy post-deployment. During Hurricane Irma, 1240 responders representing DPH and 16 Public Health Districts, and other employers, including law enforcement, fire, and education, registered in R-STaR. Of 472 responders completing daily health checks during their Irma deployment, 48 reported an injury, illness, or exposure, and were contacted to determine if services were needed. The daily health checks led to the identification of an outbreak of influenza in one of the shelters and resulted in vaccination or antiviral prophylaxis administration to 76 responders. Fifty responders to Hurricane Matthew completed the post-deployment survey; 95% found R-STaR easy to use, and 92% indicated that they liked being monitored. Supervisors indicated that the module could be used to: 1) roster and credential responders prior to an event; 2) track where responders are, monitor their health and safety during an event, and quantify the human resources deployed during a declared emergency; and, 3) to distribute post-response responder resources, monitor responder health, and gather information for after-action reports. **Conclusions** R-STaR was widely used and well received despite being implemented with no prior training, with a dramatic increase in the number of responders registering from the first implementation in 2016 to the second implementation in September 2017. Monitoring responder health and safety is crucial to responding to and preventing outbreaks during a response, and ensuring responders get appropriate mental and physical support after a deployment. Lessons learned from both events will be used to create a just-in-time training curriculum, and develop a more robust R-STaR, which will enable responder rostering, credentialing, tracking and monitoring before, during, and after an event to ensure the health and safety of our responders as well as for future planning. **References** 1. Centers for Disease Control and Prevention (2017). EMERGENCY RESPONDER HEALTH MONITORING AND SURVEILLANCE (ERHMS). Retrieved from Centers for Disease Control and Prevention: <https://www.cdc.gov/niosh/erhms/default.html>.

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# Roles of Health Literacy in Relation to Social Determinants of Health and Recommendations for Informatics-Based Interventions: Systematic Review

## Abstract

**Objective** To assess the formation and function of a joint committee of the Ahmadu Bello University (ABU) and the Ahmadu Bello University Teaching Hospital (ABUTH) to prevent and control EVD in Zaria and the North West sub region of Nigeria. **Introduction** The Ebola Virus Disease (EVD) outbreak in West Africa was unprecedented in spread and its attendant response. There were over 15 000 confirmed cases and over 9 000 suspected cases. The response to the outbreak was massive within Africa and beyond. The outbreak in Nigeria affected 19 people and led to 7 deaths (CFR 37%). There were more than 891 contacts of these cases under surveillance as at 23rd September 2014. Nigeria was declared EVD free by the World Health Organization in October 2014. Nationwide there was targeted preparedness to prevent and control EVD. In Zaria, this led to the formation of a joint committee of the Ahmadu Bello University (ABU) and the Ahmadu Bello University Teaching Hospital (ABUTH) to prevent and control EVD in Zaria and the sub region as a whole. **Methods** A joint multidisciplinary committee was formed by ABU and ABUTH with representatives from the Department of Community Medicine, Internal Medicine, Nursing sciences, Veterinary Public Health, Medical Microbiology, Mass Communication, Directorate of Public Affairs ABU Zaria, General Administration and Management services division ABUTH, the University Health Services and the Centre for Disease Risk Management under the Department of Geography. Four subcommittees were created steered by the main committee. The subcommittees were Surveillance; Case Management; Infection Control and Social and Mass mobilization subcommittees **Results** The committee conducted seminars and trainings in case management, surveillance and infection control. Mass media campaigns included radio jingles production and airing as well as production of flyers and posters on EVD prevention and control. There was a phone in live radio programme. Screening exercise for raised temperature was conducted using laser thermometers at main entry points. A case of suspected EVD was managed who turned out to be a case of dengue haemorrhagic fever. **Conclusions** The committee was enriched by its multidisciplinary nature and a blueprint for the control and prevention of EVD was developed in line with national and global standards. The committee was hampered with lack of funds to implement fully the blueprint for the prevention and control of EVD in Zaria and its environs. The committee transformed into the ABU/ABUTH Epidemic Preparedness and Response Committee after the outbreak was over to address other emerging epidemics. **References** ABU/ABUTH Joint Committee For The Prevention And Control Of Ebola Virus Disease (ABUPACE) Blueprint For Prevention And Control Of Ebola Virus Disease In ABU/ABUTH Zaria 2014. Pages 1-44 World Health Organization. WHO declares end of Ebola outbreak in Nigeria [www.who.int/mediacentre/news/statements/2014/nigeria-ends-ebola/en/](http://www.who.int/mediacentre/news/statements/2014/nigeria-ends-ebola/en/)

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## Abstract

**Objective** The objective was to assess the risk of HIV infection among the seasonal labour migrants of Nepal. Introduction HIV and AIDS is not a new problem to global community and human civilization. Though much efforts had been taken yet its devastating effects can be seen in many areas like human productivity, public health, human rights etc. Nepal is experiencing a concentrated epidemic of HIV with prevalence at, or over, 5 percent in certain high-risk groups, such as intravenous drug users (IDUs), MSM, FSW, and migrant laborers in India who go to cities such as Mumbai. The possibility of transmission of HIV infection from these high-risk groups to the general population is a serious health concern. Nepal's vulnerability to HIV has increased because of several factors including poverty coupled with the lack of employment opportunities, large-scale migration and ten years of conflict. [1] IBBS survey conducted in 2008 in mid-Terai regions reported the prevalence of HIV among seasonal migrants who had sexual contact with female sex workers in India was 2.6% [1] which indicates unsafe sex being one of the major factors of HIV transmission among the seasonal migrants. Similar study conducted among seasonal migrants reported that only 62% used condom during sex with sex worker and HIV infection was found only on those who visited Mumbai (6.1%) and had sex with sex workers without using condom [2]. Seasonal migration for income generation in Mid-Terai part of Nepal is present since the time immemorial. People migrate to India generally to Bihar, Punjab, Uttaranchal, Maharashtra, Uttar Pradesh, Delhi states. [2] Risk of HIV transmission among the seasonal migrants is very high. Separated from their spouses and adrift from social bindings, many to these migrants exercise unsafe sexual practices. Regular monitoring and health assistance to this population is lacking, especially in the case of those who migrate to neighboring countries like India, compared to those who receive authorized permission to work in other countries. **Methods** Analytical cross-sectional study was conducted to assess the risk of HIV among seasonal Labour migrants of three VDCs from three district of mid Terai Region of Nepal which is the transition point for seasonal migrants going to India. The study population was the male migrants of mid-Terai region visiting the study area who give oral consent and show interest to participate. 333 seasonal labor migrants' men aged between 18 to 47 years who went to India for work for at least three months and have returned home within the last three years was selected purposively. **Results** The Results found that majority of migrants were 15-25 age group which accounts for the 69.4% of the total participants and most of the respondents were found Disadvantaged dalit caste group which accounts for the 60.96 % of the total participants whereas 3.9% of participants were upper caste as well minority religious group. Majority of the participants were Hindu which accounts 84.7% and other were Muslim, Buddhist and Christian (15.3%). About 42 percent of the participants had their sexual intercourse onset at the age less than 18 years of age. The majority of the Migrants were found to be married, i.e. 86.49 percent. Among those that had sex with women 42.68 percent ever had sex with Female sex Worker (FSW) and rest 57.33 percent had no sex with FSW in abroad It was reported that 61.25 percent ever had sex with FSW in Nepal among them those who had sex with FSW 79.59 percent of the participants used condom during last sexual contact with FSWs in Nepal whereas 20.41 percent of the participants had not used condom. About 27.27 percent of the participants had sexual contact with the male partner whereas 72.73% had reported never had sexual contact with male partners. 53.22 % used condoms when having sexual contact with the male partners and 46.77 did not used condom. Among total respondents, 23.7 percent migrants were at risk of HIV and 76.3 percent migrants did not at risk of HIV. The risk of HIV in age group distribution found that, age group of 26-35 years was found to be 3.40 times higher in risk than 36-45 years. Similarly the risk of HIV was 4.643 times higher among age group 15-25 years as compared to 36-45 years. Among them Disadvantage Dalit caste had more risk than Upper caste. Similarly illiterate had more risk than Literate. In distribution of risk of HIV unmarried had high than ever married. **Conclusions** The Study showed that seasonal migrants of Nepal have increased vulnerability to HIV. The unmarried labor worker and disadvantaged caste group were in the higher risk of facing HIV infection. It is necessary to design better service delivery focusing on these areas and need to explore the real situations of labor migrants. **References** Integrated Biological and Behavioural Surveillance survey (IBBS) among seasonal migrants of western and mid to far western regions, 2008, FHI/New Era. Integrated Biological and Behavioural Surveillance survey 2002, FHI/New Era, IBBS. National Center for AIDS and STD Control 2007 national estimates of HIV. 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# Roles of Health Literacy in Relation to Social Determinants of Health and Recommendations for Informatics-Based Interventions: Systematic Review

## Abstract

**Objective** The present study aims to document the burden of self-reported selected zoonotic diseases (Z/D/S) among animal handlers in urban areas of Ahmedabad. **Introduction** The usual mechanism of disease or infection transmission from vertebrate animals to humans and vice-versa is classified as zoonosis [1]. Globally out of all microbial pathogenic disease, 61% are zoonotic with 13% species are regarded as emerging or reemerging [2]. Studies suggest the prevalence of innumerable known and important Z/D/S such as leptospirosis, rabies, avian influenza but the extent of burden of zoonotic diseases amongst high-risk cohorts such as animal handlers within urban geography not adequately documented. **Methods** A cross-sectional study conducted amongst animal handlers residing in the urban/peri-urban areas of Ahmedabad. A purposive sample of 170 animal handlers was included in this study. The sample size estimated based on operational feasibility and response saturation for 10%. All individuals engaged in handling animals (such as cattle, buffalos, cows, goat, dog, hen, sheep etc.) recruited from three different zones (South, East, and New west zone) randomly out of six zones of Ahmedabad city, Gujarat, India. Data collected in vernacular language by using pretested questionnaire during the month of March to May 2017. Data entered into Excel and analyzed by using SPSS V.18. The burden was estimated in form of proportion of self-reported disease. The ethical permission was sought from the ethical review board of Indian Institute of Public Health Gandhinagar. **Results** Total 170 animal handlers participated in this study and majority of them were females. Around 76% participants belonged to 26 to 60 years of age group with the mean age of 42±15 years. There were 44% of respondents illiterate however out of total literate, 50% studied up to primary or more. Around one-third, respondents belonged to Below Poverty Line status. The cumulative prevalence of self-reported Z/D/S was found 23% among respondents however amongst their family members was found 17%. The point prevalence of self-reported Z/D/S during the study was found to be 17% and 18% amongst their family members. Self-reported Z/D/S includes vector born, animal bite and respiratory diseases. Average experience and hours/day spent on handling animal was reported respectively 22±15 yrs (median age of 20 yrs) and 5±2 hrs. It was observed that median value for types of breeds of animals was five (IQR= 3 to 8) which ranged from 1 to 70 animals. Different breeds of animals reported by the livestock keepers, which included Buffalo 64%, Cow 38%, Goat 20%, Dog 5% and Sheep & Bulls 4%. On inquiring about their perception on acquiring by virtue of engagement in animal handling can be a cause of the disease was reported by only one-third of participants. Knowledge about common zoonotic reported for rabies (11%), respiratory disease (10%) followed by vector born disease (7%) and skin disease (1.2%). Average knowledge on the mode of transmission of Z/D/S was reported only 4.1%. The study also documented the commonly used methods for prevention of zoonotic disease, most common practice was found hand washing practice (83%) followed by avoiding contact to animal placenta with naked hands (68%). **Conclusions** The prevalence of self-reported Z/D/S was underestimated when compared to other studies within India. One of the common reasons could be poor awareness of Z/D/S amongst high-risk groups. Results suggest that it is important to initiate screening and improve the awareness of Z/D/S amongst animal handlers to improve the reporting of Z/D/S. **References** [1] A Tripartite Concept Note. Sharing responsibilities and coordinating global activities to address health risks at the animal-human-ecosystems interfaces, 2010. [2] Dubal, Z.-B., Barbudde, S.B. and Singh, N.P. Important Zoonotic Diseases: Prevention and control. Technical Bulletin No. 39. ICAR Research Complex for Goa (Indian Council of Agricultural Research), Old Goa- 403 402, Goa, India, 2014.

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# Roles of Health Literacy in Relation to Social Determinants of Health and Recommendations for Informatics-Based Interventions: Systematic Review

## Abstract

**Objective:** To create a baseline social network analysis to assess connectivity of healthcare entities through patient movement in Orange County, Florida. **Introduction:** In the realm of public health, there has been an increasing trend in exploration of social network analyses (SNAs). SNAs are methodological and theoretical tools that describe the connections of people, partnerships, disease transmission, the interorganizational structure of health systems, the role of social support, and social capital<sup>1</sup>. The Florida Department of Health in Orange County (DOH-Orange) developed a reproducible baseline social network analysis of patient movement across healthcare entities to gain a county-wide perspective of all actors and influences in our healthcare system. The recognition of the role each healthcare entity contributes to Orange County, Florida can assist DOH-Orange in developing facility-specific implementations such as increased usage of personal protective equipment, environmental assessments, and enhanced surveillance. **Methods:** DOH-Orange received Centers for Medicare and Medicaid Services data from the Centers for Disease Control and Prevention Division of Health Care Quality Promotion. The dataset contains the frequency of patients transferred across Medicare accepting healthcare entities during 2016. We constructed a directional sociogram using R package statnet version 2016.9, built under R version 3.3.3. Node colors are categorized by the type of healthcare entity represented (e.g., long-term care facilities, acute care hospitals, post-acute care hospitals, and other) and depict the frequency of patients transferred with weighted edges. Node sizes are proportional to the log reduction of the total degree of patients transferred, and are arranged with the Fruchterman-Reingold layout. We calculated standard network indices to assess the magnitude of connectedness across healthcare entities in Orange County, Florida. Additionally, we calculated node-level indices to gain a perspective of the strength of each individual entity. **Results:** A total of 48 healthcare entities were included in the sociogram, with 44% representing Orange County, Florida. Although the majority of the healthcare entities are located in nearby counties, 90% of patient movement occurred across Orange County entities. The range of patient movement was 1 to 5196 with a median of 15 patients transferred in 2016. The network in Orange County is sparse with a density of 0.05, but the movement of patients across the healthcare entities is predominately symmetric (reciprocity=97%). The sociogram is centralized (degree centrality= 0.70) and contains a vast amount of entities that serve as connectors (betweenness centrality=0.53). The node-level indices identified our acute care hospitals and long term acute care hospitals are the connectors of our county health system. **Conclusions:** The SNA of patient movement across healthcare entities in Orange County, Florida provides public health with knowledge of the influences entities contribute to the county healthcare system. This will contribute to identifying changes in the network in future research on the transmission risks of specific diseases/conditions, which will enhance prioritization of targeted interventions within healthcare entities. In addition, SNAs can assist in targeting disease control efforts during outbreak investigations and support health communication. A SNA toolkit will be distributed to other local county health departments for reproduction to determine baseline data and integrate county-specific SNAs.

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# Roles of Health Literacy in Relation to Social Determinants of Health and Recommendations for Informatics-Based Interventions: Systematic Review

## Abstract

**Objective:** Our objective was to assess the suitability of the data collected by the Animal Poison Control Center, run by the American Society for the Prevention of Cruelty to Animals, for the surveillance of toxicological exposures in companion animals in the United States. **Introduction:** There have been a number of non-infectious intoxication outbreaks reported in North American companion animal populations over the last decade<sup>1</sup>. The most devastating outbreak to date was the 2007 melamine pet food contamination incident which affected thousands of pet dogs and cats across North America<sup>1</sup>. Despite these events, there have been limited efforts to conduct real-time surveillance of toxicological exposures in companion animals nationally, and there is no central registry for the reporting of toxicological events in companion animals in the United States. However, there are a number of poison control centers in the US that collect extensive data on toxicological exposures in companion animals, one of which is the Animal Poison Control Center (APCC) operated by the American Society for the Prevention of Cruelty to Animals (ASPCA). Each year the APCC receives thousands of reports of suspected animal poisonings and collects extensive information from each case, including location of caller, exposure history, diagnostic findings, and outcome. The records from each case are subsequently entered and stored in the AnTox database, an electronic medical record database maintained by the APCC. Therefore, the AnTox database represents a novel source of data for real-time surveillance of toxicological events in companion animals, and may be used for surveillance of pet food and environmental contamination events that may negatively impact both veterinary and human health. **Methods:** Recorded data from calls to the APPC were collected from the AnTox database from January 1, 2005 to December 31, 2014, inclusive. Sociodemographic data were extracted from the American 2010 decennial census and the American Community Surveys. Choropleth maps were used for preliminary analyses to examine the distribution of reporting to the hotline at the county-level and identify any “holes” in surveillance. To further identify if gaps in reporting were randomly distributed or tended to occur in clusters, as well as to look for any predictable spatial clusters of high rates of reporting, spatial scan statistics, based on a Poisson model, were employed. We fitted multilevel logistic regression models, to account for clustering within county and state, to identify factors (e.g., season, human demographic factors) that are related to predictable changes in call volume or reporting, which may bias the results of quantitative methods for aberration/outbreak detection. **Results:** Throughout the study period, over 40% of counties reported at least one call to the hotline each year, with the majority of calls coming from the Northeast. Conversely, there was a large “hole” in coverage in Midwestern and southeastern states. The location of the most likely high and low call rate clusters were relatively stable throughout the study period and were associated with socioeconomic status (SES), as the most likely high risk clusters were identified in areas of high SES. Similar results were identified using multivariable analysis as indicators of high SES were found to be positively associated with rates of calls to the hotline at the county-level. **Conclusions:** Socioeconomic status is a major factor impacting the reporting of toxicological events to the APCC, and needs to be accounted for when applying cluster detection methods to identify outbreaks of mass poisoning events. Large spatial gaps in the network of potential callers to the center also need to be recognized when interpreting the spatiotemporal results of analyses involving these data, particularly when statistical methods that are highly influenced by edge effects are used.

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# Roles of Health Literacy in Relation to Social Determinants of Health and Recommendations for Informatics-Based Interventions: Systematic Review

## Abstract

**Objective:** To describe and present results for the enhanced epidemiologic surveillance system established during the 2017 National Collegiate Athletic Association Division I Men's College Basketball Championship (Final Four) events. **Introduction:** Final Four-associated events culminated in four days of intense activity from March 31st through April 3rd, and added an estimated 400,000 visitors to Maricopa County's 4.2 million residents. **Methods:** Preparation included: refinements in enhanced surveillance for previous events (including Super Bowl XLII); a rehearsal on information sharing for team leads; just in time training for field team members; a tabletop exercise on 2/22; and solicitation of lessons learned from jurisdictions recently hosting the Final Four. Enhanced surveillance began on 3/24 and continued through 4/10 (one week before the first major event until one week after the championship game) with intensified surveillance from 3/31-4/3. Subject matter experts for each enhanced surveillance component functioned as team leads. A surveillance coordinator was assigned to review data and prepare reports. Team members were sent a plan of the day detailing daily surveillance activities. An enhanced surveillance (SURV) alert requesting an increased index of suspicion for events of public health significance was sent to pre-established lists of healthcare providers. Urgent care clinics within five miles of venues were asked to report influenza-like, gastrointestinal, rash, and neurological illness visits daily. Emergency department records in the National Syndromic Surveillance Program, Electronic Surveillance System for Early Notification of Community-Based Epidemics (ESSENCE) were monitored daily for influenza-like illness, gastrointestinal illness, injury, records of interest, heat-related illness and event-specific terms. Mumps and meningitis were added after outbreak reports were received from home jurisdictions of Final Four teams. Death certificate data, Office of the Medical Examiner line lists and preliminary reports of death were reviewed daily for reportable diseases or circumstances of public health significance. Communicable disease data was reviewed daily for notifiable disease cases of concern, aberration detection as compared to the previous four years, outbreak review, and Influenza-like-illness. Field teams of staff and volunteers were deployed to three days of Music Fest, four days of Fan Fest, and three Final Four games. Attendees presenting to first aid stations were requested to complete an electronic questionnaire capturing illness and injury syndromes. These were submitted and epidemiologically assessed in near-real-time. Syndrome-specific data were geo-located on venue maps during events to identify spatial clustering. Patient Presentation Rates (PPR) and Transport to Hospital Rates (TTHR) per 10,000 attendees were calculated. To enhance animal health system surveillance, veterinarians and agencies that work with animals were notified to increase the index of suspicion for unusual animal disease, keep alert for outbreaks with zoonotic potential, and update 24/7 emergency contact lists. Health-related media reports, Final-Four-specific reports, health-aggregated Twitter reports, and breaking news alert subscriptions were monitored. Poison Control Center (PCC) reports were assessed by conducting regular queries of the National Poison Data System (NPDS). Reports from the 24/7 Disease Reporting Line were monitored. A one page enhanced surveillance report was developed for daily distribution to inter-disciplinary partners; a more detailed report was distributed to health and medical partners. Physicians overseeing the health/medical care of teams were included in information sharing. Public health intelligence information was exchanged with epidemiologists from home jurisdictions of Final Four teams. **Results:** 301 field questionnaires were completed, including 146 from Final Four games, 127 from the Music Fest, and 28 from the Fan Fest. Final Four games experienced a PPR of 9.5, and a TTHR of 0.52. Music Fest results were a PPR of 9.4, and a TTHR of 0.15. For the Fan Fest, there was a PPR of 5.5, and a TTHR of 0. PCC data review resulted in investigation of four cases for potential ricin exposure. These reports were determined to be exposure to castor beans and the castor bean plant (*Ricinus communis*) only. One report indicating potential phosgene occupational exposure to an air conditioning system worker was reviewed, and judged unlikely to cause noted symptoms. Outbreak information from home jurisdictions of Final Four teams resulted in increased index of suspicion for mumps, additional surveillance and mentions in media surveillance reports. Review of communicable disease, mortality, and ESSENCE data resulted only in routine investigations. **Conclusions:** Surveillance information from disparate surveillance systems was synthesized into reports which enhanced health and medical situational awareness and information sharing; interdisciplinary partners highlighted the utility of the one-page report. Enhanced surveillance allowed the rapid identification and characterization of potential threats, and provided an evidence base for public health decisions. Establishment of field teams allowed for near-real-time tracking of patient presentations and transports and rapid identification and characterization of syndromes of concern and potential threats. Public health intelligence information exchange with home jurisdictions of Final Four teams resulted in targeted surveillance for mumps and meningitis.

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## Abstract

**Objective:** The aim of this project was to investigate anecdotal reports of an increase in synthetic cannabinoid (SynCan) overdoses in Lexington-Fayette County area of Kentucky, using rapid surveillance systems including emergency department (ED) syndromic surveillance (SyS) and emergency medical services (EMS) data. **Introduction:** In mid-2017, the Kentucky Injury Prevention and Research Center (a bonafide agent of Kentucky Department for Public Health-KDPH) was alerted by members of KDPH to anecdotal evidence of a possible increase of SynCan (primarily “Serenity”) overdoses. The situation presented an opportunity to demonstrate the capabilities of syndromic surveillance and emergency medical services (EMS) data systems to provide rapid situational awareness about SynCan overdoses. **Methods:** SynCan cases were identified based on EMS emergency runs with narratives including mentions of ‘serenity|K2|spice’ and occurred in the Lexington-Fayette County. In ED SyS, SynCan cases were identified for Lexington-Fayette County area ED visits with a chief complaints of ‘serenity|K2|spice’ or diagnosis code of T40.7X[1-4]A. The ICD code was included after analysis of diagnosis codes in positive cases from a chief complaint only query revealed T40.7X[1-4]A as a primary code assigned in these cases. Trends for Lexington-Fayette County area were compared to state-wide total to determine if the trend is unique or related to system-wide pattern changes. EMS and ED SyS trend results were compared for internal validity. EMS incident addresses were geocoded to point-level to enable more granular analysis of geospatial patterns over time for identification of hotspots/clustering. **Results:** ED SyS and EMS results demonstrated a clear temporal increase in SynCan overdoses beginning around March of 2017[Fig 1]. Further analysis indicated that this increase was most dramatically centered in the Lexington-Fayette County area [Fig 2]. The vast majority of those overdosing were males (SyS: 88.1%) with average age 37 compared to 11.9% and 36.0 for females, respectively. These demographics are similar to those reported by the New York City Department of Health and Mental Hygiene for a K2 outbreak in New York City in 2014<sup>1</sup>. Kernel density mapping demonstrated a strong clustering in a specific area of downtown Lexington. Additionally, analysis of EMS data revealed that a large portion of these overdoses were being admitted for observational care and thus not being captured in SyS data (based on the primary hospital’s submission types). From a practical standpoint, the rapid surveillance results only took 1-2 days to complete and highlight the utility of these data systems in preparing rapid data products. The results of the analysis were shared with local and state health department authorities, including the local Emergency Medical Advisory Board. The geospatial analysis provided local authorities with information to enable precise targeting of public health and public safety messaging. **Conclusions:** By analyzing data from these systems, we were able to quickly identify the geographic areas and demographic groups that were most affected, and to describe trends in SynCan overdoses over time. As a result, we were able to provide highly-detailed data to local public health and public safety authorities to inform their response.

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# Roles of Health Literacy in Relation to Social Determinants of Health and Recommendations for Informatics-Based Interventions: Systematic Review

## Abstract

**Objective:** To measure stillbirth delivery rates and syphilis screening rates among women with a stillbirth delivery using electronic health record data available in a health information exchange. **Introduction:** Reports of infants born with congenital syphilis have increased in the United States every year since 2012. Prevention depends on high performing surveillance systems and compliance with the U.S. Centers for Disease Control and Prevention (CDC) recommendations to perform syphilis testing early in pregnancy, in the third trimester and at delivery if a woman is at high risk, and following a stillbirth delivery. These guidelines exist, because untreated syphilis is associated with adverse fetal outcomes including central nervous system infection and death. Surveillance of congenital syphilis and stillbirth is challenging because available data sources are limited. Assessment of compliance with testing guidelines is particularly challenging, since public health agencies often lack access to comprehensive cohorts of tested individuals as most public health laws only require reporting of positive disease case information. **Methods:** Using integrated electronic health records available in a community-based health information exchange, we examined syphilis testing patterns for women with a stillbirth delivery in Indiana between 2010-2016. The cohort was examined to determine whether the women received syphilis testing in accordance with the CDC recommendations. During this time period, Indiana recorded around 84,000 live births per year. Data were extracted from electronic health records, including encounter data, laboratory test results and procedure data, captured by the Indiana Network for Patient Care (INPC), one of the largest community-based HIE networks in the United States. The INPC connects over 90 health care facilities, including hospitals, physicians' practices, pharmacy networks, long-term post-acute care facilities, laboratories, and radiology centers. In addition to clinical care, the INPC supports surveillance of STIs<sup>1</sup>. Women with a stillbirth delivery were identified using International Classification of Disease (ICD) Clinical Modification (CM) codes from the 9th and 10th editions (ICD-CM-9 and ICD-CM-10). Inclusion codes: ICD-CM-9 codes 656.4, 779.9, V27.1, V27.3, V27.4, V27.6, V27.7, V32.01, V32.1, V32.2, V36.1; and ICD-CM-10 codes P95, P96.9, O36.4, Z37.1, Z37.3, Z37.4, Z37.9. Using the master person index for the INPC, we linked stillbirth deliveries with pregnancy encounters and laboratory testing data. We analyzed documentation of syphilis testing during the pregnancy (up to 270 days prior to the stillbirth delivery) as well as after the stillbirth delivery (up to 30 days). Broad time ranges were utilized to account for potential delays in reporting of either the stillbirth delivery or the syphilis test results. Documentation could include either presence of a result from a laboratory test for syphilis or a CPT code (80055, 86780, 86781, 86592, 86593) indicating performance of a syphilis test. **Results:** A total of 4,361 stillbirth deliveries attributable to 4,265 unique women were identified in the INPC between 2010-2016; representing a rate of 7.44 stillbirths per 1,000 live births during the same time period. Of the stillbirth deliveries, syphilis testing occurred within 270 days prior to or 30 days after delivery for 2,763 (63.4%) cases. Figure 1 displays the number of stillbirth cases observed each year and the number of cases in which syphilis testing occurred during the pregnancy or after delivery. **Conclusions:** Using integrated electronic health records data, we discovered that fetal deaths occurred more frequently (7.44 versus 4.09 per 1,000) than previously estimated<sup>2</sup> through fetal death reporting mechanisms in Indiana. Furthermore, we observed increasing rates of stillbirth within Indiana in recent years. Integrated data further enabled measurement of syphilis testing rates for stillbirth cases, which were similar to those reported by Patel et al.<sup>3</sup> using a large, national administrative data set. Testing rates in Indiana are well below the targets set by national and international public health organizations. Accessing more complete data on populations using a health information exchange is valuable, although doing so may uncover a more negative picture of health in one's community. Deeper analysis of these trends is warranted to explore factors related to increasing rates as well as limited testing in this population.

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## Abstract

**Objective:** This panel will: ● Discuss the importance of identifying and developing success stories ● Highlight successes from state and local health departments to show how syndromic surveillance activities enhance situational awareness and address public health concerns ● Encourage discussion on how to further efforts for developing and disseminating success stories

**Introduction:** Syndromic surveillance uses near-real-time emergency department and other health care data for enhancing public health situational awareness and informing public health activities. In recent years, continued progress has been made in developing and strengthening syndromic surveillance activities. At the national level, syndromic surveillance activities are facilitated by the National Syndromic Surveillance Program (NSSP), a collaboration among state and local health departments, the CDC, other federal organizations, and other organizations that enabled collection of syndromic surveillance data in a timely manner, application of advanced data monitoring and analysis techniques, and sharing of best practices. This panel will highlight the importance of success stories. Examples of successes from state and local health departments will be presented and the audience will be encouraged to provide feedback.

**Description:** ● Success stories – acknowledging and informing syndromic surveillance practice This presentation will discuss the importance of success stories for NSSP focused on increasing syndromic surveillance representativeness, improving data quality, and strengthening syndromic surveillance practices among grant recipients and partners. From the beginning of the program, the identification of success stories has been an important part of the efforts to develop knowledge base that better guide syndromic surveillance program activities. ● NJ and BioSense – Making The Connection The New Jersey Department of Health (NJDOH) uses Health Monitoring’s EpiCenter as its primary ED data for syndromic surveillance. This data is also submitted to CDC’s NSSP BioSense Platform. In April 2017, a spike in ED Visits of Interest was identified by a CDC NSSP subject matter expert and brought to the attention of NJDOH’s data analyst. Data showed an increase in “Exposure” and “School Exposure” chief complaints in two contiguous counties. News reports showed the visits resulted from a dormitory fire at a university in the area. The NSSP and NJDOH staff collaboration integrated data from both NJDOH’s EpiCenter and CDC’s BioSense Platform for further investigation. This activity shows BioSense Platform’s potential as an additional syndromic surveillance tool because of its different classifications and keyword groupings. ● Evaluation and Performance Measures at the Utah Department of Health Syndromic surveillance related evaluation activities at the Utah Department of Health requires collaboration between subject matter experts and system users from the UT-NSSP workgroup. The progress is examined quarterly and outcomes compared with the short-, mid-, and long-term outcomes listed in the NSSP logic model to ensure activities are in sync with the program’s overall goals. Throughout the budget year, a variety of tools were used to keep track of the progress. During this session, challenges and successes, lessons learned, and effective strategies will be discussed. ● NSSP R tool Data Download Useful in NH The New Hampshire Department of Health and Human Services (NH DHHS) uses the state-wide Automated Hospital Emergency Department Data (AHEDD) system as its primary syndromic surveillance system. A copy of this data is submitted to CDC’s NSSP BioSense Platform. In July of 2017, NH worked with the NSSP vendor, CDC staff, a jurisdictional expert, NH Division of Information Technology staff, and an external vendor to create an “R” software download in CSV format and home-based NSSP Cognos report. This allowed NH DHHS staff to compare these data to the home-based data and ultimately, it proved to be an important step in the NSSP data quality assessment process. ● Achieving success to improve data quality through collaborative Community of Practice partnerships The Data Quality Committee is a forum to identify, discuss, and attempt to address syndromic surveillance data quality issues. Maintaining data quality for the chief complaint field is a priority as it can impact the creation and refinement in the successful application of a syndrome definition for one of the fundamental data elements. An issue was observed in the Arizona data in the BioSense Platform, where chief complaint was being truncated at 200 characters. Through efforts to build relationships from the committee in the Community of Practice, Arizona was able to discover the root causes for the issue, assess if it affected other jurisdictions, and work with the partners to find a feasible resolution. This talk will discuss how this collaborative approach helped improve data quality. How the Moderator Intends to Engage the Audience in Discussions on the Topic: The moderator will introduce the session and the panelists, and will invite questions and comments from the audience.

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# Roles of Health Literacy in Relation to Social Determinants of Health and Recommendations for Informatics-Based Interventions: Systematic Review

## Abstract

**Objective** To prevent and identify gastrointestinal outbreaks due to swimming pools using a two-part surveillance system i) Model Aquatic Health Code (MAHC) Guideline Survey and ii) syndromic surveillance

**Introduction** Swimming in contaminated pools can cause gastroenteritis from water contaminated by viruses, bacteria, or parasites. Germs that cause gastroenteritis are shed in feces of infected persons, and easily spread to uninfected persons swimming in pools. Symptoms of gastrointestinal illness can include nausea, vomiting, watery or bloody diarrhea, and weight loss. Common causes of swimming-related gastroenteritis included viruses (norovirus), parasites (giardia, cryptosporidium), and bacteria (*Escherichia coli*, *Shigella*). *Cryptosporidium* is most common agent associated with swimming pool outbreaks. In 2011-2012, public health officials from 32 States reported 90 swimming-pool associated outbreaks to CDC's Waterborne Disease and Outbreak Surveillance System (WBD OSS). These 90 outbreaks resulted in 1,788 cases, 95 hospitalizations, 1 death. 52% of these outbreaks were caused by *Cryptosporidium*. Methods Literature search was conducted using published peer-reviewed articles via PubMed and Internet websites including, CDC and U.S. consumer product safety commission, Agency for toxic substance and disease registry. Statistical data on GI illness outbreaks associated with swimming pools prevalence and outcomes were also reviewed. Current surveillance methods used for detecting prevalence of waterborne disease outbreaks are based on examples from Ohio and Nebraska to determine approaches and effectiveness of the systems.

**Results** Survey and Education Packet - Distribute a survey with questions about current MAHC guideline adherence and MAHC educational packets that include the incident response guidelines and the water contamination response log

**Strengths:** Low cost, simple, and acceptable

**Limitations:** Not timely event reporting

Event Reporting - Develop a website for reporting contamination events based on the water contamination response log

**Strengths:** Timely reporting

**Limitations:** Complex to setup and maintain, moderate cost, and may not be acceptable

Pool Inspections - Require pools to undergo periodic inspections to monitor adherence to MAHC guidelines

**Strengths:** Complete and representative

**Limitations:** Complex, expensive, not timely event reporting

The current system is based on state reporting to the CDC through the paper-based reporting waterborne disease outbreaks surveillance system (WBD OSS), and the National Outbreak Reporting System (NORS), an electronic reporting system in place since 2009

CDC uses waterborne disease outbreak surveillance data to

- o identify the types of etiologic agents, and settings associated with outbreaks
- o evaluate the adequacy of regulations to promote healthy and safe swimming
- o establish priorities to improve prevention, guidelines, and regulations at the local, state, and federal levels

The WBD OSS is not sufficient to capture early detection and reporting of AGI outbreaks. We recommend the these surveillance approaches:

- Syndromic surveillance of WBD outbreaks to capture early outbreaks of diarrheal, and as many suspected cases as possible in a timely manner
- Sentinel surveillance at specific healthcare facilities in the proximity of swimming pools where outbreaks can occur
- Active Lab-based surveillance would offer more robust and complete analysis of the prevalence and incidence of acute GI illness outbreaks in the State

**Conclusions** Our study concluded that state health department should begin a two-part surveillance system: i) distributing MAHC guideline surveys & education packet; ii) syndromic surveillance system for outbreaks. MAHC Guideline Survey and Education Packet would be cost effective to educate pool operators on current MAHC guidelines and gather baseline data on adherence to MAHC guidelines for responding to contamination events. Afterwards, once baseline data is gathered and awareness of the MAHC guidelines is established, the state health department can determine if event reporting or pool inspections are necessary to increase either the timeliness or representativeness of the surveillance system. Syndromic surveillance would be the most timely and sensitive surveillance system. This is important to achieve health department's goal of early outbreak detection. Both predictive value and data quality are limitations of syndromic surveillance system. Acute gastrointestinal illness is also caused by sources other than pool contamination which can cause false positives.

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## Abstract

**Objective** In August 2017, a large influx of visitors was expected to view the total solar eclipse in Idaho. The Idaho Syndromic Surveillance program planned to enhance situation awareness during the event. In preparation, we sought to examine syndrome performance of several newly developed chief complaint and combination chief complaint and diagnosis code syndrome definitions to aid in interpretation of syndromic surveillance data during the event. **Introduction** The August 21, 2017 total solar eclipse in Idaho was anticipated to lead to a large influx of visitors in many communities, prompting a widespread effort to assure Idaho was prepared. To support these efforts, the Idaho Syndromic Surveillance program (ISSp) developed a plan to enhance situation awareness during the event by conducting syndromic surveillance using emergency department (ED) visit data contributed to the National Syndromic Surveillance Program's BioSense platform by Idaho hospitals. ISSp sought input on anticipated threats from state and local emergency management and public health partners, and selected 8 syndromes for surveillance. Ideally, the first electronic message containing information on an emergency department visit is sent to ISSp within 24 hours of the visit and includes the chief complaint for the visit. Data on other variables, such as diagnosis codes, are updated by subsequent messages for several days after the visit. Chief complaint (CC) text and discharge diagnosis (DD) codes are the primary variables used for syndrome match; delay in reporting these variables adversely affects timely syndrome match of visits. Because our plan included development of new syndrome definitions and querying data within 24 hours of visits, earlier than ISSp had done previously for trend analysis, we sought to better understand syndrome performance. **Methods** We defined messages with completed CC and DD as the last message regarding a visit where term count increased from previous messages regarding that visit, indicating new information was added to the field. We retrospectively assessed the total number of ED visits and calculated the daily frequency of completed CC and DD by days since visit date for visits during June 1–July 31, 2017. Additionally, we calculated facility mean word count in CC fields by averaging the word count of parsed, complete CC fields for visits occurring June 1–July 31, 2017 for each facility. During July 10–24, 2017, we calculated the daily frequency of visits occurring in the previous 90 days for total ED visits and syndrome-matched visits for 8 selected syndromes (heat-related illness; cold exposure; influenza-like-illness; nausea, vomiting, and diarrhea; animal/bug bites and stings; drowning/submersion; alcohol/drug intoxication; and medication replacement). Syndrome-matched visits were defined as visits with CC or DD that match the syndrome definition. We calculated the percent of syndrome-matched visits by syndromes defined with CC or CC and DD combined (CCDD) over time. Syndromes with fewer than 5 matched visits were excluded from analysis. **Results** Complete CCs were received for 99.1% of visits and complete DDs were received for 89.8% of visits. Complete CCs were submitted for 58.2% of visits within 1 day of the visit, 88.9% of visits within 3 days, and 98.9% of visits within 7 days. In contrast, complete DDs were submitted for 24.3% of visits within 1 day, 38.7% of visits within 3 days, and 53.7% of visits within 7 days (Table 1). During the observation period, data submission from facilities representing approximately 33% of visits was interrupted for 5 (36%) of 14 days. Heat-related illness, cold exposure, and drowning/submersion, were excluded from syndrome-match analysis. During the 9 days of uninterrupted data submission, 100% syndrome-matched visits for syndromes defined by CC alone and 69.1% syndrome-matched visits for syndromes defined by CCDD were identified within 6–7 days of initial visit. Facilities with interrupted data submission contributed 75% of CC syndrome-matched visits and 33% of CCDD syndrome-matched visits. The facility mean word count in CC fields from these facilities was >15 compared with 2–4 from other facilities. **Conclusions** Examination of syndrome performance prior to a known event quantitated differences in timeliness of CC and DD completeness and syndrome match. CCs and DDs in visit messages were not complete within 24 hours of initial visit. CC completion was nearly 34 percentage points greater than DD completeness 1 day after initial visit and did not converge until ≥15 days after initial visit. Higher percentages of syndrome match within 6–7 days of initial visit were seen by CC alone than CCDD defined syndromes. Facilities using longer CCs contributed disproportionately to syndrome matching using CC, but not CCDD syndrome definitions. Syndromic surveillance system characteristics, including timeliness of CCs and DDs, length of CCs, and characteristics of facilities from which data transmission is interrupted should be considered when building syndrome definitions that will be used for surveillance within 7 days of emergency department visits and when interpreting syndromic surveillance findings.

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# Roles of Health Literacy in Relation to Social Determinants of Health and Recommendations for Informatics-Based Interventions: Systematic Review

## Abstract

**Objective** To study operation feasibility and preparedness of a tablet-based participatory syndromic surveillance among pilgrims during annual ritual circumambulation (Panchkroshi Yatra) covering 15 miles daily in Ujjain, Madhya Pradesh India. **Introduction** Panchkroshi yatra is an annual ritual of circumambulation (yatra) of temples (Mahadevs) and 100,000 devotees walk for around 15 miles per day for six days and cover a total of 73 miles to worship important Mahadevs. The festival is held every year at the city of Ujjain, Madhya Pradesh, Central India. The yatra attracts large number of pilgrims especially from rural areas and usually women outnumber men. During the yatra, the pilgrims halt at several places and prepare their food in outdoors. We described the public health preparedness, implemented a tablet-based participatory syndromic surveillance among pilgrims of the yatra and reviewed satisfaction of the pilgrims regarding implementation of public health measures, Ujjain during 21-26, April, 2017. **Methods** We described preparedness and arrangements done for the Yatra. We designed tablet-based android to collect information from pilgrims on socio-demographic-economic details, location and self-reported health problems (syndromes). Trained investigators collected data from consenting pilgrims at strategically located halting places. We interviewed a convenient sample of consenting participants to assess satisfaction regarding the public health measures such as sanitation, water, safety, food and cleanliness. **Results** The district team organized round-the-clock medical camps in strategic locations (mainly at temple or halting place) of the route of the Yatra with few camps having admission facility for emergency conditions. There were no mobile medical units. Ambulance services were on standby at all medical camps. Our satisfactory survey of 360 participants indicated that 79% were satisfied with these medical facilities (79%). District administration alongwith local village administration (panchayat) had set up outlets selling provisions necessary meeting cooking needs. Eighty percent pilgrims were satisfied with food and refreshment arrangements. Permanent and temporary toilets were set-up at the halt-locations but not on the route. Sanitation measures such as chlorination and solid waste management were in place. Pilgrims' satisfaction for urinals (53%) and toilets (60%) was less as compared to cleanliness (74%). Electrical supply and lighting were arranged properly. Volunteers were available to provide assistance to pilgrims. Provision of safe drinking water and potable water were arranged by the authorities and the village-residents made water available through well, pots etc. The survey suggested that only 5% of them were not satisfied with water related arrangements. Security arrangements such as deployment of police, crowd management, and traffic control and fire safety were well-arranged by the authorities and majority of the respondents expressed satisfaction on these arrangements (79-84%). We interviewed 6435 pilgrims for any self-reported symptoms. More than half (56%) of the responders were female and majority (64%) aged 15- 59 years. Around 44% were from Ujjain district. Every second person (around 47%) reported illness with one or other symptoms. Most of them complained of injury with blister (11%). Other common complaints include stomach ache (8%), redness in eyes (7%), fever (7%), cough (6%), vomiting (4%), diarrhea (4%) and throat pain (3%) (Figure). **Conclusions** The participants' response indicates that all the public health and safety measures were satisfactory except the need for setting up urinals along the fixed route of circumambulation. Tablet-based surveillance during the yatra indicated that injury was the most commonly self-reported health problem. Implementation of such surveillance helps in tracking health events and therefore, may facilitate preparedness and response. We recommend implementation of such tablet-based surveillance during such mass gathering events. **References** 1. Qanta A Ahmed, Yaseen M Arabi, Ziad A Memish, Health risks at the Hajj, Lancet 2006; 367: 1008–15 2. Tam JS, Barbeschi M, Shapovalova N, Briand S, Memish ZA & Kieny MP. Research agenda for mass gatherings: a call to action. The Lancet infectious diseases, 2012;12,3, 231-239 3. Henning KJ, Overview of syndromic surveillance. What is syndromic surveillance? MMWR Morb Mortal Wkly Rep 53 (Suppl): 5-11 (2004). 4. Chandrasekhar, CP, Ghosh J Information and communication technologies and health in low income countries: the potential and the constraints. Bulletin of the World Health Organization, 2001, 79: 850–855

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# Roles of Health Literacy in Relation to Social Determinants of Health and Recommendations for Informatics-Based Interventions: Systematic Review

## Abstract

**Objective:** To develop, test and study tablet-based participatory syndromic surveillance system for common infectious disease conditions at community level in Simhashta religious mass gathering in Ujjain, India, 2016. **Introduction:** Infectious disease surveillance for generating early warnings to enable a prompt response during mass gatherings has long been a challenge in India 1,2 as well as in other parts of the world 3,4,5. Ujjain, Madhya Pradesh in Central India hosted one of the largest religious festival in the world called 'Simhasth kumbh mela' on the banks of River Kshipra, where more than 50 million attendees came for holy dip during April 22 to May 21, 2016. The attendees included pilgrims (residents and visitors), observers, officials and volunteers. We developed an android application with automated summary reports and an interactive dashboard for syndromic surveillance during the gathering. **Methods:** We established the participatory surveillance at all 22 sectors of the festival area, and at 20 out-patient hospitals and 12 pharmacies. We trained 55 nursing and social work graduate trainees to collect data from all these settings. The data collectors visited designated spots daily during a fixed time and collected age, gender, residence and self-reported symptoms from consenting attendees during the festival period. The application automatically added date, time and location of interview to each record and data was transmitted to a web server. We monitored the data in the interactive dashboard and prepared summary report on a periodic basis. Daily summary report of self-reported symptoms by time, place and person was shared daily evening with the festival surveillance authority. **Results:** Of the total 93,020 invited pilgrims, 91% participated in the surveillance. Almost 90% of those were from outside the festival city, 60% were men and 57% were aged 15 to 44 years. Almost 50% of them self-reported presence of at least one symptom. Most frequently reported symptoms were dehydration due to heat (13%), cold (13%), fever (7%) and loose stool (5%). During the festival period of over one month, surveillance data indicated increasing trends of self-reported cough and fever and declining trends of self-reported dehydration (Figure-1). The designated public health authorities for the festival did make use of the information for appropriate action. This tablet-based application was able to collect, process and visualise around 2500 records per day from the community without any data loss. **Conclusions:** To our knowledge, this is the first report from India documenting real-time surveillance of the community using hand-held devices during a mass gathering. Despite some implementation issues and limitations in the approach and data collected, the use of digital technology provided well-timed information avoiding tedious manual work and reduced a good amount of human resources and logistics involved in reporting symptoms with a traditional paper-based method in such a large population. In retrospect, the main utility of the surveillance output was that of giving reassurance to the officials, as no major outbreaks occurred during the event. We believe that this experience and further analyses will provide input for the establishment and use of such a surveillance system during mass gatherings. The team of investigators propose improving the methods and tools for future use.

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## Abstract

**Objective** To describe the impact of civil unrest on the mental health of a community in near real-time using syndromic surveillance. **Introduction** As part of a wide-spread community discussion on the presence of monuments to Confederate Civil War figures, the Charlottesville city council voted to remove a statue of General Robert E. Lee.<sup>1</sup> Multiple rallies were then held to protest the statue's removal. A Ku Klux Klan (KKK) rally on July 8, 2017 (MMWR Week 27) and a Unite the Right rally on August 12, 2017 (MMWR Week 32) held in Charlottesville both resulted in violence and media attention.<sup>2,3</sup> The violence associated with the Unite the Right rally included fatalities connected to motor vehicle and helicopter crashes. Syndromic surveillance has been used to study the impact of terrorism on a community's mental health<sup>4</sup> while more traditional data sources have looked at the impact of racially-charged civil unrest.<sup>5</sup> Syndromic surveillance, however, has not previously been used to document the effect of racially-charged violence on the health of a community. **Methods** The Virginia Department of Health (VDH) analyzed syndromic surveillance data from three emergency departments (EDs) in the Charlottesville area (defined to include Charlottesville city and Albemarle county), regardless of patient residence following the Unite the Right rally. Visits to these EDs between January 1 and September 2, 2017 were analyzed using the Enhanced Surveillance System for the Early Notification of Community-based Epidemics (ESSENCE) and Microsoft SQL 2012. Encounters were identified as acute anxiety-related visits based on an International Classification of Diseases, Tenth Revision (ICD-10) discharge diagnosis beginning with 'F41'. Analyses were conducted using the ESSENCE algorithm EWMA 1.2 and SAS 9.3. **Results** The greatest number of visits with a primary diagnosis of anxiety in 2017 (N=20) was observed in MMWR week 34 (August 20-26). This represented a statistically significant increase over baseline with a p-value of 0.01. By race, a significant increase over baseline in visits with a primary diagnosis of anxiety was observed among blacks or African Americans. The largest volume of visits was observed in MMWR week 33 with a total of 8 identified visits or 1.8% of total ED visit volume. The increase in visits for anxiety observed in weeks 33-35 was 2.2 times greater among blacks or African Americans than it was among whites,  $p = 0.016$ , 95% CI [1.14, 4.16]. **Conclusions** Previous work done in Virginia to identify ED visits related to anxiety included only chief complaint criteria in the syndrome definition. Due to a change in how one ED in the Charlottesville area reported data during the study period, this syndrome definition could not be applied. In order to remove any potential data artifacts, only those visits with an initial diagnosis of anxiety were included in the analysis. The resulting syndrome definition likely underestimated the occurrence of anxiety in the Charlottesville area, both because it lacked chief complaint information and because syndromic surveillance does not include data on visits to mental health providers outside of EDs. This analysis presents a trend over time rather than a true measure of the prevalence of anxiety. This analysis, while conservative in its inclusion criteria, still identified an increase in visits for anxiety, particularly among blacks or African Americans. In today's political environment of race-related civil unrest, a way to measure the burden of mental illness occurring in the community can be invaluable for public health response. In Charlottesville, the identification of a community-wide need for mental health support prompted many local providers to offer their services to those in need pro-bono.<sup>6</sup> **References** 1 Suarez, C. (2017, February 6). Charlottesville City Council votes to remove statue from Lee Park. *The Daily Progress*. Retrieved from <http://bit.ly/2wYOHhv> 2 Spencer, H., & Stevens, M. (2017, July 8). 23 Arrested and Tear Gas Deployed After a K.K.K. Rally in Virginia. *The New York Times*. Retrieved from <http://nyti.ms/2tCiBGU> 3 Hanna, J., Hartung, K., Sayers, D., & Almas, S. (2017, August 13). 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# Roles of Health Literacy in Relation to Social Determinants of Health and Recommendations for Informatics-Based Interventions: Systematic Review

## Abstract

**Objective** To grow and facilitate a community of syndromic surveillance data users in Washington State, improving and expanding local syndromic practice. **Introduction** Prior to June 2016, there were 45 registered users of syndromic surveillance data in Washington State, with 29 (64.4%) representing 5 of Washington's 35 local health jurisdictions and 16 (35.6%) at the state level. Of those registered users, 9 (8.8%) had logged into ESSENCE at least once in the 6 months before October 2016. In June 2016, the Washington State syndromic surveillance program began accepting Meaningful Use data and sought to increase its user base. To accomplish this, the Washington State Department of Health (WA DOH) designated a staff member to oversee outreach efforts to increase the visibility of syndromic data in the state, including the establishment of a Community of Practice. **Methods** The Washington State syndromic surveillance program—the Rapid Health Information NetwOrk (RHINO)—began the process of stakeholder engagement by delivering a needs assessment to 15 current and potential users of the Electronic Surveillance System for the Early Notification of Community-based Epidemics (ESSENCE) platform. The survey assessed interest in participation in a Community of Practice for Washington State syndromic data users, the timing and format for meetings, needs for technical assistance, and topic areas of interest. RHINO then used the survey results to create a bank of topics for Community of Practice calls and develop a strategy for long-term outreach and engagement. In April of 2017, the RHINO team developed a new strategic plan and outlined metrics for evaluating growth and challenges in the program's outreach efforts, including plans for outreach to novel disciplines like emergency preparedness. These metrics included counts of invitations for speaking engagements, ESSENCE users, onsite ESSENCE trainings and attendees at those trainings, organizations and disciplines represented in the Community of Practice, Community members, and webinars facilitated for the Community. RHINO staff compiled monthly tabulations of these metrics to track progress over the course of the year and aid in adjustments to outreach efforts as necessary. **Results** RHINO received 10 responses to the survey, with 9 respondents from local health jurisdictions and 1 from WA DOH. Respondents indicated particularly strong interest in regular webinars, a database of resources, and live trainings to support syndromic practice in their work. They also expressed concerns about the distance which would be required for in-person meetings. RHINO established that meetings would occur via webinar every other month and held 6 webinars between October 2016 and October 2017 on a broad range of topics including developing syndrome definitions, basic ESSENCE functions, using ESSENCE's Report Manager tool, monitoring influenza-like-illness in ESSENCE, and using syndromic data for situational surveillance. In addition to the Community of Practice webinars, RHINO staff developed technical guides for both the Washington and National Surveillance Program's (NSSP) ESSENCE platforms, a handbook for using syndromic surveillance data in Washington State, and a curriculum for onsite ESSENCE training. Between October 2016 and October 2017, RHINO offered 8 onsite ESSENCE trainings for groups of users at the Washington State Department of Health and local health jurisdictions, serving a total of 36 attendees. Over the course of the year, ESSENCE users in Washington State increased to 75, with 40 (53.3%) of them logging into the system at least once over the previous 6 months and 20 (26.7%) listed as "new users" who have not yet activated their accounts. The Community of Practice itself has 86 members representing 16 agencies and 19 disciplines. As RHINO's profile increased and more potential users became aware of the availability of syndromic data, RHINO began receiving invitations to present for external partners. Between March 2016 and October 2017, RHINO received 8 invitations to present to audiences of potential syndromic data users. These audiences included leadership at the Washington State Department of Health and emergency preparedness and response organizations. In the next year, the program will continue offering data trainings and partner meetings to better serve the needs of both current and potential data users in Washington State. As more jurisdictions begin to have production-quality data, RHINO will continue offering onsite training. RHINO has also built a relationship with the Northwest Tribal Epidemiology Center in Portland, Oregon to begin the process of exploring data sharing with the Tribal Nations and Organizations located within Washington. **Conclusions** Through the development and implementation of a detailed outreach plan, RHINO increased the user base and profile of syndromic surveillance data in Washington State. This work was made possible through the careful construction of strong relationships with new and potential partners and the decision to diversify RHINO's staff to include members with backgrounds beyond epidemiology.

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# Roles of Health Literacy in Relation to Social Determinants of Health and Recommendations for Informatics-Based Interventions: Systematic Review

## Abstract

**Objective:** The new Tourism and Health Information System (THiS) was implemented for syndromic surveillance in visitor accommodations in the Caribbean region. The objective was to monitor for illnesses and potential outbreaks in visitor accommodations (hotels/guest houses) in the Caribbean in real-time using the web-based application. **Introduction:** Travel and tourism pose global health security risks via the introduction and spread of disease, as demonstrated by the H1N1 pandemic (2009), Chikungunya (2013), and recent Zika virus outbreak. In 2016, nearly 60 million persons visited the Caribbean. Historically no regional surveillance systems for illnesses in visitor populations existed. The Tourism and Health Information System (THiS), designed by the Caribbean Public Health Agency (CARPHA) from 2016-2017, is a new web-based application for syndromic surveillance in Caribbean accommodation settings, with real-time data analytics and aberration detection built in. Once an accommodation registers as part of the surveillance system, guests and staff can report their illness to front desk administration who then complete an online case questionnaire. Alternatively guests and staff from both registered and unregistered accommodations can self-report their illness using the online questionnaire in the THiS web application. Reported symptoms are applied against case definitions in real-time to generate the following syndromes: gastroenteritis, fever & respiratory symptoms, fever & haemorrhagic symptoms, fever & neurologic symptoms, undifferentiated fever, and fever & rash. Reported data is analyzed in real-time and displayed in a data analytic dashboard that is accessible to hotel/guest house management and surveillance officers at the Ministry of Health. Data analytics include syndrome trends over time, gender and age breakdown, and illness attack rates. **Methods:** Visitor accommodations from the following countries participated: Bahamas, Barbados, Belize, Bermuda, Guyana, Jamaica, Trinidad & Tobago, and Turks & Caicos Islands. National staff from the Ministry of Health, Ministry of Tourism, and/or Tourism Authority/Board engaged accommodations to participate. Participating accommodations were provided with training by national staff on how to report cases and use data analytic functions. They were asked to provide registration information to CARPHA, such as contact information to create login credentials, and data on occupancy rates for low/high seasons, number of staff, and number of lodging rooms to calculate illness attack rates. Weekly email reminders to accommodations to report cases of illness in the THiS web application, or to confirm "nil" cases by email were sent by CARPHA staff. **Results:** Of the 105 accommodations engaged by national staff, 39.1% (n=41) registered to participate, accounting for 3738 lodging rooms. From epidemiological week 24-39, five cases of syndromes from three accommodations in two countries were reported in the THiS web application (Table). A case of gastroenteritis and fever & respiratory symptoms were self-reported from an unregistered accommodation. Three cases of gastroenteritis were reported by hotel administration from two registered accommodations. The average response rate to weekly emails confirming "nil" cases was 32.1% (range: 10.5-83.3%). One accommodation reported by email a cluster of 7 cases with possible conjunctivitis. No outbreaks or aberrations were detected in the THiS web application. **Conclusions:** Engagement of Caribbean visitor accommodations in public health surveillance is a novel but critical undertaking for promoting health, safety, and security for both visitors and locals in the tourism dependent Caribbean region, but it will take time to establish. Confirming the absence of illness is an important public health endeavor for visitor accommodations. Preliminary results have demonstrated that it is possible for public health to work in a voluntary basis with the private accommodation sector. To establish more consistent and reliable reporting public health legislation and policies will need to be explored. As more data is gathered, assessments of the validity and sensitivity of the system will need to be conducted.

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# Roles of Health Literacy in Relation to Social Determinants of Health and Recommendations for Informatics-Based Interventions: Systematic Review

## Abstract

**Objective:** In order to better describe local drug-related overdoses, we developed a novel syndromic case definition using discharge diagnosis codes from emergency department data in the Colorado North Central Region (CO-NCR). Secondly, we used free text fields to understand the use of unspecified diagnosis fields. **Introduction:** The United States is in the midst of a drug crisis; drug-related overdoses are the leading cause of unintentional death in the country. In Colorado the rate of fatal drug overdose increased 68% from 2002-2014 (9.7 deaths per 100,000 to 16.3 per 100,000, respectively)<sup>1</sup>, and non-fatal overdose also increased during this time period (23% increase in emergency department visits since 2011)<sup>2</sup>. The CDC's National Syndromic Surveillance Program (NSSP) provides near-real time monitoring of emergency department (ED) events across the country, with information uploaded daily on patient demographics, chief complaint for visit, diagnosis codes, triage notes, and more. Colorado North Central Region (CO-NCR) receives data for 4 local public health agencies from 25 hospitals across Adams, Arapahoe, Boulder, Denver, Douglas, and Jefferson Counties. Access to local syndromic data in near-real time provides valuable information for local public health program planning, policy, and evaluation efforts. However, use of these data also comes with many challenges. For example, we learned from key informant interviews with ED staff in Boulder and Denver counties, about concern with the accuracy and specificity of drug-related diagnosis codes, specifically for opioid-related overdoses. **Methods:** Boulder County Public Health (BCPH) and Denver Public Health (DPH) developed a query in Early Notification of Community Based Epidemics (ESSENCE) using ICD-10-CM codes to identify cases of drug-related overdose [T36-T51] from October 2016 to September 2017. The Case definition included unintentional, self-harm, assault and undetermined poisonings, but did not include cases coded as adverse effects or underdosing of medication. Cases identified in the query were stratified by demographic factors (i.e., gender and age) and substance used in poisoning. The first diagnosis code in the file was considered the primary diagnosis. Chief complaint and triage note fields were examined to further describe unspecified cases and to describe how patients present to emergency departments in the CO-NCR. We also explored whether detection of drug overdose visits captured by discharge diagnosis data varied by patient sex, age, or county. **Results:** The query identified 2,366 drug-related overdoses in the CO-NCR. The prevalence of drug overdoses differed across age groups. The detection of drug overdoses was highest among our youth and young adult populations; 16 to 20 year olds (16.0%), 21-25 year olds (11.4%), 26-30 year olds (11.4%). Females comprised 56.1% of probable general drug overdoses. The majority of primary diagnoses (31.0%) included poisonings related to diuretics and other unspecified drugs (T50), narcotics (T40) (12.6%), or non-opioid analgesics (T39) (7.8%). For some cases with unspecified drug overdose codes there was additional information about drugs used and narcan administration found in the triage notes and chief complaint fields. **Conclusions:** Syndromic surveillance offers the opportunity to capture drug-related overdose data in near-real time. We found variation in drug-related overdose by demographic groups. Unspecified drug overdose codes are extremely common, which likely negatively impacts the quality of drug-specific surveillance. Leveraging chief complaint and triage notes could improve our understanding of factors involved in drug-related overdose with limitations in discharge diagnosis. Chart reviews and access to more fields from the ED electronic health record could improve local drug surveillance.

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# Roles of Health Literacy in Relation to Social Determinants of Health and Recommendations for Informatics-Based Interventions: Systematic Review

## Abstract

**Objective** To evaluate current rates and temporal trends in adherence with national guidelines recommending chlamydia test-of-cure for pregnant females and test-of-reinfection for all patients. **Introduction** Sexually transmitted disease treatment guidelines have incrementally added repeat testing recommendations for Chlamydia trachomatis infections over time, including test-of-cure 3 to 4 weeks following completion of treatment for pregnant women and test-of-reinfection for all patients approximately 3 months after infection. However, few studies have investigated adherence to these recommendations and whether the evolution of guidelines have led to changes in repeat testing patterns over time. **Methods** The Electronic medical record Support for Public Health surveillance network (ESPnet) was leveraged to analyze electronic health record data for three independent practice groups serving approximately 20% of the Massachusetts population. We identified all cases with laboratory-confirmed Chlamydia trachomatis infections between 2010 and 2015 and evaluated the frequency, timing, and results of subsequent chlamydia tests in the following year. **Results** Between 2010 and 2015, 972 pregnant female cases, 10,309 non-pregnant female cases, and 4,973 male cases had a positive C. trachomatis laboratory result. Test-of-cure within 3-5 weeks following an index positive test occurred in 36.8% of pregnant females. Test-of-reinfection within 2-4 months of an index test occurred in 39.2% of pregnant females, 17.9% of non-pregnant females, and 9.0% of males. There were no significant increases in test-of-cure or test-of-reinfection rates over the study period for any groups. Among cases with repeat tests, 15.9% of pregnant females, 14.6% of non-pregnant females, and 16.3% of males had at least one repeat positive result within one year of the index positive result. **Conclusions** Chlamydia test-of-cure and test-of-reinfection rates are low, with no evidence of improvement over time. There are substantial opportunities to improve adherence to chlamydia repeat testing recommendations.

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# Roles of Health Literacy in Relation to Social Determinants of Health and Recommendations for Informatics-Based Interventions: Systematic Review

## Abstract

**Objective:** To determine the seroprevalence of Brucellosis antibodies in cattle in 3 districts in South-western Uganda (Mbarara, Kiruhura and Bushenyi) and to determine the seroprevalence of Brucellosis among the cattle keepers on farms with cattle detected with brucellosis antibodies in the same districts and also to determine the level of awareness of Brucellosis disease among individuals that get in contact with livestock in the same districts. **Introduction:** Brucellosis is among the zoonotic diseases that continue to afflict man and animals in Uganda. The increase in the number of disease outbreaks in animals from 1990 to 2013 and the number of human patients diagnosed with brucellosis in private clinics and hospitals has placed the infection to be among the top re-emerging diseases in the country. Brucellosis infection in humans is non-specific and caused by direct or indirect contact with infected animals or their products. Brucellosis manifests as intermittent fever, headache, weakness, profuse sweating, chills, weight loss, generalized aching that may involve multiple organ systems in the body. In animals, Brucella organisms localize in the reproductive organs, causing abortions, decreased milk yields and temporary sterility. Its effects impact negatively to the sale value of the affected animals causing financial losses to the animal owners. **Methods:** Purposive surveys were conducted in selected farms that were in an area with reported human cases. Ethical clearances were sought. Screening for Brucellosis was done using SAT. All positive samples were subjected to i-ELISA that detects IgM immunoglobulins. A total of 1503 cattle from 113 farms were tested for Brucellosis. **Results:** Brucellosis test results from a total of 1503 cattle showed a sero-prevalence of 14% in Kiruhura, 18% Bushenyi and 23% Mbarara districts respectively. ELISA-positive Brucella cases from farm attendants on the sampled farms in the same districts had a prevalence of 4% in Kiruhura, 9% in Bushenyi and 12% in Mbarara. **Conclusions:** Our findings underscore Brucella exposure as one of the major re-emerging diseases that should be treated with great concern by both Ministry of Health and MAAIF. We therefore recommend that the Ministries of Health and Agriculture should increase on community sensitization on the risk of Brucella infections in humans from cattle, and promote measures that can protect high risk families from getting infected. This survey indicated that Brucellosis infections are still prevalent in Uganda and continue to occur in the local communities. The public health and animal health service providers need to work together in compiling the disease epidemiological data for a concerted disease intervention measures.

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# Roles of Health Literacy in Relation to Social Determinants of Health and Recommendations for Informatics-Based Interventions: Systematic Review

## Abstract

**Objective** As the BioSense Platform matures and more sites submit surveillance data, many in the community have voiced concerns about comparing data across sites. Recently, a number of jurisdictions from across the country were asked to provide opioid overdose data to a news agency highlighting the epidemic. Many jurisdictions requested information on how to present syndromic surveillance data from across sites and shared concern about how the data would be interpreted. This round table will address those concerns and explore options for comparing data across sites. **Introduction** One of the more recent successes of NSSP has been the introduction of more robust data quality monitoring and reporting. However, despite the increased insight into data quality, there are still concerns about data sharing and comparisons across sites. For NSSP to be most effective, users need to feel confident in sharing data and making comparisons across sites. **Description** This round table session will focus on determining where the real issues are, where the myths are, and how to overcome these challenges. Topics will include data quality issues that will affect comparisons, methods for comparing data across sites, and best practices for sharing data across sites and dealing with interpretation concerns. **How the Moderator Intends to Engage the Audience in Discussions on the Topic**The moderator will provide two or three real world examples of comparisons across sites and/or HHS regions. The following questions will guide the discussion: - What are the pros of not comparing data across sites? - What are the cons of not comparing data across sites? - What are the best practices for users to consider when attempting to compare across sites – are there criteria when comparisons should not be allowed? - What development items are suggested to the system to allow the user to better evaluate comparing data across regions? - Even with the potential issues when comparing across sites, are there accepted practices that could help describe the data and/or limitations until some of the issues are better addressed?

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# Roles of Health Literacy in Relation to Social Determinants of Health and Recommendations for Informatics-Based Interventions: Systematic Review

## Abstract

**Objective** In this analysis we examine Missouri NAS discharge rates with special focus on the ICD-9-CM/ICD-10-CM transition and changes in code descriptions. **Introduction** Neonatal Abstinence Syndrome (NAS) rates have tripled for Missouri residents in the past three years. NAS is a condition infants suffer soon after birth due to withdrawal after becoming opioid-dependent in the womb. NAS has significant immediate health concerns and can have long term effects on child development and quality of life.<sup>2</sup> The Missouri Department of Health and Senior Services (MODHSS) maintains the Patient Abstract System (PAS), a database of inpatient, emergency room, and outpatient records collected from non-federal hospitals and ambulatory surgical centers throughout the state. PAS records contain extensive information about the visit, patient, and diagnosis. When examining 2015 annual PAS data for NAS-associated discharges, Missouri analysts noticed a greater than 50% increase in discharges, even larger than anticipated in light of the opioid epidemic. Provisional 2016 data produced similar high rates, dispelling the notion that the trend was a transitional problem. In fact, provisional 2016 rates are 115% higher than NAS rates in 2015. In contrast, percentage change of opioid misuse emergency department visits (as defined by MODHSS) for Missouri women age 18-44 was +13% in 2015 and -12% in 2016. **Methods** NAS discharges for Missouri residents under the age of 1 were identified using all available diagnosis fields of the PAS record, using finalized data from 2014 and 2015 and provisional data from 2016. Results were stratified by quarter and ICD-CM code. Rates for each of these stratifications were calculated using Missouri resident live births as the denominator. Adhering to methodology used by MODHSS to calculate significance on its public data query tool, 95% confidence intervals were used to determine statistical significance. Depending on numerator size, either Poisson or the inverse gamma methodology was utilized to analyze changes in discharge rates over time. Two ICD-9-CM codes and four ICD-10-CM codes (identified as equivalents using an in-house crosswalk system) were used as NAS indicators (Figure 1). **Results** An exploration of the data by quarter and diagnosis code (ICD-9-CM or ICD-10-CM), as well as supporting information from the Centers for Medicare & Medicaid Services, show that definitional changes to ICD-10-CM codes P044 and P0449, (previously 76072 in ICD-9-CM coding), was responsible for the majority of the NAS rate increase in Missouri. Annual rates for 76072 and its equivalents jumped significantly from a rate of 3.82 (per 1,000) to 8.22 Q3 to Q4-2015 (95% CI: 3.39-4.29, 7.57-8.87), while ICD-9-CM code 7795 and its equivalents had a more modest rise, from 5.57 to 6.17, which was not statistically significant (95% CI: 5.04-6.13, 5.62-6.76). Once this anomaly was identified, examination of the code's description was conducted. This exposed a change in definition, with the words 'suspected to be' added to the ICD-10-CM long description, which were not present in the ICD-9-CM equivalent. Further complicating matters is a 2017 revision (effective Q3-2016) deleting the 'suspected' language from the description. This reversion to language more closely aligning with prior descriptions may be the reason for the slight decrease in discharges coded to P044 in the provisional Q4-2016 PAS data. Though this dataset is not finalized, there was a decrease in discharges that included code P044 from 27.50 in Q3-2016 to 23.15 in Q4-2016 (Figure 2, Figure 3). **Conclusions** While NAS discharge rates are undoubtedly increasing in Missouri in tune with the opioid epidemic, the extreme escalation from 2014 to 2016 is, at least partially, the result of a definitional change that came with the transition from ICD-9-CM to ICD-10-CM and not a true indication of profound intensification. Indeed, the definitional change of a single ICD-CM code was responsible, in part, for a greater than three-fold increase in NAS discharge rates in Missouri. This analysis will allow public health program planners to better understand NAS trends and adjust intervention strategies accordingly. Further analysis exploring quarterly trends associated with the 2017 ICD-10-CM revision are ongoing. **References** 1. Centers for Medicare & Medicaid Services. ICD-9-CM and ICD-10. <https://www.cms.gov/Medicare/Coding/ICD9ProviderDiagnosticCodes/index.html>. 2. Stanford Children's Health . Neonatal Abstinence Syndrome . <http://www.stanfordchildrens.org/en/topic/default?id=neonatal-abstinence-syndrome-90-P02387>.

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# Roles of Health Literacy in Relation to Social Determinants of Health and Recommendations for Informatics-Based Interventions: Systematic Review

## Abstract

**Objective** This paper analyzes emergency department syndromic data in the Centers for Disease Control and Prevention's (CDC) National Syndromic Surveillance Program's (NSSP) BioSense Platform to understand trends in suspected heroin overdose.

**Introduction** Overdose deaths involving opioids (i.e., opioid pain relievers and illicit opioids such as heroin) accounted for at least 63% (N = 33,091) of overdose deaths in 2015. Overdose deaths related to illicit opioids, heroin and illicitly-manufactured fentanyl, have rapidly increased since 2010. For instance, heroin overdose deaths quadrupled from 3,036 in 2010 to 12,989 in 2015. Unfortunately, timely response to emerging trends is inhibited by time lags for national data on both overdose mortality via vital statistics (8-12 months) and morbidity via hospital discharge data (over 2 years). Emergency department (ED) syndromic data can be leveraged to respond more quickly to emerging drug overdose trends as well as identify drug overdose outbreaks. CDC's NSSP BioSense Platform collects near real-time ED data on approximately two-thirds of ED visits in the US. NSSP's data analysis and visualization tool, Electronic Surveillance System for the Notification of Community-based Epidemics (ESSENCE), allows for tailored syndrome queries and can monitor ED visits related to heroin overdose at the local, state, regional, and national levels quicker than hospital discharge data.

**Methods** We analyzed ED syndromic data using ESSENCE to detect monthly and annual trends in suspected unintentional or undetermined heroin overdose by sex and region for those 11 years and older. An ED visit was categorized as a suspected heroin overdose if it met several criteria, including heroin overdose ICD-9-CM and ICD-10-CM codes (i.e., 965.01 and E850.0; T40.1X1A, T40.1X4A) and chief complaint text associated with a heroin overdose (e.g., "heroin overdose"). Using computer code developed specifically for ESSENCE based on our case definition, we queried data from 9 of the 10 HHS regions from July 2016-July 2017. One region was excluded due to large changes in data submitted during the time period. We conducted trend analyses using the proportion of suspected heroin overdoses by total ED visits for a given month with all sexes and regions combined and then stratified by sex and region. To determine significant linear changes in monthly and annual trends, we used the National Cancer Institute's Joinpoint Regression Program.

**Results** From July 2016-July 2017, over 72 million total ED visits were captured from all sites and jurisdictions submitting data to NSSP. After applying our case definition to these records, 53,786 visits were from a suspected heroin overdose, which accounted for approximately 7.5 heroin overdose visits per 10,000 total ED visits during that timeframe. The rate of suspected heroin overdose visits to total ED visits was highest in June 2017 (8.7 per 10,000) and lowest in August 2016 (6.6 per 10,000 visits). Males accounted for a larger rates of visits over all months (range = 10.7 to 14.2 per 10,000 visits) than females (range = 3.8 to 4.7 per 10,000 visits). Overall, compared to July 2016, suspected heroin overdose ED visits from July 2017 were significantly higher for all sexes and US regions combined ( $\beta = .010$ ,  $p = .036$ ). Significant increases were also demonstrated over time for males ( $\beta = .009$ ,  $p = .044$ ) and the Northeast ( $\beta = .012$ ,  $p = .025$ ). No other significant increases or decreases were detected by demographics or on a monthly basis.

**Conclusions** Emergency department visits related to heroin overdose increased significantly from July 2016 to July 2017, with significant increases in the Northeast and among males. Urgent public health action is needed reduce heroin overdoses including increasing the availability of naloxone (an antidote for opioid overdose), linking people at high risk for heroin overdose to medication-assisted treatment, and reducing misuse of opioids by implementing safer opioid prescribing practices. Despite these findings, there are several limitations of these data: not all states sharing data have full participation thus limiting the representativeness of the data; not all ED visits are shared with NSSP; and our case definition may under-identify (e.g., visits missing discharge diagnosis codes and lacking specificity in chief complaint text) or over-identify (e.g., reliance on hospital staff impression and not drug test results) heroin overdose visits. Nonetheless, ED syndromic surveillance data can provide timely insight into emerging regional and national heroin overdose trends.

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# Roles of Health Literacy in Relation to Social Determinants of Health and Recommendations for Informatics-Based Interventions: Systematic Review

## Abstract

**Objective:** The objectives of this study are to (1) create a mental health syndrome definition for syndromic surveillance to monitor mental health-related ED visits in near real time; (2) examine whether CC data alone can accurately detect mental health related ED visits; and (3) assess the added value of using Dx data to detect mental health-related ED visits. **Introduction:** Between 2006 and 2013, the rate of emergency department (ED) visits related to mental and substance use disorders increased substantially. This increase was higher for mental disorders visits (55 percent for depression, anxiety or stress reactions and 52 percent for psychoses or bipolar disorders) than for substance use disorders (37 percent) visits [1]. This increasing number of ED visits by patients with mental disorders indicates a growing burden on the health-care delivery system. New methods of surveillance are needed to identify and understand these changing trends in ED utilization and affected underlying populations. Syndromic surveillance can be leveraged to monitor mental health-related ED visits in near real-time. ED syndromic surveillance systems primarily rely on patient chief complaints (CC) to monitor and detect health events. Some studies suggest that the use of ED discharge diagnoses data (Dx), in addition to or instead of CC, may improve sensitivity and specificity of case identification [2]. **Methods:** We extracted a de-identified random sample of 50,000 ED visits with CC from the National Syndromic Surveillance Program (NSSP) for the period January 1—June 30, 2017. NSSP's BioSense Platform receives ED data from >4000 hospitals, representing about 55 percent of all ED visits in the country [3]. From this sample we extracted 22868 ED visits that included both CC and Dx data. We then applied our mental health syndrome case definition which comprised mental health-related keywords and ICD-9-CM and ICD-10-CM codes. We queried CC text for the words "stress," "PTSD," "anxiety," "depression," "clinical depression," "manic depression," "unipolar depression," "agitated," "nervousness," "mental health," "mental disorder," "affective disorder," "schizoaffective disorder," "psychoaffective disorder," "obsessive-compulsive disorder," "mood disorder," "bipolar disorder," "schizotypal personality disorder," "panic disorder," "psychosis," "paranoia," "psych," "manic," "mania," "hallucinating," "hallucination," "mental episode," and "mental illness." We queried Dx fields either for ICD-9-CM codes 295-296; 300, 311 or for ICD-10-CM codes F20-F48. The ICD-9-CM and ICD-10-CM codes used to identify mental health-related ED visits are based on the mental health disorders most frequently seen in EDs. Alcohol and substance use, suicide ideation, and suicide attempt were excluded from this study because they are included in alternate syndromes [2]. We manually reviewed the CC text to validate the search terms. Sensitivity, specificity, and positive predictive value will be calculated based on agreement of coding mental health against the human review of mental health visits. Based on our case definition, the sample of 22868 ED visits with CC and Dx data was further stratified into two groups: (1) mental health identified in either CC or Dx, and (2) no mental health identified in CC and Dx. Group 1 was further stratified into three groups: (a) mental health identified only in CC, (b) mental health identified in both CC and Dx, and (c) mental health identified only in Dx. The sample of 27132 ED visits with CC and no Dx data was further stratified into two groups: (1) mental health identified in CC, and (2) no mental health identified in CC (Figure). **Results:** Of the 50,000 sample of ED visits with CC data, 22868 visits had both CC and Dx data. Of the 22868 visits, we identified 1560 mental health-related ED visits using the mental health syndrome case definition. Of those visits, 241 were identified by a CC only, 226 were identified by both CC and Dx, and 1093 by a mental health-related Dx. Of the 27132 ED visits without Dx data, 421 had mental health identified in CC. **Conclusions:** Based on our preliminary analysis these findings suggest potential benefits of including Dx data in syndrome binning for mental health. Mental health terms are more likely to be found in Dx data than in the CC (1093 vs. 662). Using CC alone may underestimate the number of mental health-related ED visits. This study had several limitations. Not all facilities reporting to NSSP provide chief complaint data in the same manner, some provide CC as a drop down menu with predefined terms while others include the full text of CC. Not all records contained a Dx code which limited our ability to examine the added value of Dx code for that subset.

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# Roles of Health Literacy in Relation to Social Determinants of Health and Recommendations for Informatics-Based Interventions: Systematic Review

## Abstract

**Objective:** To describe how the Georgia Department of Public Health (DPH) uses ICD-9 and ICD-10-based discharge diagnoses (DDx) codes assigned to Emergency Department (ED) patients to support the early detection and investigation of outbreaks, clusters, and individual cases of reportable diseases. **Introduction:** The Georgia DPH has used its State Electronic Notifiable Disease Surveillance System (SendSS) Syndromic Surveillance (SS) module to collect, analyze and display analyses of ED patient visits, including DDx data from hospitals throughout Georgia for early detection and investigation of cases of reportable diseases before laboratory test results are available. Evidence on the value of syndromic surveillance approaches for outbreak or event detection is limited (1, 2). Use of the DDx field within datasets, specifically as it might be used for investigation of outbreaks, clusters, and / or individual cases of reportable diseases, has not been widely discussed. **Methods:** The DDx field of the ED data set sent to DPH by 120 facilities was queried for diseases that are immediately-reportable, as well as those reportable within 7 days of diagnosis. The query was performed twice a day using a combination of SAS 9.4 and the internal query capabilities of SendSS. District Epidemiologists (DE) were notified by email, with an Excel file attached that includes the details of the patient's visit. DEs contacted Infection Control Practitioners (ICPs) of the facilities where the patients had received a discharge diagnosis of a reportable disease. True or false positives were determined after the outcome of the follow-up with the ICP had been known and after the patient had been entered as a case of reportable disease in SendSS by the DE. Hence, if the patient was a confirmed or probable case of a reportable disease, it was recorded as a True Positive, and True Negative otherwise. This led to the calculation of Predictive Value Positive (PVP) by reportable disease. **Results:** Table 1 shows the number of notifications sent to DEs that were later demonstrated to be True Positives and False Positives. It also shows the PVP by diseases being reported, for the period spanning from 05/01/2016 to 08/31/2017. Use of these notifications has allowed early investigation and identification of 158 cases of notifiable diseases by DEs. This includes 25 epi-linked cases (varicella=12, pertussis=4, cryptosporidiosis=3, shigellosis=2, malaria=2, and viral meningitis=2), as well as two clusters of varicella, one cluster of pertussis, and one outbreak of varicella in an elementary school that had not been reported to the local health department. A notable limitation of this study is that no systematic and exhaustive tracking is done of all notifications, as DEs have latitude to decide whether to follow up on a specific notification, depending on other local data that could be related to the event. Therefore, the PPVs may be biased due to over- / under-estimation of unknown size and direction. One exception to this is varicella notifications, whose outcomes have been exhaustively tracked by the DPH surveillance coordinator of this disease. **Conclusions:** The use of ED discharge diagnoses to examine potential cases of reportable diseases can help improve detection and early response by local health departments to outbreaks, clusters, and individual cases of reportable diseases. Exhaustive tracking of all the notifications by specific diseases may improve the estimation of the PPVs of the notifications sent to DEs.

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# Roles of Health Literacy in Relation to Social Determinants of Health and Recommendations for Informatics-Based Interventions: Systematic Review

## Abstract

**Objective:** The overall objective of this session is to discuss opportunities to use drug overdose syndromic surveillance (SyS) data to encourage action among local public health partners. After this roundtable discussion, participants will be able to: -Identify opportunities to promote use of drug overdose SyS data to their health partners. -Plan for potential drug overdose public health interventions. -Develop relationships with roundtable attendees to continue the conversation and sharing of ideas about use of drug overdose SyS data. **Introduction:** Since 2008, drug overdose deaths exceeded the number of motor vehicle traffic-related deaths in Indiana and the gap continues to widen<sup>1</sup>. As the opioid crisis rages on in the United States the federal government is providing funding opportunities to states, but it often takes years for best practices to be developed, shared, and published. Indiana State Department of Health (ISDH) has developed a standard process for monitoring and alerting local health partners of increases in drug overdoses captured in Indiana's syndromic surveillance system (ESSENCE). ISDH is launching a pilot project to encourage local partners to start a conversation about overdose response capabilities and planning efforts in their community. Other states have published articles about drug overdose syndromic surveillance (SyS) data being used to inform local public health action, however, the local overdose response activity details were vague<sup>2,3</sup>. With the opioid crisis continuing to spiral out of control in the United States, it is imperative to work together as local, state, and national partners to find potential solutions to this crisis. **Description:** Overdose Surveillance Epidemiologists from Indiana will lead a roundtable discussion about potential uses of syndromic surveillance (SyS) overdose data to kick-start overdose response and prevention efforts at the local and state level. Discussion will begin by the moderators highlighting best practices for overdose response using SyS data and some Indiana specific initiatives. Topics for the roundtable discussion will include: -Drug overdose query development and enhancement. -Dissemination strategies for SyS alerts of suspected drug overdoses. -Best practices for reporting SyS overdose data to partners and/or public. -Public health intervention and prevention strategies using real-time hospital emergency department (ED) data. -Review of national or regional work groups focused on drug overdose SyS. **How the Moderator Intends to Engage the Audience in Discussions on the Topic:** The moderators, Mandy Billman and Kayley Dotson, are Overdose Surveillance Epidemiologists for Indiana, and they intend to kick off the discussion by presenting a short handout that will highlight Indiana's efforts to engage local health partners with near real-time drug overdose data, (i.e. monitoring and alerting local partners, developing a resource tool kit, sharing drug overdose queries, etc.). Mandy and Kayley will also develop a series of questions to actively engage participants in the discussion of bridging the gap from data to action using overdose surveillance data.

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# Roles of Health Literacy in Relation to Social Determinants of Health and Recommendations for Informatics-Based Interventions: Systematic Review

## Abstract

**Objective** To describe a novel application of ESSENCE by the Saint Louis County Department of Public Health (DPH) in preparation for a mass gathering and to encourage discussion about the appropriateness of sharing syndromic surveillance data with law enforcement partners. **Introduction** In preparation for mass gathering events, DPH conducts enhanced syndromic surveillance activities to detect potential cases of anthrax, tularemia, plague, and other potentially bioterrorism-related communicable diseases. While preparing for Saint Louis to host a Presidential Debate on October 9, 2016, DPH was asked by a partner organization whether we could also detect emergency department (ED) visits for injuries (e.g., burns to the hands or forearms) that could possibly indicate bomb-making activities. **Methods** Using the Electronic Surveillance System for the Notification of Community-Based Epidemics (ESSENCE), version 1.9, DPH developed a simple query to detect visits to EDs in Saint Louis City or Saint Louis County with chief complaints including the word “burn” and either “hand” or “arm.” A DPH epidemiologist reviewed the results of the query daily for two weeks before and after the debate (i.e., from September 25, 2016 to October 23, 2016). If any single ED visit was thought to be “suspicious” – if, for example, the chief complaint mentioned an explosive or chemical mechanism of injury – then DPH would contact the ED for details and relay the resulting information to the county’s Emergency Operations Center. **Results** During the 29 day surveillance period, ESSENCE detected 27 ED visits related to arm or hand burns. The ESSENCE query returned a median of 1 ED visit per day (IQR 0 to 2 visits). Of these, one was deemed to merit further investigation – two days before the debate, a patient presented to an ED in Saint Louis County complaining of a burned hand. The patient’s chief complaint data also mentioned “explosion of unspecified explosive materials.” Upon investigation, DPH learned that the patient had been injured by a homemade sparkler bomb. Subsequently, law enforcement determined that the sparkler bomb had been made without any malicious intent. **Conclusions** DPH succeeded in using ESSENCE to detect injuries related to bomb-making. However, this application of ESSENCE differs in at least two ways from more traditional uses of syndromic surveillance. First, conventional syndromic surveillance is designed to detect trends in ED visits resulting from an outbreak already in progress or a bioterrorist attack already carried out. In this case, syndromic surveillance was used to detect a single event that could be a prelude to an attack. The potential to prevent widespread injury or illness is a strength of this approach. Second, conventional syndromic surveillance identifies potential outbreak cases or, in the case of a bioterrorist attack, potential victims. In this case, syndromic surveillance was used to identify a potential perpetrator of an attack. While public health and law enforcement agencies would ideally coordinate their investigative efforts in the wake of an attack, this practice has led to conversations within DPH about the appropriateness of routinely sharing public health surveillance data with law enforcement.

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# Roles of Health Literacy in Relation to Social Determinants of Health and Recommendations for Informatics-Based Interventions: Systematic Review

## Abstract

**Objective** Malaria is one of the top causes of death in Africa and some other regions in the world. Data driven surveillance activities are essential for enabling the timely interventions to alleviate the impact of the disease and eventually eliminate malaria. Improving the interoperability of data sources through the use of shared semantics is a key consideration when designing surveillance systems, which must be robust in the face of dynamic changes to one or more components of a distributed infrastructure. Here we introduce a semantic framework to improve interoperability of malaria surveillance systems (SIEMA). **Introduction** In 2015, there were 212 million new cases of malaria, and about 429,000 malaria death, worldwide. African countries accounted for almost 90% of global cases of malaria and 92% of malaria deaths. Currently, malaria data are scattered across different countries, laboratories, and organizations in different heterogeneous data formats and repositories. The diversity of access methodologies makes it difficult to retrieve relevant data in a timely manner. Moreover, lack of rich metadata limits the reusability of data and its integration. The current process of discovering, accessing and reusing the data is inefficient and error-prone profoundly hindering surveillance efforts. As our knowledge about malaria and appropriate preventive measures becomes more comprehensive malaria data management systems, data collection standards, and data stewardship are certain to change regularly. Collectively these changes will make it more difficult to perform accurate data analytics or achieve reliable estimates of important metrics, such as infection rates. Consequently, there is a critical need to rapidly re-assess the integrity of data and knowledge infrastructures that experts depend on to support their surveillance tasks. **Methods** In order to address the challenge of heterogeneity of malaria data sources we recruit domain specific ontologies in the field (e.g. IDOMAL (1)) that define a shared lexicon of concepts and relations. These ontologies are expressed in the standard Web Ontology Language (OWL). To overcome challenges in accessing distributed data resources we have adopted the Semantic Automatic Discovery & Integration framework (SADI) (2) to ensure interoperability. SADI provides a way to describe services that provide access to data, detailing inputs and outputs of services and a functional description. Existing ontology terms are used when building SADI Service descriptions. The services can be discovered by querying a registry and combined into complex workflows. Users can issue SPARQL syntax to a query engine which can plan complex workflows to fetch actual data, without having to know how target data is structured or where it is located. In order to tackle changes in target data sources, the ontologies or the service definitions, we create a Dashboard (3) that can report any changes. The Dashboard reuses some existing tools to perform a series of checks. These tools compare versions of ontologies and databases allowing the Dashboard to report these changes. Once a change has been identified, a series of recommendations can be made, e.g. services can be retired or updated so that data access can continue. **Results** We used the Mosquito Insecticide Resistance Ontology (MIRO) (5) to define the common lexicon for our data sources and queries. The sources we created are CSV files that use the IRbase (4) schema. With the data defined using we specified several SPARQL queries and the SADI services needed to answer them. These services were designed to enable access to the data separated in different files using different formats. In order to showcase the capabilities of our Dashboard, we also modified parts of the service definitions, of the ontology and of the data sources. This allowed us to test our change detection capabilities. Once changes were detected, we manually updated the services to comply with a revised ontology and data sources and checked that the changes we proposed were yielding services that gave the right answers. In the future, we plan to make the updating of the services automatic. **Conclusions** Being able to make the relevant information accessible to a surveillance expert in a seamless way is critical in tackling and ultimately curing malaria. In order to achieve this, we used existing ontologies and semantic web services to increase the interoperability of the various sources. The data as well as the ontologies being likely to change frequently, we also designed a tool allowing us to detect and identify the changes and to update the services so that the whole surveillance systems becomes more resilient. **References** 1. P. Topalis, E. Mitraka, V Dritsou, E. Dialynas and C. Louis, "IDOMAL: the malaria ontology revisited" in Journal of Biomedical Semantics, vol. 4, no. 1, p. 16, Sep 2013. 2. M. D. Wilkinson, B. Vandervalk and L. McCarthy, "The Semantic Automated Discovery and Integration (SADI) web service design-pattern, API and reference implementation" in Journal of Biomedical Semantics, vol. 2, no. 1, p. 8, 2011. 3. J.H. Brenas, M.S. Al-Manir, C.J.O. Baker and A. Shaban-Nejad, "Change management dashboard for the SIEMA global surveillance infrastructure", in International Semantic Web Conference, 2017 4. E. Dialynas, P. Topalis, J. Vontas and C. 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# Roles of Health Literacy in Relation to Social Determinants of Health and Recommendations for Informatics-Based Interventions: Systematic Review

## Abstract

**Objective:** To monitor opioid-related overdose in real-time using emergency department visit data and to develop an opioid overdose surveillance report for Utah Department of Health (UDOH) and its public health partners. **Introduction:** The current surveillance system for opioid-related overdoses at UDOH has been limited to mortality data provided by the Office of the Medical Examiner (OME). Timeliness is a major concern with OME data due to the considerable lag in its availability, often up to six months or more. To enhance opioid overdose surveillance, UDOH has implemented additional surveillance using timely syndromic data to monitor fatal and nonfatal opioid-related overdoses in Utah. **Methods:** As one of the agencies participating in the National Syndromic Surveillance Program (NSSP), UDOH submits de-identified data on emergency department visit from Utah's hospitals and urgent care facilities in close to real-time to the NSSP platform. Emergency department visit data are available for analysis using the Electronic Surveillance System for the Early Notification of Community-based Epidemics (ESSENCE) system provided by NSSP. ESSENCE provides UDOH with patient-level syndromic data for analysis and early detection of abnormal patterns in emergency visits. A total of 38 out of 48 acute care hospitals and multiple urgent care facilities are enrolled in the system in Utah. More than 90% of these hospitals report chief complaint data, and discharge data are available from about 15% of the facilities. Data were analyzed by querying key terms in the chief complaint field including: any entry of: 'overdose', drug and brand names for opioids, street names, 'naloxone', and miss-spellings. Exclusion terms included any mention of: 'denies', 'quit', 'refill', 'withdraw', 'dependence', etc. Data containing any ICD entry of: T40.0-T40.4, T40.60, and T40.69 were included in the analysis. **Results:** Between September 1, 2016 and August 31, 2017, Utah Department of Health identified 4,063 opioid-related overdose emergency department (ED) visits through the ESSENCE system using both chief complaint and discharge diagnosis queries. Of these visits, 3,865 (95%) were identified using chief complaints alone and 198 (5%) visits were added by searching the discharge diagnosis field. Opioid-related visits comprised approximately 0.3% of the total ED visits (1,267,244) reported during this time (Graph 1). More than half of the opioid-related emergency visits were reported from just five facilities. Rate of opioid-related visits ranging from 0 to 292 visits per 100,000 population per year (median: 108 visits per 100,000 population per year), with an overall rate for the state of 129 visits per 100,000 population per year. The highest rate of opioid-related visits occurred among patients aged 18 to 24 (219 visits per 100,000 population per year), and 59% of all opioid-related patients in Utah were female. **Conclusions:** The results presented are estimates of opioid-related overdoses reported using close to real-time data. These results would not include visits with incomplete or incorrectly coded chief complaints or discharge codes, or cases of opioid overdose who do not present to an emergency department or urgent care facility. The results from using syndromic data are consistent with existing surveillance findings using mortality data in Utah. This suggests that syndromic surveillance data are useful for rapidly capturing opioid events, which may allow for a timelier public health response. UDOH is currently evaluating syndromic surveillance data versus hospital discharge data for opioid-related emergency department visits, which may further optimize queries in ESSENCE, in order to provide improved opioid surveillance data to local public health partners. This analysis demonstrates that using syndromic surveillance data provides a more time-efficient alternative, enabling more rapid public health interventions, which improved opportunities to reduce opioid-related morbidity and mortality in Utah.

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# Roles of Health Literacy in Relation to Social Determinants of Health and Recommendations for Informatics-Based Interventions: Systematic Review

## Abstract

**Objective:** To describe the use of Florida Poison Information Center Network (FPICN) and Electronic Surveillance System for the Early Notification of Community-based Epidemics (ESSENCE-FL) emergency department (ED) chief complaints data to identify acute naled-related illness following aerial spraying in Miami-Dade county, Florida in response to the Zika outbreak. **Introduction:** Pesticide-related illness and injury is a reportable condition in Florida. In August and September 2016, aerial spraying for mosquito control was conducted in an effort to reduce the population of *Aedes aegyptimosquitoes* in Miami-Dade County.1 Two areas Wynwood (in August) and Miami Beach (in September) were sprayed with naled. Naled is an organophosphate insecticide registered with the U.S. Environmental Protection Agency (EPA) which is applied via aerial ultra-low volume (ULV) spraying. In addition to routine surveillance using FPICN and reportable disease surveillance data to identify acute naled-related illness, the Florida Department of Health (DOH) also monitored ED chief complaints data to identify any associated increase in ED visits. **Methods:** In 2016, DOH used three datasets to monitor illness related to naled exposure: FPICN call data, reportable disease (Merlin) data, and ED chief complaints. Product code 2327991 was used to search FPICN data for naled-related exposure calls. FPICN calls with the following medical outcomes were excluded: no health effect, not followed - judged as nontoxic exposure, unrelated effect, and confirmed non-exposure. Individuals who met the reportable disease surveillance case definition for pesticide-related illness and injury<sup>2</sup> were entered into Merlin. ESSENCE-FL was monitored to evaluate ED visits in Miami-Dade County for the syndrome categories and free text chief complaints involving eyes (free text queries for eye irritation, eye burning, eye redness, and conjunctivitis), skin (syndrome category for rash), and respiratory (sub-syndrome categories for shortness of breath, wheezing, acute bronchitis, sore throat, and asthma) illnesses. **Results:** Twenty-two exposure calls were identified through FPICN data in 2016. Seven calls were excluded after DOH review determined that these individuals were not exposed to naled. Fifteen exposure calls were investigated and eight individuals met the surveillance case definition for pesticide-related illness and injury. Among the eight DOH cases, one individual was exposed in August (12.5%), and seven in September (87.5%). Everyone had low severity illness, five (62.5%) were female, and the mean age was 39.6 years (range: 27 to 46 years). Two cases (25%) were work-related. Review of ESSENCE ED chief complaints data for eye, skin, and respiratory illnesses showed a few statistically significant increases in daily patient visits. However, these increases were not attributed to aerial spraying. **Conclusions:** FPICN data are useful in identifying cases of naled-related illness. Near real-time access to ED chief complaints data along with FPICN and Merlin data has enhanced surveillance capability for DOH and helped address public health concerns related to naled-related illness following aerial spraying in Miami-Dade County.

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## Abstract

**Introduction:** Respiratory pathogens continue to present an ever increasing threat to public health (1,2). Influenza, Respiratory syncytial virus, human metapneumovirus and other respiratory viruses are major etiological agents for influenza like illnesses (ILI) (3-5). Establishment of viral causes of ILI is critical for prevention and mitigation strategies to disease threats. Makerere University Walter Reed Project (MUWRP) together with the Ugandan Ministry of Health and partners undertook surveillance to determine viral causes of influenza-like illness in Uganda. **Methods:** From 2008, MUWRP established hospital-based sentinel sites for surveillance activities. A total of five hospital-based sites were established, where patients aged 6 months or older presenting with ILI were enrolled. Consents were obtained as required, and a throat and/ or nasopharyngeal swab collected. Samples were screened by PCR for viral causes. **Results:** From October 2008 to March 2017 a total of 9,472 participants were enrolled in the study from five hospital-based surveillance sentinel sites. Majority of participants were children under 5 years n= 8,169 (86.2%). 615 (6.5%) samples tested positive for influenza A, while 385 (4.1%) tested positive for influenza B viruses and 10 (0.1%) were co-infections between influenza A and B. Of the 2,062 influenza negative samples, results indicated positivity for the following organisms; adenoviruses (9.4%), respiratory syncytial B (7.3%), parainfluenza-3 (4.5%), parainfluenza-1 (4.3%), respiratory syncytial A (3.5%), human bocavirus (1.7%), human metapneumovirus (1.7%), human coronavirus (1.5%), parainfluenza-4 (1.4%) and parainfluenza-2 (0.9%) by PCR. **Conclusions:** Influenza viruses account for about 11% of the causes of influenza like illness, with influenza A being the dominant type. Among the other viral causes of ILI, adenoviruses were the most dominant. Detection of other viral causes of ILI is an indication of the public health threats posed by respiratory pathogens.

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# Roles of Health Literacy in Relation to Social Determinants of Health and Recommendations for Informatics-Based Interventions: Systematic Review

## Abstract

**Objective:** To share Vietnam's experiences piloting the integration of viral load (VL) testing into the national HIV sentinel surveillance (HSS) system to better understand the level of HIV viral transmission among people who inject drugs (PWID). **Introduction:** Vietnam initiated the HSS system in 1994 in selected provinces with high HIV burden. The surveillance has two components: monitor HIV sero-prevalence and risk behaviors among key population including PWID. However, no VL data were collected among HIV infected people. In 2016, Vietnam piloted an added component of VL testing to the existing HSS system. The purpose was to test the feasibility of adding VL testing to the HSS so that VL data among PWID would be available. The pilot was conducted in two provinces in southern Vietnam-Ho Chi Minh City and Long An. It was expected that adding the VL testing to the existing HSS would also save resources and help monitor HIV viral transmission among PWID in the community regardless if they are currently on anti-retroviral therapy (ART). **Methods:** Male PWIDs were enrolled into 2016 HSS+ following the standard operating procedure (SOP)[1]. Community-based sampling was based on random selection of wards/communes listed in the sampling frame. In each selected ward/commune, all eligible PWID were invited to voluntarily participate in the survey. Eligibility criteria were males 16 years of age or older, reporting injecting drug in the past month, and residing in the selected area. The survey included an interview using a standardized questionnaire and 7ml blood drawn for HIV testing. Blood specimens were transferred from districts to provincial labs for plasma separation in the same day. Each plasma specimen was divided into three aliquots of 1ml each. One aliquot was used to test for HIV diagnosis at provincial labs, using the national HIV testing strategy III[2]. The remaining 2 aliquots were stored at provincial labs at 2-80C and within 5 days, were shipped to Pasteur Institute in Ho Chi Minh City (PIHCM) where the plasma specimens were stored at -800C. Processing of samples for VL testing was conducted at the end of the survey where all plasma specimen were transferred to PIHCM lab, which was 2 months since the collection of the first blood specimen. VL was undertaken on COBAS AMPLYPREP/COBAS TAQMAN 48, with identification threshold 20 cps/ml and specificity of 100% using Kit CAP-G/CTM HIV-1 V 2.0. The VL testing results were sent back to relevant Provincial AIDS Centers to return to respective participants, within 3 months. **Results:** Five hundred male PWID (HCMC: 300; LA: 200) were enrolled into 2016 HSS/HSS+ and agreed to provide blood specimen without any refusal. 84 tested positive for HIV (16.8%. HCMC: 15.0%; LA: 19.5%), 43 (51.2%) specimens had unsuppressed VL (>1000 copies/ml) (HCMC: 66.7%; LA: 33.3%), 35 (41.7%) specimens had undetected level (<50 copies/ml or undetected) (HCMC: 31.1%; LA: 53.9%), and 7.1% had VL that ranged from 50-1000 copies/ml (HCMC: 2.2%; LA: 12.8%). Among those who had VL < 1000 copies/ml, 22 (53.7%) had ever been on ART. **Conclusions:** The pilot survey has measured VL among male PWID, including those who were aware of their HIV status and those who did not know their status before. Findings indicate that a significant proportion of PWID do not have their VL suppressed leading to high-risk of HIV transmission from PWID to their sexual partners[3] in the community although level of unsuppressed viral load is not a direct measure of HIV viral transmission in itself. This pilot indicated that it was feasible to add VL testing into HSS and Vietnam government can add it as a routine practice in HSS and can be expanded in the coming years.

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# Roles of Health Literacy in Relation to Social Determinants of Health and Recommendations for Informatics-Based Interventions: Systematic Review

## Abstract

**Objective** To assess the equivalence of hypertension prevalence estimates between longitudinal electronic health record (EHR) data from a community-based health information exchange (HIE) and the Behavioral Risk Factor Surveillance System (BRFSS). **Introduction** Hypertension (HTN) is a highly prevalent chronic condition and strongly associated with morbidity and mortality. HTN is amenable to prevention and control through public and population health programs and policies. Therefore, public and population health programs require accurate, stable estimates of disease prevalence, and estimating HTN prevalence at the community-level is acutely important for timely detection, intervention, and effective evaluation. Current surveillance methods for HTN rely upon community-based surveys, such as the BRFSS. While BRFSS is the standard at the state- and national-level, they are expensive to collect, released once per year, and their confidence intervals are too wide for precise estimates at the local level. More timely, frequently updated, and locally precise prevalence estimates could greatly improve the timeliness and precision of public health interventions. The current study evaluated EHR data from a large, mature HIE as an alternative to community-based surveys for timely, accurate, and precise HTN prevalence estimation. **Methods** Two years (2014-2015) of EHR data were obtained from the Indiana Network for Patient Care for two major health systems in Marion County, Indiana, representing approximately 75% of the total county population (n=530,244). These data were linked and evaluated for prevalent HTN. Six HTN phenotypes were defined using structured data variables including clinical diagnoses (ICD9/10 codes), blood pressure (BP) measurements (HTN =  $\geq 140$ mmHg systolic or  $\geq 90$ mmHg diastolic), and dispensed HTN medications (Table 1). Phenotypes were validated using a random sample of 600 records, comparing EHR phenotype HTN to HTN as determined through manual chart review by a Registered Nurse. Each phenotype was further evaluated against BRFSS estimates for Marion County, and stratified by sex, race, and age to compare EHR-generated HTN prevalence measures to those known and in current use for chronic disease surveillance. Comparisons were made using the two one-sided statistical test (TOST) of equivalence, wherein the null hypothesis is the BRFSS and EHR prevalence estimates are different by  $\pm 5\%$  and the alternative is estimates differ by less than  $\pm 5\%$ . Rejection of the null resulted in the conclusion of equivalence of the estimates for use in population/public health. **Results** In general, the performance of the EHR phenotypes was characterized by high specificity ( $\geq 87\%$ ) and low to moderate sensitivity (range 25.4%-95.3%). The false positive rate was lowest among the phenotype defining HTN by both clinical diagnosis and BP measurements (0.3%), and sensitivity was greatest for the phenotype combining all three structured data elements (95.2%). The prevalence of HTN in Marion County, Indiana (2014-2015) for the EHR sample (n=530,244) ranged between 13.7% and 36.2%, compared to 28.4% in the BRFSS sample (Table 1). Only one EHR phenotype ( $\geq 1$  HTN BP measurement) demonstrated equivalence with BRFSS prevalence at the county level (difference 0.9%, 90% CI for difference -2.3%-4.0%). HTN prevalence by sex, race, age, sex and age, and sex and race (n=120 comparisons) failed to demonstrate equivalence between EHR and BRFSS measures in all but two comparisons, both among females aged 18-39 years. Differences between EHR and BRFSS HTN prevalence at the subgroup level varied but were particularly pronounced among older adults. As suspected, HTN prevalence precision was improved in the EHR sample with the largest subgroup 95% CI width of 0.7% for male African Americans compared to the BRFSS sample 95% CI width of 29.6%. **Conclusions** The applicability of the tested HTN phenotypes will vary based upon which EHR structured data elements are available to public health (i.e., ICD10, vitals, medications). We found that HTN surveillance using a community-based HIE was not a valid replacement for the BRFSS, although the HIE-based estimates could be readily generated and had much narrower confidence intervals. **References** Mozaffarian D, et al. Heart Disease and Stroke Statistics — 2016 Update. *Circulation*. 2016; 133: e38-e360. Yoon S, Fryar C, Carroll M. HTN Prevalence and Control Among Adults: United States, 2011–2014. NCHS Data Brief No. 220. 2015; Hyattsville, MD: National Center for Health Statistics, Centers for Disease Control and Prevention, US Dept of Health and Human Services.

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## Abstract

**Objective:** Within the BioSense Platform, users have the ability to view HHS Region level data that can provide insight into what may be happening around the country. Epidemiologists can examine this information for changes in trends of subsyndromes or other potential issues of public health concern and compare it to their local data. However, the insight that regional data can provide is limited without better understanding of what is happening in the jurisdictions that make up the region. This round table will discuss the benefits of engaging with other jurisdictions within regions and attempt to define rules of engagement that can be used to facilitate interactions. **Introduction:** One of the early successes for the National Syndromic Surveillance Program's (NSSP's) BioSense Platform was community agreement on what should make up national and regional picture of the data. For NSSP to meet program objectives, National level surveillance and situational awareness had to be made available – not just to CDC, but to the entire community. To make this possible, the community had to agree on a limited dataset that would be sufficient to produce national and regional picture. Currently when NSSP staff at CDC or a particular program review HHS Regional data, they can only see trends at high levels. Although, this information is proving useful, when very unusual data spikes occur there is insufficient information to determine its public health significance. CDC would like to set up HHS Regional Epi groups made up of syndromic surveillance practitioners within regions in order to communicate about potentially unusual findings and discuss implications for local jurisdictions. **Description:** This round table will use case examples of data spikes for sub-syndromes in HHS Regions and discuss the following: - What observations might warrant communications with local sites and potentially even warrant further investigation - How the information should be communicated - Ideas for ways that jurisdictions could collaborate on an investigation - Any challenges to the current concept of operations. **How the Moderator Intends to Engage the Audience in Discussions on the Topic:** The moderator will lay out two or three real world examples that might have benefited from having an HHS Regional Epi group to address the issue. Then the audience will be asked to comment on the following questions: - What are the potential pros of such HHS regional epi groups? - What are the potential cons of such HHS regional epi groups? - What are best practices for communicating with HHS Regional epi groups (i.e. through list serve, forum, Event Communications System within ESSENCE, etc.)? - What are the best ways to keep these HHS Regional Epi groups properly engaged and responsive without overwhelming them with requests? - How can these HHS Regional Epi groups be used by other HHS Regions that are looking to collaborate?

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## Abstract

**Objective** We used experiences in multiple countries to determine that owner engagement is critical for successful evaluations of surveillance system viability. Introduction Pilot projects help determine utility and feasibility of a system, but even if considered successful, cost could prevent further scale-up. When evaluating a surveillance system pilot, cost and benefits are key factors to examine. In Cote d'Ivoire and Tanzania, Ministry of Health (MoH) and non-governmental partners receive funding under the Global Health Security Agenda to strengthen disease surveillance for earlier detection and improved response to potential infectious disease outbreaks. To this end, Community based surveillance (CBS) projects were implemented in 2016 as a means for early warning of potential events to facilitate a more rapid response. Currently, these CBS projects are being evaluated collaboratively with the primary stakeholder, the host country government (HCG), as lead, and partners such as CDC providing technical assistance. In other instances, partners may conduct an evaluation and share the results and recommendations with the HCG; however, if the HCG is not actively engaged as the primary executor, outcomes may not be endorsed or implemented. Therefore, these evaluations were approached from an owner's (HCG) perspective. In this way, the governmental agencies develop capabilities to conduct similar activities in other areas, reduce dependencies on outside entities, and promote enactment of resulting recommendations. **Methods** Once the determination was made that an evaluation was necessary to decide the usefulness of the projects for future planning, key stakeholders worked together to design and execute the evaluation. For Cote d'Ivoire, the evaluation team consisted of representatives from the MoH's National Institute of Public Health, Directorate of Informatics and Health Information, and Directorate for the Coordination of the Expanded Immunization Program, along with delegates from CDC and implementing partners. In Tanzania, evaluation team members came from the MoH, the Ministry of Agriculture, Forestries and Livestock, WHO, CDC and implementing partners. Team members participated in either planning, conducting or analyzing the evaluation, while some contributed to a combination or to all aspects. MoH members led the effort with CDC and other partners providing technical assistance, while implementing partners contributed only to planning and logistics to reduce the potential for bias. For the initial step, representatives came together to fully document the system to be evaluated. This system description details the purpose, relevant stakeholders and current operation of the pilot system. As the evaluation question should remain within the scope of the system's purpose, it was necessary to definitively understand and confirm the goal and objectives set out for the system. Next, the sites, participants and roles, and data flows were described, noting that verification of the actual processes would occur during the site visit portion of the evaluation. Total cost of ownership was calculated by considering solution costs, implementation costs and ongoing support, and then broken down by district. The CBS pilots implemented early warning notification systems in two districts in Cote d'Ivoire and in five districts in Tanzania using a combination of paper-based and electronic reporting formats. Evaluation teams visited pilot sites and routine surveillance sites for comparison and conducted in-person interviews using questionnaires specific to the individual's role. Data were either collected in the field on paper forms or electronically on tablets for subsequent upload to a centralized database for later analysis. Data from project and routine reporting databases were comparatively analyzed to calculate timeliness, validity, usefulness, acceptability and value of the early warning system pilots. **Results** Although final interpretations of the evaluation results are pending, the evaluations were successfully led by the HCG and jointly conducted with other stakeholder engagement. Leadership by the owners of the systems has already resulted in the recognition that certain aspects of the pilot surveillance systems demonstrate a successful and affordable approach, while others will need to consider more cost-effective strategies. Though further analysis will likely continue to show the utility of CBS strategies, the ownership approach is resulting in an outcome of broad stakeholder input with approval from the host country government. **Conclusions** Community based surveillance can help to detect events of public health importance and effect earlier introduction into the health system for more timely situational awareness and response. However, it is difficult to determine the costs associated with different strategies of implementation and operation in order to ascertain the value for public health action. Additionally, pilot implementations of these systems are often funded at a level that cannot be replicated nationally and not for a prolonged period of time. While it is believed that CBS can be a cost effective early notification system, continual monitoring and routine evaluation is required. By routinely monitoring cost and quality, sustainability of the system can be continually assessed and system adaptations made accordingly. Key to remember is that evaluation must occur from an owner's perspective and must engage the people who are going to govern, operate and provide the ongoing resources for system operation. In this way, effectiveness and efficiency can be continually monitored within the parameter of cost so that viability of the system can be ascertained.

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# Roles of Health Literacy in Relation to Social Determinants of Health and Recommendations for Informatics-Based Interventions: Systematic Review

## Abstract

**Objective** To describe the implementation and preliminary results of returning HIV test results to participants in Vietnam HIV sentinel surveillance. **Introduction** Knowledge of one's HIV serostatus helps improve quality of life for those who test positive and decreases the risk of HIV transmission. WHO recommends that all participants in HIV prevalence surveys be provided access to their test results, especially those who test HIV positive [1]. Anonymous Vietnam HIV sentinel surveillance (HSS), implemented since 1994, focuses on people who inject drugs (PWID), female sex workers (FSW), and men who have sex with men (MSM) [2]. According to national guidelines, the HIV testing algorithm for surveillance purposes was based on two tests whereas the diagnostic algorithm for individuals was based on three tests. Thus, surveillance test results could not be returned to participants [3] who were instead encouraged to learn their HIV serostatus by testing at public confirmatory testing sites. In 2015, a three-test strategy was applied as part of HSS so that test results could be returned to participants. **Methods** In 2015, return of HIV test results was implemented as a pilot in 16 HSS provinces. HSS participants were asked to identify which of the designated HIV testing and counselling centers (HTC) in the province was most convenient for them. Participants were then given appointment cards with an assigned survey ID to receive their test results at the chosen venue at a specific date and time. Specimens, with assigned survey IDs, were transferred to the respective HIV laboratory at the Province AIDS Center (PAC) for confirmatory testing. The same three-test algorithm was used for surveillance purposes as well as to return confirmatory test results to participants [3]. Final test results were classified as "positive", "negative" or "indeterminate". HIV confirmatory test results were made available at all designated HTC in the provinces within 10 days after blood collection; thus, if a participant presented at a location, date or time that differed from the appointment card, s/he could still receive the test result. In some settings in which provinces integrated HSS with either static or mobile HTC, three rapid tests were used at point-of-care so that same-day test results were available. In this case, participants received test results at the end of the specified time regardless of their infection status. At the HTC, individuals showed their appointment cards. The IDs were used to identify the correct test results which were then given verbally to participants by HTC counsellors. Test results were not returned by phone or email. Individuals who tested positive were immediately referred to HIV treatment and other available health/social services in the province. The proportion of participants who received their test results was calculated for each survey group and province. **Results** The number of provinces that reported returning of HIV test results in 2015 and 2016 were 14 and 15, respectively. Overall, among 15,530 persons tested through HSS in 2015 and 2016, 7,354 persons returned to receive their test results. The proportion of participants who returned for test results varied by province and survey population (table 1). In some provinces where HSS was integrated with HTC, such as Hai Phong and Dong Thap, 100% of participants received their test results within a day [4]. **Conclusions** Returning HIV test results to HIV surveillance participants is feasible and beneficial in low-income countries like Vietnam. This enhancement facilitates participants learning their serostatus and contributes toward Vietnam's achievement of HIV control [4]. Based on the pilot experiences, Vietnam Ministry of Health decided to extend test result notifications to all 20 HSS provinces in 2017. Key factors that contributed to the success of the activity were fast turnaround time, roles and level of commitment of PAC, and coordination between the survey and HTC. The returning rate in HSS 2015 and 2016 are promising but these could be improved further. Better coordination and commitment between the survey and HIV testing service are needed to further increase return rates so that HIV-positive individuals can learn their serostatus and be better linked to care and treatment services. **References** 1. WHO, Guidelines for second generation HIV surveillance: An update: Know your epidemic, 2013. 2. VAAC, Guidance for epidemiological surveillance of HIV/AIDS & sexually transmitted infections, 2012. 3. MOH, National guideline on HIV serology testing, in Decision 1098/QD-BYT, 2013. 4. VAAC, Primarily results of HSS, 2016.

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## Abstract

**Objective** The aim of this work was to determine the impact of vaccination on the dynamics of mortality and the contribution of vaccine preventable infections to the structure of total infectious mortality of the population of Ukraine over the past 50 years to develop a more effective system of surveillance for this group of infections. **Introduction** Infectious diseases are still the cause of a large number of deaths in Ukraine. Analysis of infectious mortality allows the study of the dynamics of diseases that pose the greatest danger. In particular, those that are vaccine-preventable and suggest more effective methods for organizing an epidemic surveillance system. **Methods** This work describes a retrospective population epidemiological study. The material for the statistical analysis was taken from the statistical form C-8 "Distribution of deceased by sex, age groups and causes of death" of the Ukrainian Center for Disease Control and Monitoring of the MoH of Ukraine for the period 1965-2015. This work analyzed the mortality dynamics of 1965, 1991 and 2015, which correspond to the firstly achieved 90-95% vaccination coverage against diphtheria, whooping cough, tetanus and poliomyelitis (1965), the first year of Ukraine's independence (1991), after its separation from the Soviet Union and the end of the study period (2015). **Results** Our data shows the difference in the number of deaths from all vaccine-preventable and non-vaccine-preventable infections in 1965, 1991 and 2015 among the total population, children aged 0-14 years and in the age group 15 years and older. We also have data on the proportion of some infections in the nosological structure and total infectious mortality. The proportion of all infectious diseases decreased in the total number of deaths from 7.47% in 1965 to 1.53% in 1991 and 2.51% in 2015. The proportion of deaths from all infections was significantly higher in the overall structure of child mortality. It was 39.4% in 1965 and 7.25% in 2015. Almost the same decrease of proportion is demonstrated by all non-vaccine-preventable infections. The proportion of all vaccine-preventable infections (diphtheria, tetanus, whooping cough, poliomyelitis, hepatitis B, tuberculosis) in the total number of deaths decreased from 3.77% in 1965 to 0.85% in 2015. The decrease in the proportion of children deaths from vaccine-preventable infections was from 2.12% in 1965 to 0.35% in 2015. There is a 2.6-fold decrease in the total number of deaths from all vaccine-preventable infections among the general population, but for the children's population the reduction rate in 2015 compared to 1965 was 31.2 times. In the context of infant infectious mortality, vaccine-preventable infections (inclusive of tuberculosis) were 5.39% in 1965 and 4.8% in 2015. Potentially vaccine-preventable infections (pneumonia, meningococcal infection, influenza and other acute upper respiratory infections) demonstrated a child mortality rate of 80.52% in 1965 and 60.17% in 2015, and the number of deaths from these infections among children in 2015 was 37.3 times less than in 1965. **Conclusions** Collection of data on infectious diseases mortality should be included into the epidemiological surveillance system. Decrease in mortality from non-vaccine-preventable infections may indicate a significant impact of natural, demographic and economic factors that can influence the decrease in mortality from vaccine-preventable diseases too. In Ukraine, vaccination of certain infections certainly had and in the future will also have an important value for controlling infectious incidence and mortality. Moreover, vaccination continues to be the most accessible and effective intervention for achieving global or regional eradication of infections.

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# Roles of Health Literacy in Relation to Social Determinants of Health and Recommendations for Informatics-Based Interventions: Systematic Review

## Abstract

**Objective** To describe the use of an online survey tool to rapidly collect data from a large community outbreak of enteric illness in Toronto, Canada. **Introduction** In the early morning of Friday January 20, 2017, Toronto Public Health (TPH) was notified of several reports of acute vomiting, diarrhea, and stomach pain/cramps among students living in residence at a post-secondary institution in Toronto, Canada. A public health investigation was initiated and it was quickly determined that a large number of students and visitors to the campus were affected. Following considerable media coverage, TPH began receiving an overwhelmingly high volume of reports from ill individuals who lived, visited, or worked at the college campus and had experienced gastrointestinal illness. **Methods** GastroBusters – an established online foodborne illness reporting tool was quickly adapted to support the outbreak investigation. GastroBusters was rapidly updated to include a screening question allowing ill individuals connected with the outbreak location to self-identify and report their symptoms, onset dates and times, and food histories to TPH securely online. The necessary updates were developed, tested, and implemented in less than one hour. Ill individuals were directed to the GastroBusters website – [tph.to/gastrobusters](http://tph.to/gastrobusters) - by college administrators and through media messaging. Those who were ill and reported to TPH through other methods (e.g., by phone) were interviewed by TPH investigators to collect comparable data, which were entered by staff into an online survey that mirrored the structure of the GastroBusters questions. These two data sets were merged and descriptive analyses were conducted using MS Excel and SAS v9.2. **Results** In total, 354 reports associated with the outbreak were received by TPH - 232 who self-reported through GastroBusters, and 122 reported through other methods who were interviewed by TPH. Use of GastroBusters allowed ill individuals to report at a time convenient to them - 204 (88%) reports were submitted outside of TPH's business hours. As well, by providing ill individuals a method to self-report, TPH was able to rapidly collect, analyze and interpret data over the weekend while minimizing use of TPH staff resources. A summary report was available on Monday January 23, 2017 by 9:00 am, describing 236 confirmed and probable cases whose data were collected via both online surveys (GastroBusters and TPH data collection tool), between Friday and Sunday evenings. These data supported the hypothesis that the source of illness for the outbreak was likely norovirus; this was later confirmed through laboratory results. **Conclusions** This investigation provides a successful example of how an existing online reporting system for foodborne illness can be used for rapid data collection during a large-scale community enteric outbreak, where the exposed population could not be easily defined and the source of illness was unknown. Advantages of using this approach included: 1) rapid and robust data collection resulting in prompt analysis, and 2) efficient use of public health resources given the volume of reports otherwise processed by a public health investigator. Moreover, the investigation coincided with a weekend when there are fewer staff available and large amounts of overtime costs would have been accrued. TPH is currently developing standards for the use of similar tools in the future. **References** 1. Toronto [Internet]. Toronto: City of Toronto; c1998-2017. GastroBusters; [cited October 2, 2017]. Available from: [tph.to/gastrobusters](http://tph.to/gastrobusters)

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