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ISDS 2015 Conference Abstracts

ISDS INTERNATIONAL SOCIETY FOR DISEASE SURVEILLANCE

Towards Influenza Surveillance in Military Populations Using Novel and Traditional Sources

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Objective

To integrate existing influenza surveillance data sources and social media data into an accurate and timely outbreak detection model embedded into dashboard biosuveillance analytics for the Department of Defense.

Introduction

Influenza-like illness (ILI) remains a significant public health burden to both the general public and the U.S. Department of Defense. Military personnel are especially susceptible to disease outbreaks owing to the often-crowded living quarters, substantial geographic movement, and physical stress placed upon them.[1] Currently, the military employs syndromic surveillance on electronic reporting of clinical diagnoses. While faster than traditional, biologically-focused monitoring techniques, the military surveillance system proved inadequate at detecting outbreaks quickly enough in a recent study conducted by the CDC.[2] Recently, research has included novel data sources, like social media, to conduct disease detection in real-time and capture communities not traditionally accounted for in current surveillance systems. Data-mining techniques are used to identify influenza-related social media posts and train a model against validated medical data.[3] By integrating social media data and a medical dataset of all ILI-related laboratory specimens and doctor visits for the entire military cohort, a more comprehensive model than presently exists for disease identification and transmission will be possible.

Methods

For analyses, the Armed Forces Health Surveillance Center (AFHSC) provided about 1000 military health facilities' Defense Medical Surveillance System data, recorded between December 1999 and 2014. This data included laboratory results and medical clinical visits coded with an International Classification of Disease, 9th edition (ICD-9) code under the AFHSC's syndromic definition of ILI. Health facilities were mapped in ESRI ArcGIS with a 25-mile buffer. To determine specific locations of interest for historical Twitter data purchase and analyses, facilities within each buffer were condensed into a merged location and areas with substantial medical data, military populations, and social media usage were targeted. From this analysis, 25 U.S. and 6 international condensed locations were chosen as study sites. Three additional non-military locations, based on comparative attributes, were identified as control sites. Geo-tagged tweets, from November 2011 to June 2015, were purchased within a 25-mile radius of the centroid for each of the 31 identified locations of interest.

Descriptive summary statistics for each location, time series analyses, and correlation studies of ICD-9 codes and laboratory data against regional CDC ILI-NET and city-level Google Flu Trends were conducted. Social media analytics on military and non-military tweets identified differences in Twitter discourse between the 2 cohorts, including common language, sentiment and health-related topics (Table 1).

Conclusions

Twitter flu-related discourse from military members and electronic medical data will be incorporated into a robust outbreak detection model. This model will continually ingest new health and social media data to nowcast and forecast influenza activity on military bases. A user-friendly application will provide military analysts with tools required to allocate resources efficiently and effectively.

Table 1. Differences in Twitter health-related terminology between military and non-military populations.

Category	Mean (Military)	Mean (Control)	T-statistic	P-value
Self-related heath experience	0.0037	0.0031	3.907	9.74E-05
ILI-specific symptoms	0.0008	0.0008	0.261	7.94E-01
Disease names and terms	0.0012	0.0012	0.668	5.04E-01
Entities	0.0012	0.0012	0.559	5.77E-01
Parts of body and related	0.0003	0.0003	-1.216	2.24E-01
Non-ILI specific symptoms	0.0006	0.0006	-0.382	7.01E-01

Keywords

social media; Influenza-like illness; ICD9; HL7; military

Acknowledgments

This work was funded by DoD Defense Threat Reduction Agency.

References

1. Sueker J, et al. 2010. Influenza and respiratory disease surveillance: the US military's global laboratory-based network. Influenza and Other Respiratory Viruses.
2. Assessment of ESSENCE performance for influenza-like illness surveillance after an influenza outbreak—U.S. Air Force Academy, Colorado, 2009. MMWR Morb Mortal Wkly Rep, 2011. 60(13): 406-9.
3. Fairchild GC. 2014. Improving disease surveillance: sentinel surveillance network design and novel uses of Wikipedia, in University of Iowa: Iowa Research Online.

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