

Situational Awareness for Unfolding Gastrointestinal Outbreaks Using Historical Data

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Objective

The objectives of this project are to identify properties that influence the progression of an outbreak, evaluate the ability of a property-based algorithm to differentiate between military and civilian outbreaks and different pathogens, and develop a decision support tool to enhance situational awareness during an unfolding outbreak.

Introduction

The CDC defines a foodborne outbreak as two or more people getting the same illness from the same contaminated food or drink. These illnesses are often characterized as gastroenteritis until the causative agent is identified (bacterial or viral). Due to the globally interconnected food distribution system, local foodborne disease outbreaks often have global impacts. Therefore, the rapid detection of a gastroenteritis outbreak is of utmost importance for effective control. Situational awareness is important for early warning or detection of a disease outbreak, and tools that provide such information facilitate mitigation actions by civil/military health professionals. We have developed the Surveillance Window app (SWAP), a web based tool that can be used to help understand an unfolding outbreak. The app matches user input information to a library of historical outbreak information and provides context. This presentation will describe our analysis of global civilian and military gastrointestinal outbreaks and the adaptation of the SWAP to enhance situational awareness in the event of such outbreaks.

Methods

We collected data on about 100 civilian and military outbreaks caused by five pathogens (*E. coli*, *Salmonella spp.*, *Campylobacter jejuni*, *Shigella spp.* and Norovirus). Outbreak history (causative agent, location, time of year, environmental conditions, population at risk), time series, and methods of detection were compiled. By comparing civilian and military outbreaks and performing cross pathogen analysis, we identified properties that would distinguish between different types of outbreaks that could be used in an algorithm applied in the SWAP. Analyses were performed to understand the influence of identified properties on cumulative case numbers and duration of an outbreak.

Results

We identified five properties with a potential to distinguish between the different outbreak types. These properties are cumulative case count, time information, product or site/event (e.g. salad or wedding), source of contamination (e.g. cooked food, uncooked food, live animals), and season. Using these properties, we compared outbreaks occurring in civilian and military populations (Table 1). Similarly, these properties were used to differentiate between outbreaks caused by different pathogens. Figure 1 shows the outbreak trends for cumulative case count, duration, and time to peak for different pathogens. The epidemiological and biological reasons for these differences are discussed in the presentation. The SWAP based evaluation of outbreaks is ongoing. Initial analyses showed that when data for military outbreaks were used as input, more than 50% of the top matches were other military outbreaks. We are currently working on SWAP based analyses for identification of the pathogen.

Conclusions

The SWAP is a free web based tool that facilitates understanding of an unfolding outbreak in the context of a similar historical epidemic. Our research indicates that this tool may be used in identifying probable causes and pathogens associated with a gastrointestinal outbreak. An early and accurate identification of cause will aid public health officials during the surveillance of the outbreak and in developing appropriate control measures.

Table 1: A comparison of military and civilian outbreak properties

Characteristic	Civilian	Military	Proposed cause
Cumulative case count and duration of an outbreak	Varies based on pathogen	Smaller than civilian outbreaks and similar across pathogens	Exposed population (population at risk) is small and homogeneous
Time to peak	Varies based on pathogen	Military outbreaks peak within 1-2 weeks	A closely knit population
Source of contamination	Nine possible sources for contamination	Contaminated cooked food causes majority of military outbreaks	Military installations provide most of the food for the soldiers
Season	Most cases occur in summer	Most military outbreaks occur in autumn	New recruits

Cross pathogen analyses - Mean

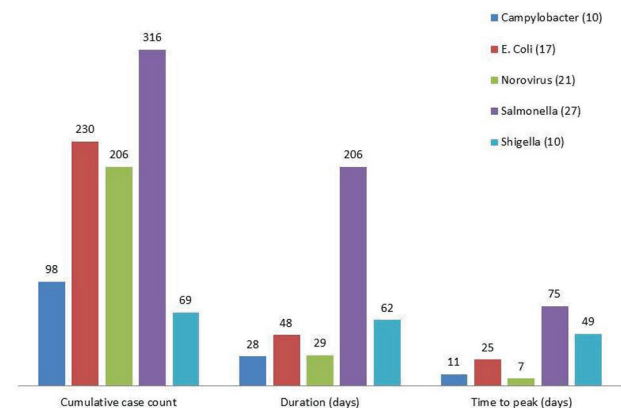


Figure 1: Cross pathogen comparison for selected gastrointestinal outbreak pathogens. The figure shows cumulative case counts, duration and time to peak for outbreaks differ based on the pathogen.

Keywords

Surveillance window app (SWAP); food borne outbreaks; decision support tools; situational awareness and surveillance; gastroenteritis

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References

<http://swap.lanl.gov>

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