Application of event-based biosurveillance to the 2011 *E. coli* outbreak in Germany

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Objective

To demonstrate how event-based biosurveillance, using direct and indirect indications and warning (I&W) of disease, provides early warning and situational awareness of the emergence of infectious diseases that have the potential to cause social disruption and negatively impact public health infrastructure, trade, and the economy (1). Specifically, tracking of I&W during the 2011 enterohemorrhagic *Escherichia coli* (EHEC) O104:H4 outbreak in Germany and Europe was selected to illustrate this methodology.

Introduction

Argus is an event-based, multilingual surveillance system, which captures and analyzes information from publicly available Internet media. Argus produces reports that summarize and contextualize I&W of emerging threats and makes these reports available to the system's users (1). The significance of the EHEC outbreak analyzed here lies primarily in the fact that it raised epidemiological questions and public health infrastructure concerns that have yet to be resolved, and required the development of new resources for detecting and responding to newly emerging epidemics (2).

Methods

Argus reports meeting the following inclusion criteria were reviewed: (1) entities: *E. coli* and food/crop contamination, (2) location: Germany and the European Union (EU), (3) time period: May–July 2011. The reports were reviewed for relevant I&W with the primary goal of identifying factors that inhibited effective control of the outbreak and resulted in public health infrastructure strain. Geospatial visualizations of the Argus outbreak reports were created as the event unfolded.

Results

On May 23, a surge in EHEC infections was reported at hospitals mainly in northern Germany; the outbreak was unusual in that it caused atypically severe symptoms in adult females. By May 26, state health authorities had identified over 600 EHEC cases, including 214 severe cases with hemolytic uremic syndrome (HUS), and confirmed the causative agent as a highly virulent HUS-associated EHEC 41 strain belonging to serotype O104:H4. Faced with a rapidly growing number of cases, health authorities notified the EU of a potential public health emergency of international concern and implemented new surveillance systems (2). Media reports suggested that the public health infrastructure was strained to a breaking point, as hospitals in northern Germany issued appeals for blood donations and transferred cases to hospitals in neighboring states. These problems were compounded by the lack of an effective HUS treatment, causing health officials to resort to an emergency experimental treatment instead. As the outbreak continued to spread, up to 130 cases primarily associated with travel were detected in 13 other European countries (3). The EU

responded by implementing a new case definition twice over the course of 1 month, to allow for effective surveillance and treatment of cases (3, 4). By June 29, an investigation launched by the European Food Safety Agency (EFSA) had determined that contaminated fenugreek seeds imported from Egypt were the most probable source of the outbreak (3, 5). Previous efforts to locate the source of infection had failed, resulting in strained trade relations and major economic losses among EU member states (3). On July 26, Germany's Robert Koch Institute (RKI) declared the outbreak over and reported a cumulative total of 4321 EHEC cases, including 852 HUS cases and 52 fatalities (6).

Conclusions

This study highlights the challenges faced in providing a timely response to a rapidly spreading infectious disease outbreak and the role that event-based biosurveillance can play in quickly identifying areas for public health intervention. Argus reporting identified that the EHEC outbreak fundamentally challenged the public health system in Germany, by exposing deficiencies in infectious disease surveillance. More importantly, it evidenced that even a strong public health system must be able to adapt rapidly to challenges posed by the changing epidemiology of infectious diseases (2). To that end, an interdisciplinary approach to event-based biosurveillance that allows for the timely detection of outbreaks and astute analysis of pertinent I&W is of paramount importance.

Keywords

Event-based biosurveillance; infectious disease; social disruption; *E. coli* O104:H4; food contamination

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