

Event-based surveillance and response to food- and water-borne disease outbreaks in the European Union

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VALORISATION

Political relevance

The first record of international health cooperation between countries that are now part of the EU can be traced-back to the middle of the ninetieth century. Prompted by the cholera threat, the first International Sanitary Conference took place in Paris in July 1851 and aimed at the establishment of harmonized maritime quarantine requirements. Following the Second World War, WHO was created to reinforce international cooperation on health matters. At the EU level, it is in 1998 that the European Parliament and the European Council approved the decision to set up a European network for epidemiological surveillance and control, the EWRS. The emergence of the severe acute respiratory syndrome (SARS) coronavirus in 2003 and the threat it posed to the EU highlighted the need to reinforce the coordination of EU public health authorities' activities towards common threats. Subsequently, in 2005 ECDC was created with the mandate "to identify, assess and communicate current and emerging threats to human health from communicable diseases". As demonstrated in this thesis, both ECDC and WHO have been playing key roles in the detection of the international aspect of major food- and water-borne disease outbreaks and events and in the coordination of the response. Multi-sectorial collaboration at national but also EU level was shown to be crucial. The review of the event-based surveillance and outbreak response presented in this thesis is important in terms of EU politics as it could in theory influence EU strategy for public health and food safety.

Societal and economical relevance

In 2014, about 386 000 cases of food- or water-borne infections were reported in the EU. The number of outbreaks for 2014 has not yet been published by EFSA but following data from previous years, it is expected that the number of outbreaks in 2014 would be above 5000. In 2013, there were 5 196 outbreaks of food- or water-borne infections in the EU. These outbreaks accounted for 40 726 human cases among which 5 935 were hospitalized and 10 had a fatal outcome. Aside from the most common gastro-intestinal discomfort, long term health outcomes may occur (e.g. neuromuscular paralysis, kidney diseases).

In parallel, food-borne infections and outbreaks often create direct repercussion on the food industry. The outbreak of shiga-toxin-producing *Escherichia coli* (STEC) O104:H4 that started in Germany in May 2011 and led to the well-known "Spanish cucumber" scandal caused an estimated loss for EU farmers in the fruit and vegetable sector of at least EUR 812 million.

The main focus of this thesis is to identify opportunities to strengthen event-based surveillance and outbreak response at the EU level in order to timely detected multi-country outbreaks of FWD and to rapidly respond to such outbreaks while ensuring an overall coordination of the response between affected Member States. Through the identification of avenues to strengthen outbreak detection and response mechanisms, this thesis aims at minimizing both the societal impact and the economical cost of food-and water-borne infections and outbreaks in the EU.

In addition, this thesis aims at facilitating the work of EU public health and food and veterinary institutions by addressing the challenges of inter-sectorial collaboration,

highlighting the limitations of the systems they have put in place and describing new epidemiological and microbiological methods for outbreak detection and investigation they should consider for future updates of their systems. By optimizing event-based surveillance and outbreak response at the EU level, one can combine resources and avoid duplication of efforts, which ultimately save EU tax payers' money.

Target groups

This thesis primarily targets EU institutions and national authorities in EU Member States working in the fields of public health and food safety and veterinary health. This group includes ECDC, EFSA, DG SANTE C and DG SANTE G, ministries of health, ministries of agricultures, public health institutes and food safety and veterinary health institutes. This thesis presents some clear recommendations to address the current challenges faced by EU institutions and national authorities in terms of event-based surveillance and outbreak response.

This thesis also targets Members of the Parliament and Members of the Council of the EU as they have legislative and budgetary authority at the EU level and could therefore influence the activities of the EU institutions.

More broadly, this thesis could be of interest to anybody interested in learning how EU institutions working on public health and food safety and veterinary health matters are leading and coordinating event-based surveillance and outbreak response at EU level. This group may include not only national or regional authorities from non-EU Member States working on public health and food safety and veterinary health matters, but also universities (researchers and students), food industries and press/media.

FWD outbreaks could be the results of accidental contamination or deliberate contamination for economical purposes or bioterrorism. Therefore this thesis could also be of interest to EU or national Intelligence Services who would like to know how is organized event-based surveillance and response to multi-country FWD outbreaks.

Next steps...

Additional studies could be designed to strengthen event-based surveillance for FWD and outbreak response. For instance, this thesis identified the need to further integrate ECDC tools for indicator-based surveillance and event-based surveillance, TESSy and EPIS-FWD respectively. A comparative study on retrospective salmonellosis data collected through TESSy and EPIS-FWD has just been initiated. Algorithms for the detection of salmonellosis outbreak signals based on serotype information have been developed and applied to 2008-2015 data collected through TESSy. The signals detected will be compared to the events reported in EPIS-FWD. The results remain to be analyzed and will be made public. Considering the delay in reporting case-based data to TESSy (quarterly reporting), signal detection in the prospect to detect ongoing multi-country outbreak has so far been limited. Therefore, ECDC, together with EU Member States, is currently revising the reporting protocol to increase the frequency of the reports of serotype information. Ultimately, ECDC aims at using serotype information collected through TESSy to detect potential multi-country outbreaks that are not detected or not reported by Member States to EPIS-FWD. Serotype

information would however be of limited use for detection of outbreak of very common serotypes such as Typhimurium and Enteritidis. In such cases, further characterization would be required.

To facilitate the response to FWD multi-country outbreaks, ECDC initiated a new project on outbreak investigation questionnaires. The aims of this project is to develop a pool of questions for descriptive and analytic studies that would be already translated in different languages and could be easily used to rapidly build questionnaires in multiple languages. Though a system of coding of questions, results from several countries could be analyzed at a central level which should facilitate the interpretation of the results. The creation of the pool of questions started in May 2016 and the first set of translations should be made public early 2017.

The results presented in this thesis may be used by ECDC in the context of the ongoing revision of its surveillance systems. ECDC aims at strengthening its data collection process and facilitating the joint analysis of the indicator- and event-based surveillance data. The strengths and weaknesses of FWD surveillance and outbreak response tools highlighted in this thesis will be considered while defining future systems requirements.

Innovation and challenges

While investigating the outbreaks presented in this thesis, I perceived that there were many misunderstandings and confusions about the roles and responsibilities of the different EU stakeholders and the systems in place for outbreak detection and response. This reflects the absence of such review in the past and the innovative aspect of this thesis, not on the methodological level but rather on the topic and the EU level angle. The mapping of the stakeholders and tools presented in this thesis would be very valuable to clarify to a large audience how event-based surveillance and outbreak response at the EU level is organized. Potentially, to reach as many experts as possible, the publication of a synthesis of this thesis in a peer-reviewed journal targeting public health experts and food safety and veterinary health experts could be considered.

To strengthen event-based surveillance and outbreak response, ten recommendations were proposed. Considering that changes at the EU level take time, it is unlikely that those recommendations would be implemented in the immediate future. Those changes will require willingness from all the stakeholders but also empowerment from the strategic leaders at the EU level. Additionally, to implement these recommendations, some financial and human resources will be necessary.