Preventive Veterinary Medicine xxx (2015) xxx–xxx

Contents lists available at ScienceDirect

Preventive Veterinary Medicine

journal homepage: www.elsevier.com/locate/prevetmed

The value of information: Current challenges in surveillance implementation

Katharina D.C. Stärk[a,b,*], Barbara Häsler[a]

[a] Royal Veterinary College, London, UK
[b] Safe Food Solutions (SAFOSO) Inc., Bern-Liebefeld, Switzerland

ARTICLE INFO

Article history:
Received 30 January 2015
Received in revised form 24 April 2015
Accepted 11 May 2015

Keywords:
Surveillance
Economics
Disease control

ABSTRACT

Animal health surveillance is a complex activity that involves multiple stakeholders and provides decision support across sectors. Despite progress in the design of surveillance systems, some technical challenges remain, specifically for emerging hazards. Surveillance can also be impacted by political interests and costly consequences of case reporting, particularly in relation to international trade. Constraints on surveillance can therefore be of technical, economic and political nature. From an economic perspective, both surveillance and intervention are resource-using activities that are part of a mitigation strategy. Surveillance provides information for intervention decisions and thereby helps to offset negative effects of animal disease and to reduce the decision uncertainty associated with choices on disease control. It thus creates monetary and non-monetary benefits, both of which may be challenging to quantify. The technical relationships between surveillance, intervention and loss avoidance have not been established for most hazards despite being important consideration for investment decisions. Therefore, surveillance cannot just be maximised to minimise intervention costs. Economic appraisals of surveillance need to be done on a case by case basis for any hazard considering both surveillance and intervention performance, the losses avoided and the values attached to them. This can be achieved by using an evaluation approach which provides a systematic investigation of the worth or merit of surveillance activities. Evaluation is driven by a specific evaluation question which for surveillance systems commonly considers effectiveness, efficiency, implementation and/or compliance issues. More work is needed to provide guidance on the appropriate selection of evaluation attributes and general good practice in surveillance evaluation. Due to technical challenges, economic constraints and variable levels of capacity, the implementation of surveillance systems remains variable. Political and legal issues are also influential. A particular challenge exists during outbreaks when surveillance needs to be conducted under emergency conditions. Decision support systems can help make epidemiologically and economically sound choices amongst surveillance options. However, contingency planning is advisable so that pre-defined options allow for rapid decision making.

1. Introduction

Surveillance has been defined as "the ongoing collection, validation, analysis and interpretation of health and disease data that are needed to inform key stakeholders in order to permit them to take action by planning and implementing more effective, evidence-based public health policies and strategies relevant to the prevention and control of disease or disease outbreaks" (ECDC, 2007). Although this definition was established for surveillance in the context of public health, it is largely transferable to veterinary contexts. The information of stakeholders – often referred to as dissemination – is an essential component of surveillance as it assures that the purpose of collecting surveillance data is to inform decisions. If the last step is missing, the value of surveillance information is likely to remain limited.

The past decade has shown considerable progress in the design, implementation and evaluation of surveillance systems including economic evaluation, but several challenges remain related to economic constraints, technical aspects, political requirements, and multiple stakeholder interests, which may influence the acceptance and quality of surveillance. In this article, we aim to provide an overview of current challenges in surveillance planning and implementation and to propose ways to address them.

* Corresponding author. Tel.: +41 31 544 25 03.
E-mail address: kstaerk@rvc.ac.uk (K.D.C. Stärk).

http://dx.doi.org/10.1016/j.prevetmed.2015.05.002
0167-5877/

2. State-of-the art in surveillance

In animal health, surveillance is applied to a large number of applications. This section presents an overview of the state-of-art in animal health, zoonotic disease and food safety surveillance pointing out gaps and areas for improvement.

As part of a European-wide research project, reviews of surveillance activities with different objectives are being conducted. These include surveillance for emerging diseases (Rodriguez-Prieto et al., 2014), surveillance for endemic diseases and surveillance for disease freedom. Surveillance provides decision support across sectors, including government, private industry and individual veterinary practices and their clients. Surveillance standards for selected hazards are set at both international and national level, most importantly by the World Organisation for Animal Health (OIE) and published in the Terrestrial Animal Health Code. Such standards are also relevant for international trade decisions and thus have economic impact.

Some technical challenges in the design of surveillance systems remain. Over the last years, risk-based surveillance has become popular and progress in its development has been made (Stärk et al., 2006; Cameron, 2012). For some hazards, however, considerable design issues remain. Most notably, the surveillance for antimicrobial resistance continues to challenge surveillance system design at multiple levels. First, it is not clear what the unit of analysis should be. We could focus on certain phenotypes of pathogens which exhibit defined resistance patterns against specific antimicrobials. However, some genetic elements are mobile and can be exchanged between bacteria of different species. Thus, EFSA suggests that the focus should rather be at the gene level (EFSA, 2011). Due to the almost unlimited number of combinations between host species, bacteria species and antimicrobial substances, priority setting is a paramount need. Some attempts have been made, but are quickly outdated also due to the rapid progress in diagnostic possibilities. Next generation sequencing is now much more widely available and may well become the tool of choice in the near future. However, statistical tools, sampling frameworks and surveillance designs have yet to adapt to this new situation. And until international standards will integrate these new methods, even more time – possibly years – will be needed.

The emergence of Schmallenberg virus in the European Union in 2011 (Afonso et al., 2014) is a good example to illustrate both strengths and limitations of surveillance systems at present (Roberts et al., 2014). The first signal of the outbreak came from performance recordings on dairy farms. This could be seen as a successful application of syndromic surveillance, a relatively recent approach to surveillance where unspecific signals such as performance, body temperature, abortion rates or mortality are used to trigger investigations at an early stage of an outbreak (Vial and Berezowski, 2014). In the case of this incident, a previously unknown virus was isolated as part of the investigations and disease control measures were taken based on a tentative case definition. Using a metagenomics approach, a novel viral agent was identified (Beer et al., 2013). Emergency risk assessments were conducted with emphasis on both animal and public health. The development of diagnostic procedures was very rapid with only three months until validation and commercialisation; mass-screening kits were available within five months. The development of a legal status for Schmallenberg, however, took longer and remained variable across Europe. While some countries made it notifiable, others did not. It was highlighted that disease control policy should be such that early reporting of unusual cases is not penalised (Anonymous, 2012; Beer et al., 2013).

The Schmallenberg example also illustrates the close links between surveillance and disease control as described by Häsler et al. (2011). The purpose of surveillance is to provide information for evidence-based disease control decisions. The value of surveillance information remains therefore limited, if it is not considered in a disease management context. Interventions can of course have very different features and range from extremes such as eliminating animals on affected farms to very minor measures such as information of farmers to heighten awareness or improve biosecurity. The decision can of course also be not to initiate any measures, or not yet. As animal health decisions are taken by different stakeholders, in different contexts and for different reasons, the decision making process is generally complex and influenced by many factors. Ideally, most relevance would be attributed to factual information on disease occurrence as produced by surveillance activities and the quality, feasibility, economics and acceptance of disease management options.

With regards to international trade, if surveillance data demonstrated a favourable health situation, and if the surveillance was conducted according to international standards or even more demanding requirements, animals and animal-derived products should be accepted by all markets. Unfortunately, this is not always how it works out. Other factors such as consumer concerns or protection of the domestic industry are a political reality. In principle, all countries being member of the World Trade Organisation (WTO) are subscribing to the principle of free trade. To protect the health of animals, plants and people, the Sanitary and Phytosanitary (SPS) Agreement (WTO, 1995) allows for trade restriction measures to be taken albeit only for a limited period or if based on a formal risk assessment. A dispute settlement process is in place to address disagreements on trade restrictions. This system is now well established, and although it appears to be generally working, economic and political factors do remain active and influential in trade decisions. However, not all countries are member of the WTO; it currently has 160 members including all the major trade partners (www.wto.org).

Constraints on surveillance can therefore be of technical, economic and political nature. Consider two countries, one with a very effective surveillance in place which duly reports outbreaks at an early stage, and another, with limited surveillance and therefore less ability to detect outbreaks. In the latter, some diseases may go undetected for a long time while trade still continues. This can have wide reaching consequences in the long run, if losses are higher than if control started earlier. However, short-term economic interests, fear of loss of reputation and other factors may still provide incentives for non-reporting. This is also true at the farm level where reporting decisions may be influenced by compensation as well as the fear of discrimination and stigmatisation.

3. Economics of surveillance

In economic terms, animal production systems exist to provide goods or services to people in society, such animal source foods, wool, and leather, animals kept as companions, used for sport, work, or research. However, animal disease reduces the economic benefit people gain from animals, poses a threat to human health because of foodborne and zoonotic diseases and uses resources that in the absence of disease could be allocated to alternative purposes and therefore have an opportunity cost. The economic cost of animal disease is of growing concern given increasing international trade, changes in production practices fuelled by changes in lifestyle across the world, and changing environmental condition. This section discusses the various benefits that can accrue from surveillance as an important element in disease management and outlines conceptual approaches to determine the value of surveillance.

Both surveillance and intervention are resource-using activities that are part of a mitigation strategy. Surveillance provides

Please cite this article in press as: Stärk, K.D.C., Häsler, B., The value of information: Current challenges in surveillance implementation. PREVET (2015), http://dx.doi.org/10.1016/j.prevetmed.2015.05.002