

Integrating qualitative and quantitative data to enhance scanning surveillance: experiences from Great Britain

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Abstract

Scanning surveillance in Great Britain, for novel diseases or pathogens particularly, has traditionally relied primarily on information derived from carcase and sample submissions to government animal health diagnostic laboratories. Recently, however, a restructured model has been implemented to reduce the number of government laboratories, involve other providers of diagnostic services such as universities in the network and to make more use of intelligence and data capture from other sources such as private veterinarians, abattoirs and private laboratories.

The Surveillance Intelligence Unit was set up within the UK Government Animal and Plant Health Agency to co-ordinate the timely detection and investigation of new and/or re-emerging animal health threats. While surveillance information from the restructured laboratory network still has a key role in the new model, there is an additional focus on collecting surveillance data from others in the livestock industry, and bringing qualitative information and quantitative data sources together to create new forms of intelligence to enhance that derived from veterinary diagnostic investigation. Qualitative data is sourced from the contact networks of government veterinarians in geographically distributed Veterinary Investigation Centres and through six ‘Species Expert Groups’ (SEGs): virtual networks of engagement with a variety of experts and stakeholders within and external to Government including representatives from veterinary practice, universities, the livestock industry and providers of private diagnostic services. The SEGs act as initial interpreters of surveillance intelligence, using both quantitative and qualitative sources to provide a focus for collaborative surveillance intelligence gathering, analysis and dissemination in the main livestock species and wildlife.

Keywords: *Animal health surveillance, early warning*

Introduction

Early warning or scanning surveillance is defined as ‘Surveillance of health indicators and diseases in defined populations to increase the likelihood of timely detection of undefined (new) or unexpected (exotic or re-emerging) threats (1). In Great Britain, the Animal and Plant Health Agency (APHA) carries out a broad range of veterinary scanning surveillance activities in livestock and wildlife to safeguard animal and plant health for the benefit of people, the environment and the economy.

Specifically, the Surveillance Intelligence Unit (SIU), a team within APHA, analyses information from scanning surveillance to provide information and intelligence on animal health and welfare to enable farmers, the veterinary profession and Government to:

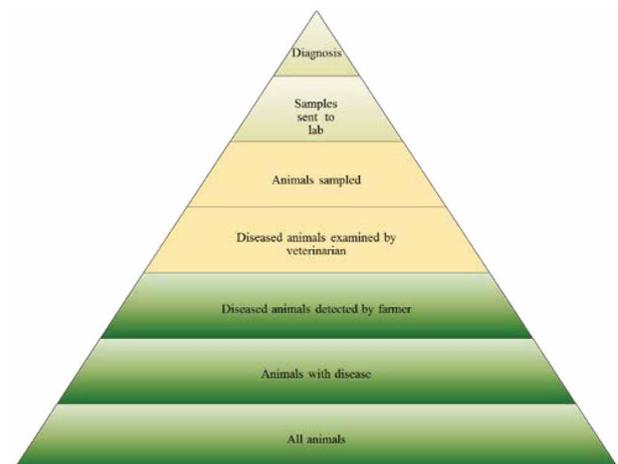
- (a) Identify and characterise new and re-emerging animal related threats so that prompt action can be taken to reduce their impact.
- (b) Take decisions that can improve animal health, welfare and productivity.

New and re-emerging threats include novel diseases or pathogens such as BSE or Schmallenberg; exotic diseases such as Foot and Mouth disease or Bluetongue; new strains of an infection already present in the country; new, rare or unusual antimicrobial resistance patterns; disease or infection in animals with a human health concern, e.g. zoonoses and toxicities; and changes in endemic disease patterns or in livestock demographics or production systems that present an increased risk for animal or public health.

Materials and methods

Surveillance, for novel diseases or pathogens particularly, has traditionally relied primarily on information derived from carcase and sample submissions to government animal health diagnostic laboratories, i.e. from the top of the ‘surveillance pyramid’ (Figure 1).

Figure 1. The surveillance pyramid.



However, following a number of reviews of scanning surveillance, including by the independent Surveillance Advisory Group (2), a restructured model has been implemented to reduce the network of APHA laboratory facilities and to involve other non-APHA providers of diagnostic services in the surveillance system value chain (3). One aim of the new surveillance delivery model was to improve the coverage and representativeness of the scanning surveillance system. An additional aim was to improve access to information from further down the 'surveillance pyramid' by developing surveillance intelligence gathering and exchange between Government, veterinarians in private practice, veterinary laboratories and the livestock industry (4).

Thus, while surveillance information from the laboratory network still has a key role in the new model, there is now an additional focus on collecting surveillance data from others to bring a variety of quantitative data sources and qualitative information together to create new forms of intelligence to enhance the data derived from veterinary diagnostic investigation. Qualitative data is sourced from the contact networks that exist between Veterinary Investigation Officers (VIOs) in APHA Veterinary Investigation Centres (VICs) and private veterinary practitioners, as well as through the veterinarians in SIU who lead six individual 'Species Expert Groups' (SEGs): virtual networks of engagement with a variety of experts and stakeholders within and external to APHA, including industry and academia. These groups focus on cattle, small ruminants, pigs, avian, wildlife and miscellaneous (e.g. deer, alpaca, llama) species acting as initial interpreters of surveillance data, both quantitative and qualitative. They are a focus for collaborative surveillance intelligence gathering and dissemination in the main livestock species and wildlife, operating as hubs for detecting, investigating, characterising and managing potential emerging threats. The SEGs are supported in sourcing, collating, integrating, analysing and presenting surveillance intelligence by a small Surveillance Epidemiology and Data Analysis team working in collaboration with mathematical modellers, biostatisticians, epidemiologists, GIS analysts and IT providers.

Quantitative data is derived from submissions to the diagnostic service provided by APHA Veterinary Investigation Centres and the five private contractors of post-mortem examinations, and is captured by the Veterinary Investigations Diagnostic Analysis (VIDA) database (5). VIDA comprises diagnoses coded to robust, harmonised case definitions as well as systematic classification of Diagnosis Not Reached (DNR) cases. The data are subject to routine analyses describing spatio-temporal trends, frequency and patterns of diagnoses and syndromes. Statistical aberration detection methods are applied to DNR case data by presenting syndrome, to identify any increase in submissions in which a diagnosis has not been reached that may indicate presence of a new animal health threat. Additional data, such as on livestock demographics (including animal populations, movements

and imports/exports), statutory notifications including bovine abortions and suspect cases of exotic disease, field welfare visits and livestock mortality are gradually being incorporated into routine scanning surveillance analyses and work is under way to explore capturing animal health data from other sources such as private veterinarians, ante- and post-mortem data from abattoirs and submission data from private veterinary laboratories.

Emerging threats detected through scanning surveillance are reported to Defra's Veterinary Risk Group (6) and other routes of information dissemination include an internal fortnightly surveillance digest, monthly surveillance reports for the Veterinary Record (7), quarterly 'Emerging Threats' reports for government and industry summarising threats detected within GB as well as potential threats identified through the horizon-scanning activities of APHA's International Disease Monitoring team, information notes and disease alerts (including letters to the Veterinary Record), national and international conference presentations and posters, training and CPD meetings and scientific articles in peer-reviewed publications.

The importance of veterinary diagnostic investigation in surveillance for new and (re)-emerging threats is highlighted by the finding that, in 2015, of 61 threats identified in GB 41 (67%) were detected by diagnostic submissions to APHA VICs or one of the non-APHA post-mortem providers.

Sharing surveillance intelligence in a more timely and accessible way with the livestock industry is a route to not only improving dissemination of information and encouraging action, but also to engagement with scanning surveillance by veterinarians and the livestock industry. The Defra 'Open Data' strategy, which encourages sharing of data collected by government, has paved the way for sharing data from the VIDA database. A web-based platform to present visualisations of disease patterns and trends using APHA data is under development. This initiative will allow data from the diagnostic service to be shared with those who contribute to the data and thus improve engagement between private veterinary practitioners, farmers and APHA. An interactive dashboard including options for data selection, by the user, of animal health diagnoses by geographical area, syndrome, time period and age group is proposed. Initial user feedback to the proposal has been positive, with interest generated among some veterinarians in contributing their own data on clinical and post-mortem diagnoses to supplement the diagnostic data collected by APHA.

A more comprehensive project is planned to develop a 'Surveillance Club' of members including private veterinarians, academia and various sectors of the livestock industry. Members would contribute data, both qualitative and quantitative, and in return have access to the data provided by others in the form of descriptive and statistical analyses and spatial and temporal data visualisations. Researchers would have access to the raw data and could

thus be directly involved in developing new techniques and analytical/modelling approaches to enhance the value of the diverse data that would be available.

Discussion

The GB scanning surveillance approach explicitly recognises the key contribution of qualitative data to the detection of new and re-emerging animal health threats. A view of the animal health surveillance landscape is developed through integration of qualitative with a variety of quantitative animal health and livestock demographic indicator data to enhance the intelligence derived from traditional veterinary diagnostic investigation. The Surveillance Intelligence Unit, comprising the veterinary leaders of the six Species Expert Groups with networks across government, industry, wildlife groups and academia, together with the Surveillance Epidemiology and Data Analysis team and supported by a Surveillance Network Management team, are at the heart of this intelligence gathering, interpretation and dissemination.

The network is under continuous development to include new streams of quantitative and qualitative data to enhance the coverage, representativeness and timeliness of surveillance for new and re-emerging animal health threats in Great Britain.

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