

Transforming a wildlife disease surveillance program into a new health intelligence system

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Abstract

The changing interface between people, domestic animals and wildlife challenges our ability to monitor health across these different populations. In order to meet these challenges, a health intelligence system that combines traditional health surveillance approaches (e.g. collection of data about incidents of disease and hazard discovery) with information about social and environmental conditions is needed. For wildlife, the Canadian Wildlife Health Cooperative (CWHC) is adapting its core activities and focus to provide a framework that supports a new wildlife health intelligence system that is better able to inform public, livestock and wildlife health threat detection, risk assessment and risk communication. To make the transition to a health intelligence system, the CWHC has identified three areas for improvement: (i) better data management and interoperability of wildlife health information, (ii) incorporation of non-traditional information sources to complement existing surveillance data, and (iii) improved use of new tools and approaches to analyse data and communicate findings to a wide range of decision makers. This paper presents tangible examples under each of these thematic areas of how the CWHC is making the switch to a wildlife health intelligence approach.

Keywords: *wildlife, health, surveillance, intelligence*

Introduction

With unprecedented changes in the environment due to climate change, urbanisation and expansion of livestock farming, people, domestic animals and wildlife are coming into closer contact as they compete for resources. This increased contact presents growing opportunities for disease transmission and the emergence of new infectious diseases. Beyond infectious disease, environmental pollution, habitat loss and increased competition for resources can increase exposure to non-infectious disease agents such as toxins and also lead to higher stress levels. All of these changes have the ability to negatively impact the health of humans and animals making them less able to adapt to their changing environments and more susceptible to disease agents.

The changing interface between people, domestic animals and wildlife presents new risks and challenges our ability to monitor health across these different populations, to provide early warning and to identify appropriate interventions. One important part of meeting this challenge is to invest in and

improve current wildlife health monitoring and surveillance programs. The Global Early Warning System for Emerging Diseases (1) stated that “obtaining information about wildlife events and integrating them into them into the GLEWS regular activities is the first step towards better disease intelligence and risk assessment at the animal/human/ecosystem interface that will improve early warning and support response when relevant.”

In Canada, the Canadian Wildlife Health Cooperative (CWHC) is a leading voice for wildlife health. The CWHC monitors for changes in wildlife health by supporting the diagnostic needs of a national surveillance program and also by providing infrastructure that supports targeted surveys and provides research and analytic capabilities to help interpret and act on the information (signals) that is generated. At its core, the CWHC is a network of highly qualified people, partners and collaborators dedicated to generating the knowledge needed to assess and manage wildlife health and ensuring that knowledge is used in a timely fashion.

Because of growing recognition of the need for, and value of, wildlife health information, the CWHC is actively transitioning into a health intelligence system. A wildlife health intelligence system combines traditional wildlife health surveillance approaches (e.g. collection of data on incidents of disease) with information about social and environmental conditions (2) that can affect risk perception and the likelihood of human or domestic animal exposure. Most traditional wildlife disease surveillance programs fail to provide quick and reliable signals about wildlife health because sick and dead wild animals can be hard to find and they can be even harder to transport for complete diagnostic evaluation. More and more we lack current population estimates that are critical to appropriate signal interpretation and, in the context of climate change, environmental and ecological baselines are dynamic and can impact wildlife in multifaceted and complex ways.

The CWHC has identified three areas for improvement that will support transition to a wildlife health intelligence system: (i) improved data management and interoperability of wildlife health information, (ii) identification and incorporation of non-traditional information sources to complement existing surveillance data, and (iii) improved use of new tools and approaches to analyse data and communicate findings to a

wide range of decision makers. In this paper we will provide tangible examples in each of these thematic areas, including successes to date, challenges and plans for the future.

Materials and methods

To illustrate the transition of the CWHC from a traditional surveillance program to a wildlife health intelligence system, we reviewed the CWHC websites, examined the data captured by the CWHC database, and examined internal CWHC reports and other documents, contracted reports and peer-reviewed literature. Additionally, we consulted with CWHC staff members about specific developments and initiatives that are advancing our ability to do health intelligence.

Health intelligence activities were identified and grouped under three main themes: (i) Improved data management and interoperability of wildlife health information, (ii) identification and incorporation of non-traditional information sources, and (iii) improved use of new tools and approaches to analyse data and communicate findings. Under each theme, 1-2 activities were selected and are presented as tangible examples of how the CWHC is making the transition to a wildlife health intelligence system.

Results

Improved data management and interoperability of wildlife health information: The CWHC database has gone through numerous changes since the first centralised database was developed in 2001. Ongoing evolution of the database is needed to continually increase efficiency, improve effectiveness and to advance functionality of the systems for a wide range of data users. To facilitate integration of data from external systems and to compare results from CWHC with other surveillance programs in Canada or in other countries, the CWHC is actively working with partners to develop case definitions for the common infectious diseases that are detected in Canadian wildlife. For example, White Nose Syndrome (WNS) is an emerging pathogen of North American bats caused by the fungus *Pseudogymnoascus destructans* that is threatening the conservation status of several bat species. To keep consensus standards for testing and interpretation of results from Canada and the US, case definitions are being developed for suspected and confirmed cases of WNS (3).

Ongoing and enhanced use of the data in the database has also lead to changes that have, and will, improve utility of the data. The CWHC is working to better standardise data entry (i.e. the same information is entered by all database users). Standardisation of data entry not only makes data entry easier, but it also facilitates data searches and extraction of select data. Better confidence in the data and access to it means that more robust and frequent analyses can be carried out, which helps in trend and pattern identification.

An ongoing challenge of the CWHC is that most diagnosticians also have their own research projects. Although these data are typically entered into the database

and so are accessible to others, the data are different from the routine surveillance cases. As such, these data need to be interpreted differently. The CWHC continues to make changes so that data ownership and intellectual property are protected. For example, in 2015, a label for “special project” was added to the database; researchers can select this option to ensure that these cases are flagged as being different from the routine diagnostic submissions that make of the bulk of submissions.

Identification and incorporation of non-traditional information sources

One of the biggest challenges in traditional wildlife disease surveillance is finding and accessing representative specimens from populations that are often located in remote areas. Historically, the CWHC has relied on a network of parks staff, wildlife biologists, conservation officers, wildlife rehabilitators, hunters, trappers and anyone else who may come into contact with wildlife to not only detect but also submit specimens for diagnostic work up. Incorporating reports of wildlife morbidity and mortality from the general public (citizen science) can help to fill in spatial and temporal gaps in traditional surveillance (4).

The CWHC Ontario/Nunavut Region in collaboration with the University of Guelph and Wilfrid Laurier University has developed a new web-based reporting tool (www.wildlifehealthtracker.ca). Through this tool, the CWHC aims to improve surveillance coverage through increased reporting and better coverage in remote areas. The tool is currently in the pilot phase and we predict that the data submitted will allow us to better identify situations that require rapid assessment and response and may also increase the number of specimens submitted for in depth analysis.

Improved use of new tools and approaches to analyse data and communicate findings

In 2015, the CWHC started producing quarterly reports that summarised findings from scanning surveillance activities and also provided information about other CWHC activities and important wildlife news updates. The development of the quarterly reports was an iterative process. The first report was developed by a small group of CWHC staff and research associates. This version (Version 1) was sent the CWHC Management Committee for feedback; the Management Committee is made up of the directors from each regional centre and the Chief Executive Officer, Chief Operating Officer and the Information Services Manager from the CWHC National Office. Based on the feedback, changes were made to the quarterly report and Version 2 was sent to CWHC stakeholders for feedback. The stakeholders included individuals from various Canadian federal government departments, the Canadian Wildlife Directors Committee, the Council of Chief Veterinary Officers, international wildlife health groups, Canadian integrated surveillance programs, and non-profit organisations working in wildlife health. The feedback received from stakeholders was incorporated into Version 3 of the quarterly report and then recirculated

to ensure that suggestions had been correctly incorporated. The final version of the report was completed in the fall of 2015 and has been used as the template for all 2016 reports to date. The quarterly report has been very well received and has been adapted by some of the CWHC regional centres to report out regional wildlife health data and news to local stakeholders. Example reports are available at: http://www.cwhc-rccsf.ca/quarterly_report.php.

The CWHC plays an important coordination role in targeted surveillance projects (e.g. avian influenza and West Nile virus). Many of these targeted surveillance programs are initiated because of human health concerns (the pathogens are zoonotic) or because they pose a threat to domestic livestock (e.g. Chronic Wasting Disease). There are important policy decisions that rely on the knowledge generated by these targeted programs and, as such, it is critical that the information generated be shared quickly and efficiently.

In 2014, Eurasian highly pathogenic avian influenza (HPAI) virus was introduced to North America (5). Detection of HPAI in wild birds and the resulting outbreak in domestic poultry forced a shift in the current understanding about these viruses (6). The changing situation meant that public health and agriculture departments needed fast access to new information about the virus and current surveillance findings. To respond to this demand, the CWHC developed an avian influenza portal in 2015 (http://www.cwhc-rccsf.ca/surveillance_data_aiv.php). The portal brings together tables and maps of current testing results from wild birds in Canada and provides links to relevant news articles and scientific papers. Essentially it acts as a one-stop shop for all things related to avian influenza.

Discussion

The mission of the CWHC is to promote and protect the health of wildlife and Canadians through leadership, partnership, investigation, and action. In this time of unprecedented social and environmental changes, there is a critical need to triangulate multiple clues and information sources so that more timely and useful signals are generated. The CWHC is leading development of a wildlife health intelligence system for Canada that is much more than a wildlife disease surveillance program.

A wildlife health intelligence platform supports strong data management, integration of new data sources and communication of findings to a wide range of stakeholders. Without this framework, the CWHC will continue to struggle with limited capacity for harmonisation across systems, reduced ability to assess the results of monitoring activities, and compromised ability to communicate findings effectively.

A wildlife health intelligence system can support public, livestock, wildlife health threat detection, risk assessment and risk communication by (i) detecting and tracking infectious and non-infectious hazards, (ii) helping to better understand how new or changing hazards may effect

different host species, and (iii) providing easy to understand information to decision makers. Healthy wildlife populations provide Canadians with income and contribute to their social wellbeing. Changes in wildlife health status can signal important environmental changes and new disease threats. Being able to quickly recognise, assess and communicate these changes, and their potential causes, will help Canada respond faster and more appropriately to these emerging threats. New intelligence will also help better predict when and where negative health impacts may occur in the future.

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