Prioritizing surveillance: A science-based approach

By National Surveillance Unit staff

The Veterinary Services (VS) Centers for Epidemiology and Animal Health (CEAH) National Surveillance Unit (NSU) is responsible for recommending priorities for animal health surveillance activities in the United States. Priorities are set by coordinating stakeholders' needs with scientific justification. A variety of approaches are currently used to prioritize surveillance; some are scientific and some political.

Many long-standing animal disease surveillance programs are considered priorities by Federal or State governments because of a historical promise to the livestock industry to eradicate a disease. Some of these programs are integral to maintaining the animal health infrastructure, and are maintained as priorities to prevent instability.

Federal and State governments have also established surveillance priorities in response to political pressures regarding trade issues and negotiations. These pressures include meeting notifiable disease requirements; addressing international trade concerns; and responding to perceptions of the voting public, such as perceived health risks.

The National Animal Health Surveillance System Steering Committee identifies and communicates surveillance priorities from constituent groups to the Federal government. These constituents include representatives from State and Federal agencies, industry, laboratories, academia, producer groups, and other national organizations. Additionally, animal health organizations such as the United States Animal Health Association empower their committees and members to recommend new disease surveillance programs or changes in existing programs.

Science-based methods

Pathways assessments and risk analyses are conducted to identify the risk of foreign animal diseases entering the United States and establishing an outbreak. These assessments are used to inform surveillance prioritization, planning, and modeling.

NSU has adapted a semi-quantitative methodology (a spreadsheet-based tool) from other international risk-assessment work to guide outside groups, particularly industry, in

determining the relative priority for surveillance in diseases of concern. The approach involves identifying potential diseases for which surveillance is a useful tool for management, defining the scope and population for each, and then scoring a number of factors related to consequences. This is followed by a second group of factors related to likelihood of exposure or prevalence of the disease. Algorithms score the diseases using logic that compares likelihood and consequence, which must both be present for consideration of the disease. The algorithm also assumes that if any one factor is extremely high, it will override other factors. The tool rates the priority of each disease for the expert-group to subsequently 'truth test' the outcome.

NSU has also developed an alternate, more quantitative approach that combines Bayes' theorem principles with Delphi expert opinion techniques. The resulting product includes a series of likelihood ratios that quantitatively rank the importance of qualitative risk factors for a disease, according to expert opinion. These ratios then help determine surveillance implementation priorities, as characterized by risk factors.

As NSU develops new surveillance plans, a benefit-cost component is included in each. This component requires estimation of surveillance system sensitivity, estimation of the value of surveillance, and the cost to implement and operate the surveillance system.

NSU uses a variety of methods to assess the sensitivity of a surveillance system and/or sensitivity of components within a surveillance system. This estimate, which uses both qualitative and quantitative data, allows NSU to define the ability of the system or a component within the system to detect disease at a specific prevalence within a specific timeframe. If the estimate finds that the sensitivity is low, for example, then this information demonstrates that the system or component's appropriate priority level is low due to its inability to accomplish the needs of surveillance.

The value of surveillance information is related to the cost of an outbreak minus the cost of a fully-implemented surveillance system. These values are not directly measurable except after the fact; however, advances in computer modeling methods provide several different approaches to sensitivity estimation, disease spread, and economic impacts through simulation modeling and/or data analysis. Projections of the value of surveillance and disease outbreak spread predictions are coupled with sensitivity

estimates to provide a more complete picture of the surveillance system's overall utility to inform the prioritization process.

A recently developed approach to prioritize funding for avian influenza surveillance involves a structured approach for assessing utility, either qualitatively or quantitatively. Each surveillance system has specific purposes and objectives. Five factors are used to assess the utility of the system to achieve each of its goals:

1. Probability of introduction (risk assessment);
2. Value of surveillance (impacts of outbreak minus impacts without surveillance);
3. Sensitivity estimation;
4. Cost of surveillance; and
5. Mitigation potential (feasibility of achieving success in an action to prevent or control the disease).

In addition, a multidisciplinary team at CEAH has developed a tool for providing science-based guidance to decisionmakers regarding animal health events. This multidisciplinary team combined its expertise in epidemiology, economics, and statistics to produce the Tool for the Assessment of Intervention Options (TAIO). TAIO provides a means for systematically and consistently evaluating information related to an animal health event. It also provides a means for documenting the information that was available and used at the time of an initial decision. TAIO is intended to be used on an iterative basis as an event unfolds. It allows users to revise information and document how these revisions may impact adjustments to earlier decisions. TAIO does not make decisions for decisionmakers; rather, the tool helps to better inform the science-based portions of a decision and assess the relative efficiencies of the use of scarce funding dollars.

Conclusion

These methods and tools are designed to help decisionmakers find a balance between policy-driven approaches and science to determine surveillance priorities. Although differing opinions will still drive many decisions about which diseases are of utmost surveillance priority, providing a scientific foundation will help streamline and guide the process.