Targeted surveillance methods developed

By Aaron Scott, National Surveillance Unit Director

Collaborators from the Veterinary Services (VS) Centers for Epidemiology and Animal Health (CEAH) National Surveillance Unit (NSU) and the University of Minnesota recently developed methodology to define the concept of targeted sampling, draw valid population inference from targeted sampling data, and evaluate the methodology's use in surveillance applications.

Targeting subpopulations of animals for sampling has long been used as a surveillance strategy to find diseases in a cost-effective manner. This strategy is generally based on expert opinion or subjective conclusions about the relative risk of disease in subpopulations and even individual animals in each group. Targeted surveillance assumes that specified high-risk subpopulations will have higher prevalence, which can be more readily detected during surveillance efforts compared to surveillance in the whole population where the overall disease prevalence is low. One commonly used type of targeted surveillance has been the visual observation of individual animals within herds that show specific clinical signs of disease. This form of targeted surveillance has proven critical for detecting and eradicating important diseases, such as foot–and–mouth disease, contagious pleuropneumonia, and others.

The Minnesota-NSU team adapted sampling theory using Monte Carlo simulation methods to determine target population sample size to detect disease with 95 percent confidence. The team used information from the epidemiologic parameters of relative risk and fraction of the population with the target factor, as well as design prevalence. Targeted surveillance is most appropriate for prevalence estimation when valid (representative and justifiable) estimates of these key epidemiologic parameters are available. The results showed that when uncertainty around epidemiologic parameters is present, modeling the input parameter distributions to reflect the uncertainty increases the sample size accordingly and permits detection of the disease with a known confidence.

The targeted sampling methods were then applied to three data sets. The first example randomly divided a set of scrapie surveillance data and derived input parameters from one half to estimate prevalence in the other half. The second and third examples (Johne's disease and *Neospora caninum* data) used increasingly uncertain inputs from historical and limited unrelated data. The targeted surveillance methods performed well, and as predicted, required larger sample sizes as the uncertainty about the relative risk of the target factor and the targeted sub-population increased. The studies concluded that targeted surveillance can be a cost-effective alternative to random sample designs, but only when there is adequate understanding of these inputs.

Three papers that provide a more detailed explanation of the targeted surveillance methodology have been submitted for publication in *Preventive Veterinary Medicine:* "Use of Epidemiologic Information in Targeted Surveillance for Population Inference;" "Population Inferences from Targeted Sampling with Uncertain Epidemiologic Information;" and "Poisson Sampling: A Sampling Strategy for Concurrently Establishing Freedom from Disease and Estimating Population Characteristics."

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