

Johne's Disease in the Maritime Districts of Canada: Prevalence Estimate Adjusted for Test Variability

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Introduction

Ignoring the limited precision of diagnostic tests can incur serious bias in prevalence (P) estimation. Most studies treat the sensitivity (SE) and specificity (SP) of the tests as constants. This will result in an underestimation of the variability of P. Bayesian inference provides a natural framework with which to integrate the variability in the estimates of SE and SP with estimation of P.¹

Materials and Methods

A study to obtain a prevalence estimate for, among others, Johne's disease, was carried out in the Maritime districts of Canada.² The data were collected on 90 randomly selected dairy farms; 30 on Prince Edwards Island, 30 in New Brunswick and 30 in Nova Scotia. On every dairy farm, 30 serum samples were collected of a random sample of the milking cows. When a farm had less than 30 cows, all milking cows were sampled. Serum was tested in duplicate for antibodies with the IDEXX enzyme-linked immunosorbent assay (ELISA). Cows with a corrected optical density (OD) ratio larger than 0.25 were considered positive for Johne's disease (JD). The dataset contains data of 2604 cows, the raw

and corrected optical density (OD) values, test date, total number of cows at the farm, the number of cows tested, and weights for cows within a farm and herds within a province. The initial weighed estimate for the prevalence of JD was 2.6%.

In the initial P estimate the SE and SP of the ELISA are supposed to be constant 43% and 99.2%, respectively. In the study, the P estimates are adjusted for variability of SE and SP.

To obtain the corrected P, Bayesian methods are used, such as those carried out by Tu *et al.* Prior estimates for P, SE, and SP are defined, and with a Gibbs sampler (Markov Chain Monte Carlo method) a corrected P is estimated. Calculations are carried out using (MATLAB).

References

1. Tu X.M., Kowalski J., Jia G: Bayesian analysis of prevalence with covariates using simulation-based techniques: application to HIV screening. *Statistics in Medicine* 18, 3059-3073, 1999.
2. VanLeeuwen, J.A., Keefe, G.P., Tremblay, R., Power, C., Wichtel, J.J.: Seroprevalence, spatial distribution and productivity effects of infection with Johne's disease and Bovine Leukosis in maritime Canadian dairy cattle. *9th International Symposium on Veterinary Epidemiology and Economics*, Breckenridge, CO, 2000.