Theme 4

Evaluation of diagnostic tests for Johne's disease with multiple tests per animal

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Poor test sensitivity is a major constraint in the investigation and control of Johne's disease (JD). Multiple repeated tests are required to establish that dairy cows are likely non-infected. This study compares results of an ELISA and culture test from cows that were tested up to 5 times by both methods simultaneously. A serial interpretation of ≥4 negative ELISA and ≥3 negative culture tests provided 95% sensitivity in detecting infected animals and was chosen as the gold standard.

The aim of the study was to estimate the accuracy of these tests using the gold standard approach and alternative methods in which we consider the effect of conditional independence.

Cows (n=828) from four infected herds were tested twice annually for four years by antibody-ELISA and faecal culture. For the gold standard, a single positive result defined a cow as infected. A minimum of 4 negative ELISA tests defined an ELISA negative cow. A minimum of 3 negative culture tests defined a culture negative cow. Gold standard results were compared with Bayesian estimates in the absence of a gold standard assuming conditionally dependent (code in WinBugs®) or independent (code in TAGS website) tests in two populations (pooled data from two high and two low prevalence farms). The sensitivities of both tests were overestimated by TAGS due to a moderate conditional dependence among diseased (-0.23) animals and a strong dependence among non-diseased (0.60) animals. The impact of prior information on these estimates is demonstrated.