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Evaluation of a PCR test for Coxiella burnetii detection in dust samples in dairy cattle farms using latent class analysis

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Purpose: Different tests performed on bulk tank milk samples (BTM) are available to determine the C. burnetii (causative agent of Q fever) status of herds. However, these tests, which are based on the detection of either antibodies directed against C. burnetii (ELISA) or bacterial DNA (PCR), have limitations. A currently disease-free herd infected in the past may continue to test positive with ELISA due to the persistence of antibodies in animals that were infected and that subsequently cleared the infection. Infectious herds can also be misclassified using PCR due to absence of bacteria in the BTM when the test is performed. Recently, PCR has been used for bacterial DNA detection in the farm environment, which constitutes the main reservoir of C. burnetii. The objectives of this study were to (i) assess and compare the sensitivities and specificities of one commonly used PCR test in BTM and of a PCR applied to environmental samples in dairy cattle farms, and (ii) infer the relevance of these tests to detect farms where C. burnetii is present (referred to as 'infectious farms').

Methods: BTM and dust samples (using environmental swabs) were collected at the same time in 95 herds. Test performance was assessed using latent class analysis and parameters estimated. within a Bayesian framework.

Results: PCR applied to dust samples had a slightly higher sensitivity than PCR applied to BTM (0.72 versus 0.68). Moreover, when responses from both PCR tests using a parallel reading were considered, 91% of infectious farms were detected.

Conclusions: The test based on the detection of C. burnetii DNA in dust samples had good test performance in order to assess the status of ruminant farms towards Q fever.

Relevance: Therefore this test could be used in surveillance programs of Q fever, alone or in combination with a PCR applied to BTM, to assess the risk of C. burnetii transmission between ruminant farms, together with the zoonotic risk.