

Re-introduction drives the within-herd persistence of bovine tuberculosis in Great Britain

Conlan, A.J.K., Mckinley, T.J., Brooks Pollock, E. and Wood, J.L.N., University of Cambridge, Disease Dynamics Unit, Department of Veterinary Medicine, United Kingdom; jlw2@cam.ac.uk

The number of cattle herds placed under restrictions in Great Britain (GB) due to the suspected presence of bovine tuberculosis (bTB) has progressively increased over the past 25 years despite a costly test-and-slaughter control program. Recent research has focused on the contribution of cattle-movements and wildlife reservoirs on incidence as measured by the number of so-called 'breakdown' herds. However, around 38% of herds that clear restrictions experience a recurrent breakdown within 24 months suggesting that infection may be persisting within herds. Persistence is likely to be facilitated by the imperfect sensitivity and specificity of the tuberculin skin test. The contribution of missed infection cannot be directly quantified, as the sensitivity of the tuberculin test is dependent on the time from infection and thus the frequency of testing and the history of transmission within the herd. In this study we develop a systematic framework to infer the efficiency of the GB surveillance regime using dynamic within-herd models. We use statistical measures of persistence, which describe the balance between local persistence and the rate of re-introduction of infection, as a probe for inference. Stochastic persistence has been extensively studied for endemic childhood diseases, but has not previously been used as a basis for inference for managed infections such as bTB. We introduce a systematic, and general, framework for model-based inference based upon measures of stochastic persistence using Approximate Bayesian Computation (ABC). Using routinely collected epidemiological data we estimate that 8.4% (3.7-16; 95% credible interval) of British breakdowns have infected animals remaining after a herd has been declared 'bTB free', leaving a median of 1 (1-3; 95% CI) infectious animals within these herds. Our analyses suggest that it is extrinsic transmission into herds, rather than this infectious burden, that drives recurrence.