

An evaluation of Australian surveillance for freedom from bovine tuberculosis

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Abstract

Australia declared freedom from bovine tuberculosis in accordance with international guidelines in 1997 and has since maintained ongoing surveillance for this disease, primarily through abattoir surveillance of cattle carcasses (meat inspection) for tuberculosis-like granulomas. The objectives of this study were to estimate the sensitivity of Australia's surveillance system and quantify the probability that Australia is free from bovine tuberculosis at the specified design prevalence.

The analysis included approximately 80 million records of individual cattle slaughtered and meat inspected at Australian abattoirs between 2005 and 2015 calendar years. Animals were identified and aggregated by property of birth within year. Herd and population level sensitivities and probability of freedom were estimated on an annual basis using a simulation model to account for uncertainty about the unit sensitivity of the meat inspection process.

The estimated median population sensitivity of Australia's tuberculosis surveillance system varied from a high of 80% in years when traditional meat inspection was used to as low as 50% after the introduction of visual-only meat inspection, for a design prevalence of 0.01% (19 herds) of Australian breeding cattle herds and 0.5% of animals within infected herds. The level of confidence in Australia's freedom from bovine TB was >95% after the first year of the analysis and >99.5% from 2007 through to the end of the analysis period in 2015. Reducing the animal-level or herd-level design prevalence, or the estimated sensitivity of meat inspection, reduced system sensitivity but confidence of disease freedom remained high.

Keywords: *Bovine, tuberculosis, freedom, surveillance, evaluation*

Introduction

Bovine tuberculosis (TB) is a chronic respiratory disease of cattle caused by the bacterium *Mycobacterium bovis*. The disease is characterised by the formation of nodular granulomas within the respiratory system and associated lymph nodes. *M. bovis* has zoonotic potential and can infect other animals including water buffalo.

Australia ran a bovine tuberculosis eradication campaign for 27 years from 1970 to 1997 (1,2) and declared freedom in accordance with international guidelines (3) in 1997. Eradication activities included destocking of domesticated buffalo herds and culling feral animal reservoir hosts: buffalo and cattle. There were no reservoirs of infection in wildlife. Ongoing surveillance is maintained, primarily through abattoir surveillance of cattle carcasses (meat inspection) for tuberculosis-like granulomas.

The objectives of this study were to estimate the sensitivity of Australia's surveillance system for bovine tuberculosis and quantify the probability that Australia is free from the disease at the specified design prevalence.

Methods

Of the four cattle surveillance activities identified as potential sources of data supporting Australia's claim of disease freedom – abattoir surveillance of cattle for TB-like granulomas, pre-export testing of live cattle using the caudal fold test (CFT), herd testing of live cattle using the CFT and general surveillance (clinical disease investigations) – only abattoir surveillance was considered suitable for this analysis.

The available data were analysed using a simulation model, developed in the R software environment (4). The analysis included approximately 80 million records of individual cattle slaughtered and meat inspected at Australian abattoirs between 2005 and 2015 calendar years. Animals were identified and aggregated by property of birth within year. Herd and population level sensitivities and probability of freedom were estimated on an annual basis using a simulation model to account for uncertainty about the unit sensitivity of the meat inspection process.

Results

The estimated median population sensitivity of Australia's tuberculosis surveillance system varied from a high of 80% in years when traditional meat inspection was used (2006–2010) to as low as 50% after the introduction of visual-only meat inspection (2011–2015), for a design prevalence of 0.01% (19 herds) of Australian breeding cattle herds and 0.5% of animals within infected herds. The results of this analysis indicate that contemporary abattoir surveillance of cattle has a moderate sensitivity for detection of bovine TB at a national level on an annual basis. However, taking advantage

of historical data allows progressive increase in confidence of freedom over time, such that >99.5% confidence of freedom was achieved within three years and was maintained thereafter for the remainder of the period evaluated.

Discussion

Discussion is withheld. A complete paper describing this study has been accepted for publication in the Australian Veterinary Journal.

Conclusion

The results of this analysis demonstrate a very high level of confidence that Australia's cattle herd is truly free from bovine TB (>99.5% for the period 2007–2015). Meat inspection for granulomas in the head and thorax of slaughtered cattle underpins this result by providing surveillance data on an extremely large number of animals each year.

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