EPIDEMIOLOGICAL ANALYSIS OF TUBERCULOSIS IN CATTLE HERDS

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ABSTRACT

Studies were made of the occurrence and distribution of bovine tuberculosis in the Taumarunui and Masterton veterinary districts, within which endemic wildlife tuberculosis is widespread. These districts were compared with the movement control herds of the surveillance areas of New Zealand, which are free of wildlife tuberculosis. The study covers the period from 1985-1990. The frequencies of tuberculosis infection for different categories of herds and different veterinary districts were examined and comparisons made of rates and risk of disease between the herd categories and districts under consideration.

A comparison of incidence measures showed a strong positive correlation between cumulative, corrected and true incidence values. Cumulative and corrected cumulative incidence values calculated for calendar, financial and test years were compared. Some disparity was found between annual cumulative incidences and annual corrected cumulative incidences calculated on the basis of calendar and test years, with measures calculated on the basis of test year having the highest values.

Regional comparisons showed that movement control herds in surveillance areas had higher incidences of tuberculosis than did herds in the Taumarunui and Masterton veterinary districts. Beef dry stock herds had higher incidences of tuberculosis than did dairy or beef breeding enterprises. Endemic areas had the highest incidence of all tuberculosis area classes.

Simple regression analyses indicated that the risk of tuberculosis for any animal in a herd was more closely related to the level of infection in adult cows than any other age or sex group. Cumulative incidence in yearlings was a poor predictor of risk for individual animals in a herd but there was a stronger relationship for the level of infection in 2 year-old animals.

Stepwise logistic regression was used to explore and quantify associations between cumulative incidence and putative risk factors. The odds of cattle testing positive in herds

in endemic areas was about five times as high as in herds in surveillance and fringe areas, where the risks of tuberculosis were about the same. The likelihood of reacting to the tuberculin test was considerably lower for animals in the Masterton and Taumarunui districts than for animals from movement control herds in surveillance areas outside those districts. The overall risk of infection increased slightly from 1985 to 1990.

Poisson regression was used to examine the relationships between incidence density and the same independent variables which were examined using logistic regression. The relative risks for infection were higher in beef breeding, beef dry stock and other herd types than in dairy herds. Herds in endemic areas had rates of infection about seven times those in Fringe and Surveillance area herds, where the rates were about the same. The incidence of infection in herds increased with increased herd size and was considerably less in the Masterton and Taumarunui districts than in movement control herds in the Surveillance areas. There was a good general agreement between the logistic and poisson regression models in the overall relationships between the predictor variables common to both models and their respective dependent variables.

Survival analysis showed that after going on to movement control for the first time, about 75% of herds could be expected to be still on movement control after 12 months and about 50% after 2 years. Herds in the Masterton veterinary district tended to stay on movement control longer than herds in the Taumarunui veterinary district and Surveillance areas (Risk ratio = 0.69). After 2 years of testing, about 60% of infected herds in the Taumarunui veterinary district and Surveillance areas had come off movement control, compared to 40% of infected herds in the Masterton veterinary district.

The survivorship probability of infected herds in Fringe, Surveillance and non-endemic zones for coming off movement control was lower than that for infected herds in endemic zones (Risk ratio = 0.61). The estimated median time on movement control was 3 years for herds from endemic areas and 2 years for herds in Fringe, Surveillance and non-endemic zones. The risk of coming off movement control decreased with increasing herd size. Herds with high levels of cumulative incidence were more likely to stay on movement control for longer periods than those with lower levels of incidence.

Simple linear regression indicated that distance from the nearest case herd with tuberculosis, distance from the Rangitoto buffer, distance from the nearest case in year one after breakdown and total number of cattle purchased were poor predictors of cumulative incidence.

A multivariate logistic regression analysis of the association between cumulative incidence and putative risk factors during the first year after a breakdown indicated that risk was lower on farms where the main activity was dairying (MAINOP) and in herds in which the proportion of adult cattle (ADULTCAT) was high. Over the whole period for which herds were under movement control, risk levels remained lower for dairy farms and increased as the proportion of beef cattle was increased.

Increased rates of infection were associated with the practice of buying replacements (BUYREPLA) in the first year after breakdown and rates were higher for the whole period in herds which ran cattle on agistment (OTHERCAT). Rates were lower on farms where cattle had access to bush (BUSHACCE), but despite the higher rates, survival analysis clearly showed that herds with access to bush could be expected to stay on movement control for longer periods than farms with no bush access. The median time on movement control was 1 year for farms without access to the bush and slightly more than 2 years for farms with access to the bush. Movement control farms without bush access were free from infection by 3 years, whereas farms with bush access took more than 5 years.

Both the risk and incidence of infection tended to be lower at higher stocking rates in the short and long term after first going onto movement control. The association between personal qualities of farmers and the risk and rate of infection were also examined using multivariable regression analyses.

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