TOPICS

Summary of Doctoral Dissertation (2000)

Modelling bovine spongiform encephalopathy using a herd based stochastic approach

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The thesis describes the development of a computer based model designed to improve the understanding of the future course of the BSE epidemic and to assist in the planning of disease control measures to accelerate the eradication of BSE.

A stochastic herd model was developed to describe population dynamics in a UK dairy herd. Production parameters used in the model were taken from published data. Then, disease factors were incorporated into the model using the clinical incidence rates of BSE observed in dairy herds. The stochastic nature of the model enabled the eftect of chance on disease transmission to be demonstrated. The model was verified against observed herd data and found to be able to well replicate the dynamics of animals in a typical UK dairy herd and the clinical incidence of BSE. This model also had the advantage that it could trace individual cattle and their oftspring over the modelling period enabling a closer analysis of the significance of maternal transmission.

In order to derive precise estimates of maternal transmission risks in the field, an analysis of field data was carried out. The analysis found that a matched cohort study was the most suitable technique to avoid confounding factors due to the variation in exposure to BSE between herds. However, the study using 32 matched pairs selected from four infected herds did not find significant risk difference between calves born to BSE aftected dams and those to control dams.

The potential influence of maternal transmission was evaluated by a number of simulations based on different assumptions on maternal transmission. The results indicated that maternal transmission would have a limited impact on the future course of the BSE epidemic, although the high maternal transmission rate extends the duration of the BSE epidemic. A 10% maternal transmission rate of the disease from BSE affected dam to calf had no effect on the predicted duration of the epidemic. Various culling policies were examined for effectiveness and efticiency. Maternally targeted slaughter was found to be eftective if maternal transmission actually occurs, but currently applied offspring culling scheme had no significant eftect on the eradication of BSE due to the small number of maternally derived cases predicted in future.

The herd based modelling approach provides a unique approach with helps to improve our understanding of the diseases like BSE where the epidemiology of the diseases is poorly understood. The usefulness of this approach in BSE suggests the possibility of its application to other diseases or situations.