

A dynamic simulation model for cost-benefit analysis of paratuberculosis control strategies in dairy farms

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Efforts to reduce prevalence of paratuberculosis can be jeopardised if farmers don't enrol in control programmes. For these decision-makers, the expected efficiency of the programme in the situation of their own farm is paramount. Methods to compare the costs of a programme and its expected benefits should account for the goals and constraints of the farm management. The objective of this study was to evaluate the costs and benefits of control programmes in infected dairy herds, taking into account the production goal and the constraints on replacement, assuming it varies with the frequency of other health disorders. A stochastic dynamic herd model was developed. Parameters for horizontal transmission of *Mycobacterium avium paratuberculosis* (Map) were issued from an epidemiological model where the contamination of the environment and the contact structure in the herd are explicitly represented. Herd dynamics and management were detailed. Inputs and outputs were estimated to calculate the gross margin. Different scenarios of Map control were simulated (systematic test-and-cull versus passive surveillance, improving hygiene of calf rearing) and compared to a do-nothing scenario. A sensitivity analysis was carried out with high or low levels of mastitis and infertility. When culling for infertility or mastitis was high, Map infection and Map control programme resulted in an annual herd milk yield below the production goal of the farmer, and in reduced gross margin for all scenarios. When it was low, several scenarios of Map control were beneficial after 7 to 13 years. This model shows that the efficiency of Map control can be reduced, and enables to identify the conditions for positive return on investment of a control programme in a variety of production contexts representative of goals and constraints of dairy farms.