Mathematical Model Demonstrating Indirect Effects of Subclinical Mastitis Treatment in Dairy Herds

John Barlow[1], Ruth Zadoks[2], Lisa White[3] and Ynte Schukken2

1. University of Vermont, 2. Cornell University and, 3. University of Warwick

The objective of this research is to evaluate the impact of treatment of subclinical mastitis on duration of infection and mastitis transmission in dairy herds. We describe the use of a deterministic state-transition model of intramammary infections (IMI) to predict the impact of subclinical mastitis treatment programs in populations of lactating dairy cattle. Four states are included in the model: uninfected susceptible (S), new subclinically infected (I_A), chronic subclinically infected (I_C), and recovered susceptible (R_S). Variables in the model include proportion of individuals within each state. Fixed parameter estimates in the model include values for proportions entering and exiting each state, spontaneous recovery rates from each of the infected states, and cure rates due to antimicrobial treatment of infected individuals. Initial variable and fixed parameter values are estimated from peer-reviewed literature and field observations. Steady state conditions for the proportion of individuals in infected and uninfected states, and pathogen transmission rate parameters are estimated from the model. The model is used to explore the effect of varying the cure rate associated with antimicrobial treatment on output values describing the transmission rate for contagious mastitis pathogens, and the prevalence of infected and uninfected individuals. The model predicts that reductions in duration of subclinical infections caused by contagious pathogens results in a decrease in the prevalence and incidence of new IMI among susceptible individuals. Thus the model demonstrates indirect effects of mastitis control interventions that result from changes in the intensity of pathogen transmission.