Comparison of Modeling Methods for Defining the Optimum Control Effort for Peste Des Petits Ruminants (PPR)

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Peste des petits ruminants (PPR), a major disease of small ruminants, is spreading across Africa and Asia. The development of effective decision-support tools for PPR control requires an improved understanding of the disease's epidemiology. Models are needed to define/test disease control methods and to gain a better understanding of PPR virus ecology. Several ruminant species appear susceptible to the disease in varying degrees, including sheep and goats which express clinical symptoms. Other domestic and wild animal species are known to generate immunological responses to infection but their role in PPR epidemiology remains unknown. Data from serological surveys in goats, sheep, cattle and buffaloes were used to calculate the forces of infection by means of catalytic models combined to @risk® probabilistic functions. Contact parameters were computed from “Who Acquires Infection From Whom” (WAIFW) matrices using probability distributions applied to each input parameter. R0 distribution was computed after solving the Next-Generation-Matrix and fit a BetaGeneral distribution (• 1=3.3; • 2=8.7; min=1.4; max=23.4). R0 mean and median were respectively equal to 7.4 and 7.1. The resulting estimates of R0 defined the control effort needed to eliminate the infection from a homogeneous host population. A second step based on a deterministic compartmental model, stratified by metapopulation and stochastic simulation for the contact and transition parameters consequently was implemented to define the levels of vaccination required in small-ruminants. Another approach based on the type-reproduction number T also was used to define the critical control effort for heterogeneous populations and was compared with the previous one.