

Mathematical Model for Rabies Transmission and Control in Nepal

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Rabies is a neglected tropical disease caused by *Rhabdovirus* and often transmitted to humans and animals through the bites of infected animals. Even though vaccines against rabies are available, rabies still remains a burden killing a significant number of humans as well as domestic and wild animals in many parts of the world, including Nepal. In this study, we develop a mathematical model to describe transmission dynamics of rabies in Nepal. In particular, an indirect interspecies transmission from jackals to humans through dogs, which is relevant to the context of Nepal, is one of the novel features of our model. Using our model with some parameters estimated from human rabies data, we calculated the basic reproduction number (\mathcal{R}_0) for Nepal, and performed sensitivity analysis to identify that the dog-related parameters are primary contributors to \mathcal{R}_0 . We analyze the role of intraspecies and interspecies transmission between dog and jackal population in the persistence of rabies in Nepal. We found that even though intraspecies basic reproduction numbers of both dogs (\mathcal{R}_0^D) and jackals (\mathcal{R}_0^J) are less than 1, the rabies epidemic may still occur ($\mathcal{R}_0 > 1$) due to interspecies transmission. Our results show that, along with dogs, jackals also play an important role in the persistence of rabies in Nepal. We also discussed the insufficiency of currently practiced intervention strategies: pre-exposure vaccines for dogs and post-exposure vaccines for exposed humans to control the human rabies in Nepal. In addition, we presented the impact of other intervention strategies such as dog sterilization, dog culling and jackal bait vaccination on rabies transmission in Nepal.