A mathematical model for rabies epidemic among wild dogs

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Rabies is caused by a virus that affects the central nervous system, particularly, causing in ammation in the brain. The virus is transmitted from an infected dog through a bite or by saliva touching an open wound of an uninfected animal. Dogs are the most common reservoir of the virus. There is no effective treatment or cure for rabies once symptoms show.

The incubation period of rabies generally ranges between three to seven weeks; it can also go up to a year depending on the time take by a virus to spread from the brain to the salivary glands. Some factors contributing to the length of rabies incubation period are wound severity and location, the amount of virus transmitted as well as the status of an animal's immune system. As a result, we are proposing a system of differential equations representing an epidemic model that takes into consideration the time delay that is; from the time a dog is bitten to the time it becomes infectious depending on the wound location. Thus, our model includes the asymptomatic and symptomatic classes.

Our choice of human intervention is 'targeted culling' instead of 'random culling' to prevent the virus from being transmitted uncontrollably. Random culling is intervening by culling any random dog that is thought to be infected but this means there is chance to also cull healthy dogs. As a result, targeted culling is more effective and humane since we only cull the symptomatic dogs. Our aim is to understand the dynamics of rabies among dogs as well as seek to predict if the proposed model can help to control the virus. Numerical simulations are presented to support theoretical results.

References

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