Optimal control and cost-effectiveness analysis of an echinococcosis transmission model with interventions

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Abstract

A dynamical model of echinococcosis transmission with optimal control strategies is presented. The basic reproduction number of the model is obtained and used to study the stability of the disease-free and endemic equilibrium points. Sensitivity analysis of the basic reproduction number to the model parameters and control variables is performed. It finds that the natural death of dogs has a strong impact on the basic reproduction and the only anthelmintic treatment against echinococcosis does not eliminate the disease. The optimal control problem is formulated and solved analytically. Numerical simulations show that optimal control strategies could effectively eliminate the transmission of echinococcosis and the disinfection or cleaning of environment may shorten the time of eliminating the disease. The cost-effectiveness analysis suggests that a combination of health education and anthelmintic treatment could provide the best cost-effective strategy to control the transmission of echinococcosis. The findings could be helpful for the prevention and control of echinococcosis in Ganzi Tibetan Autonomous Prefecture, China and other areas of echinococcosis.

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