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A mathematical model for assessing the spraying as a vector control strategy for Chagas disease in Colombia

Chagas disease or American trypanosomiasis is a neglected disease in Latin America, which means that attacks people already affected by poverty and inequality. Over time its manifestations lead to arrhythmias and heart failure, and in some cases can cause death. In Colombia this parasitic disease, that affects 1.2 million people (with a population of 3 million more at risk of contracting it), is transmitted by the insect Rhodnius prolixus in a cycle in which wild animals, domestic animals and humans, act as reservoir. While research aimed at combating the disease in the country has shown progress in different fields, one of the most important questions to be answered is how efficacious and efficient are the control interventions. Little is known about them and nowadays there is no quantitative tool that allows for prediction, so that can be used for control and prevention. The purpose of this work is to propose a mathematical model for describing the population dynamics of the vector and identifying different scenarios that might contribute to the spread of the disease. In particular we want to explore the effects of insecticide house spraying. Our approach consists of a system of nonlinear differential equations that describes the rate of change of the susceptible and infected classes of three populations: domiciliated vectors, domestic animals and man. We present an analytical approach to get the basic reproductive number, the steady states and the equilibria as well as an implementation of the model for computer simulations. In addition, we show alternatives to reduce the domiciliated vector population. We expect that these preliminary results can be useful in the reduction of uncertainty of control strategies at local level, and thereby improve decision making about preventive management of the disease.