The application of System Dynamics Modelling approach to understand the brucellosis transmission system

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Abstract

Background: Brucella transmission is a complex multisector system. A better understanding of transmission dynamics helps pinpoint the most effective interventions to reduce human cases. Modelling methodologies have not been applied extensively to brucellosis. This paper applies System Dynamics Modelling to identify the interplay between the different sectors that drive disease transmission and suggest and assess scenarios to control brucellosis. Methods: The study applied a qualitative in-depth analysis of Brucella transmission system in Jordan. Current published literature, government and policy documents were reviewed supplemented by interviews with stakeholders. Data were analysed manually to establish causal pathways to develop a Stock and Flow (SF) model. The structure was examined and reviewed by key informants. Several scenarios to control Brucella transmission were assessed. Results: The model demonstrated the complex interaction of different sectors that drove transmission. Brucella transmission among sheep and between farms and markets are the main drivers of human incidence. Farmers' visits to veterinary clinics are a critical intervention point for control regarding access to vaccination. Vaccination by itself might not be efficient due to the low compliance of farmers. Test and cull sheep is the most efficient control strategy. Conclusions: The synthesis of the current knowledge through the model enabled better understanding, visualisation and interpretation of the sectors involved in Brucella transmission. The model highlighted specific leverage points at which the transmission could be controlled like encouraging visits to the veterinary clinics. There is a strong synergy between sectors, therefore, a greater control might be produced by utilising multi-sectoral relationships embedded in the system. This application of System Dynamics Approach to understand disease transmission systems can be used to complement other methods and detect leverage points for disease control.

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