Modelling the role of treatment and vaccination in the control of transmission dynamics of pneumonia among children in Uganda

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Abstract

Pneumonia is one of the leading causes of serious illness and deaths among children around the world. Efforts to effectively treat and control the spread of pneumonia is possible if its dynamics is well understood. In this paper, a mathematical model for the transmission dynamics of pneumonia is studied. The population is divided into five epidemiological classes to evaluate the role of treatment and vaccination in mitigating the spread of the disease. A system of differential equations is used to study the disease dynamics. Model analysis is carried out to establish the existence and stability of the steady states. It is revealed that the disease-free equilibrium point is globally stable if and only if the basic reproduction number $R0<1$ and the disease will be wiped out of the community. If $R0>1$, the endemic equilibrium point is globally stable and the disease persists at the endemic steady state. We infer the impact of control strategies on the dynamics of the disease through sensitivity analysis of the effective reproduction number Re from which the results showed that the combination of treatment and vaccination can eradicate the pneumonia infection.