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The effect of PrEP uptake and adherence on the spread of HIV in the presence of casual and long-term partnerships

Sylvia J. Gutowska

University of Maryland - Baltimore County, sylviag1@umbc.edu

Katharine Gurski

Howard University

Kathleen Hoffman

University of Maryland - Baltimore County

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S.J. Gutowska
K.A. Hoffman
K.F. Gurski

Title

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Abstract

A classic approach for modeling the spread of the sexually transmitted diseases is to assume a zero inherent length infection contact. However, in the population with long-term partnerships, the infection status of the partners, the length of the partnership, and the exclusivity of the partnership, all affect the rate of infection. Additionally, the presence of the pre-exposure prophylaxis (PrEP) also impacts the dynamics of the disease. Our goal is to develop a compartmental model that accounts for various partnership scenarios as well as the uptake and adherence to the PrEP treatment. Reproduction numbers are calculated, and global stability of both disease-free and endemic equilibria will be shown with appropriate conditions. Sensitivity and PRCC analysis are performed on the key parameters to determine the degree to which each affects the disease transmission dynamics. The results suggest that increasing the adherence among the current PrEP users is a more effective (and likely more cost-efficient) strategy in the fight against the HIV epidemic, than increased coverage with poor adherence. However, when both casual and long-term partnerships are accounted for in the population, even with the maximum level of compliance and full PrEP coverage, stopping the spread of HIV will require additional interventions.