

A MODEL OF HIV TRANSMISSION WITH INTERACTING HIGH RISK GROUPS AND A BRIDGE POPULATION

Chengjun Sun¹, Ying-Hen Hsieh², and Paul Georgescu^{3*}

¹School of Management and Economics, Kunming University of Science and Technology, 253
Xuefu Road, Kunming, Yunnan 650093, China

²Department of Public Health and Center for Infectious Disease Education and Research,
China Medical University, Taichung 40402, Taiwan

³Department of Mathematics, Technical University of Iași, Bd. Copou 11A, 700506 Iași, Romania

cjunsun@gmail.com, hsieh@mail.cmu.edu.tw, v.p.georgescu@gmail.com (*corresponding author)

We formulate a model of HIV transmission which accounts for two interacting high-risk groups, namely female sex workers (FSWs) and male injecting drug users (IDUs) along with a bridge group of male drug-free clients (DFCs), allowing for the inhibition of strength of HIV infection among male IDUs and assuming for two HIV transmission routes: needle sharing between male IDUs and commercial sex between FSWs and sexually active male clients (including IDUs). To characterize the global stability properties of the model, we use the graph theoretic approach of Li and Shuai, for an abstract disease propagation model introduced *ad hoc* which features mass action incidence given in a generic, unspecified form. We then establish the stability properties of both the disease-free equilibrium and the endemic equilibrium in terms of a basic reproduction number, which is seen to be a threshold parameter as far as the stability of the system is concerned. The global stability of the endemic equilibrium is obtained in terms of sign conditions which are a priori satisfied for a large class of functions which are suitable to represent forces of infection. Stability results for the originating HIV transmission model are then obtained via suitable particularizations, possible extensions of this model being also outlined.

To establish mitigation and eradication strategies for the spread of the disease, we obtained partial reproduction numbers for each disease transmission route in the model, explicit conditions for the global stability of equilibria being then derived in terms of the partial reproduction numbers. We are then able to establish that if the goal of an intervention measure is to eradicate, significant reduction in transmission between FSW and IDU is needed, in addition to reduction in other routes of transmission. On the other hand, if the aim is to mitigate the disease spread, reduction in any

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one or more routes of disease transmission will be useful, albeit reduction in transmission between the two high-risk groups will be more impactful than others.