

Modeling Intracellular Delay in Within-host HIV Dynamics Under Conditioning of Drugs of Abuse

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Drugs of abuse, such as opiates, have been widely associated with the enhancement of HIV replication, the acceleration of disease progression, and severe neuropathogenesis. In particular, the presence of drugs of abuse switches target cells (CD4+ T cells) from lower-to-higher susceptibility to HIV infection. The effect of such switching behaviors on viral dynamics may be altered due to the intracellular delay (the replication time between viral entry into a target cell and the production of new viruses by the infected cell). In this study, we develop, for the first time, a viral dynamics model that includes an intracellular delay under the conditioning of drugs of abuse. We parameterize the model using experimental data from simian immunodeficiency virus infection of morphine-addicted macaques. Results from thorough mathematical analyses and numerical simulations of our model show that the intracellular delay can play a significant role in HIV dynamics under conditioning of drugs of abuse. Our model and the related results give new insights into the HIV dynamics, and may help in the development of strategies to control HIV infections in drug abusers.

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