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On the duration of the period between exposure to HIV and detectable infection

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Abstract

HIV infection cannot be detected immediately after exposure because plasma viral loads are too small initially. The duration of this phase of infection (the "eclipse period") is difficult to estimate because precise dates of exposure are rarely known. Therefore, the reliability of clinical HIV testing during the first few weeks of infections is unknown, creating anxiety among HIV-exposed individuals and their physicians. We address this by fitting stochastic models of early HIV infection to detailed viral load records for 78 plasma donors, taken during the period of exposure and infection. We first show that the classic stochastic birth-death model does not satisfactorily describe early infection. We therefore apply a different stochastic model that includes infected cells and virions separately. Since every plasma donor in our data eventually becomes infected, we must condition the model to reflect this bias, before fitting to the data. Applying our best estimates of unknown parameter values, we estimate the mean eclipse period to be 8-10 days. We further estimate the reliability of a negative test t days after potential exposure.

Keywords: HIV; eclipse period; viral kinetics; stochastic modelling

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