

Model-based evaluation of the implementation of STI screening among men who have sex with men in Tokyo

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Mathematical models of chlamydia transmission incorporating screening tests can help policymakers decide optimal control strategy in eradicating the disease. We used mathematical modeling to assess the impact of targeted screening for NG and CT incidence among MSM in Tokyo. We have developed a six-compartmental deterministic model with Chlamydia infection. We have divided the total population into susceptible, exposed, asymptomatic infectives, symptomatic infectives, test and treated infectives, and recovered. The basic reproduction number (\mathcal{R}_0) and the effective reproduction number (\mathcal{R}_{eff}) are calculated using the next-generation matrix method. The stability analysis of the model shows that the system is locally asymptotically stable at the disease-free equilibrium (DFE) E_0 when $\mathcal{R}_0 < 1$. When $\mathcal{R}_{eff} > 1$, an endemic equilibrium point (EEP) E_1 exists and the system becomes locally asymptotically stable. Numerical simulations of the model confirmed the theoretical analysis of the stability of DFE and EEP. Analysis of the control strategy shows that if the testing rate is greater than 0.2, it is possible to eradicate chlamydia from the MSM population in Tokyo. The model predicts that annual screening cannot mitigate the chlamydia infections; however, if the number of screenings per year is increased to twice or more, it is possible to eradicate the chlamydia infections.

Keywords screening; sexually transmitted infections; men who have sex with men; transmission model; simulation;