

A dynamic model of substance abuse: the case of ‘meth’

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The global rise in the use of methamphetamine has been documented to have reached epidemic proportions. Researchers have focussed on the social implications of the epidemic. A typical drug use cycle consists of concealed drugs use after initiation, addiction, treatment-recovery-relapse cycle, whose dynamics are not well understood. The model by White and Comiskey, on heroin epidemics, treatment and ODE modelling, is modified to model the dynamics of methamphetamine use in a South African province. The analysis of the model is presented in terms of the methamphetamine epidemic threshold \mathcal{R}_0 . It is shown that the model has multiple equilibria and using the center manifold theory, the model exhibits the phenomenon of backward bifurcation where a stable drug free equilibrium co-exists with a stable drug persistent equilibrium for a certain defined range of \mathcal{R}_0 . The stabilities of the model equilibria are carried out and persistence conditions established. Furthermore, numerical simulations are done including fitting the model to the available data on the number of patients with methamphetamine problems. The implications of the results to drug policy, treatment and prevention are discussed.