

AN INTEGRO-DIFFERENTIAL EQUATION MODEL FOR THE SPREAD OF ALCOHOL ABUSE

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ABSTRACT. The alcohol abuse level of individuals in a population as it depends on resilience and peer influence is considered in this paper. Several simple models are studied as well as an integro-differential equation model which is derived using coarse graining from a pre-existing discrete network system. The connection structure of the discrete system tends to be richer than that of the integro-differential equation model; however, the continuum problem can be studied analytically using traveling wave, perturbation and phase plane techniques.

The analysis presented in this paper suggests that, in both the discrete network and integro-differential models, nearly alcoholic or highly sober individuals are relatively unaffected by peer pressure, and this aspect of the models leads to an inertia in the spread of alcohol abuse or sobriety depending on the connectivity, initial conditions and resilience of the population. A related but different model is introduced that avoids this inertia.

A treatment scheme had also been developed for the discrete network system. A continuum version for the integro-differential model is provided here.

1. Introduction. Alcohol abuse is an important social problem in the world today. The papers [2, 17] introduce a discrete network model with a bistable-type rate function for the spread and treatment of this condition along with computational studies. Here, in order to examine the bistable mechanism analytically, we introduce several simple new models as well as a continuum model adaptation involving an integro-differential equation (IDE). We study the IDE using perturbation and traveling wave techniques as well as scientific computing.

Keywords and phrases. Spread of alcohol abuse or integral equations.
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