

The global Dynamics of an age structured alcoholism model.

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Abstract

We study the global stability of new alcoholism model with alcoholics have age structure, we propose the following model:

$$\begin{cases} \frac{dS(t)}{dt} = \Lambda - S(t)L(t) - (\mu + \alpha)S(t) \\ \frac{\partial A(t,a)}{\partial t} + \frac{\partial A(t,a)}{\partial a} = -(\mu + a_1 + \delta(a))A(t,a) \\ \frac{dR(t)}{dt} = \int_0^{+\infty} \delta(a)A(t,a)da - (\mu + a_2 + \rho)R(t) \end{cases} \quad (1)$$

with the boundary and initial conditions

$$\begin{cases} A(t,0) = \alpha S(t) + \rho R(t) + S(t)L(t), \\ A(0,a) = A_0(a) \in L_+^1((0, +\infty), \mathbb{R}), \quad S(0) = s_0 > 0, \quad R(0) = r_0 > 0 \end{cases} \quad (2)$$

where alcoholics A are assumed to be age-structured, whereas susceptible drinkers S and recuperator R are not age-structured. r is the birth rate, μ is the natural death rate, a_1 , a_2 are the death rates of excessive drinking, respectively. δ is the transfer rate from alcoholics to recovered individuals, ρ is the relapse rate from recovered individuals to alcoholics. The coefficient α is the fraction of susceptible drinkers $S(t)$ develop into alcoholics because of some of their own reasons, such as losses of earnings, unemployment or family problems, etc. The incidence rate at time t and alcoholism age a is

$S(t)\beta(a)A(t, a)$, where $\beta(a)$ is the transmission rate due to pressure from alcoholics with alcoholism age a .

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