Mathematical modeling of epidemics: ODE's, complex networks and hybrid models

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This talk is divided in three parts. We start by presenting a SICA (Susceptible–Infectious–Chronic–AIDS) mathematical model given by a system of ordinary differential equations (ODE's) for the transmission dynamics of human immunodeficiency virus (HIV), considering real data from Cape Verde [3, 4].

After, we propose a complex network built with non identical instances of the SICA model, in heterogeneous geographical areas. We analyze the effect of different coupling and intensity of migratory movements between nodes and explore the effect of human displacement and behavior [1].

Finally, we built hybrid models by coupling epidemic models given by ODE's systems and agent-based models. These hybrid models intend to integrate the microscopic dynamics of individual behaviors into the macroscopic evolution of various population dynamics models. We apply the hybrid model general framework to the COVID-19 pandemic in Portugal [2].

References

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