

Unveiling the Role of Human Mobility and Network Structure in Epidemic Dynamics

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Human mobility is an inherent aspect of the interconnected world and a key driver in disease transmission through networked populations. Despite its importance, the role of actual mobility patterns in driving or containing disease transmission has received relatively less attention. To address this limitation, we investigated the impact of network structure and human mobility on disease spread within a metapopulation and derived epidemic threshold formulas that take mobility into account. We implemented simplified analogs of real-world networks, such as stars and cycles, and obtained classes of networks with the same epidemic threshold formula. Identifying the pivotal role of network structures in disease dynamics, we developed and deployed a novel hybrid mechanistic metapopulation model that incorporated cellphone mobility data, such as human movement trajectories between counties, into the mechanistic model. This allowed us to trace the realistic evolution of the disease across counties.

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