

Topological considerations of social contact networks for disease transmission

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Abstract

We study the topological variation in social contact networks generated via an agent-based simulation of SARS-CoV-2 transmission in rural communities. The synthetic populations and community features were fit to two rural towns in the Western US. We show that the short-lived features of persistence diagrams can be used to develop a notion of thickness of a social contact network. In this framework, thick social contact networks are permissive to disease transmission and thin social contact networks pose a barrier to disease spread.

We consider multiple disease mitigation strategies, including masking and vaccination, in both of the modeled communities, and report on their impact on the epidemic and topological features. We distribute vaccines among the agents both randomly and by social contagion using the Watts threshold model, showing that targeting the thicker areas of the network is more effective at preventing the spread of disease than distributing vaccines randomly.