

The role of network analyses in research on prevention of HIV infection

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Efforts at prevention of HIV or other infectious diseases can be aided by an understanding of the transmission networks along which infection spreads. This understanding can aid in several ways : (1) characterization of the conditions under which interventions such as treatment, chemo-prophylaxis or vaccine can succeed in controlling the HIV epidemic, (2) identification of appropriate means of tailoring implementation strategies to local conditions, and (3) determination of the level of adherence with community-wide interventions needed for successful control. However it can be challenging to identify the most valuable network features to estimate, and to obtain sufficiently reliable estimates of them, particularly in the setting of sexually transmitted infections. Currently most efforts to understand sexual networks make use of only egocentric (individual level data), which allow estimation of certain quantities of interest like degree distribution (for sexual networks, this would be distribution of number of partners) but does not allow for estimation of other relevant quantities, like assortativity (the tendency of people with many partners to have partners who do as well). This presentation will start with a discussion of how network features can improve prediction of epidemic characteristics and therefore of impact of prevention strategies, compared to egocentric data alone. We will address the question : Given all relevant ego-centric data does additional information about the underlying sexual network still improve understanding of the spread of the disease? In particular, we will investigate the impact of graphical properties on the spread of infection. We then consider estimation of network features from a sample of a network ; our focus will be on estimating the degree-degree mixing matrix — a matrix that quantifies assortativity. In addition we will discuss the use of the estimated degree mixing matrix for network construction. Such construction is valuable in the development of epidemic models that can be used for testing potential value of intervention strategies though simulation. The methods will be investigated using a data set characterizing the sexual network in Likoma Island, Malawi. We also consider ways in which network-level information can be incorporated into cluster randomized trials to improve efficiency, and interpretability of results.

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