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Topological and Historical Considerations for Infectious Disease Transmission among Injecting Drug Users in Bushwick, Brooklyn (USA)

Kirk Dombrowski[1*], Richard Curtis[1], Samuel Friedman[2], Bilal Khan[1]

[1]Social Networks Research Group, John Jay College CUNY, New York, USA; [2]National Development Research Institute, New York, USA.
Email: [*]kdombrowski@jjay.cuny.edu

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ABSTRACT

Recent interest by physicists in social networks and disease transmission factors has prompted debate over the topology of degree distributions in sexual networks. Social network researchers have been critical of "scale-free" Barabasi-Albert approaches, and largely rejected the preferential attachment, "rich-get-richer" assumptions that underlie that model. Instead, research on sexual networks has pointed to the importance of homophily and local sexual norms in dictating degree distributions, and thus disease transmission thresholds. Injecting Drug User (IDU) network topologies may differ from the emerging models of sexual networks, however. Degree distribution analysis of a Brooklyn, NY, IDU network indicates a different topology than the spanning tree configurations discussed for sexual networks, instead featuring comparatively short cycles and high concurrency. Our findings suggest that IDU networks do in some ways conform to a "scale-free" topology, and thus may represent "reservoirs" of potential infection despite seemingly low transmission thresholds.

Keywords: Social Network Analysis; Injecting Drug Users; Scale-Free Networks

1. Introduction

Recent interest by physicists in social networks and their relationship with disease transmission factors has prompted debate among social network theorists over the extent to which social networks conform more closely to general structural principles or to local social norms. This paper examines a smaller subset of this debate, and asks whether Injecting Drug User (IDU) networks responsible for the transmission of sexually transmitted and bloodborne diseases look more like topologies recently labeled "scale-free" by network theorists [1], or whether they are more like sexual networks, which have been shown to conform mainly to social principles like homophily and other specifically local norms [2]. This is important because the answer to this question bears strongly on intervention, prevention, and treatment strategies as they apply to IDU networks, and, to the extent that IDU networks continue to overlap with larger society in critical health related ways, bears on larger questions of public health and disease transmission more generally [3].

What follows is a reanalysis of data collected between 1991 and 1993 in the Bushwick neighborhood of Brooklyn, New York, on the social networks of injecting drug users (IDUs) [4]. Our analysis employs analytical strategies developed in the last few years by physicists working on what have come to be called "scale-free" networks, as developed by Barabasi and Albert [5,6]. Partly because our data were not collected with such an analysis in mind, throughout the paper we pose the findings and conclusions as "suggested," noting that several problems preclude more firm conclusions, and likewise note that this comparison leaves many aspects of IDU networks unexplained. Yet the apparent similarities between the network structure of the Bushwick IDU network and structures examined by Barabasi, Albert and others, prompt us to conclude that scale-free modeling can help elicit critical differences between IDU network topologies and those associated with sexual networks. Our results indicate that IDU networks may in fact represent the sorts of structural reservoirs of HIV and other bloodborne and sexually transmitted diseases at issue in the debates between physicists and sociologists, and thus require special consideration for prevention/transmission/intervention planners. What's more, if IDU networks do in fact conform more closely to general structural principles than to local norms, police intervention strategies of

[*]Corresponding author.

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