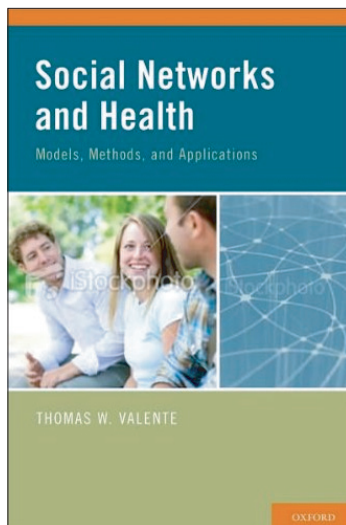**HIR**
Healthcare Informatics Research

Social Networks and Health: Models, Methods, and Applications

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Thomas W. Valente, the author of *Social Networks and Health: Models, Methods, and Applications*, is a Professor and Director of the Master of Public Health Program in the Department of Preventive Medicine, Keck School of Medicine, University of Southern California. He received his BS in Mathematics, MS in Mass Communication, and PhD in Communication. In addition, the author has published *Evaluating Health Promotion Programs* (Oxford University Press, 2002) and *Network Models of the Diffusion of Innovations* (Hampton Press, 1995); he has also published about 100 articles and chapters on social network analysis, health communication, health behavior change, and program evaluation, especially focusing on smoking cessation, substance abuse, family planning, HIV/STD, social support, etc.

This book provides researchers in medical and public health with a useful introduction to social network analysis research. Although social network analysis has been employed in scientific research for over 70 years, the analysis methods have recently gained greater recognition and are currently widely used in research requiring interdisciplinary academic methods and advanced computing and statistics [1,2]. Social networks among, within, and between people and group are used to define their relationships and/or connections. Social networks are defined as a social structure connecting a set of actors such as people, organizations, political entities (states or nations), and/or other units [3]. Researchers in various fields have employed the methods of social network analysis to medical [4-6], epidemiology [7], and nursing [8] fields.

This book is divided into three sections. Part I, "Models," outlines fundamental knowledge and background information of social network analysis research. Chapter 1 provides

an overview of the major models and concepts of social network analysis. The models can address various health topics and questions concerning health risks and human behaviors.

Chapter 2 provides a brief historical review of social network analysis. Scientists in mathematical and computational fields have developed methods to study interpersonal environments regarding the distinction as well as the similarity of "individual behavior and that of their peers" (p. 40). As an integral part of interdisciplinary research, social network analysis also has been widely used in the fields of medical and public health.

Chapter 3 provides an introduction of network data collection techniques (survey, egocentric, sequenced, census, and two-mode) and management procedures using computer software. Network data characteristics (symmetric or asymmetric, binary or valued) are also reviewed. A discussion of network variables (relational or structural) is also presented in the chapter.

Chapter 4 presents the definition of egocentric network data and how to collect the data. Egocentric data characterize an individual's personal contextual network environment, not a connected network of the individual. Various methods to convert egocentric data to a dyadic dataset for analysis and snowball sampling for network recruitment are discussed.

Part II, "Measures," provides mostly mathematical information on methods used to calculate centrality measures from data in networks. Chapter 5 describes background knowledge on "measures designed to determine which nodes occupy the center of a network" (p. 81). Social networks are visualized as connections between each individual's relationships. Nodes represent an individual; links represent interactions between two nodes. As centrality measurement plays a key role in the network field, this chapter provides the equations frequently used to calculate centrality measures and their application to health behaviors.

Chapter 6 presents how scholars who have conducted research on groups define and form groups. People like to socialize with others who are similar to themselves; people accordingly enjoy being in groups. Groups provide people with a sense of belonging. People can then not only find their identity from the group but also feel protected in the group. In the chapter, groups are defined as "a subset of a least three people" (p. 113). This chapter closes by addressing how groups influence the diffusion of health behaviors in many different social networks.

Chapter 7 presents a positional analysis to understand how behaviors diffuse through networks. Positions are defined as a grouping of nodes (people) in a network. Once positions

are identified in a network, the network may be reduced to a set of positions by researchers. In addition, an image matrix, where each position is a node, can be created from the network. While groups are a set of nodes that are connected to others in the network, a network position is "a set of nodes that occupy the same place or have similar relations with others in the network" (p. 114). There are two levels of position analysis: the individual level and network level.

Chapter 8 presents algorithms and interpretations for eight network level measures, such as size, density and cohesion, mutuality/reciprocity, triads/transitivity, diameter/average path length, clustering, centralization, and core-periphery. In addition, the chapter includes two mode data, derived from information on events, organizations, or situations in which people participate" (p. 144) and how it creates networks. The network level position analysis is most appropriate when researchers study social networks; this chapter thus also presents how various network level measures influences on behaviors within the networks.

Part III, "Applications," discusses the applications of network analysis to areas of interest such as behavior change, in Chapters 9 through 11. Chapter 9 provides a nontechnical introduction to exponential random graph models, P* models, and actor oriented models. Exponential random graph models are derived from the P* model, which is used in a logistic regression analysis. Researchers use these models employing statistical analyses on networks "to determine what behaviors drive social network evolution and whether social relationships influence behavioral changes" (p. 151). This chapter also includes some empirical examples.

Chapter 10 presents diffusion of innovations theory, which explains how new ideas flow through networks. The five steps of diffusion are: perceived characteristics of innovation adoption, a cumulate adoption S-shaped pattern (early or late adopters), classified stages during adoption (knowledge, persuasion, decision, implementation, and confirmation), modification of the innovation, and mathematical models to measure the rate and character of diffusion curves. This chapter also presents relevant literature on the four classes of the theory: opinion leaders/integration, structural influences, critical levels/tipping points, and dynamic/event history models.

Chapter 11 presents network interventions in many different forms and specific techniques to use network data. Network interventions have the potential to identify influential people within social networks and also empower them to accelerate change of behavior or enhance community performance. In the chapter, six different classes of methods are reviewed: opinion leaders, groups, leaders within groups or

leader-learner pairings, snowball sampling or recruitment, rewriting (changing) networks, and crossing networks with attributes. Network interventions implemented in communities were found to be mostly effective; however, researchers have also reported several cautionary points and implications in the studies. Finally, Part III closes with a book summary in Chapter 12.

With the rapid advance of information and communication technology, various types of communication currently exist in society. Upon this background, attention to network analysis from a transdisciplinary perspective is increasing; the medical and public health fields are expanding the application of this method from risk behaviors to chronic diseases, community coalitions, and systems approaches to social change and other areas.

Many books on social network analysis are overly technical, presenting too many mathematical and/or statistical equations in the text. This book helps readers who are not experts in social network analysis to easily understand the concepts of social networks and ultimately answer the question, "How does an understanding of social networks help us understand the spread of disease and risk behaviors at the individual and population levels?" (p. 25). This book is not only well written in a very clear style but is also comprehensive and provides interesting examples of real projects in the field of health. I therefore do not hesitate to highly recommend this book to those studying or working in a variety of scientific communities such as epidemiology, medicine, and public health.

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