



## Social integration in friendship networks: The synergy of network structure and peer influence in relation to cigarette smoking among high risk adolescents

Cynthia M. Lakon<sup>a,\*</sup>, Thomas W. Valente<sup>b</sup>

<sup>a</sup> Department of Population Health and Disease Prevention, Program in Public Health, University of California, Irvine, CA, USA

<sup>b</sup> Department of Preventive Medicine, Keck School of Medicine, University of Southern California, Los Angeles, CA, USA

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### ABSTRACT

Using data from a study of high risk adolescents in Southern California, U.S.A. (N = 851), this study examined synergy between social network measures of social integration and peer influence in relation to past month cigarette smoking. Using Hierarchical Linear Modeling, results indicated that being central in networks was significantly and positively related to past month cigarette smoking, across all study models. In addition, there is modest evidence that the number of reciprocated friendship ties was positively related to past month cigarette smoking. There is also some modest evidence that the relationship between having reciprocated friendships and past month cigarette smoking was moderated by a network peer influence process, smoking with those in youths' best friend networks. Findings indicate that being integrated within a social network context of peer influences favoring drug use relates to more smoking among these high risk youth.

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### Introduction

Numerous studies spanning multiple decades suggest a protective effect of social network ties on health (e.g., Berkman & Syme, 1979; Durkheim, 1858/1917; House, Robbins, & Metzner, 1982; Seeman, Kaplan, Knudsen, Cohen, & Guralnik, 1987). Other studies, however, indicate that social ties can deleteriously affect health (e.g., Rook, 1992; Rook & Pietromonaco, 1987). Given this competing evidence, one critical step toward a better understanding of the relationship between social networks and health is to elucidate linkages through which social networks ties adversely affect health, which are currently not well understood.

The literature examining the relationship between social network ties and health generally focuses either on structural aspects of social network ties, such as network size, or on the commodities ties transmit (e.g., Lin, Woelfel, & Light, 1985), such as social support, in relation to health. Less research theorizes the interrelationship of network structure and the commodities transmitted through ties as a linkage between social network ties and health behavior. Among studies of adolescents, past research suggests that not only does network structure influence health

behavior, but that normative and other peer influences transmitted through network ties shape risk behavior (Krohn, 1986).

Grounded conceptually in social network theory, this study draws on theoretical intuition from Granovetter (1973) to focus on both individual and network level structures, including the relevance of weak ties, to examine how peer influence acts jointly with adolescent friendship networks in relation to cigarette smoking. This study examines potential synergy between characteristics of network ties and peer influences in relation to cigarette smoking among high risk adolescents in southern California continuation high schools. Youth who attend these schools have exited mainstream high schools due to reasons including truancy, drug use, and lack of academic credits (Sussman, Dent, Stacy, & Craig, 1998) and are at high risk for substance use relative to mainstream youth from adolescence into adulthood (e.g., Rohrbach, Sussman, Dent, & Sun, 2005; Sussman, Dent, & Leu, 2000; Sussman, Dent, & Stacy, 2002). In the present study, we focus on both structural and positional characteristics of youths' friendship networks. Structural characteristics describe linkages among individuals in a network, while positional characteristics describe the significance of occupying different network positions. This study attempts to elucidate linkages between social network ties and cigarette smoking among the adolescents under study. The network characteristics under study are salient from a theoretical standpoint to the peer influences under study and reflect the extent to which youth were socially integrated in their friendship networks. We define social

\* Corresponding author. Tel.: +1 949 824 0946.

E-mail address: [clakon@uci.edu](mailto:clakon@uci.edu) (C.M. Lakon).

integration as the extent and nature in which youth are embedded in networks. We also account for various dimensions of smoking related peer influence, including a normative process relevant to adolescent smoking. Few studies if any to date have taken this multidimensional theoretical approach in studying the relationship between adolescent friendship networks and smoking.

### Social integration in networks and adolescent smoking

Past studies examining relationships between both structural and positional characteristics of adolescent networks and cigarette smoking (e.g., Abel, Plumridge, & Graham, 2002; Ennett & Bauman, 1993; Ennett et al., 2006; Fang, Li, Stanton, & Dong, 2003) generally find that adolescents occupying less socially integrated positions in networks are more likely to smoke. Other studies, however, show that popular (well connected) youth are likely to smoke (Alexander, Piazza, Mekos, & Valente, 2001; Valente, Unger, & Johnson, 2005) and that smoking largely takes place within the peer group context (Pearson & West, 2003). Interestingly, Valente et al. (2005) found that both popular and isolated youth were likely to smoke cigarettes. They assert that because popular youth are well connected in school, they may be disproportionately exposed to the pro-smoking peer influences that may be present in schools. Furthermore, they suggest that isolated youth likely associate with friends outside of school who smoke (Valente et al., 2005). Other work suggests that peer influence may mirror pervasive smoking trends in schools, as Alexander et al. (2001) found that popular youth were more likely to smoke in schools with a high smoking prevalence. Also indicating the importance of both friend smoking and network position to adolescent smoking, Ennett et al. (2008) found that the relationship between popularity and smoking involvement was negatively moderated by the smoking behavior of adolescents' friends. This finding suggests that being less well known in adolescent networks and having a higher proportion of friends who smoke relates to more smoking among adolescents. On a related note, Haynie (2001) found that personal network density and being central in networks (i.e., popular) positively moderated the delinquency-peer relationship among youth.

In sum, this mixed pattern of findings on the relationship between social integration in networks and smoking suggests the need for considering not only the structure of ties and position of adolescents in networks, but also their exposure to smoking relevant peer influences in their school and possibly other friendship network environments. In the remainder of this theoretical section, we describe peer influence processes relevant to adolescent smoking and conclude with a section on how network structure and position may act jointly with peer influence in relation to adolescent smoking.

#### *Peer influence and adolescent smoking*

Studies consistently and positively relate peer influence to adolescent smoking, both cross-sectionally and longitudinally (e.g., Flay et al., 1994; Hoffman, Monge, Chou, & Valente, 2007). Peer influence processes have been measured in relation to adolescent smoking in numerous ways. In order to capture different dimensions of the construct of smoking related peer influences arising from friends both inside and outside of adolescents' schools, we conceptualize this construct from three different perspectives, as the influence exerted by: 1) adolescents' best friends' (whose nominations were not restricted to school) smoking behavior; 2) adolescents' classroom friends' smoking behavior; and 3) adolescents' perceived normative beliefs of their friends about drug use.

A second rationale for examining various dimensions of peer influence was to tap into a normative dimension of peer influence,

namely adolescents' perceived normative beliefs of friends about drug use. It has long been recognized that the norms of adolescents' peers play an important role in the transmission of substance use behaviors among adolescent youth (e.g., Dishion, 2000; Kandel, 1973; Krohn, 1986; Sutherland, 1947). Norms influence behavior through such mechanisms as comparison of attitudes with those of a similar reference group (Marsden & Friedkin, 1994), modeling (Bandura, 1977), creating expectations for behavior (Rimal & Real, 2003), and negative social feedback (Fischer & Misovich, 1990). The influence of norms may also extend to adolescents' perceptions of their peers' behavioral norms, as one study found that adolescents' perceptions of their peers' behavioral norms about cigarette smoking predicted their own smoking behavior (Ellickson, Bird, Orlando, Klein, & McCaffrey, 2003).

One possible explanation for why continuation high school youth display relatively high rates of cigarette smoking is because they may be disproportionately exposed to pro-drug use norms transmitted through relationships with their substance using friends. A number of theoretical perspectives support this notion: Differential Association theory (Sutherland, 1947), emphasized learned associations about deviance from close network contacts with deviant norms, and the work of Krohn (1986) emphasized the role of norms in shaping delinquent behavior among youth. In addition, other research finds that youth who maintain friendships with deviant peers adopt deviant behavior (Dishion, 2000). Lastly, one study highlighted the importance of friends' norms about smoking among continuation high school youth in southern California, as friends' norms regarding substance use predicted daily cigarette smoking among youth (Rohrbach et al., 2005).

#### *Peer influence, adolescent network structure and position*

That peer influence plays an important role in adolescent smoking is well documented, however the question of how peer influence works in concert with structural and positional characteristics of adolescent networks in relation to smoking is less well understood. Network ties carry resources throughout a network, including peer influence. The structure and position of network ties may either amplify or attenuate peer influence in relation to adolescent smoking. Because both the local network (e.g., youth each adolescent is directly connected to, and the ties among them) and whole network structure may affect peer influence, this study examines adolescents' socio-metric (whole) network characteristics at two levels: 1) the individual adolescent and 2) friendship networks of adolescents bounded by their school classrooms. At the individual level, we examine: 1) in-degree centrality, 2) reciprocity, 3) bridging, and 4) personal network density. At the network level, we examine clustering and path length. High scores on any of these constructs likely represent a moderate to high degree of social integration in a network at the level of the adolescent or the network. It is important to examine network characteristics at both levels as whole network structure may give rise to lower order structure in networks (Bearman, Moody, & Stovel, 2004). Below we describe the theoretical intuition and relevance of each network characteristic under study to peer influence and to adolescent smoking.

First, in-degree centrality reflects how directly connected an actor is to others in a network and indicates the number of people that report knowing an individual in a network. In general, centrality measures indicate prominence or popularity within the larger network (Wasserman & Faust, 1994). If an individual is directly connected to many others, then this actor can easily influence and be influenced by others. In-degree centrality has been positively related to adolescent smoking (Valente et al., 2005).

Second, the reciprocity or mutuality of ties is an important dimension of social cohesion (Wasserman & Faust, 1994) and likely

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