

Original article

## Do popular students smoke? The association between popularity and smoking among middle school students

Thomas W. Valente, Ph.D.\*, Jennifer B. Unger, Ph.D., and C. Anderson Johnson, Ph.D.

*Institute for Prevention Research School of Medicine, University of Southern California, Alhambra, California*

Manuscript received April 26, 2004; accepted manuscript October 12, 2004

### Abstract

**Background:** Several studies have shown an association between popularity and behavior, indicating that popular people tend to reflect the norms of their group. Among adolescents, it has been hypothesized that popular students are more likely to smoke, especially in schools with high smoking prevalence.

**Methods:** Data were collected on friendship patterns and smoking from 1,486 sixth and seventh graders in 16 middle schools in southern California. Susceptibility to smoke was measured as not stating a commitment not to smoke in the future, and smoking as ever taken a puff or smoked a whole cigarette. We measured popularity as the number of times a student was chosen as a friend. Multivariate logistic regression was used to correlate popularity with susceptibility to smoke and smoking at follow-up controlling for baseline outcomes, demographic characteristics, and clustering within schools.

**Results:** Popularity was associated with increased susceptibility to smoke (Adjusted Odds Ratio [AOR] = 5.64,  $p < .001$ ) and smoking (AOR = 5.09,  $p < .05$ ) over the 1-year interval between surveys. Although the association was strongest for non-White boys, we did not find evidence of interactions between popularity and gender or ethnicity.

**Conclusions:** Popular middle school students were more likely to become smokers compared to their less popular peers. Although there seems some difference in the association by gender and ethnicity, the evidence does not suggest subgroup effects in this population. Implications for the study of adolescent smoking and prevention programming are discussed. © 2005 Society for Adolescent Medicine. All rights reserved.

**Keywords:** Adolescents; Tobacco; Smoking; Peer influence; Popularity

Smoking is the single most preventable cause of premature death and disability in the United States [1] with an estimated 430,000 deaths per year attributable to cigarette smoking. This number exceeds that for AIDS, motor vehicle crashes, alcohol and other substances, and violence combined [2]. It is estimated that about 1 million people under the age of 18 start smoking annually. Although not all adolescents who experiment with cigarettes progress to regular tobacco use, data on adults suggest that between 80–90% of smokers began smoking by 18 years of age [3]. Data from the Monitoring the Future study suggest that there has

been an increase in smoking prevalence among high school seniors during the 1990's despite an earlier trend of decreasing rates from the late 1970's through the mid 1980's. Over 50% of high school students have tried smoking and many become nicotine-dependent [4].

Although many factors are associated with adolescent smoking, peer influence (broadly defined) has been identified as a leading correlate, and perhaps cause of smoking-initiation [5–7]. Nichter and others [8] argue that teenagers feel that they should smoke if others around them smoke. Youths smoke to be socially acceptable, “fit in,” and to facilitate social interaction [9]. Popular students are likely to have a strong influence in setting these norms and providing particularly visual or apparent cues to the acceptability (or lack thereof) of smoking.

Peer influence is contextual, often dependent on the

\*Address correspondence to: Dr. Thomas Valente, University of Southern California, 1000 South Fremont, Bldg A, Room 5133, Alhambra, CA 91803.

E-mail address: tvalente@usc.edu

norms in the community, school or environment in which peers socialize [10]. Whether adolescent friendship networks influence behavior often depends on the norms within the group or community, and on the perception of these norms, whether accurate or not [11–13]. Social learning theory posits that behavior is learned through modeling and imitating the behavior of others [14] and diffusion of innovations [15] models show how this tendency aggregates into normative beliefs. Norms and perceptions of what is normative are often shaped by the attitude and behaviors of popular members of the group [16–20]. Conversely, the behavior of popular people is often shaped by the perceived norms of the community which, for adolescents, may be the school environment [21,22]. In cultures or communities in which smoking will become widespread, peer influence promotes smoking; whereas, in cultures or communities in which smoking will not be popular, peer influence dissuades adolescents from smoking [23].

Since popular students both influence others and reflect group trends, they may act as bellwethers of adolescent cultural trends. Popular students will attempt to set trends while at the same time try not to deviate too much from the cultural norms of the group [21]. If popular adolescents are early initiators of smoking, we can expect smoking to spread more rapidly than if they do not become early smokers; conversely, if popular adolescents delay smoking initiation, then we might expect smoking in that culture or subgroup to spread more slowly.

Prior research on the diffusion of innovations and health behavior has shown a link between the behavior of opinion leaders and the behavior of the community they represent. In Rogers' [24] early work on the diffusion of innovations, opinion leaders were found to be early, but not the earliest, adopters of new behaviors and practices. Becker [21] showed that opinion leaders were earlier adopters of practices they expected to be widely embraced, but later adopters of practices they expected to be met with resistance by the community. Rogers and Kincaid [25], in their study of family planning in Korea, showed that opinion leaders tended to adopt the same contraceptive method as the majority of other women in their community. Thus, it appears that opinion leaders choose to adopt behaviors that they expect to be acceptable to the community, and subsequently their own modeling of those behaviors speeds the diffusion of those behaviors throughout the community.

Opinion leadership is measured as the frequency with which one is nominated as someone others turn to for advice or counsel, whereas popularity is measured as the frequency with which one is nominated as a friend. Alexander and others [26] demonstrated that popular students were more likely to smoke overall, and especially in schools with high smoking prevalence. The Alexander and others [26] study replicates results found in the opinion leadership studies. The opinion leader studies and the Alexander and others [26] study were cross-sectional, showing an association

between popularity and smoking, but not a longitudinal prediction. The aim of the current article is to replicate and extend the Alexander and others [26] findings to determine if popularity predicts smoking uptake at 1-year follow-up. The secondary aim is to determine whether the association between popularity and smoking varies by gender and/or ethnicity.

Understanding whether popular students exemplify the norms of their communities (schools, cultures, groups) with respect to smoking has important implications for prevention efforts. Current guidelines [27] recommend peer opinion leaders be used in school-based prevention programs [28]. Programs that use peers have been found to be more effective [29–31]. It is, thus, important to know whether and under what conditions popular students will be early or later users of tobacco or other illicit substances.

#### *Variations by gender and ethnicity*

Smoking and peer influences on smoking may vary by gender and ethnicity [32]. In the United States, smoking is more prevalent among White and Hispanic adolescents than among African-American and Asian adolescents [33,34]. Evidence exists that smoking rates differ by gender, with adolescent boys showing slightly higher smoking prevalence rates than adolescent girls [35].

Peer influence to smoke may also vary by gender and ethnicity. Urberg and others [36] found that boys seemed to be more influenced to smoke by their best friends than girls. Wang and others [37] found that regular smoking by girls was associated with having a boyfriend who smoked, but for boys there was no association between smoking and having a girlfriend who smoked. Some research suggests that European-American youths may be more influenced by their close friends in the initiation of cigarette smoking than African-American, Hispanic or Asian-American adolescents [36,38–40]. Other investigators have failed to find any ethnic variations in the influence of peers on measures of problem behaviors [41].

Popularity, particularly in early adolescence (12–14-year-olds), subgroups, subcultures, and friendship are likely to be strongly gender- and ethnically-based. Homophily in friendship choices will predominate [42] such that friendships will form between people of the same gender and of the same ethnicity. Consequently, the association between popularity and smoking should be stratified by gender and ethnicity.

#### *Network position*

Most studies of peer influence focus on individuals and the behavior of their immediate social networks. A different approach, however, has been to determine whether an individual's position in a social network is associated with the individual's behavior. For example, being a member of a group composed of smokers is associated with smoking.

Michell and Amos [43] showed that adolescents who belonged to groups where smoking was common were more likely to smoke. Pearson and West [44], in a 3-wave Markov analysis, showed that students progressed from being in a group of non-risk-takers to a group of risk-takers. Ennett and Baumann [45] showed that liaisons, students who bridged different groups, were more likely to become smokers.

Isolates are students who have no contacts within the network being studied [46]. Studies have found that adolescents who are isolated or rejected from the group are more likely to smoke [47,48]. Youths might become isolated out of choice by rejecting the practices and norms of the dominant group. If this dominant group does not approve of smoking, then isolated youths might be more likely to smoke. Youths may also become isolated because the dominant group rejects them, typically because the individual espouses beliefs and opinions that are different from the dominant group. There are many reasons why some students become popular and others do not that are beyond the scope of this article. Here we take as given that there are different social positions formed in adolescent, school-based friendships networks but do not address their etiology. Again, this may result in smoking if the individual identifies with a group that supports smoking and their main reference group does not. For young adolescents [12–14-years-old], isolates might be expected to smoke since most young adolescents do not smoke and do not approve of smoking [48]. Thus, various studies have identified different social network positions as risk factors for smoking, including popular students, isolates, members of specific groups, and liaisons between groups. Resolving discrepancies from these findings constitutes a third aim of this article.

In all, this study attempts to answer 3 questions: (1) Are popular students more likely to start smoking? (2) Does the association between popularity and smoking vary by gender and/or ethnicity? (3) Are isolates more or less likely to start smoking? Using network analytic techniques, we measure popularity by counting the number of times each student is chosen as a friend by other students in his/her class divided by class size. We then correlate popularity with changes in susceptibility to smoke and smoking over a 1-year period. We control for a variety of background characteristics as well as other network measures derived from a second network question. Finally, we shed some light on why earlier studies have reported contradictory findings on the association between network position and smoking.

## Methods

This study was nested within a larger trial evaluating 2 social influence programs for smoking prevention in 16 middle schools, 1 that addressed cultural diversity and 1 that did not [22,49]. Schools were located in Los Angeles County and were either majority Hispanic/Latino or had no

single ethnicity in the majority but at least 35% Hispanic/Latino or Asian-American. The curricula were implemented in sixth grade classrooms in April and May 2001. Analysis comparing participating schools with those that declined to participate due to district or supervisor refusal or because of low consent rates showed no significant differences on ethnic composition, scholastic achievement, and socio-economic status.

Three in-school student surveys were administered: a baseline (January, 2001) measuring gender, ethnicity, age, grades, susceptibility to smoke, and smoking behavior; a pre-curriculum survey (March 2001) measuring social networks with 2 questions “name your 5 closest friends” and “name 5 students who make the best leaders for a project in class”; and a 1-year follow-up survey similar to the baseline (January, 2002). There were 2,002 eligible students (those with parental consent and student assent) who completed a baseline survey. Of these, 350 (17.3%) were lost to follow-up and 166 (8.2%) had some missing data on specific survey items. Due to different consent requirements, there were 2,618 students who completed social network surveys as part of the curriculum program. This left 616 students with social network data, but no demographic or outcome information. Thus, the final sample is 1,486 (74.5% retention) who completed a baseline, social network, and follow-up survey. Table 1 provides a description of the study sample’s characteristics and a comparison between the analytic sample and baseline-only students, social network-only students, and those with some missing data.

The outcome variables were “susceptibility to smoking anytime in the future” (refusing to state they would not smoke in the future [50]) and “ever smoked” (ever taking a puff, ever smoked whole cigarette, smoked any cigarette in the last 30 days) at 1-year follow-up, each coded as no = 0, yes = 1. We controlled for these smoking variables at baseline (lagged regression, [51]). Other controls included age, gender, ethnicity (White, Latino, or Asian-American, or other), having a foreign-born parent, having a parent who is a college graduate, having expectations of strong academic performance (mostly As and Bs), number of rooms in the household, and having a parent who smokes.

Popularity was measured with a social network instrument [46,52,53]. We asked students to name their 5 closest friends in the classroom and asked them to name 5 students who would make a good leader for a project in the classroom. Students were given a class roster with random numbers next to each name to use when responding. Popularity was the number of times a person was named as a friend, divided by class size.

For network controls, we included the proportion of students: (1) named as a friend, (2) named as a leader, and (3) that nominated the respondent as a leader. Analyses consist of multi-level logistic regression controlling for clustering within school. All procedures, protocols, and

**Table 1**  
Comparison of study variables between those lost to followup, those with social network data only, those with missing data, and those with complete data

	Baseline Only N = 350	Social Network Only N = 616	Missing Data n = 166	Complete Data n = 1,486	p-value
Susceptible to smoke baseline	16.7%	—	8.2%	11.7%	.01
Susceptible to smoke followup	—	—	20.1%	16.2%	.20
Smoked at baseline	13.7%	—	8.0%	10.1%	.09
Smoked at followup	—	—	17.7%	16.1%	.61
10–11 years old	32.0%	—	40.8%	30.8%	.04
Male	49.6%	—	49.6%	46.1%	.41
White	22.3%	—	30.3%	23.2%	.16
Hispanic/Latino	60.0%	—	48.0%	56.3%	.05
Asian American	19.7%	—	25.0%	26.5%	.04
1 Parent foreign born	81.3%	—	83.2%	84.3%	.42
1 Parent college graduate	40.0%	—	36.7%	40.6%	.63
Strong academic performance	66.3	—	65.0	69.4	.33
Rooms in house	3.54	—	3.71	3.79	.04
Parental smoking	33.3	—	32.4	31.8	.87
Project leaders named	11.5%	12.1%	11.6%	12.3%	.07
Named as project leader	11.2%	8.8%	11.1%	13.8%	.00
Friends named	13.1%	13.5%	13.3%	13.6%	.35
Popularity (% named as friend)	13.9%	12.1%	13.3%	14.0%	.00

Note: 99 cases recoded to this modal category. Ethnic categories sum to greater than 100% because students could select more than one ethnicity.

instruments were reviewed and approved by the USC Institutional Review Board.

**Results**

Table 2 provides a logistic regression of factors associated with the respondent’s susceptibility to smoking and

**Table 2**  
Effects (adjusted odds ratios) of demographic, smoking, social network, and popularity variables on susceptibility and smoking at one year followup (N = 1,486)

	Susceptibility	Smoked
Susceptibility to smoke at baseline	4.39**	2.02 <sup>†</sup>
Smoked at baseline	2.22**	14.4**
Age 12+ yrs (ref: 10–11 yrs)	1.52**	1.30 <sup>†</sup>
Male	1.17	1.29
White	1.19 <sup>†</sup>	.91
Hispanic/Latino	1.02	1.34
Asian American	.74	.55 <sup>†</sup>
Parent(s) foreign born	.73	.84
Parent(s) graduated from college	1.08	.77**
Strong academic performance	.95	1.09
Rooms in house	.95	.99
Parent(s) smokes	1.56**	1.13
Project leaders named	3.09	.11
Named as project leader	.41*	.34 <sup>†</sup>
Friends named	.03*	5.92
Popularity (% named as friend)	5.64**	5.09 <sup>†</sup>
R <sup>2</sup>	12%	23%

Note: Regression controls for intra-school co-variation.  
<sup>†</sup> p < .05; \* p < .01; \*\* p < .001.

smoking at follow-up. Baseline values on these variables are, not surprisingly, strongly associated with follow-up. Students who were susceptible or smoked in sixth grade were much more likely to do so in seventh grade. For example, susceptible students in sixth grade were 4.39 times more likely to be so in seventh grade. Similarly for smoking, students who smoked in sixth grade were more than 14 times more likely to smoke in seventh grade than those who had not smoked in sixth grade. Control variables operated as expected, students who were older, White, and had a parent who smokes were more likely to increase their smoking risk. Asian-American students and those with a parent who graduated from college were less likely to become smokers.

Popularity was associated with increased susceptibility to smoke and smoking. Specifically, increased susceptibility was associated with popularity by an adjusted odds ratio (AOR) of 5.64 (p < .001). Increased smoking was associated with popularity by an AOR of 5.09 (p < .05). Note that since the measure of popularity controls for class size, it is a proportion, and the AOR indicates that students who received 100% nominations as friends would be >5 times more likely than those who received no nominations to have started smoking in the past year. No student received this many friendship nominations, the highest being .45 (indicating that 45% of students in the class named him/her as a friend). The mean popularity score was .14 (SD = .09), indicating that, on average, students received nominations as friends from 14% of the class.

Popularity scored as a count of friendship nominations received (and not dividing by class size) is also associated

with susceptibility (AOR = 1.07,  $p < .001$ ) and smoking (AOR = 1.05,  $p < .05$ ). Thus, each additional friendship nomination received was associated with a 5% increase in the likelihood of becoming a smoker. Popularity is best measured as a proportion, since class size matters: receiving 5 friendship nominations in a class of 20 is different than receiving 5 in a class of 40. To determine whether there was a dose-response relationship between popularity and smoking, we categorized popularity as zero (no nominations),  $\leq 10\%$ ,  $\leq 20\%$ ,  $\geq 30\%$ . Results showed a dose-response effect. Specifically, for susceptibility, the adjusted odds ratios for each category were 10%, 1.48 ( $p < .10$ ); 20%, 1.46 ( $p < .10$ ); 30%, 2.13 ( $p < .001$ ); for smoking, they were 10%, 1.44 ( $p < .05$ ); 20%, 1.62 ( $p < .05$ ); 30%, 1.79 ( $p < .01$ ). We also tested network centrality measures [54] such as betweenness, closeness, and integration/ radiality and found them also to be associated with becoming a smoker.

The popularity measures described above indicate the number of other students in the class who nominated the respondent as a friend (in-degree). We also examined smoking behavior as a function of how many students the respondent named as a friend (out-degree). The number of friends named by a student was negatively associated with susceptibility (AOR = .03;  $p < .01$ ) indicating that students who named more friends in the classroom were less likely to increase their susceptibility. Naming others to be project leaders was not associated with either outcome, but being named as a project leader was negatively associated with susceptibility indicating that students were more likely to name project leaders who are less susceptible to becoming smokers.

We tested whether students who were considered popular and also chosen to be leaders were more or less likely to become smokers but found the interaction term to be non-significant. This indicates that being popular is associated with becoming a smoker but not more or less so among those considered to make good leaders. We also tested whether popularity was more strongly associated with smoking in schools with higher smoking prevalence, but did not find support for that association. Popularity is associated with becoming a smoker in both high and low prevalence schools in this study.

Table 3 reports the same regressions separately by gender and ethnicity. The association between popularity and smoking was significant for girls only (AOR = 9.14;  $p < .001$ ) and Latinos only (AOR = 7.08;  $p < .05$ ). The association between popularity and susceptibility and smoking was statistically significant for Latina girls (AOR = 5.65,  $p < .05$ ; AOR = 8.49,  $p < .001$ ; respectively). When classified as White or non-White, the association between popularity and smoking was statistically significant for non-Whites only (AOR = 19.0,  $p < .001$ ). The association between popularity and smoking was strongest for non-White boys (AOR=28.6;  $p < .001$ ).

Table 3

Adjusted odds ratios for popularity and susceptibility to smoke and smoked by gender and ethnicity\*

	Susceptible to Smoke (N = 1,486) 5.64**	Smoked (N = 1,486) 5.09 <sup>†</sup>
Male (n = 685)	3.78	2.53
Female (n = 801)	5.20	9.14*
Non-Latino (n = 649)	6.81	2.77
Latino (n = 837)	4.68 <sup>†</sup>	7.08 <sup>†</sup>
Male Non-Lat. (n = 322)	5.60	1.90
Male Latino (n = 363)	2.40	3.03
Female Non-Lat. (n = 327)	7.94	3.22
Female Latina (n = 474)	5.65 <sup>†</sup>	8.49**
Non-Whites (n = 1,126)	4.17	19.0**
Whites (n = 360)	4.06	0.07
Male Non-Wt. (n = 505)	3.94	28.6**
Male Whites (n = 180)	1.03	.01
Female Non-Wt. (n = 621)	2.52	12.8
Female Whites (n = 180)	13.2	.75

Note: Controls for age, ethnicity, having a parent foreign born, having a parent graduated from college, expected strong academic performance, rooms in house, parental smoking, leader nominations sent, leader nominations received, friendship nominations sent, and clustering within schools.

Lat. = Latino; Wt. = White.

<sup>†</sup>  $p < .05$ ; \*  $p < .01$ ; \*\*  $p < .001$ .

We constructed interaction terms of popularity and Latina girls and between popularity and non-White boys to test whether gender or ethnicity influenced the association between popularity and smoking. These interactions were not statistically significant, indicating that the association between popularity and smoking is not necessarily specific to subgroups in this study.

## Discussion

Interpretation of these results must be qualified given the limited nature of this sample. All schools are located in southern California and the students were primarily Hispanic/Latino and Asian-American. These schools were purposely selected for their ethnic diversity, as required by the larger study of cultural influences on smoking. Further, we expect smoking prevalence to be high in these schools. Thus, inferences to the general US population are not warranted. In addition, this study was conducted in the context of an intervention designed to slow smoking uptake which may have affected outcomes. However, the social network survey was administered only in the schools that received smoking prevention curricula (i.e., not in the control schools). Therefore, these results are not confounded by program effects. Nonetheless, we have shown that popular students in a set of southern California middle schools increased their susceptibility to smoking and smoking compared to their non-popular peers. Popular students are more visible and, thus, contribute disproportionately to the estab-

lishment of social norms and, in this case, one that favors tobacco use. When popular adolescents start to smoke, it sends a signal to other adolescents that smoking is acceptable and even desirable. Popular students are connected socially to a larger number of students and so might contribute disproportionately to the process of peer influence on smoking [55].

It is also possible that their popularity led them to smoke. Students who were popular in the sixth grade may have felt that they needed to smoke in order to maintain their popularity. Popular students have a need to embrace the norms of their community to remain popular and so they may have felt subtle pressure to be among the first to experiment with smoking [21]. If true, we can expect these same students to be among the first to experiment with other illegal substances in order to remain popular.

We found that naming fewer friends was associated with smoking (in contrast to being named as a friend; the correlation between naming friends and being named as a friend was .34 ( $p < .001$ )). This is possibly a function of those who have more friends outside the classroom, in other classes, or outside of school, being more likely to become smokers. This lends support to the hypothesis that isolates are early smokers. This finding sheds some light on an apparent paradox in previous studies showing that isolates and popular students both are more likely to become smokers. It might be that isolates smoke because their ties are to others outside the school and their normative reference is to people that support smoking. Thus, isolates in a class are more likely to become smokers. Conversely, in a school environment in which smoking is likely to become widespread, popular students are also likely to be early smokers.

The multivariate analysis reported in this article between popularity and smoking controlled for naming and being named as a project leader. This suggests that results for the friendship networks are not a function of being visible or available to be nominated, rather it is being nominated frequently as a *friend* by others. Indeed, there is approximately 50% overlap between friendship and peer leader nominations (mean = 48.2%, SD = 11.5%), yet it is popularity in the friendship network that is associated with becoming a smoker.

We found the association between popularity and smoking seemed stronger for girls than boys, but the interaction term of popularity and being a girl was not statistically significant. We found the association between popularity and smoking to be stronger for Latinos and particularly for Latina girls. The association was strongest for non-White boys. None of these interaction terms, however, was significant. This suggests that, in this study, popularity and smoking are linked irrespective of gender and ethnicity.

Overall, this study suggests that programs aimed at deterring the initiation of smoking in this population face

the challenge of how to address the influence of these popular students. In order to be effective, smoking prevention and cessation programs will need to convince these popular students to support anti-tobacco norms. As long as these popular students embrace smoking, programs aimed at preventing smoking will have limited effectiveness. Programs need to create a cultural climate in which smoking is not perceived as desirable perhaps by using celebrities and/or popular music. Further, programs may need to recruit popular students directly to implement their programs.

### Acknowledgment

Research for this article was supported by NCI grant # P50-CA84735-01 (Transdisciplinary Tobacco Use Research Center) and NIDA grant P50-DA16094 (Transdisciplinary Prevention Research Center).

### References

- [1] CDC MMWR. Youth tobacco surveillance—United States, 1998–1999. Available at: [www.cdc.gov/mmwr/preveiw/](http://www.cdc.gov/mmwr/preveiw/). Accessed October, 13, 2000.
- [2] Turnok BJ. Public Health: What it is and how it works. Gaithersburg, MD: Aspen; 2000.
- [3] Bonnie BS, Bonnie RJ, (eds). Growing up tobacco free. Washington, DC: National Academy Press; 1994.
- [4] Johnston LD, O'Malley PM, Bachman JG, Schulenberg JE. (2004). Monitoring the Future national survey results on drug use, 1975–2003. Volume I: Secondary school students (NIH Publication No. 04–5507).
- [5] Beal AC, Ausiello J, Perrin JM. Social influences on health-risk behaviors among minority middle school students. *J Adolesc Health* 2001;28:474–80.
- [6] Donaldson SI. Peer influence on adolescent drug use: a perspective from the trenches of experimental evaluation research. *Am Psychologist* 1995;50:801–2.
- [7] Rutger CM, Engels MA, Knibbe RA, et al. Homogeneity of cigarette smoking within peer groups: influence or selection? *Health Ed Behav* 1997;24:801–11.
- [8] Nichter M, Nichter M, Vuckovic N, et al. Smoking experimentation and initiation among adolescent girls: qualitative and quantitative findings. *Tobacco Control* 1997;6:285–95.
- [9] Evans N, Gilpin E, Farkas AJ, et al. Adolescents' perceptions of their peers' health norms. *Am J Public Health* 1995;85:1064–9.
- [10] Borsari BB, Carey KB. Peer Influences on College Drinking: A Review of the Research. *J Substance Abuse* 2001;13:391–424.
- [11] Eisenberg ME, Forster JL. Adolescent smoking behavior: Measures of social norms. *Am J Preventive Med* 2003;25:122–8.
- [12] Perkins HW, (ed). The Social Norms Approach to Preventing School and College Age Substance Abuse: A Handbook for Educators, Counselors, Clinicians. San Francisco, CA: Jossey-Bass; 2003.
- [13] Sussman S, Dent CW, Stacy AW. Project towards no drug abuse: a review of the findings and future directions. *Am J Health Behavior* 2002;26:354–65.
- [14] Bandura A. Social Foundations Of Thought And Action. Englewood Cliffs, NJ: Prentice-Hall; 1986.
- [15] Rogers EM. Diffusion of Innovations 5th edition. New York, NY: Free Press; 2003.

- [16] Kelly JA, St. Lawrence J, Diaz Y, et al. HIV risk behavior reduction following intervention with key opinion leaders of population: An experimental analysis. *Am J Pub Health* 1991;81:168–71.
- [17] Latkin C. Outreach in natural setting: the use of peer leaders for HIV prevention among injecting drug users' networks. *Pub Health Reports* 1998;113(S1):151–9.
- [18] Lomas J, Enkin M, Anderson GM, et al. Opinion leaders vs. audit and feedback to implement practice guidelines: delivery after previous cesarean section. *JAMA* 1991;265:2202–7.
- [19] Sikkema KJ, Kelly J, Winett R, et al. Outcomes of a Randomized Community-Level HIV Prevention Intervention for Women Living in 18 Low-Income Housing Developments. *Am J Pub Health* 2000;90:57–63.
- [20] Soumerai SB, McLaughlin TJ, Gurwitz JH, et al. Effect of local medical opinion leaders on quality of care for acute myocardial infarction: a randomized controlled trial. *JAMA* 1998;279:1358–63.
- [21] Becker M. Sociometric location and innovativeness: reformulation and extension of the diffusion model. *Am Sociological Rev* 1970;35:267–82.
- [22] Valente TW, Hoffman BR, Ritt-Olson A, et al. The effects of a social network method for group assignment strategies on peer led tobacco prevention programs in schools. *Am J Pub Health* 2003;93:1837–43.
- [23] Pokomy SB, Jason LA, Schoeny ME. Current smoking among young adolescents: Assessing school based contextual norms. *Tobacco Control* 2004;13:301–7.
- [24] Rogers EM, Cartano DG. Methods of measuring opinion leadership. *Publ Opinion Q* 1962;26:435–41.
- [25] Rogers EM, Kincaid DL. *Communication Networks: A New Paradigm For Research*. New York, NY: Free Press; 1981.
- [26] Alexander C, Piazza M, Mekos D, Valente TW. Peer networks and adolescent cigarette smoking: An analysis of the national longitudinal study of adolescent health. *J Adolesc Health* 2001;29:22–30.
- [27] Journal of School Health (1994). Guidelines for school health programs to prevent tobacco use and addiction. *J School Health*, 64, 353–360.
- [28] Perry CLO, Komro KA, Vebeln-Mortenson S, et al. A randomized controlled trial of the middle and junior high school D.A.R.E. and D.A.R.E. plus programs. *Archives Ped Adolesc Med* 2003;157:178–84.
- [29] Tobler N. Meta-analysis of 143 adolescent drug prevention programs: quantitative outcome results of program participants compared to a control or comparison group. *J Drug Issues* 1986;16:537–67.
- [30] Tobler N, Stratton HH. Effectiveness of school-based drug prevention programs: A meta-analysis of the research. *J Primary Prev* 1997;18:77–128.
- [31] Gottfredson DC, Wilson DB. Characteristics of effective school-based substance abuse prevention. *Prev Sci* 2002;4:27–38.
- [32] Griesler PC, Kandel DB. Ethnic differences in correlates of adolescent cigarette smoking. *J Adolesc Health* 1998;23:167–80.
- [33] Centers for Disease Control and Prevention. Youth Risk Behavior Surveillance, United States, 1999. *MMWR Surveillance Summaries* 2000;49(SS05):S1–96.
- [34] Johnston, L.D., O'Malley, P.M., & Bachman, J.G. (2002). *The Monitoring the Future national survey results on adolescent drug use: Overview of key findings, 2001* (NIH Publication No. 02–5105). Bethesda, MD: National Institute on Drug Abuse, c. 61 pp.
- [35] Centers for Disease Control and Prevention. Trends in cigarette smoking among high school students—United States, 1991–2001. *MMWR* 2002;51:409–12.
- [36] Urberg KA, Degirmencioglu SM, Pilgrim C. Close friend and group influence on adolescent cigarette smoking and alcohol use. *Dev Psych* 1997;33:834–44.
- [37] Wang MQ, Fitzhugh EC, Turner L, Fu Q. Social influence on southern adolescents' smoking transition: a retrospective study. *Southern Med J* 1997;90:218–22.
- [38] Flay BR, Hu FB, Siddiqui O, et al. Differential influence of parental and friends' smoking on adolescent initiation and escalation of smoking. *J Health Soc Beh* 1994;35:248–65.
- [39] Landrine H, Richardson JL, Klonoff EA, Flay B. Cultural diversity in the predictors of adolescent smoking: the relative influence of peers. *J Behav Med* 1994;17:331–46.
- [40] Unger JB, Rohrbach LA, Cruz TB, et al. Ethnic variation in peer influences on adolescent smoking. *Nicotine Tobacco Res* 2001;3:167–76.
- [41] Rowe DC, Vazsonyi AT, Flannery DJ. No more than skin deep: ethnic and racial similarity in developmental process. *Psych Rev* 1994;101:396–413.
- [42] McPherson M, Smith-Lovin L, Cook JM. Birds of a feather: homophily in social networks. *Annual Rev Sociol* 2001;27:415–44.
- [43] Michell L, Amos A. Girls, pecking order and smoking. *Social Sci Med*. 1997;44:1861–9.
- [44] Pearson M, West P. Drifting smoke rings: social network analysis and Markov processes in a longitudinal study of friendship groups and risk-taking. *Connections* 2003;24:59–76.
- [45] Ennett ST, Bauman KE. The contribution of influence and selection to adolescent peer group homogeneity: the case of adolescent cigarette smoking. *J Personality Social Psychol* 1994;67:653–63.
- [46] Wasserman S, Faust K. *Social Networks Analysis: Methods And Applications*. Cambridge, UK: Cambridge University Press; 1994.
- [47] Ennett ST, Bauman KE. Peer group structure and adolescent cigarette smoking: a social network analysis. *J Health Social Behav* 1993;34:226–36.
- [48] Tani CR, Chavez EL, Deffenbacher JL, et al. Peer isolation and drug use among White non-Hispanic and Mexican-American adolescents. *Adolesc* 2001;36:127–39.
- [49] Unger JE, Chou CP, Palmer PH, et al. Project Flavor: 1-year outcomes of a multicultural, school-based tobacco prevention curriculum for adolescents. *Am J Pub Health* 2004;94:263–5.
- [50] Pierce JP, Choi WS, Gilpin EA, et al. Validation of susceptibility as a predictor of which adolescents take up smoking in the United States. *Health Psych* 1996;15:355–61.
- [51] Valente TW. *Evaluating health promotion programs*. New York, NY: Oxford University Press; 2002.
- [52] Scott J. *Network Analysis: A Handbook* (2nd edition). Newbury Park, CA: Sage; 2000.
- [53] Valente TW. *Network Models Of The Diffusion Of Innovations*. Cresskill, NJ: Hampton Press; 1995.
- [54] Freeman LC. Centrality in social networks: conceptual clarification. *Social Networks* 1979;1:215–39.
- [55] Valente TW, Mouttapa M, Gallaher M. (in press). Social network analysis for understanding substance abuse: A transdisciplinary perspective. *Substance Use & Misuse*.