Alcohol Peer Influence of Participating in Organized School Activities: A Network Approach

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Abstract

Objective—This study compares the network influences on adolescent substance use from peers who co-participated in school-sponsored organized activities (affiliation-based peer influence) with the influence both from their "nominated" friends (i.e., the adolescent named the alter as a friend), and only "reciprocated" friends (i.e., both adolescents mutually named each other as friends). The study also attempts to parse affiliation-based peer influence into the influence of both activity members who are also friends, and those who are not, to address the potential confounding of these sources of peer influence.

Methods—The study data consisted of a nationally representative sample of 12,551 adolescents in Grades 7–12 within 106 schools from the Add Health data. Ordinal logistic regression was conducted to estimate the effects of affiliation-based and friends influence on alcohol use and drinking frequency.

Results—Peer influence via organized activities (sports or clubs) with drinkers and the influence of friends who drink had significant effects on adolescent drinking. Peer influence through club activities with drinkers had a stronger effect on any drinking behavior than through sports activities with drinkers. After decomposing peer influence through activities by friendship status, influence through sport activities had a significant effect on drinking only when co-participant drinkers were also "reciprocated" friends (but not "nominated" friends), whereas influence through club activities had a significant effect on drinking, regardless of friendship reciprocation.

Conclusions—The design and implementation of school based substance use prevention and treatment programs should consider the contextual effects of school-sponsored activities.

Keywords

affiliation; peer influence; friends influence; organized school activities; alcohol use; adolescents

Introduction

Numerous studies have been conducted to examine the role peers play in adolescent substance use. Social Network Analysis (SNA) has been widely employed to examine

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network influence on adolescent substance use (Bauman & Ennett, 1996; Ennett et al., 2008; Valente, Gallaher, & Mouttapa, 2004). SNA is broadly defined as a set of theories, methods, and techniques that are used to study a pattern of social relationships among actors (such as individuals, organizations, nations, etc.), as well as to understand how such relationships may affect individual or group behaviors (Valente, 2010). In the context of adolescent substance use, existing network studies of peer influence have illustrated the importance of direct influence on negative health behaviors by demonstrating a significant positive correlation between exposure to friends' substance use and the likelihood of individual substance use (Crosnoe, Muller, & Frank, 2004; Ennett, et at., 2006; Urberg, De irmencio lu, & Pilgrim, 1997). For example, an adolescent's drinking and their friends' drinking are positively associated with each other (Bauman & Ennett, 1996). Such a tendency is shown to be stronger when peer support (referring to emotional support and tangible support such as shelter, food, money, etc.) is high (Urberg, Goldstein, & Toro, 2005). Previous network studies have also stressed the importance of positional influence and identified various network positions that are associated with adolescent substance use (Alexander, Piazza, Mekos, & Valente; Cleveland & Wiebe, 2003, Ennet, et al., 2006; Fujimoto & Valente, in press; Kobus & Henry, 2011). For instance, popular middle school students (i.e., those who occupy central network positions) were more likely to become smokers (Valente, Unger, & Johnson, 2005), drink alcohol, or use other drugs (Pearson et al., 2006).

Peer influence may extend beyond friendships and is embedded in multiple social contexts (Ennett, et al., 2008; Hussong, 2002). These contexts range from immediate friendships to more distant peer crowd affiliations. Peer group affiliations are formed through joint participation in school-sponsored organized activities such as sports, clubs, and academic groups. One of the major limitations in previous network studies on peer influence has been that these affiliation-based sources of peer influence have not been studied in a way that allows comparison between the influence of friends and influence derived from participation in clubs and sports (with both friends and non-friends). In general, the influence of participating in school-wide organized activities and the potential influence from sharing these activities (i.e., co-participation) with peers who use substances with the adolescent have been ignored as a candidate source of peer influence, and yet expecting that peer influences derive from both direct friendships and affiliations formed in organized activities is reasonable.

This study investigates the relative strengths of two network influences on adolescent drinking (and drinking frequency), derived from affiliation with organized sports/club activities with their friends, using the affiliation exposure model (Fujimoto, Chih-Ping, & Valente, 2011; Fujimoto, Unger, & Valente, 2012). (See the Online Supplement for a discussion of how affiliation measures differ from other widely network influence measures (Christakis & Fowler, 2007; 2008; Rosenquist, Murabito, Fowler, & Christakis, 2010)). Furthermore, given the potential overlap between affiliation influence and friends influence, our study investigates how these different influence effects operate together as risk factors for adolescent drinking and drinking frequency, allowing us to disentangle overlapping influences from friend and non-friend affiliates.

Theoretical Framework of Peer Influence

Peer Influence based on friendship network

Peer influence from friendship relations is the most obvious and direct influence on adolescent problem behaviors. The two most well-known theories of peer influence on adolescent deviant behavior, such as substance use, are differential association theory (Sutherland, 1947; Sutherland & Cressey, 1978) and social learning theory (Burgess &

Akers, 1966; Ackers, 1998). Differential association theory takes an interactionist approach by stressing the process of how individuals learn to behave "deviantly"; it posits that adolescents learn the norms, attitudes, techniques, rationalizations, and motives for delinquent behavior through interaction with intimate personal friends. Social learning theory emphasizes the process of learning deviancy and posits that adolescents learn deviant behavior by observing, modeling or imitating the behaviors of intimate others and subsequent social reinforcement.

The majority of prior studies in differential association or social learning tradition (Akers, Krohn, Lanza-Kaduce, & Radosevich, 1979; Akers & Lee, 1996; Haynie, 2001; Lee et at., 2004; Urberg, 1992) operationalize differential peer association through immediate friendships, such as one's best friend or a few "closest" friends (Payne & Cornwell, 2007). In particular, for adolescent drinking behavior, studies show that differential association was most strongly associated with adolescent drinking alcohol and drug use behavior among the other social learning variables (definitions, differential reinforcement, and imitation) (Akers et al., 1979). These studies, however, consider only the direct influence processes of friendship in measuring the differential associations and do not take into account the influence of group affiliations.

Peer Influence based on Group Affiliation

During adolescence, peer interactions are not only limited to friendship relations, but also expand to include the school-based aggregates that are commonly referred to as peer groups or peer crowds (such as "jocks," "brains," or "druggies"). Belonging to a crowd plays an important role in adolescent personal and social development (Coleman, 1961; 1974). Peer crowds often establish "reputations" that embody certain attitudes, activities, or behaviors that adolescents internalize (Brown, 1990; Brown, Lohr, & Trujillo, 1990). Affiliation-based peer influence through school-sponsored organized activities is situated in-between the direct friend and the school crowd affiliation influence. Participation in organized activities contributes to peer group formation by providing a context in which adolescents share experiences and (possibly) goals with each other (Eccles & Barber, 1999). Thus, participation in activities also serves as a context of identifying with peer groups, whereby adolescents express and refine their crowd identity (Eccles, Barber, Stone, & Hunt, 2003; Barber, Stone, Hung, & Eccles, 2005; Eccles & Barber, 1999) and absorb the shared values and norms associated within the specific activity-based culture (Eccles & Barber, 1999).

School-sponsored organized activities provide a forum for adolescents to identify with peer groups formed within peer crowds. From a social network perspective, affiliation through co-membership is a structural feature that defines individual social identities and increases the likelihood of forming acquaintances (McPherson, 1982). However, peer group affiliations are not necessarily friendships, and affiliation-based peer influence is conceptually different from the influence of friends as it assumes that peer influence extends to school-wide aggregates. It may also involve more pronounced influences from social norms and group dynamics.

Peer influence based on affiliations with organized activities can be either a risk or a protective factor for problem behavior. Many researchers believe that adolescents who participate in school-based extracurricular activities are more likely to have positive academic outcomes and less likely to be involved in problem behavior than non-participants. For example, Mahoney and colleagues (Mahoney & Cairns, 1997; Mahoney, 2000) noted that having peers involved in extracurricular activities was associated with a reduction in early dropout or antisocial behavior for high-risk youth. Other studies report that adolescents involved in school-based extracurricular activities were less likely to be involved in the use of substances except alcohol (Darling, 2005), male and female athletes were less likely to

have ever smoked regularly (Melnick, et al., 2001), and male sports participants were less likely than non-participants to report cigarette smoking, cocaine and other illegal drug use (Pate, Trost, Levin, & Dowda, 2000).

However, this tendency does not seem to apply for drinking alcohol (Darling, 2005; Eccles & Barber, 1999; Eccles et al., 2003). Eccles and Barber report that participation in extracurricular team sports activities was linked to an increase in drinking, and adolescents who participate in team sports have a higher proportion of friends who drink than their peers (Eccles & Barber, 1999). Another study reported that athletes with a "jock" identity and having riskier friends had higher levels of drinking than those who had less risky friends (Barber, et al., 2005). These results indicate that group affiliation through participation in extracurricular sports activities influences adolescent alcohol consumption (through their self-identified "peers"), perhaps more so than for other substances.

The current study examines the relative strength of two types of peer influence on alcohol use: (a) alcohol exposure based on friends and (b) alcohol exposure based on group affiliation through organized activity participation. Additionally, this study partitions the overlapping influences of affiliates who are friends and those who are not friends. These associations are studied for drinking as well as drinking frequency (i.e., comparing drinkers and nondrinkers; and between frequent drinkers and non-frequent drinkers). This study employs two operationalizations of friendship based on (1) all nominated friends (i.e., the adolescent named the alter as a friend), and (2) only reciprocated friends (i.e., both adolescents mutually named each other as friends). Throughout this paper, the former will be referred to as "nominated friends" and the latter as "reciprocated friends."

Data and Methods

Sample

This study uses data from the National Longitudinal Study of Adolescent Health (Add Health), which consists of a nationally representative sample of adolescents who were in Grades 7–12 in randomly selected schools in the United States during 1994–95 (Harris, 2009). Data are from all students from 7th through 12th grades who attended on the day of interview (N=90,118 nested within 144 schools) completed the 45-minute paper-and-pencil In-School questionnaire from September 1994 through April of 1995. The In-School questionnaire asked students about general information such as basic demographic characteristics, friends, school life including organized activity participation, and about general health status and health related risk behaviors including alcohol use. A second component of the Add Heath data involved adolescents in grades 7–12 who were sampled to participate in the Wave I In-Home Interview from April through December of 1995. In-Home Interview data include the following subpopulations of the core-sample: purposely selected schools, over sampled groups of adolescents with specific racial or ethnic backgrounds, over-sampled groups of disabled youth, and the genetic supplement (Chantala, 2006); all totaling to 20,745 adolescents nested within 145 schools. Additionally, an In-Home Parent Interview (N=17,670) was conducted at the same time with In-Home Student Interview.

For the current study, both surveys (the In-School Survey, and the Wave I In-Home Student and Parent Interview Data) were used in the analysis. The In-School Survey was used for creating friendship network data, determining the affiliation network through organized activities, obtaining information on adolescent drinking in order to compute alcohol exposure terms, and obtaining basic demographic information. The In-School Survey asked students to nominate their 5 best male and 5 best female friends from a school roster (up to 10 friends for both sexes) and these friendship nominations were recorded by the student

identification number in the school rosters. The Wave I In-Home Student Interview data were used for the dependent variables of alcohol use and for the control variables of psychological and family-related information. Additionally, the Wave I In-Home Parent Interview data were used to extract socioeconomic information (see the Online Supplement for the use of parental information, and more on how we arrived at the 12,551 students and 106 schools used in our analysis).

Measures

The study *outcome* of adolescent drinking was measured using the Wave I In-Home interview. Adolescents reported how often they drank alcohol in the past year, and drinking level was assessed with a single item asking respondents, "During the past 12 months, on how many days did you drink alcohol?" Responses were collapsed into a scale ranging from 0 to 6: 0=never, 1=1–2 days in the past 12 months, 2=once a month or less (3–12 times in the past 12 months), 3=2–3 days a month, 4=1–2 days a week, 5=3–5 days a week, and 6=everyday. There were 26 (0.21%) missing information. The In-School Survey also asked respondents the same question (discussed below), but we used the In-Home interview when measuring drinking behavior as our dependent variable to reflect the time-sequence of the Add Health data collection. We further categorized alcohol use into three dummy dependent variables: (1) "Non-drinkers," those who did not drink alcohol in the past year (0 in the questionnaire); (2) "Occasional drinkers," those who drank alcohol more than once a year but once a month or less in the past year (1 or 2 in the questionnaire); and (3) "Frequent drinkers," those who drank alcohol two or three times a month or more (3 or more in the questionnaire) (Crosnoe et al., 2004). The rationale for recoding the original scale to a three-level drinking outcome variable was mainly to address the skewed distribution of the original scale and to create a meaningful categorical variable that facilitates interpretation.

To compute the *independent* variables of alcohol exposure measures (i.e., the levels of exposures to friends' drinking or activity members' drinking), we used the past-year drinking variable (ranging from 0 to 6) from the In-School Survey. We linked this variable to the friendship nominations and the activity participation information that was available only from the In-School Survey. We used the original scale ranging from 0 to 6 (rather than categorizing it into 3 levels for dependent variables) to better capture the nuances of peer drinking levels. To compute the level of alcohol exposure based on friends, we specified two operationalizations of friendship defined by (1) all nominated friends (i.e., the adolescent named the alter as a friend), and (2) only reciprocated friends (i.e., both adolescents mutually named each other as friends) to examine how different operational definitions affect results. We computed the mean drinking level of nominated friends or reciprocated friends, which ranged from 0 to 6 using the network exposure model (Valente, 1995; 2005).

In order to compute the level of alcohol exposure based on group members, first, we assessed adolescents' participation in school-organized sports or clubs/organizations with multiple items asking respondents, "Here is a list of clubs, organizations, and teams found at many schools. Darken the oval next to any of them that you are participating in this year, or that you plan to participate in later in the school year." We divided types of activities into 12 sports and 19 clubs and organizations (see the Online Supplement for the individual sports and clubs/organizations used for our study). To operationalize our concept of affiliation-based peer influence, we focused on two components of the affiliation-related measures: (1) the number of co-participated organized activities (separately for sports and clubs/ organizations) for all pairs of adolescents, and (2) the number of organized activities (separately for sports and clubs or organizations) each adolescent participated in.

For (1), we computed the level of co-participation in the same activities with drinkers, measuring the extent to which an adolescent is exposed to co-members who drink alcohol by

employing the affiliation exposure model (Fujimoto, et al., 2012; Fujimoto, et al., 2011). Alcohol exposure based on co-membership is the mean level of member drinkers (ranging from 0 to 6) with whom an adolescent co-participated in the activity, weighted by the proportion of all activities each pair of respondents participated in. For example, consider an adolescent, Alex, who participated in three sports (soccer, baseball, basketball) with one student (Bob), and a single sport (basketball) with another friend, Chuck. Bob's influence ("affiliation exposure") on Alex is three times greater than Chuck's influence. If Chuck was a heavy drinker and Bob was not, then potentially Bob and Chuck would have similar influence scores on Alex. Thus, a friend's influence can be magnified or attenuated by the number of activities that they co-participate in.

For (2), our study also included the number of sports and clubs a student participated in as one of the control variables. To deal with potentially confounding the two alcohol exposure measures (group affiliation and friends), this study incorporates the network information of all nominated friends (or alternatively reciprocated friends) into the computation of alcohol exposure based on group affiliation. We then calculated (1) exposure based on co-participation with friends (or reciprocated friends) and (2) exposure based on co-participation with others who are not friends (or non-reciprocated friends) (Fujimoto, 2012).

As for our network control variables, we used "popularity" and "isolated" as network variables following the findings of prior network studies. Based on the network measure of centrality (Freeman, 1979), "popularity" was computed as the number of times a student was named as a friend (indegree). As a measure of marginality, we defined "isolated" as those who did not nominate anyone and who received no nominations. Additionally, we included the proportion of friendship ties that were outside of the school in the analysis. Socio-demographic control variables identified in the past as correlates of alcohol use were age (in years), gender, race/ethnicity (Hispanic, African American, Asian, White, and Other), academic grade (average GPA), and parental education (the maximum level in the household where 1=less than high school; 2=high school graduate, 3=some college, 4=college graduates, and 5=graduate education). Other control variables of family structure (living with two married biological parents or not), public assistance (resident mother or father receive public assistance or not), emotional state (the modified version of CES-D), and parental monitoring (sum of a seven-item parent monitoring index that taps the number of decisions that parents make for the child (Demuth & Brown, 2004) were used as they are often correlated with risk behaviors. School-level controls of size (total number of students at each school) and prevalence of drinking (proportion of past-year drinkers) were used from the In-School Survey. Finally, we also included a dichotomous indicator of whether the adolescent participated in at least one sport or club to control for the potentially skewed distribution of the exposure variables arising from those with zero participation. Our study employed multiple imputation via switching regression, an iterative multivariable regression technique by chained equations (Royston, 2004) implemented in Stata 11 to address the missing values of any covariates (17% of the sample).

Analyses

Ordinal regression was used to model the association between network influences and frequency of drinking. The outcome variable of reported frequency of past-year drinking status was divided into three ordinal categories of (1) "Non-drinkers," (2) "Occasional drinkers," and (3) "Frequent drinkers" and employed a cumulative logit model to model cumulative probabilities of drinking status based on a specific dividing point. The first equation (cutpoint j=1: non-drinkers) models the log odds of drinkers (occasional or frequent drinkers) versus non-drinkers, and the second equation (cutpoint j=2: occasional drinkers) models the log odds of frequent versus non-frequent drinkers (occasional or non-drinkers) as a function of the independent variables. Our study assumed "partial proportional

odds" (Williams, 2006) where some but not all variables meet the proportional odds assumption where all covariates have the same effect on the odds as the response variable has at any dividing points. See the Online Supplement for more detailed descriptions of statistical methods used.

We fitted three main models of "General affiliation," "Friends' affiliation," and "Non-friends' affiliation." For the "General affiliation" model, we included the affiliation influence of all members (regardless of friendship status) using the entire sample (N=12,551). Then we fit two additional decomposed models that included the affiliation influence only from nominated friends ("Nominated-friends' affiliation" model), and the affiliation influence only from non-nominated friends ("Non-friends' affiliation" model) that is defined by peers who are in an activity but who were not nominated as a friend by the respondent. For both models of "Nominated-friends' affiliation" and "Non-friends' affiliation," we restricted the sample to 10,493 adolescents (84 % of the sample) who had at least one nominated friend. Then, we repeated the analysis using reciprocated friends, creating three models of "General affiliation" (N=12,551), "Reciprocated-friends' affiliation," and "Non-reciprocated-friends' affiliation," by restricting the sample to the 8,433 adolescents (67 % of our sample) who had at least one reciprocated friend for the latter two models, since the inclusion of adolescents with no reciprocated friends would artificially inflate the affiliation influence only from non-reciprocated friends, but not change the influence of reciprocated friends.

Results

Descriptive Statistics

Table 1 reports univariate statistics for the variables overall and by drinking status. The last column of the table provides measures of association between each variable and drinking using Cramer's V for categorical variables, and η^2 for interval-ratio ones. Overall, the average age of our sample was 15 years old, and age is positively associated with drinking (η^2=0.06). In terms of ethnicity (V=0.10), more than half of the sample consisted of white students (51.79%), and white students tended to drink more, while African American or Asian students tended to drink less. The overall average level of alcohol exposure to nominated friends (η^2=0.10) was 1.04, indicating that on average, the drinking level of nominated friends was a bit more than 1–2 days in the past 12 months.

(See the Online Supplement for the additional information on the descriptive statistics).

Ordinal logistic regression analysis

Table 2 shows the results of the pooled estimates from the imputed datasets on any drinking and frequent drinking for (1) General affiliation exposure (N=12,551), (2) friends' affiliation exposure, and (3) non-friends' affiliation exposure; calculated for (a) "Nominated friends" (N=10,493) and (b) "Reciprocated friends (N=8,433)."

Regarding the results of "General affiliation" model based on "nominated friends" (N=12,551), the affiliation influence through sports had a significant effect on both any drinking and frequent drinking (AOR=1.20; p<0.05). This result indicates that greater alcohol exposure to sports member drinkers leads to a higher likelihood of any drinking (or frequently drinking). On the other hand, the influence through clubs had a significant effect on any drinking (AOR=1.46; p<0.01), but only a marginal effect on frequent drinking (AOR=1.23; p<0.1). These results indicate that adolescents exposed to drinkers in their sports or clubs were more likely to drink themselves, but the effect on frequent drinking was stronger in a sports context than in a club one. The friends' exposure had a significant effect on both any drinking and frequent drinking (AOR=1.55; p<0.001), which indicates that

adolescents with friends who drink were more likely to drink themselves. Just participating in sports or clubs was not associated with any drinking or frequent drinking, with the exception of a significant positive association for the number of club participations on frequent drinking versus not-frequently drinking (AOR=1.08; p<0.01).

As for the "Nominated-friends' affiliation" model (N=10,493), results showed that the affiliation influence through sports members who were also friends had marginal effects on any drinking and frequent drinking (AOR=1.08; p<0.1), but the affiliation influence through club members who were also friends had a significant effect on any drinking and frequent drinking (AOR=1.15; p<0.01). For the "Non-friends' affiliation" model (N=10,493), the results showed that the affiliation influence through non-friends sports members did not have a significant effect on any drinking and frequent drinking (AOR=1.17; p>0.1), but the affiliation influence through non-friend club members had a significant effect on both drinking behaviors (AOR=1.37; p<0.01). The friends' exposure variables had a significant effect on any drinking and frequent drinking in both the "Friends' affiliation" model (AOR=1.64; p<0.001) and "Non-friends' affiliation" model (AOR=1.73; p<0.001).

Analyses were repeated using reciprocated friends. For the "General affiliation" model based on reciprocated friends (N=12,551), the results were similar to the ones based on nominated friends, but the effect's magnitude for reciprocated-friends' exposure decreased (AOR=1.41; p<0.001). In the "Reciprocated-friends' affiliation" model (N=8,433), the results showed that the effects of affiliation influence through fellow sports members who were also reciprocated friends became significant for both any drinking and frequent drinking (AOR=1.16; p<0.01). Additionally, the magnitude of the effect through club members who were also reciprocated friends became larger and more significant (AOR=1.22; p<0.001) compared with the results of the "Nominated-friends' affiliation" model (AOR=1.15; p<0.01). Conversely, for the "Non-reciprocated-friends' affiliation" model (N=8,433), the results were consistent with the "Non-friends' affiliation model." The affiliation influence through non-reciprocated-friends sports members was not significant for any drinking and frequent drinking, whereas affiliation influence through non-reciprocated friend club members was significant (AOR=1.25; p<0.05).

Discussion

This study introduces an innovative network measure of peer influence called affiliation exposure, which is based on the joint participation in school-based organized activities with drinkers, and decomposed that influence into co-participation with friends and non-friends. There are several points to emphasize in our study. First, peer influence through co-participating in organized sports/club activities with drinkers had significant effects on adolescent drinking, controlling for the influence of friends' drinkers. At the same time, our findings showed that the number of sports or club activities participated in did not have a significant effect on drinking behavior (except for the effect of the number of clubs on frequent drinking). These results imply that exposure to drinkers through school-sponsored organized activities serves as a risk factor for adolescent drinking behavior. In relation to the existing studies on organized school activities, our findings contribute to the studies on organized activity by providing more concrete evidence to support the potential risky effect of participation in organized sports activities on adolescent drinking behavior (Eccles & Barber, 1999; Eccles, et al., 2003) by stressing the importance of the level of exposure to drinkers in the context of organized activity participation at school. In this sense, our study goes beyond the existing literature by directly capturing activity-based peer influence using social network analysis, instead of simply recording or counting the number of organized activities adolescents participated in.

Second, our results suggest that the influence of activity co-participation on any drinking was consistently stronger for club activities than for sports activities. This may be a function of the idiosyncratic nature of club activities (e.g., playing chess or studying French may be more idiosyncratic than playing sports), which may contribute to the formation of a stronger crowd affiliation with respect to drinking behavior. Clubs may also represent more distinct crowd identities than those of sports. Additionally, it may be that the club environment supports one-on-one interactions more and also allows for non-club-related topics to be discussed more easily. In contrast, organized sports are usually focused entirely on the sport activity itself (especially during competitions) with little time for other non-sport related conversations (but more time for passively observing behaviors). Conversely, our findings indicated a weaker peer influence through co-participation in club activities with drinkers on drinking frequency than on any drinking. The attenuation in the adjusted odds ratio for drinking frequency on general club affiliation indicates that club membership may mark a cultural preference to be in a group that drinks. However, peer influence is less likely to occur via this co-membership. In other words, membership in certain clubs is associated with being a drinker, and so co-membership is associated with drinking. However, the club itself does not provide opportunities for drinking influence to occur, so co-membership is not associated with increasing rates of drinking. Future research may be required to understand these nuances in affiliation exposure effects.

Third, our study indicated that influence through sport activities played an important role in adolescent drinking, but only when the co-participant's drinkers were also reciprocated friends (but not for all nominated friends). Sports participation in activities serves as an opportunity for adolescents to express their crowd identity (Eccles, et al., 2003), and an athletically-oriented crowd identity is associated with high peer status (Brown & Lohr, 1987). Under such conditions, involvement in sports activities is more likely to reinforce friendship between peers. Shared values and norms associated within the organized sports culture with respect to drinking could be intensified when activity members share mutual friendship. Our study also showed that influence through club activities had a significant effect on drinking, not only among friend participants, but also among non-friend participants. Recent studies have reported that adolescents in less popular activities (i.e., academic clubs) produce higher levels of friendship amongst members than in more popular activities (i.e., sports); since the participants in less popular activities may receive fewer gestures of friendship from non-participants, higher levels of friendship builds among activity members (Schaefer, et al., 2011). Our findings indicate that this social island-effect may be facilitating the spread of drinking behavior, regardless of friendship status.

Finally, our study showed that individual alcohol use was strongly influenced by one's friend network, and demonstrated the utility of social network analysis for understanding peer influence on adolescent substance use (Valente, Gallaher, & Mouttapa, 2004). Our study distinguished different types of friends by operationalizing friendship as nominated versus reciprocated friends. It also extended the existing network literature by showing that the magnitude and type of friend influence differs depending on how one operationalizes friendship (Fujimoto & Valente, in press). These different operationalizations also affect estimates of more distal social influences such as co-participation in organized activities.

The results, however, are tempered by some limitations in data availability and in some methodological issues. First, measuring alcohol exposure based on group affiliation may be limited in accurately capturing the role of extracurricular activities on substance use, as it may depend upon the particular sports or club activities considered. Norms and influences regarding drinking might vary by the type of sport or club. Future research may benefit from a more complete categorization of the activities and a particular student's membership role (e.g., team captain, strong performer, or leader) and/or activity interaction patterns (e.g.,

frequency of participation, eager participation, or how long the adolescent is involved in the sport/club).

Second, the results yield no insight into understanding peer selection processes. Many studies have demonstrated that both the process of selection and the process of influence are important in accounting for the similarity in substance use among adolescents (Engeles, Knibbe, Drop, & de Haan, 1997; Ennett & Bauman, 1994; Fisher & Bauman, 1988; Hall & Valente, 2007; Mercken, Candel, Willems, & de Vries, 2009; Urberg, et al., 1997), and social network analysis has increasingly explored the evolutionary aspect of social networks (Steglich, Snijders, & Pearson, 2010). Such analyses are usually conducted using longitudinal data, and thus our study does not deal with this issue.

Third, when dealing with potential confounding of the two alcohol exposure measures (group affiliation and friends) our analysis restricted the sample to those adolescents who had at least one reciprocated friends (67%) or who had at least nominated friends (84%) in our models. This may limit the generalizability of our results, and so our results should be interpreted with this in mind.

Despite these limitations, this study demonstrates the usefulness of examining affiliation-based peer influence through organized activities (sports and clubs) and friends' influence on adolescent drinking behavior, and separating the friends' network influence from affiliation influence. This study has implications for policies regarding school-based alcohol prevention programs that address social-influences. Current guidelines recommend the use of peer leaders to implement substance use prevention programs, and a number of studies have found peer leaders able to implement effective substance use (mainly tobacco) prevention and health promotion programs (Valente, Hoffman, Ritt-Olsen, Lichtman, & Johnson, 2003). School-based prevention programs are usually implemented in a classroom, and leaders are selected from the class. The effectiveness of such peer-led interactive programs, which incorporate student-to-student exercises, would be enhanced if the programs are implemented in the context of school-sponsored organized activities, whereby leaders are selected within the activities.

Indeed, understanding that peer influences occur within the context of both friendships and co-participation in activities provides an important distinction in how adolescents normalize substance use. Friends are not only strong influences on adolescent behavior, but adolescents are also influenced by others who co-participate in organized activities, even if participants are not friends. Consequently, intervention programs should address the cultural norms regarding alcohol associated with certain groups, and the program developers must be aware that these group identities influence individual substance use in addition to friendship ties.

Additionally, the proposed study may inform potential multi-level interventions as to which forms of peer influence are more effective for a given level of alcohol consumption, serving to guide and enhance the effectiveness of such peer-led programs. The selection of peer leaders and, indeed, the very nature of how programs are designed and developed may need to be adapted to these differing contexts. For example, programs are typically delivered within a particular classroom context, yet do not (and perhaps cannot) address how social influence occurs outside the classroom, whether in clubs or on the field. Given the varying nature of direct versus distal peer influences, adolescents are embedded in multiple situational contexts that can increase their risk behavior.

Adolescent peer influence arises from many situations and sources. Here we have shown that alcohol use by friends has a strong association with individual alcohol use; this association is magnified by joint participation in clubs and sports. Participation in clubs and

sports provides the opportunity for existing norms and behaviors to be reinforced and also provides mechanisms by which friendships can evolve (as new friendships are formed or dissolved within the group). Understanding how these affiliations influence adolescent risk behavior is a critical step in understanding how risk behaviors become entrenched in many communities.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

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Table 1

Descriptive Statistics (Mean or Percentage) by Drinking Status (N= 12,551)

	Overall	Three levels of drinking			Measures of association
		Non-drinkers	Occasional drinkers	Frequent drinkers	
Individual and network characteristics					
Age (in years)	15.04 (1.70)	14.67 (1.74)	15.33 (1.54)	15.70 (1.50)	η^2=0.06
Female	51.68 %	52.22%	54.90%	44.97%	V=0.07
Race/Ethnicity					V=0.10
Hispanic	18.29%	17.76%	19.36%	18.65 %	
African American	19.06%	23.22%	14.67%	13.06%	
Asian	7.35%	8.89%	6.23%	4.48%	
White	51.79%	46.62%	56.31%	60.34%	
Other	3.50%	3.51%	3.43%	3.47%	
Academic grade (GPA)	2.56 (0.91)	2.64 (0.91)	2.49 (0.89)	2.39 (0.88)	η^2=0.01
Live with married biological Parents	53.17%	55.03%	51.46%	47.76%	V=0.05
Parental education	3.05 (1.20)	3.06 (1.23)	3.05 (1.17)	3.04 (1.18)	η^2=0.00
Receive public assistance	8.56%	9.62%	7.25%	8.11%	V=0.04
CES-D	11.09 (7.50)	10.10 (7.00)	11.69 (7.55)	13.20 (8.39)	η^2=0.02
Parental monitoring	1.80 (1.55)	2.06 (1.59)	1.61 (1.46)	1.33 (1.42)	η^2=0.03
Popularity (indegree)	4.53 (3.81)	4.17 (3.62)	4.92 (4.00)	5.01 (3.96)	η^2=0.01
Isolates	4.10%	5.18%	2.83%	3.62%	V=0.05
Non-school nomination	17%	16%	19%	18%	η^2=0.00
Number of sport participation	1.06 (1.38)	1.08 (1.42)	1.02 (1.29)	1.07 (1.43)	η^2=0.00
Number of club participation	0.94 (1.51)	0.98 (1.52)	0.88 (1.38)	0.89 (1.71)	η^2=0.00
Network exposures					
Affiliation exposure					
Sports	0.66 (0.69)	0.61 (0.64)	0.70 (0.71)	0.78 (0.77)	η^2=0.01
Clubs	0.52 (0.64)	0.49 (0.60)	0.55 (0.67)	0.57 (0.72)	η^2=0.00
Exposure to nominated friends	1.04 (1.02)	0.76 (0.86)	1.22 (1.02)	1.58 (1.19)	η^2=0.10
Exposure to recip. friends	0.76 (1.09)	0.51 (0.88)	0.92 (1.11)	1.29 (1.36)	η^2=0.08
School-level variables					

	Overall	Three levels of drinking			
		Non-drinkers	Occasional drinkers	Frequent drinkers	Measures of association
Individual and network characteristics					
School size	941.90 (623.06)	916.20 (631.39)	987.43 (627.53)	943.85 (583.28)	η^2=0.00
Prevalence of drinking	0.51 (0.13)	0.48 (0.13)	0.54 (0.12)	0.56 (0.11)	η^2=0.07
N	12,525	6,721	3,704	2,100	
Percent	99.79%	53.66%	29.57%	16.77%	

Note: The parentheses next to a given mean value denote the standard deviation. There are 26 (0.21%) missing values for the variable of level of past-year drinking. As for measures of association, V represents Cramer's V that measures the strength of association between two categorical variables, and η^2 measures the proportion of the total variance attributed to the effect.

Table 2

Results (Adjusted Odds Ratio) of Cumulative Logit Models with Partial Proportional Odds Assumption

(1) Models based on 'nominated friends'

	"General affiliation" (N=12,551)		"Nominated-friends' affiliation" (N=10,493)		"Non-friends' affiliation" (N=10,493)	
	Any Drinking	Frequent drinking	Any Drinking	Frequent drinking	Any Drinking	Frequent drinking
Affiliation exposure						
Sports	1.20* (0.11)	1.20* (0.11)	1.08# (0.04)	1.08# (0.04)	1.17 (0.11)	1.17 (0.11)
Clubs	1.46** (0.16)	1.23# (0.15)	1.15** (0.05)	1.15** (0.05)	1.37** (0.15)	1.37** (0.15)
Exposure to nominated friends	1.55*** (0.06)	1.55*** (0.06)	1.64*** (0.08)	1.64*** (0.08)	1.73*** (0.08)	1.73*** (0.08)
Number of sports participated in	0.99 (0.03)	0.99 (0.03)	0.96 (0.03)	0.96 (0.03)	0.97 (0.03)	0.97 (0.03)
Number of clubs participated in	1.01 (0.03)	1.08** (0.03)	1.02 (0.03)	1.02 (0.03)	1.02 (0.03)	1.02 (0.03)

(2) Models based on 'reciprocated-friend'

	"General Affiliation" (N=12,551)		"Reciprocated-friends' affiliation" (N=8,433)		"Non-reciprocated-friends' affiliation" (N=8,433)	
	Any Drinking	Frequent drinking	Any Drinking	Frequent drinking	Any Drinking	Frequent drinking
Affiliation exposure						
Sports	1.24* (0.11)	1.24* (0.11)	1.16** (0.05)	1.16** (0.05)	1.16 (0.13)	1.16 (0.13)
Clubs	1.51*** (0.16)	1.26# (0.15)	1.22*** (0.06)	1.22*** (0.06)	1.25* (0.13)	1.25* (0.13)
Exposure to reciprocated friends	1.41*** (0.04)	1.41*** (0.04)	1.44*** (0.06)	1.44*** (0.06)	1.57*** (0.06)	1.57*** (0.06)
Number of sports participated in	1.00 (0.03)	1.00 (0.03)	0.95 (0.03)	0.95 (0.03)	0.97 (0.03)	0.97 (0.03)
Number of clubs participated in	1.01 (0.03)	1.08** (0.03)	0.98 (0.04)	0.98 (0.04)	0.99 (0.04)	0.99 (0.04)

Note: Parentheses indicate standard errors. Models controlled for age, gender, race, academic performance (GPA), family structure, parental education, public assistance, emotional state (CES-D), popularity, isolates, non-school nominations, school size, and prevalence of drinking, and participation in at least one sport or club.

# p < 0.1;

* p < 0.05;

** p < 0.01;

*** p < 0.001