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Relationships Between Social Network Characteristics, Alcohol Use, and Alcohol-Related Consequences in a Large Network of First-Year College Students: How Do Peer Drinking Norms Fit In?

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Abstract

A burgeoning area of research is using social network analysis to investigate college students' substance use behaviors. However, little research has incorporated students' perceived peer drinking norms into these analyses. The present study investigated the association between social network characteristics, alcohol use and alcohol-related consequences among first-year college students' (N = 1,342; 81% of the first-year class) at one university. The moderating role of descriptive norms was also examined. Network characteristics and descriptive norms were derived from participants' nominations of up to 10 other students who were important to them; individual network characteristics included popularity (indegree), network expansiveness (outdegree), relationship reciprocity, and network density. Descriptive norms were defined as participants' average perceived binge drinking frequency among their nominated peers. Network autocorrelation models revealed that indegree and descriptive norms were positively associated with participants' average number of drinks per week, binge drinking frequency, and alcohol-related consequences. Indegree and outdegree interacted with descriptive norms, such that when

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participants perceived less frequent binge drinking among their peers, outdegree was associated with less alcohol consumption, but not consequences. When participants perceived more frequent binge drinking among their peers, indegree and outdegree were associated with more alcohol consumption, but not consequences. The present results suggest that being popular and believing that heavy episodic drinking is normative among one's peers is associated with greater alcohol risk. Further, alcohol risks associated with nominating more peers may be enhanced or lessened depending on students' peer drinking norms. Implications for future research and interventions are discussed.

Keywords

social networks; alcohol; college

Background

Rates of alcohol use increase significantly during the transition from high school to college (Derefinko et al., 2016; Fromme, Corbin, & Kruse, 2008). College students who engage in heavy episodic drinking (i.e., "binge drinking", defined as four or more drinks in one occasion for females, or five or more drinks in one occasion for males) are at greater risk of experiencing negative alcohol-related consequences, including significant morbidity and mortality (Hingson, Zha, & Smyth, 2017; Johnston, O'Malley, Bachman, Schulenberg, & Miech, 2016). Given that the transition from high school to college is accompanied by increased independence from parents, experimenting with new behaviors, and expansion of social networks (Arnett, 2000; Meisel & Barnett, 2017; Wrzus, Hanel, Wagner, & Neyer, 2013), understanding how peer relationships and social contexts influence the development of risky drinking among first-year college students is of continued importance.

Social factors are among the most robust predictors of college student alcohol use (Abar & Maggs, 2010; Baer, 2002). Social network theory posits that understanding relationships, or connections between people, is necessary to understand health behaviors (Valente, 2010). Therefore, social network theory and network analysis provide a sophisticated framework for understanding the social processes underlying college students' alcohol use and associated consequences. Although a rather large body of literature has investigated the social network factors involved in adolescents' substance use (Ennett et al., 2006; Fujimoto & Valente, 2012; Moody, Brynildsen, Osgood, Feinberg, & Gest, 2011; Pearson et al., 2006; Valente, Unger, & Johnson, 2005), these methods have only recently been applied to college student populations.

A review of recent studies using social network methods to investigate college student addictive behaviors found that in general, exposure to alcohol or substance using peers was associated with students' own substance use (Rinker, Krieger, & Neighbors, 2016). Additionally, students' position and relationship to others within a network has been associated with alcohol use behaviors. In particular, students' popularity (or *centrality* in social network terminology), relationship reciprocity, and density of network ties (i.e., the extent of students' peers who are tied to one another) were associated with greater alcohol

use (Rinker et al., 2016). This is consistent with more recent research linking popularity within college student drinking groups to greater drinking (Dumas, Davis, Merrin, Puccia, & Blustein, 2018; Meisel et al., 2018). Having a more expansive network (i.e., nominating more peers, or having greater outdegree) has also been associated with more frequent binge drinking in one residence hall in a U.S. university ($N = 129$) (Barnett, Ott, & Clark, 2014), but not in two sociocentric networks at a Belgian university (Lorant & Nicaise, 2015). Finally, recent research suggests that that college students' drinking behavior is more similar among students with reciprocated friendship ties (i.e., if student *a* nominates student *b*, and student *b* also nominates student *a*) (Giese, Stok, & Renner, 2017). The precipitating role of these network characteristics in relation to college students' alcohol use deserves further investigation.

The social norms approach provides a relevant theoretical framework through which to understand relationships between social network characteristics and substance use. Perceived alcohol use norms are consistently one of the strongest predictors of college students' own drinking behavior (Neighbors, Lee, Lewis, Fossos, & Larimer, 2007; Perkins & Berkowitz, 1986), and perceived norms can be particularly influential during the first year of college (Borsari, Murphy, & Barnett, 2007). Alcohol use norms are generally assessed in two ways: *Descriptive norms* reflect perceptions of how often or how much others drink, and *injunctive norms* reflect perceptions of others' approval of particular drinking behaviors (Borsari & Carey, 2003). Recent research within one college student residence hall suggests that students descriptive drinking norms are more accurate when specific, nominated peers are the reference group, compared to when the "typical student" is the reference group (Kenney, Ott, Meisel, & Barnett, 2017). Further, when students' (mis)perceived, or overestimated such descriptive norms, these overestimates more strongly predicted students' own alcohol use when close, nominated peers were the reference group. Such a finding illustrates the influential role of close peers on students' alcohol use, compared to more distal peer groups.

The Present Study

There is a growing body of evidence linking students' social network characteristics with substance use behavior. However, little research to date has incorporated the role of social norms within this line of work. In the present study, we present cross-sectional data from the first wave of a longitudinal social network intervention intended to reduce harmful alcohol use among first-year college students. Additional detail about the larger study from which these data were drawn can be found at Barnett et al (Manuscript under review) and ClinicalTrials.gov Identifier: NCT02895984.

The present study used a *sociocentric* network approach, in which the majority of individuals in one bounded network were surveyed, and connections between them were determined by way of important peer nominations. One advantage of the sociocentric approach lies in its ability to characterize an individual's network characteristics (e.g., network position, size, reciprocity, or density) using all possible connections within one community—in this case, a first-year college student class. Network characteristics of interest were popularity (indegree), network expansiveness (outdegree), relationship

reciprocity, and personal network density. In addition, we investigated the role of descriptive binge drinking norms among participants' nominated peers as a moderator of the relationship between participants' network characteristics and their alcohol use behaviors.

Based on previous findings, we expected that popularity (indegree) and descriptive norms would be associated with greater alcohol consumption (i.e., average number of drinks per week and binge drinking frequency) and alcohol-related consequences. Further, we expected that the relationships between popularity and these outcomes would be moderated by participants' descriptive norms—i.e., popularity would be positively associated with alcohol use and consequences at high levels of descriptive norms. Given inconsistent evidence for the role of network expansiveness (outdegree) in increasing alcohol risks, we did not propose a hypothesis for how this variable would be independently related to alcohol outcomes. However, we did expect that network expansiveness would interact with descriptive norms to be positively associated with alcohol outcomes at high levels of descriptive norms. We also did not expect that relationship reciprocity or personal network density would be independently associated with alcohol outcomes, but that these network characteristics would be positively associated with alcohol use and alcohol-related consequences at higher levels of descriptive norms.

Results of the current study may aid researchers and college health officials by clarifying how social network factors and normative beliefs about peers' alcohol use may interact to contribute to alcohol risks in the first year of college. Such knowledge may be valuable for improving social network interventions, potentially by incorporating social norms components.

Method

Participants

Participants were first-year college students enrolled in their first semester at a private university in the Northeastern U.S. All first-year students living in first-year dormitories on campus were eligible to participate. From the potential participant pool of 1,693 students, 31 did not meet this eligibility criterion (they were older students who lived off-campus or were enrolled in a dual-degree residency program at a neighboring University). Of the 1,660 eligible students remaining, 1,342 (81%) consented to participate and completed the baseline survey.

Procedures

During the fall 2016 semester, first-year students were invited to participate in a "study about social networks and health." Strategies to advertise the study included postcards mailed to students' homes and campus mailboxes, flyering and promotional events on campus, and emails containing links to enroll in the study. Students could consent to participate in person or online. Students under the age of 18 provided their assent to participate, and requested parental/guardian consent either via a mailed consent form, or more commonly, through a secure online system through which students could compose a personal e-mail message to their parent/guardian containing a link to the parental consent

form. Consent forms allowed non-participating students to opt-out of having their name displayed in the drop-down list of all first-year students in the network portion of the survey. Forty-two students (2.5%) opted out of this list.

The baseline survey was open for a two-week period six weeks into the fall semester, with reminders sent to students who had not yet enrolled or had not yet completed the survey. The survey assessed participants' demographics, alcohol use and related consequences, and social connections to up to 10 important peers in the first-year class. The baseline survey took approximately 45 minutes to complete, and participants were compensated with a $50 Amazon gift card delivered via email. All procedures were approved by the University's Institutional Review Board.

Measures

Demographics.—Participants self-reported their birth sex, race, ethnicity (Hispanic or non-Hispanic), whether they were a member of a varsity athletic team, and whether they were planning to become a member of a sorority or fraternity (students at the University can join a Greek organization after their first spring semester). Students can also request to live in on-campus substance-free housing; this information was received from the University prior to the baseline survey.

Alcohol use.—Past 30-day alcohol use was assessed using items derived from the Behavioral Risk Factor Surveillance System (BRFSS) questionnaire (Centers for Disease Control and Prevention, 2014). *Average number of drinks per week* was calculated using participants' self-reported number of drinking days in the past 30 days, divided by 4.29 (the average number of weeks in a month), then multiplying this quotient by the number of standard drinks consumed on a typical drinking day. A chart accompanied these questions, which defined a standard drink as "12 oz. of beer, 5 oz. of wine or 1.5 oz. of 80 proof liquor". *Binge drinking frequency* was assessed by asking, "Considering all types of alcohol beverages, how many times during the past 30 days did you have four/five or more drinks in one occasion?" Four or five standard drinks was presented to female or male gendered participants, respectively.

Alcohol consequences.—Alcohol consequences were assessed using the Brief Young Adult Alcohol Consequences Questionnaire (BYAACQ; Kahler, Strong, & Read, 2005). The BYAACQ was developed and validated using a college student sample, and has been used extensively in this population (Kahler, Hustad, Barnett, Strong, & Borsari, 2008). The BYAACQ presents 24 statements that describe a broad range of negative alcohol use consequences (example item: "I have had a hangover [headache, sick stomach] the morning after I had been drinking"). Participants endorsed whether they had experienced each consequence in the past 30 days (no = 0; yes = 1). Responses were summed to create a total score (range: 0 – 24), with higher scores indicating greater number of consequences and problem severity. Participants reporting 0 drinking days in a previous question were not presented with the BYAACQ, therefore, alcohol consequences were assessed only for participants reporting alcohol use in the past 30 days. The BYAACQ demonstrated good internal consistency in the current sample (α = .82).

Network characteristics.—Participants were asked to select up to 10 other first-year students at the University who were important to them in the past month (adapted from Longabaugh & Zywiak, 2002). Participants' entered the first name and last initial of each person, selected the name of each of these individuals from a drop-down list of all eligible first-year participants (excluding opt-outs), and answered subsequent questions about them. The option, "I can't find this person on the list" was available. The peers' first name and last initials were stored as run-time variables in the survey only (i.e., not stored in the final data set) so that participants could identify their peers in the subsequent questions. The following individual network characteristics were calculated from each participants' network nominations using Butts' (2010) sna package in R.

Popularity.: Popularity was measured using *Indegree*, one of the most common popularity measures in social network research (Valente, 2010). Indegree was calculated as the number of times an individual was nominated by others in the first-year student network.

Expansiveness.: Network expansiveness was measured using *Outdegree*, or the number of outgoing nominations each participant made to other students. Outdegree is an indicator of an individual's sociality (Wasserman & Faust, 1994).

Relationship reciprocity.: Relationship reciprocity is the proportion of bidirectional (incoming or outgoing) ties that were reciprocated. A tie or connection between individuals A and B was reciprocated if A nominated B, and B also nominated A, or vice versa. Higher scores indicate a greater tendency for ties to be reciprocated.

Personal network density.: Personal network density was calculated for each individual by calculating the proportion of completed triads, out of all possible triads, among participants' peer nominations. For closure among triads to occur among persons A, B and C, person A must nominate person B, person B must nominate person C, and person C must nominate person A. The number of possible triads was calculated as $n \times (n-1)/2$, where n is the number of participants the participant selected. For example, if a participant selected 8 peers, each of those 8 peers has 7 others they could be connected with (not counting the participant); this is divided by 2 since we do not want to double count a connection between peers. Thus, in this example, $8 \times 7/2 = 28$ serves as the denominator, or possible number of triads in the participants' network. Higher scores indicate a greater tendency for connectivity among an individual's network members.

Descriptive Binge Drinking Norms.—For each peer nominated in the network survey, participants were asked, "How many times in the past 30 days do you think this person had five or more drinks in one occasion?" Descriptive binge drinking norms were calculated by averaging the perceived binge drinking frequency among all of the peers that participants' nominated.

Data Analysis

First, we calculated descriptive statistics for network and participant characteristics, including participant demographics, alcohol use and related consequences. A bivariate

correlation matrix was then created to examine the associations among all of the above network and alcohol variables. Prior to creating the correlation matrix and subsequent network models, average number of drinks per week was log transformed due to positive skewness.

Network Models.—To examine the association between network characteristics and drinking outcomes, we employed separate network autocorrelation models for each outcome variable using the sna package in R (Butts, 2010). Network autocorrelation models are appropriate for social network data because the presence of non-independence of observations/autocorrelation among network members (i.e., similar drinking behaviors among peers who are socially connected to one another) can be determined using a likelihood ratio test, and models can be adjusted for this (Cressie, 1993). This contrasts to typical linear regression models, which assume no correlation between observations, potentially leading to an underestimate of standard errors and/or Type I error (falsely claiming statistical significance). Thus, network autocorrelation models are appropriately conservative, taking into account the often autocorrelated nature of social network data. All models controlled for the following dichotomous variables: male birth sex, white race, non-Hispanic ethnicity, athlete status, intentions to join a fraternity/sorority, and residence in a substance free dormitory. To determine whether any relationship with consequences was present after controlling for consumption, number of alcohol consequences was estimated with and without number of drinks per week as a covariate in separate models. To test the moderating effects of descriptive norms, two-way interaction terms were created between descriptive norms and the network variables using mean centered predictor variables. Final models included covariates, main effects, and interaction terms. For significant interaction terms, follow-up tests examined simple slopes of each covariate at low and high levels (±1 SD above/below the mean) of the moderator variables.

Results

Sample Descriptives.

Descriptive statistics for demographics, alcohol use and network variables are presented in Table 1. The sample was 55.3% female and 47.0% non-Hispanic White (1.1% did not report their race / ethnicity); 35.5% were considering joining a Greek organization, 14.0% were athletes, and 13.6% lived in substance-free housing.

Bivariate Correlations.

Results in Table 2 show that popularity was positively associated with average number of drinks per week, number of heavy drinking days, and number of alcohol consequences. Network expansiveness and relationship reciprocity were not significantly associated with these outcome variables. Personal network density had a weak, yet significantly positive relationship with heavy drinking days. As expected, descriptive binge drinking norms were positively associated with all three alcohol outcomes.

Multivariate/Network Autocorrelation Analyses.

Four network autocorrelation models were conducted, using the following outcome variables: 1) average number of drinks per week, 2) heavy drinking frequency, 3) alcohol-related consequences, and 4) alcohol-related consequences after controlling for drinks per week. Results of the final models are displayed in Table 2.

After controlling for demographic variables, popularity and descriptive norms were positively associated with average number of drinks per week (Model 1). Adding interaction terms in the next step of the model revealed a significant interaction between descriptive norms and popularity ($b = 0.41$, $SE = 0.11$, $p < .001$) and a significant interaction between norms and network expansiveness ($b = 0.52$, $SE = 0.12$, $p < .001$). As shown in figure 1a, Results of simple slopes tests showed that at low levels of descriptive norms, the relationship between popularity and drinks per week was nonsignificant ($b = 0.25$, $SE = 0.17$, $p = 0.13$), but at high levels of descriptive norms, popularity was positively related to average number of drinks per week ($b = 1.09$, $SE = 0.16$, $p < .001$). For network expansiveness (Figure 1b), at low levels of descriptive norms expansiveness was negatively associated with average number of drinks per week ($b = -0.35$, $SE = 0.18$, $p = 0.05$). At high levels of descriptive norms, network expansiveness was positively associated with average number of drinks per week ($b = 0.70$, $SE = 0.17$, $p < .001$).

Popularity and descriptive norms were positively associated with binge drinking frequency (Model 2). When adding interaction terms to the model, popularity significantly interacted with descriptive norms ($b = 0.39$, $SE = 0.06$, $p < .001$), and network expansiveness significantly interacted with descriptive norms ($b = 0.30$, $SE = 0.06$, $p < .001$). Similar to the simple slope effects for drinks per week, at low levels of descriptive norms, popularity was not significantly associated with binge drinking frequency ($b = -0.03$, $SE = 0.09$, $p = 0.75$) (see Figure 1c). At high levels of descriptive norms, popularity was positively associated with binge drinking frequency ($b = 0.75$, $SE = 0.08$, $p < .001$). As shown in figure 1d, at low levels of descriptive norms, network expansiveness was negatively associated with binge drinking frequency ($b = -0.19$, $SE = 0.10$, $p = 0.04$), but at high levels of descriptive norms, network expansiveness ($b = 0.40$, $SE = 0.09$, $p < .001$) was positively associated with binge drinking frequency.

Popularity and descriptive norms were positively associated with alcohol-related consequences among participants who drank in the past 30 days (Model 3). Upon adding interaction terms to this model, network expansiveness significantly interacted with descriptive norms ($b = 0.30$, $SE = 0.11$, $p = 0.005$); the interaction between popularity and descriptive norms was not significant. In simple slopes analysis, at low levels of descriptive norms, network expansiveness showed a trending negative association with alcohol-related consequences ($b = -0.35$, $SE = 0.18$, $p = .06$). At high levels of descriptive norms, the association between network expansiveness and alcohol-related consequences trended toward the positive direction ($b = 0.26$, $SE = 0.14$, $p = .07$).

After controlling for average number of drinks per week, popularity and descriptive norms were positively associated with alcohol-related consequences among participants who drank in the past 30 days (Model 4). In the next step of this model, none of the interaction terms

between network variables and descriptive norms were significantly associated with alcohol-related consequences.

Discussion

The current study examined cross-sectional relationships between social network characteristics, alcohol consumption, and alcohol-related consequences in a large network of first-year college students. We also investigated the role of descriptive binge drinking norms as a moderator of these relationships. As expected, popularity (i.e., indegree) and descriptive norms showed significant positive associations with average number of drinks per week, heavy drinking frequency, and alcohol-related consequences, and remained significantly associated with alcohol-related consequences even after controlling for alcohol consumption. The finding that popularity is associated with increased alcohol risks is consistent with established findings among adolescents (Ennett, 2006, Hahm et al., 2012, Moody et al., 2011) and in more recent surveys of college students (Lorant & Nicaise, 2015; Phua, 2011), but diverges slightly from what was reported by Barnett et al. (2014), who used a sociocentric network approach in one university residence hall. In that study, popularity was associated with greater consequences, but only for women. Taken together, this body of research appears to support that greater popularity—when determined by peer network nominations—is a robust indicator of alcohol risks among first-year college students. Reasons for this are not entirely clear, but it is reasonable to assume that students who are important among a large number of their peers may be present at more social events where alcohol is available, or may have easier access to alcohol by virtue of their social connections. Further research is needed to determine if unique risk and protective factors for alcohol use are present among this group of students, and whether tailored interventions are effective. The significant interaction between descriptive norms and popularity suggests that for more popular students, believing that one's peers engage in more frequent binge drinking increases the risk for greater alcohol consumption (i.e., drinks per week and binge drinking episodes), but not alcohol-related consequences. Thus, endorsing greater descriptive binge drinking norms may enhance alcohol risks among an already at-risk group of students.

Our results add to the available evidence relating network expansiveness (i.e., outdegree, or nominating more network peers) to college students' alcohol use. Consistent with Lorant and Nicaise (2015), our results suggest that in and of itself, having a more expansive network is not associated with alcohol use or related consequences. However, expansiveness interacted with student normative perceptions such that for students who endorsed lower descriptive norms (i.e., perceived a lower average binge drinking frequency among their peers), greater network expansiveness was related to a lower number of drinks consumed per week and less frequent binge drinking. The inverse can be stated for students with low network expansiveness and low descriptive norms—such students tended to consume more alcohol, relative to students with low descriptive norms and high network expansiveness. (However, it is important to note that students with low descriptive norms had overall lower alcohol risk than students with high descriptive norms.) For students who endorsed higher descriptive norms, greater network expansiveness was associated with a greater number of drinks consumed per week and more frequent binge drinking. Stated differently, students have higher alcohol risk when they nominate a larger number of (perceived) binge drinking

peers, and have lower alcohol risk when they nominate a larger number of peers perceived not to be binge drinkers. Thus, students' alcohol use may be similar to the perceived majority of their important peers. This is consistent with previous research on college students' conformity motives to drink (Kuntsche, Knibbe, Gmel, & Engels, 2005). It may also be an example of the sociological principal of homophily, or the tendency for individuals to affiliate with others with similar attributes—in this case, alcohol use. Homophily is thought to come about through social selection and influence processes (Lewis, Gonzalez, & Kaufman, 2012). Six weeks into their first semester, students who wished to be a part of a larger peer group composed of individuals who binge drank frequently (or not) may have actively selected into such groups (i.e., social selection). Alternatively, students' alcohol use may have been influenced by their peers' alcohol use (i.e., social influence), and the number of individuals that the student nominated and perceived to engage in binge drinking (or not) may have amplified this social influence effect. More longitudinal research is needed to investigate these hypothesized temporal and causal relationships.

As expected, neither relationship reciprocity nor personal network density were independently associated with alcohol outcomes. Contrary to our hypotheses, we did not find support for descriptive norms interacting with relationship reciprocity or personal network density. This suggests that six weeks into students' first semester, neither reciprocated relationships nor cohesiveness among students' close social ties were important determinants of students' alcohol use or consequences. It is possible that students' alcohol use may be influenced by these relationship characteristics at a later point in time, as relationships with peers become more established.

One of the primary limitations of the current study is its cross-sectional nature. Although we measured network characteristics and alcohol outcomes during a particularly high-risk period (CASA, 2003; Del Boca, Darkes, Greenbaum, & Goldman, 2004; Fromme et al., 2008; O'neill, Parra, & Sher, 2001; Tremblay et al., 2010), results cannot inform how students' network characteristics or alcohol use change over time, or whether these relationships are causal in nature. Second, network ties and other characteristics are missing from roughly 19% of first-year students who did not participate in the study. We also did not analyze information about students' ties to others outside of the first-year class. These missing ties may have impacted the results in unknown ways. Third, data were collected from one private, residential university in the northeastern United States. Findings from the current study may not generalize to other colleges or universities. Finally, this study did not include other network characteristics (e.g., homophily and proximity) that could be relevant for understanding students' alcohol use (Barnett, Ott, Rogers, et al., 2014; Preciado, Snijders, Burk, Stattin, & Kerr, 2012).

Despite the limitations, the study had a number of strengths including the high enrollment rate (81% of eligible incoming first-year students). This allowed us to observe a large proportion of the all possible connections among students in one college class, and to derive relevant network characteristics from these connections. Additionally, this is the first known study to investigate the moderating role of peer drinking norms on the relationships between college students' network characteristics and alcohol use outcomes. Knowledge gained will

help determine how these two established predictors of college students' alcohol use interact and relate to students' alcohol risks.

Results of this study have implications for college student alcohol use interventions. This study supports that students who are both more popular within the first-year class and endorse greater descriptive peer binge drinking norms are at particularly higher risk for alcohol use and associated consequences. Such students may be prime targets for alcohol interventions. The significant main and moderating effects of descriptive norms suggest that interventions that correct (mis)perceived drinking norms may be especially effective (Carey, Scott-Sheldon, Carey, & DeMartini, 2007). Thus, normative feedback interventions may be enhanced if they are specifically targeted towards students who endorse high norms and who are popular, or who endorse high norms and nominate a greater number of peers. Social network theory and diffusion of innovations theory suggest that targeting popular individuals for interventions may not only result in benefits for those individuals, but may also lead to a reduction in unhealthy behaviors throughout a network (Latkin & Knowlton, 2015). To date, available evidence for the effectiveness of such an intervention on reduced alcohol use relies on simulation data (Braun, Wilson, Pelesko, Buchanan, & Gleeson, 2006). More evidence from clinical trials is needed to determine if incorporating students' social network information into existing interventions is a useful approach to reducing alcohol risks throughout college student peer networks.

Acknowledgments

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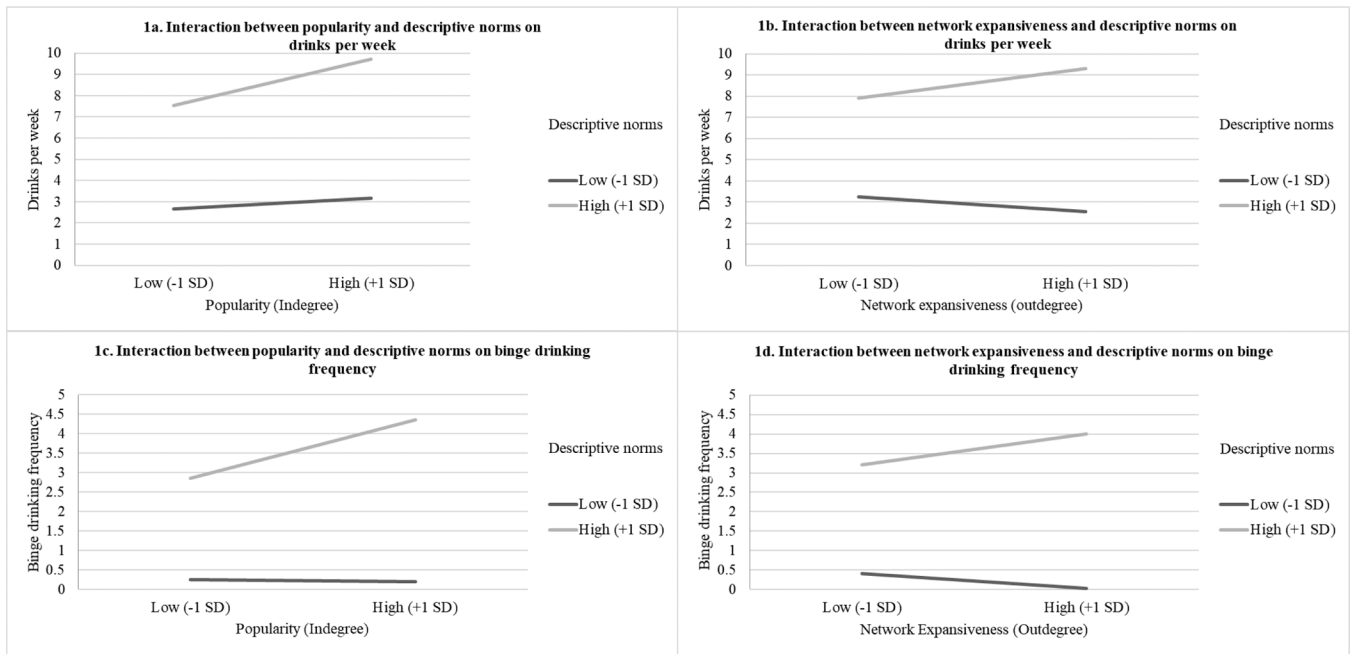
Figure 1.
Four Panel Figure Depicting Descriptive Norms Interacting with Popularity and Network Expansiveness to Predict Drinks per Week and Binge Drinking Frequency

Table 1.

Correlations Between Network Characteristics and Alcohol Variables

	Mean (SD)	Average number of drinks per week	Binge drinking frequency	Number of alcohol consequences	Indegree	Outdegree	Reciprocity	Descriptive Norms	Network Density
Average number of drinks per week	4.80 (6.28)	1.00	--	--	--	--	--	--	--
Binge drinking frequency	2.10(2.96)	0.86 [**]	1.00	--	--	--	--	--	--
Number of alcohol consequences	3.77 (3.44)	0.55 [**]	0.57 [**]	1.00	--	--	--	--	--
Popularity (Indegree)	5.60(3.12)	0.20 [**]	0.20 [**]	0.15 [**]	1.00	--	--	--	--
Network expansiveness (Outdegree)	5.60 (2.99)	0.01	0.03	0.02	0.24 [**]	1.00	--	--	--
Reciprocity	0.36 (0.22)	-0.03	-0.001	0.01	0.17 [**]	0.34 [**]	1.00		
Descriptive Norms	2.51 (2.82)	0.63 [**]	0.66 [**]	0.37 [**]	0.12 [**]	0.02	-0.06 [*]	1.00	
Personal Network Density	0.21 (0.17)	0.05	0.07 [**]	0.02	-0.02	-0.15 [**]	0.28 [**]	0.04	1.00

Note. Correlations are Pearson's correlation coefficient.

[*]
significant at p   .05;

[**]
significant at p   .01

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Table 2.

Network Autocorrelation Models Using Network Characteristics and Alcohol Variables

Variable	Model 1: Average number of drinks per week		Model 2: Binge drinking frequency		Model 3: Number of alcohol consequences		Model 4: Number of alcohol consequences (adjusted for drinks per week)	
	b (SE)	P	b (SE)	P	b (SE)	P	b (SE)	P
Step 1								
Popularity (Indegree)	0.69(0.12)	**< 0.001**	0.39 (0.06)	**< 0.001**	0.47(0.11)	**< 0.001**	0.26(0.10)	**0.008**
Network expansiveness (Outdegree)	0.19(0.12)	0.13	0.11(0.07)	0.13	0.03(0.12)	0.78	−0.02(0.11)	0.84
Reciprocity	0.02(0.14)	0.89	0.00 (0.07)	0.99	0.00(0.13)	1.00	0.03(0.12)	0.79
Personal network density	0.17(0.13)	0.20	0.14(0.07)	0.06	0.08(0.13)	0.50	0.02(0.12)	0.87
Descriptive norms	2.78(0.13)	**< 0.001**	1.69(0.07)	**< 0.001**	1.09(0.11)	**< 0.001**	0.23(0.11)	**0.04**
Step 2								
Indegree × Descriptive norms	0.41 (0.11)	**< 0.001**	0.39 (0.06)	**< 0.001**	−0.01 (0.11)	0.90	−0.18(0.10)	0.06
Outdegree × Descriptive norms	0.52(0.12)	**< 0.001**	0.30 (0.06)	**< 0.001**	0.30(0.11)	**0.005**	0.14(0.10)	0.15
Reciprocity × Descriptive norms	−0.04(0.14)	0.75	−0.04 (0.08)	0.63	−0.18(0.13)	0.16	−0.09(0.11)	0.41
Personal network density × Descriptive norms	−0.02(0.12)	0.88	0.08 (0.07)	0.18	0.06(0.11)	0.58	0.11 (0.10)	0.29

Note. Analyses were conducted separately for each model. Models adjusted for gender, race, athlete status, fraternity/sorority status, and substance free dormitory residence. Average number of drinks per week was log-transformed.

Bold values are significant at $p < .05$.