



Published in final edited form as:

Psychol Addict Behav. 2021 September ; 35(6): 650–658. doi:10.1037/adb0000704.

Associations Between Social Network Characteristics and Alcohol Use Alone or in Combination with Cannabis Use in First-Year College Students

Matthew K. Meisel¹, Hayley Treloar Padovano¹, Mary Beth Miller^{1,2}, Melissa A. Clark³, Nancy P. Barnett¹

¹Center for Alcohol and Addiction Studies, Brown University, Providence, RI 02903

²Department of Psychiatry, University of Missouri, 1 Hospital Dr DC 067.00, Columbia, MO, 65201

³Department of Health Services, Policy and Practice, Brown University School of Public Health, Providence, RI 02912

Abstract

Objective: Simultaneous use of alcohol and cannabis is common among young adults, but little research has examined social ties and their relation to simultaneous use. This study investigated the social network characteristics of college students at two time points in the first year of college. Participants were categorized into those who used alcohol and cannabis such that their effects overlap (simultaneous users), those who used both substances without overlapping effects (concurrent users), and those who used alcohol only.

Method: First-year college students ($N=1294$) completed online questionnaires during the fall and spring semester. At both assessments, participants nominated up to 10 important peers in their class, reported on peers' alcohol and cannabis use, and reported their own use of alcohol or cannabis with each peer.

Results: Concurrent and simultaneous users reported a greater proportion of drinking buddies than those who used alcohol only. A greater proportion of friends who used alcohol or cannabis, but not the proportion who were “drinking buddies” or “cannabis buddies”, was associated with increased odds of simultaneous use relative to concurrent use. Participants nominated network ties that paralleled their own substance use (e.g., the majority of simultaneous users' networks ties were also simultaneous users).

Conclusion: Having a larger percentage of friends who use cannabis and alcohol is associated with increased odds of using both substances at the same time, perhaps because it allows for access to both substances at the same time. Interventions should account for amount of exposure to alcohol and cannabis use from network members.

Keywords

alcohol; cannabis; simultaneous use; concurrent use; college; social network

Introduction

The transition from high school to college is a critical trajectory in the life span marked not only by the initiation and increase in alcohol and cannabis use, but also by changes in the environment (Suerken et al., 2014; White, Kraus, & Swartzwelder, 2006). During this high risk period, there is a large amount of turnover in friendship networks and adolescents become less close to their parents (Meisel & Barnett, 2017). Thus, the transition from high school to college represents an important time to examine how peers influence alcohol and cannabis use.

Alcohol and cannabis are the two most commonly used substances among college students (Arria et al., 2017). Recent epidemiological data suggest that, in the past month, 60% of college students have used alcohol and 25% have used cannabis (Schulenberg et al., 2019). Concern about co-use of these substances and their effects is growing; co-use has been categorized as *concurrent* - defined as using both substances during the same time period (e.g., past month) but not necessarily on the same day or the same occasion (Earleywine & Newcomb, 1997; McCabe, Cranford, Morales, & Young, 2006; Patrick, Kloska, et al., 2018) or *simultaneous* - defined as using both substances in the same time period such that the effects overlap (Patrick, Terry-McElrath, Lee, & Schulenberg, 2019). The simultaneous use of alcohol and cannabis is the highest during emerging adulthood (Midanik, Tam, & Weisner, 2007; Subbaraman & Kerr, 2015), with approximately 24% of 19- to 20-year-olds in four-year college reporting past year simultaneous use (Patrick et al., 2019). Compared to concurrent use, simultaneous use is associated with more frequent and greater amounts of use of both substances, greater consequences from use of both substances, and higher likelihood of alcohol dependence (Arterberry, Treloar, & McCarthy, 2017; Brière, Fallu, Descheneaux, & Janosz, 2011; Jackson, Sokolovsky, Gunn, & White, 2020; Lee et al., 2020; Mallett et al., 2017; Midanik et al., 2007; Patrick, Kloska, et al., 2018; Subbaraman & Kerr, 2015).

Consistent with social learning theory, in which characteristics of the social environment may contribute to the initiation and maintenance of the simultaneous use of alcohol and cannabis (Bandura, 1977, 1986), social factors are implicated in the use of alcohol, cannabis, and the simultaneous use of alcohol and cannabis (Beck et al., 2009; Bell, Wechsler, & Johnston, 1997; Borsari & Carey, 2001; Conway, Sokolovsky, White, & Jackson, 2020; Cronin, 1997; LaBrie, Hummer, & Pedersen, 2007; Lee, Neighbors, & Woods, 2007; Patrick, Fairlie, & Lee, 2018). Specifically, the high concentration of peers in the social context of young adulthood influences substance use and problems through increased opportunities to engage in the behaviors, the norms surrounding use, and behavioral modeling. Descriptive norms, or global perceptions of the prevalence of use among one's peers, is one of the most robust predictors of use and consequences (Borsari & Carey, 2001; Buckner, 2013; Neighbors, Geisner, & Lee, 2008; Pearson et al., 2018). Furthermore,

individuals who use alcohol and cannabis simultaneously report higher levels of descriptive norms for drinking compared to alcohol-only users (Linden-Carmichael, Stamatēs, & Lau-Barraco, 2019). Building on this, a recent study examined normative perceptions of peer simultaneous alcohol and cannabis use. Compared to non-simultaneous users, simultaneous users perceived higher descriptive norms for simultaneous use among same-gender, same-year students, and their friends (White et al., 2019).

Recently, there has been interest in understanding the influences of more proximal referent groups (e.g., perceptions of one's friends, rather than college students as a whole). In social network studies in the substance use literature, participants enumerate each of their friends and answer questions about each friend's substance use. These network studies build on the norms literature because this methodology leads to more accurate perceptions of peer use (Cox et al., 2019; Kenney, Ott, Meisel, & Barnett, 2017). In social network studies, perceptions of friends' use of alcohol and cannabis have been associated with one's own use of alcohol and cannabis cross-sectionally and longitudinally (Barnett et al., 2014; MacKillop et al., 2013; Meisel, Clifton, MacKillop, & Goodie, 2015; H. R. White et al., 2006; Windle, Haardörfer, Lloyd, Foster, & Berg, 2017). These findings suggest that perceptions of substance using peers in the social network may be an indicator of risk for an individual's co-use of alcohol and cannabis. However, no research has examined the network composition of simultaneous users.

Ecological momentary assessment studies have also found that cannabis and alcohol use are more likely to occur in social situations than when an individual is alone. Similarly, individuals are significantly more likely to use substances if others are using them (Buckner, Crosby, Silgado, Wonderlich, & Schmidt, 2012; Lipperman-Kreda, Gruenewald, Grube, & Bersamin, 2017; Muraven, Collins, Morsheimer, Shiffman, & Paty, 2005; Phillips, Phillips, Lalonde, & Prince, 2018; Simons, Gaher, Oliver, Bush, & Palmer, 2005). Thus, the use of substances *with* peers (referred to throughout as "drinking buddies" or "cannabis buddies") may confer additional risk beyond just having friends who use substances. In the alcohol literature, there is evidence that the presence of "drinking buddies" exerts a strong influence on alcohol use, even after controlling for the overall drinking of the social network (Lau-Barraco & Linden, 2014; Leonard & Homish, 2008; Leonard & Mudar, 2003; Reifman, Watson, & McCourt, 2006). However, to our knowledge, the unique association between "cannabis buddies" and one's own cannabis use, as well as the co-use of alcohol and cannabis has not been examined.

The aim of the current study was to investigate the associations between network ties, peer behavior, and simultaneous and concurrent use of cannabis and alcohol across two time points during the first year of college. Specifically, within a social network of one college class year, we investigated the network characteristics of simultaneous users, concurrent users, and alcohol only users. First, because peer use of alcohol and cannabis is associated with increased likelihood of use (Barnett et al., 2014; MacKillop et al., 2013; Meisel et al., 2015; H. R. White et al., 2006; Windle et al., 2017), we hypothesized that simultaneous and concurrent users would report more network ties to peers who they perceived as being cannabis users (i.e., a greater proportion of friends who participants perceive as also using cannabis) than those who only used alcohol. We also conducted auxiliary analyses to

confirm these patterns using network members' reports of their own substance use. Second, we hypothesized that simultaneous users would report a higher proportion of drinking and cannabis buddies than concurrent users. This hypothesis was based on research indicating that the presence of drinking buddies predicts heavy drinking over time (Lau-Barraco, Braitman, Leonard, & Padilla, 2012; Leonard & Homish, 2008), and that heavy drinkers have a great proportion of drinking buddies who used multiple substances (Lau-Barraco & Linden, 2014). Third, because the substance use of peers in one's social network may have an impact on one's behavior over time, we hypothesized that the proportion of friends who used cannabis and who are "cannabis buddies" would be positively associated with change from alcohol only/concurrent use to simultaneous use. Due to the infrequent use of "cannabis only", we excluded this category from our hypotheses. Given that social factors are one of the strongest predictors of cannabis and alcohol use, understanding how the composition of the social network influences use is imperative for prevention and intervention efforts.

Methods

Participants

All incoming first-year students at a private, northeastern university were recruited to participate in a longitudinal study on social networks and health. The aim of this larger study was to examine the indirect effects of a brief motivational intervention on a subset of centrally positioned peers (Barnett et al., 2019). Eligibility criteria were: residing on campus in a first-year residence hall, full-time enrollment, and ages 17 – 23 (the traditional age range for college). After excluding the 33 students who did not meet these criteria, 1660 participants remained. Eighty-one percent ($N = 1342$) of the eligible first-year class completed the first web-based survey, which was conducted six weeks into the fall semester. The second survey was administered in the spring during the same time of the semester as the fall survey; the retention rate at the spring survey was 98% ($n = 1313$). Of those, 19 participants did not answer the cannabis use question at one or both of the assessments. Thus, the present analyses are restricted to 1294.

Procedures

Prior to their arrival on campus, students were contacted through mailed postcards and email about the opportunity for study participation. The recruitment materials contained an explanation of the study, including information indicating that their name would be available on a drop-down list on the social network survey so other students in the first-year class could select them as a network member (see description of the social network survey below). Students who did not enroll in the study had the option to either allow or opt out of having their name on the list ($n = 49$ did not enroll and $n = 42$ opted out). Incoming students under the age of 18 had to have parental consent and provide assent. All procedures were approved by the university's Institutional Review Board.

Measures

Demographics.—At Time 1, sex, race, ethnicity, intentions to join a fraternity/sorority (yes, no, maybe), and athletic status were collected. The university provided information on whether the student lived on a substance-free floor.

The following measures were collected at both time points:

Alcohol use.—Participants were first presented with the definition of a standard drink (defined as 12 oz. beer, 5 oz. wine, or 1.5 oz. of 80 proof liquor). Participants indicated the number of days they consumed alcohol in the past month on a scale ranging from 0 to 30 days. One or more days was categorized into past-month use.

Cannabis use.—Participants reported the number of days they used cannabis in the past month. One or more days was categorized into past-month use.

Co-use of alcohol and cannabis.—Participants who reported both alcohol and cannabis use were asked whether they had used these substances at the same time (within 3 hours of each other) in the past 30 days (Martin et al., 1996). Participants who indicated yes were classified as simultaneous users, and participants who indicated no (but who still reported both alcohol and cannabis use in the past month) were classified as concurrent users.

Social network survey.—Participants were asked to identify first-year students at the university “who have been important to you in the past month, regardless of whether or not you liked them. These might be people you socialized with, studied with, or regularly had fun with.” All students in the class year who had not opted out were listed on a drop-down list in the survey and up to 10 could be selected. If participants could not find a student’s name on the list (e.g., someone who opted out of participating), they could select, “I can’t find the person on the list.”

Network alcohol use.—For each network member selected, participants were asked, “In the past 30 days, what is the most you think this person had to drink on any one day?” on a scale ranging from 0 to 30 drinks. Network members were dichotomized as either a drinker (perceived to have at least one drink in the past month) or nondrinker (perceived to have zero drinks in the past month). For each network member defined as a drinker, participants were asked, “In the past 30 days, how often did you drink with this person (while both of you were drinking)?” with response options ranging from not in the past 30 days (0) to daily (8). If the participant indicated any past month use of alcohol with the selected network member, the network member was classified as a “drinking buddy.”

Network cannabis use.—For each network member listed, participants were asked, “In the past 30 days, how often do you think this person used cannabis?” Network members were dichotomized as either a user of cannabis (perceived to have used cannabis at least once in the past month) or a nonuser of cannabis (perceived as not having used cannabis in the past month). For each network member perceived as being a cannabis user, participants were asked, “In the past 30 days, how often did you use cannabis with this person (while

both of you were using cannabis)?” with response options ranging from not in the past 30 days (0) to daily (8). If the participant indicated past month use of cannabis with the network member, the network member was classified as a “cannabis buddy.”

Data Analysis

First, we ran descriptive statistics on the alcohol and cannabis use categories (see Table 1). As stated above, “cannabis only” users (0.5% at Time 1 and 0.9% at Time 2) were excluded from subsequent analyses due to very small numbers. Next, to investigate social network differences between alcohol only users, concurrent users, and simultaneous users, network autocorrelation regression models were computed. These models are similar to regression analysis, but account for the non-independence of the network data (because nominated peers were also participants; see Ord (1975) for a thorough review of these models). This analysis was conducted using the *sna* package in R (Butts, 2008).

Next, we ran multinomial and logistic multilevel models. These models accounted for the non-independence of observations within participants due to repeated assessments of network variables and substance use behaviors in the fall and spring semesters (Gibbons, Hedeker, & DuToit, 2010; Raudenbush & Bryk, 2002; Singer & Willett, 2003). Analyses were implemented with SAS software version 9.4 (SAS Institute Inc., 2016) using the PROC GLIMMIX procedure. All multilevel models utilized maximum likelihood estimation based on Laplace approximation and a variance components covariance structure with between-within degrees of freedom. Fit was identical for unstructured and variance components covariance types. All models included random intercepts and fixed slopes. Focal network variables were: (1) proportion of friends identified as drinkers and cannabis users, and (2) proportion of friends identified as drinking buddies and cannabis buddies.

Multinomial logistic multilevel models (MLMMs) compared three categories of substance-use outcomes: Alcohol Only, Concurrent, and Simultaneous. These models utilized a generalized logit link function and multinomial (nominal) response distribution. MLMMs were implemented to examine the relative importance of proportion in one’s network of drinkers and cannabis users on participant substance-use category. An MLMM also evaluated the effect of proportion drinking buddies on participant substance-use category. All participants included in these analyses were drinkers, some of which used cannabis concurrently or simultaneously with alcohol. For participants who did not use cannabis themselves, values for variables reflecting the proportion of cannabis buddies were necessarily missing by design. Thus, the relative importance of proportion drinking buddies and proportion cannabis buddies on participant substance-use category could only be implemented for those participants in the Concurrent or Simultaneous category. A logistic multilevel model (LMM) was implemented for examining the relative importance of proportion of drinking buddies and cannabis buddies on participant substance-use category. This LMM compared two categories of substance-use outcomes: Concurrent and Simultaneous. The LMM utilized a binary link function and binary response distribution.

Key study aims were (a) to evaluate the importance of network variables in predicting simultaneous use, compared to concurrent and alcohol only use and (b) to evaluate how network variables predict change from fall semester alcohol only or concurrent use to spring

semester simultaneous use. Relative importance was tested by including competing network variables in the same model. Change was tested by including interactive effects of focal network variables with measurement timepoint (Spring semester = 1; Fall semester = 0 as reference). The main effect of the “semester” variable reflects change in substance-use category from fall to spring. Interactive effects of “semester” with network variables reflect the degree to which the network variable influenced change in substance-use category from fall to spring. All analyses contained the following covariates: male sex, non-Hispanic White ethnicity (race and ethnicity were combined into one variable), athlete status, substance-free dorm residence, and intention to join a fraternity/sorority (coded as yes/no/maybe). Covariates were chosen a priori due to their association with the three categories of substance-use outcomes, as well as consistency with covariates in previous manuscripts using the same dataset (DiGiuseppi et al., 2018; Kenney, DiGiuseppi, Meisel, Balestrieri, & Barnett, 2018).

Results

Descriptive analysis

The sample (N = 1294) was 55.8% women and racially diverse: 56.1% Caucasian, 23.4% Asian, 10.1% Multi-racial, 6.9% African American, 0.8% American Indian or Alaskan Native, 0.3% Other, 0.2% Native Hawaiian or other Pacific Islander, and 2.2% declined to respond. In all, 15.4% identified as Hispanic, and 13.5% lived in a substance-free dorm. Rates of no use, alcohol use, cannabis use, concurrent alcohol/cannabis use, and simultaneous use (i.e., use of both substances within 3 hours) are depicted in Table 1. All following analyses only contained participants who reported alcohol use only, concurrent use, or simultaneous use.

Table 2 displays the alcohol and cannabis use frequency of participants in the three co-use categories. The frequency of drinking and cannabis use of participants was related to the co-use of participants, such that simultaneous users consumed alcohol and used cannabis more often in the past month than concurrent users and alcohol only users. Likewise, concurrent users consumed alcohol more often than alcohol only users.

Network Differences by Substance-Use Category Membership

As shown in Table 3, simultaneous users were significantly different from alcohol only users on all network indices except total number of nominations. This pattern of cross-sectional results was consistent at Time 1 and Time 2. Also, at both time points, concurrent users had a higher proportion of friends who used cannabis than alcohol only users. Compared to concurrent users, simultaneous users had a greater proportion of friends who drank and drinking buddies in their networks. Furthermore, at Time 2 only, simultaneous users had a greater proportion of friends who used cannabis, but at both time points, simultaneous users had a greater proportion of cannabis buddies than concurrent users.

Relation of Network Variables to Substance-Use Category Membership

Initial models examined the relative importance of network variables for indicating whether a participant engaged in simultaneous use as compared to concurrent and alcohol only use.

Table 4 presents results of all substance-use category comparisons, including all covariates together with proportion of friends who drink and use cannabis as focal network variables. Proportions of friend drinkers and friend cannabis users were both related to increased odds of being a simultaneous user, relative to a concurrent user (see rightmost columns, Table 4). Odds ratios for network variables reflect the change in relative odds of being in the simultaneous category, relative to the concurrent category, for a 1-unit change in the focal predictor, adjusting for covariates. Because these were proportions, the 3.22 odds ratio for Proportion Friend Drinkers can be interpreted as follows: for a participant who identified all of their network members as drinkers (i.e., Proportion Friend Drinkers = 1.00), the relative risk of being in the simultaneous category increased by a factor of 3.22, $p = .017$, relative to the concurrent category, and relative to a participant who did not identify any network members as drinkers (i.e., Proportion Friend Drinkers = 0.00). Given the base odds ratio (1.75), this corresponds to 5.64 times the odds (i.e., 1.75×3.22). Similarly, for a participant who identified all of their network members as cannabis users, the relative risk of being in the simultaneous category increased by a factor of 5.98, $p < .001$, relative to the concurrent category, and relative to a participant who did not identify any network members as cannabis users. Given the base odds ratio, this corresponds to 10.47 times the odds (1.75×5.98).

It is important to note the size of the confidence limits for the network variables related to cannabis use. Wide intervals are indicative of large standard errors and imprecision of estimates. Thus, there is quite a bit of uncertainty in the actual size of the effects for the categories that include cannabis; although in all cases, confidence limits exceed 1.00, indicating that having more cannabis users in one's network generally increases odds of the participant being in a riskier substance-use category. The wide confidence intervals may arise from the distribution of the cannabis use network variable, with a little less than one-third of participants reporting no cannabis users in their network and approximately one in ten participants reporting that all network members were cannabis users.

Table 5 presents results of models testing whether proportion of friends who were drinking buddies related to greater concurrent or simultaneous substance-use category membership, relative to alcohol only. Proportion of Drinking Buddies was significantly associated with greater odds of being in either the concurrent or simultaneous category, relative to alcohol only. Specifically, for a participant who identified all of their friends as drinking buddies, odds of reporting concurrent use, relative to use of alcohol only, were 2.00 times those for a participant who did not identify any friends as drinking buddies, $p = .014$. Likewise, identifying all friends as drinking buddies was associated with 16.62 times the odds of reporting simultaneous use, $p < .001$, relative to use of alcohol only, and relative to participants who did not identify any drinking buddies.

We tested the relative importance of Proportion Drinking Buddies and Proportion Cannabis Buddies network variables for distinguishing between the participant's membership in the simultaneous vs. concurrent substance-use category (Table 6). Identifying a higher proportion of network members as drinking buddies was not related to greater odds of being in the simultaneous category (OR=2.37, $p = 0.436$; 95% CI = 0.27, 20.79). Identifying a higher proportion of network members as cannabis buddies was also not related to greater odds of being in the simultaneous category (OR=6.63, $p = .084$; 95% CI = 0.78, 56.36).

Relation of Network Variables to Change in Category Membership Over Time

Interactive effects with a “semester” variable tested whether network variables predicted change from alcohol only or concurrent use in the fall semester to simultaneous use in the spring semester. The only significant interaction was between Semester and Proportion Drinking Buddies: proportion of drinking buddies was related to decreased odds of changing from alcohol only to simultaneous use from fall to spring, OR = 0.25, 95% CI (0.09, 0.69), $p = .008$. Proportion of Friend Drinkers and Proportion of Friend Cannabis Users were not related to change from alcohol only to concurrent or simultaneous use, Type III β s = .864 and .166, respectively, or from concurrent to simultaneous use, β s = .951 and .617, respectively. Proportion of Drinking Buddies was not related to change from alcohol only to concurrent use, $p = .277$, or change from concurrent to simultaneous use, $p = .239$. Finally, Proportion of Cannabis Buddies was not related to change from concurrent to simultaneous use, $p = .803$.

Auxiliary analysis – Examination of the self-report of peers

Lastly, to determine the extent to which participants’ perceptions of peer simultaneous use mapped onto network members’ reports of their own substance use, we examined rates of network members’ actual substance use across participant user groups. As shown in Table 7, bottom row, the majority of network members in simultaneous users’ networks were also simultaneous users (52.4% at T1 and 55.0% at T2); networks of simultaneous users were comprised of more simultaneous than concurrent or alcohol only users (see Row E; $X^2(60, N = 578) = 123.09, p < .001$). Networks of concurrent users were comprised of more concurrent than simultaneous or alcohol only users (see Row D; $X^2(34, N = 578) = 60.86, p < .01$); and networks of alcohol only users were comprised of more alcohol only than simultaneous or concurrent users (see Row B; $X^2(60, N = 578) = 98.02, p = .001$). Similar results were obtained at T2: the percent of network members who self-reported alcohol use ($X^2(58, N = 583) = 101.56, p < .001$) and concurrent use ($X^2(48, N = 583) = 128.49, p < .001$) differed significantly according to participant substance use, but there was only a marginal effect for the percent of network members who self-reported simultaneous use ($X^2(52, N = 583) = 69.27, p = .055$).

Discussion

The main objective of this study was to further our understanding of the social network ties of concurrent and simultaneous cannabis and alcohol users during the first year of college. Consistent with hypotheses, at both time points, simultaneous and concurrent users of alcohol and cannabis reported more network ties to other cannabis users compared with alcohol only users. At both time points, and again compared to alcohol only users, simultaneous (but not concurrent) users reported significantly more ties to other drinkers. Simultaneous users also reported significantly more ties to drinkers, drinking buddies, cannabis users (but at only Time 2 and not Time 1), and cannabis buddies than concurrent users, with 91–92% of their network ties described as drinkers and 64–74% described as cannabis users. Thus, simultaneous users (relative to concurrent and alcohol only users) seem to be surrounded by important peers who also use these substances.

Although simultaneous users reported a higher network concentration of alcohol and cannabis users within their network, contrary to our hypothesis, neither the proportion of drinking buddies nor cannabis buddies indicated greater odds of simultaneous use compared to concurrent use. Although previous literature has found that the presence of drinking buddies predicts heavy drinking, even after controlling for number of drinkers in the network (Lau-Barraco & Linden, 2014; Leonard & Homish, 2008; Leonard & Mudar, 2003; Reifman et al., 2006), we found that alcohol and cannabis use *with* network members (proportion of “drinking buddies” and “cannabis buddies”) was not associated with simultaneous use compared to concurrent use. Instead, only the perceived alcohol and cannabis use *of* network members (proportion of “drinkers” and “cannabis users”) was associated with increased odds of simultaneous use compared to concurrent use. It is possible that the reason for this counterintuitive finding is that perceived norms, and not the sharing of the substance use experience, is the driver of simultaneous use. However, this seems to indicate that just having friends who use each substance is more relevant to one’s personal simultaneous use than using with those friends. While speculative, it is possible that this occurs because cannabis use is more likely than alcohol use to occur in small group settings (Lipperman-Kreda et al., 2017; Price Wolf, Lipperman-Kreda, & Bersamin, 2019). In this case, it may be socially acceptable to ask a friend for some of their cannabis supply and then use it without them (or potentially in a separate room), perhaps to protect them from the legal consequences of being caught with cannabis.

When comparing concurrent and simultaneous use relative to alcohol only, we found that the proportion of cannabis users in one’s network was associated with increased odds of concurrent and simultaneous use. This is consistent with the finding that greater access to cannabis use may explain changes from alcohol use only to concurrent use, and then consequently, from concurrent to simultaneous use. Interestingly, simultaneous users also reported a greater proportion of drinking buddies than alcohol users, and the proportion of drinking buddies was related to increased odds of simultaneous versus alcohol only use at T1. Again, we propose that this is related to opportunity: the more drinkers in your network, the greater likelihood that at least one of them will also use cannabis; and the more cannabis users in your network, the greater likelihood that you will also use cannabis. However, this contradicts our finding that the proportion of drinking buddies was related to *decreased* odds of changing from alcohol only to simultaneous use from fall to spring. This suggests that, in this specific context, drinking buddies may be protective against SAM use. Future research is needed to replicate these findings. It is possible that it is really the ratio of drinking to cannabis buddies – rather than the overall proportion of drinking buddies – that drives these findings. Specifically, if the majority of one’s close social network is comprised of drinkers (rather than cannabis users or co-users), then one may be less likely to transition to simultaneous use of alcohol and cannabis.

We also examined whether participants’ perceptions of peer simultaneous use mapped onto network members’ reports of their own substance use. To test this, we used the self-report of the participant and the self-report of their nominated peers. We found that a little over half of the peers in simultaneous users’ social networks were also simultaneous users. This replicates and extends White et al. (2019), who found that simultaneous users perceived greater simultaneous use among their closest ties than non-simultaneous users (White et

al., 2019). These findings suggest that among SAM users, normative interventions utilizing close friends as a referent may not be effective because they do not seem to overestimate the use of close friends. It is unclear to what extent normative feedback comparing SAM users' perceptions of broader groups to the actual SAM use of broader groups will be effective. Notably, recent research suggests that young adults are more likely to experience negative consequences (e.g., feeling nauseated, forgetting things) on days of SAM use versus days of only alcohol or cannabis use (Linden-Carmichael, Van Doren, Masters, & Lanza, 2020). Therefore, personalized feedback highlighting the association between SAM use and negative substance use outcomes may be relevant for this population.

The current study is not without limitations. First, since a very small proportion of individuals reported cannabis use only (less than 1% at both time points), analyses were restricted to those who also reported alcohol use. However, these results are consistent with previous studies that alcohol use is common among those who use cannabis (Barrett, Darredeau, & Pihl, 2006; Pape, Rossow, & Storvoll, 2009). Second, the current study only included first-year college students living on campus. Results may not generalize to other college students, college students not living on campus, or young adults not in college. Third, we did not link peer nominations across both time points, based on the assumption that young adults are constantly meeting and making friends with new individuals throughout their first year of college. Specifically, only about 30% of network ties were retained from T1 to T2. Network turnover is expected to have little impact on the conclusions drawn in this study, which aimed primarily to characterize social network differences between alcohol only users, concurrent users, and simultaneous users. However, future research examining the association between network turnover and change in alcohol and cannabis use behaviors over time is encouraged. Fourth, we defined a drinking/cannabis buddy as use with that network member at least once in the past month; the participants may not have thought of these network members as a drinking/cannabis buddy. Fifth, the social network was defined as important people in the first-year class. Because of this, we may have missed sources of peer influence from outside of the class year.

The present study contributes to the growing literature on the dual use of cannabis and alcohol by examining social network differences among individuals who demonstrate patterns of use that differ in risk (e.g., use alone versus concurrent or simultaneous use). We found consistently that individuals who use alcohol and cannabis such that their effects likely overlap (simultaneous users) are more likely than those who do not use simultaneously to have friends who use alcohol and more likely to have friends who use cannabis. Although we hypothesized that substance use with network members (e.g., "cannabis buddies") would be the focal network variable that predicted greater risk, we found that the proportion of network members who used substances (friends who use cannabis) increased the odds of being a simultaneous user instead of a concurrent user. Thus, having close peers who use cannabis is a risk factor for simultaneous alcohol and cannabis use, but not personally using with those friends. Based on these results, interventions incorporating substance-using peers may hold promise in the prevention and treatment of high-risk substance use among young adults in college.

Acknowledgments

This research was supported in part by grant numbers R01AA023522 (PI Barnett), and K01AA025994 (PI Meisel), K23AA024808 (PI Treloar Padovano), and K23AA026895 (PI Miller) from the National Institute on Alcohol Abuse and Alcoholism. NIH had no role in the study design, collection, analysis, or interpretation of the data, writing the manuscript, or the decision to submit the paper for publication.

REFERENCES

- Arria AM, Caldeira KM, Allen HK, Bugbee BA, Vincent KB, & O'Grady KE (2017). Prevalence and incidence of drug use among college students: An 8-year longitudinal analysis. *The American journal of drug and alcohol abuse*, 43(6), 711–718. [PubMed: 28402711]
- Arterberry BJ, Treloar H, & McCarthy DM (2017). Empirical profiles of alcohol and marijuana use, drugged driving, and risk perceptions. *Journal of Studies on Alcohol and Drugs*, 78(6), 889–898. [PubMed: 29087824]
- Bandura A (1977). *Social learning theory*. Upper Saddle River, NJ: Prentice Hall.
- Bandura A (1986). *Social foundations of thought and action: A social cognitive theory*. Upper Saddle River, NJ: Prentice Hall.
- Barnett NP, Clark MA, Kenney SR, DiGuseppi G, Meisel MK, Balestrieri S, ... Light J. (2019). Enrollment and assessment of a first-year college class social network for a controlled trial of the indirect effect of a brief motivational intervention. *Contemporary clinical trials*, 76, 16–23. [PubMed: 30391343]
- Barnett NP, Ott MQ, Rogers ML, Loxley M, Linkletter C, & Clark MA (2014). Peer associations for substance use and exercise in a college student social network. *Health Psychology*, 33(10), 1134. [PubMed: 24364375]
- Barrett SP, Darredeau C, & Pihl RO (2006). Patterns of simultaneous polysubstance use in drug using university students. *Human Psychopharmacology: Clinical and Experimental*, 21(4), 255–263. [PubMed: 16783813]
- Beck KH, Caldeira KM, Vincent KB, O'Grady KE, Wish ED, & Arria AM (2009). The social context of cannabis use: relationship to cannabis use disorders and depressive symptoms among college students. *Addictive Behaviors*, 34(9), 764–768. [PubMed: 19497678]
- Bell R, Wechsler H, & Johnston LD (1997). Correlates of college student marijuana use: Results of a US national survey. *Addiction*, 92(5), 571–581. [PubMed: 9219379]
- Borsari B, & Carey KB (2001). Peer influences on college drinking: A review of the research. *Journal of Substance Abuse*, 13(4), 391–424. [PubMed: 11775073]
- Brière F, Fallu J-S, Descheneaux A, & Janosz M (2011). Predictors and consequences of simultaneous alcohol and cannabis use in adolescents. *Addictive Behaviors*, 36(7), 785–788. [PubMed: 21429672]
- Buckner JD (2013). College cannabis use: The unique roles of social norms, motives, and expectancies. *Journal of Studies on Alcohol and Drugs*, 74(5), 720–726. [PubMed: 23948531]
- Buckner JD, Crosby RD, Silgado J, Wonderlich SA, & Schmidt NB (2012). Immediate antecedents of marijuana use: An analysis from ecological momentary assessment. *Journal of behavior therapy and experimental psychiatry*, 43(1), 647–655. [PubMed: 21946296]
- Butts CT (2008). network: a Package for Managing Relational Data in R. *Journal of Statistical Software*, 24(2), 1–36. [PubMed: 18612375]
- Conway FN, Sokolovsky A, White HR, & Jackson KM (2020). Simultaneous alcohol and marijuana use: a brief measure of motives. *Journal of Studies on Alcohol and Drugs*, 81(2), 203–211. [PubMed: 32359050]
- Cox MJ, DiBello AM, Meisel MK, Ott MQ, Kenney SR, Clark MA, & Barnett NP (2019). Do misperceptions of peer drinking influence personal drinking behavior? Results from a complete social network of first-year college students. *Psychology of Addictive Behaviors*, 33(3), 297. [PubMed: 30869918]
- Cronin C (1997). Reasons for drinking versus outcome expectancies in the prediction of college student drinking. *Substance use & misuse*, 32(10), 1287–1311. [PubMed: 9286001]

- DiGuseppi GT, Meisel MK, Balestrieri SG, Ott MQ, Clark MA, & Barnett NP (2018). 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? *Psychology of Addictive Behaviors*, 32(8), 914. [PubMed: 30265059]
- Earleywine M, & Newcomb MD (1997). Concurrent versus simultaneous polydrug use: Prevalence, correlates, discriminant validity, and prospective effects on health outcomes. *Exp Clin Psychopharmacol*, 5(4), 353. [PubMed: 9386962]
- Gibbons RD, Hedeker D, & DuToit S (2010). Advances in analysis of longitudinal data. *Annual review of clinical psychology*, 6, 79–107.
- Jackson KM, Sokolovsky AW, Gunn RL, & White HR (2020). Consequences of alcohol and marijuana use among college students: Prevalence rates and attributions to substance-specific versus simultaneous use. *Psychology of Addictive Behaviors*.
- Kenney SR, DiGuseppi GT, Meisel MK, Balestrieri SG, & Barnett NP (2018). Poor mental health, peer drinking norms, and alcohol risk in a social network of first-year college students. *Addictive Behaviors*, 84, 151–159. [PubMed: 29684764]
- Kenney SR, Ott M, Meisel MK, & Barnett NP (2017). Alcohol perceptions and behavior in a residential peer social network. *Addictive Behaviors*, 64, 143–147. [PubMed: 27614052]
- LaBrie JW, Hummer JF, & Pedersen ER (2007). Reasons for drinking in the college student context: The differential role and risk of the social motivator. *Journal of Studies on Alcohol and Drugs*, 68(3), 393. [PubMed: 17446979]
- Lau-Barraco C, Braitman AL, Leonard KE, & Padilla M (2012). Drinking buddies and their prospective influence on alcohol outcomes: Alcohol expectancies as a mediator. *Psychology of Addictive Behaviors*, 26(4), 747–758. [PubMed: 22732054]
- Lau-Barraco C, & Linden AN (2014). Drinking buddies: Who are they and when do they matter? *Addiction Research & Theory*, 22(1), 57–67. [PubMed: 25429255]
- Lee CM, Neighbors C, & Woods BA (2007). Marijuana motives: Young adults' reasons for using marijuana. *Addictive Behaviors*, 32(7), 1384–1394. [PubMed: 17097817]
- Lee CM, Patrick ME, Fleming CB, Cadigan JM, Abdallah DA, Fairlie AM, & Larimer ME (2020). A Daily Study Comparing Alcohol-Related Positive and Negative Consequences for Days With Only Alcohol Use Versus Days With Simultaneous Alcohol and Marijuana Use in a Community Sample of Young Adults. *Alcoholism: Clinical and Experimental Research*.
- Leonard KE, & Homish GG (2008). Predictors of heavy drinking and drinking problems over the first 4 years of marriage. *Psychology of Addictive Behaviors*, 22(1), 25. [PubMed: 18298228]
- Leonard KE, & Mudar P (2003). Peer and partner drinking and the transition to marriage: A longitudinal examination of selection and influence processes. *Psychology of Addictive Behaviors*, 17(2), 115. [PubMed: 12814275]
- Linden-Carmichael AN, Stamatos AL, & Lau-Barraco C (2019). Simultaneous use of alcohol and marijuana: patterns and individual differences. *Substance use & misuse*, 54(13), 2156–2166. [PubMed: 31304834]
- Linden-Carmichael AN, Van Doren N, Masters LD, & Lanza ST (2020). Simultaneous alcohol and marijuana use in daily life: Implications for level of use, subjective intoxication, and positive and negative consequences. *Psychology of Addictive Behaviors*.
- Lipperman-Kreda S, Gruenewald PJ, Grube JW, & Bersamin M (2017). Adolescents, alcohol, and marijuana: Context characteristics and problems associated with simultaneous use. *Drug and Alcohol Dependence*, 179, 55–60. [PubMed: 28755540]
- MacKillop J, Acker JD, Bollinger J, Clifton A, Miller JD, Campbell WK, & Goodie AS (2013). The brief alcohol social density assessment (BASDA) Convergent, criterion-related, and incremental validity. *Journal of Studies on Alcohol and Drugs*, 74(5), 810–815. [PubMed: 23948542]
- Mallett KA, Turrisi R, Hultgren B, Sell N, Reavy R, & Cleveland M (2017). When alcohol is only part of the problem: An event-level analysis of negative consequences related to alcohol and other substance use. *Psychology of Addictive Behaviors*, 31(3), 307–314. [PubMed: 28182448]
- Martin CS, Clifford PR, Maisto SA, Earleywine M, Kirisci L, & Longabaugh R (1996). Polydrug use in an inpatient treatment sample of problem drinkers. *Alcoholism: Clinical and Experimental Research*, 20(3), 413–417.

- McCabe SE, Cranford JA, Morales M, & Young A (2006). Simultaneous and concurrent polydrug use of alcohol and prescription drugs: prevalence, correlates, and consequences. *Journal of studies on alcohol*, 67(4), 529–537. [PubMed: 16736072]
- Meisel MK, & Barnett NP (2017). Protective and risky social network factors for drinking during the transition from high school to college. *Journal of Studies on Alcohol and Drugs*, 78(6), 922–929. [PubMed: 29087828]
- Meisel MK, Clifton AD, MacKillop J, & Goodie AS (2015). A social network analysis approach to alcohol use and co-occurring addictive behavior in young adults. *Addictive Behaviors*, 51, 72–79. doi:10.1016/j.addbeh.2015.07.009 [PubMed: 26240940]
- Midanik LT, Tam TW, & Weisner C (2007). Concurrent and simultaneous drug and alcohol use: results of the 2000 National Alcohol Survey. *Drug and Alcohol Dependence*, 90(1), 72–80. [PubMed: 17446013]
- Muraven M, Collins RL, Morsheimer ET, Shiffman S, & Paty JA (2005). One too many: Predicting future alcohol consumption following heavy drinking. *Exp Clin Psychopharmacol*, 13(2), 127. [PubMed: 15943545]
- Neighbors C, Geisner IM, & Lee CM (2008). Perceived marijuana norms and social expectancies among entering college student marijuana users. *Psychology of Addictive Behaviors*, 22(3), 433. [PubMed: 18778137]
- Ord K (1975). Estimation methods for models of spatial interaction. *Journal of the American Statistical Association*, 70(349), 120–126.
- Pape H, Rossow I, & Storvoll EE (2009). Under double influence: assessment of simultaneous alcohol and cannabis use in general youth populations. *Drug and Alcohol Dependence*, 101(1–2), 69–73. [PubMed: 19095380]
- Patrick ME, Fairlie AM, & Lee CM (2018). Motives for simultaneous alcohol and marijuana use among young adults. *Addictive Behaviors*, 76, 363–369. [PubMed: 28915500]
- Patrick ME, Kloska DD, Terry-McElrath YM, Lee CM, O'Malley PM, & Johnston LD (2018). Patterns of simultaneous and concurrent alcohol and marijuana use among adolescents. *The American journal of drug and alcohol abuse*, 44(4), 441–451. [PubMed: 29261344]
- Patrick ME, Terry-McElrath YM, Lee CM, & Schulenberg JE (2019). Simultaneous alcohol and marijuana use among underage young adults in the United States. *Addictive Behaviors*, 88, 77–81. [PubMed: 30170141]
- Pearson MR, Hustad JT, Neighbors C, Conner BT, Bravo AJ, & Team MOS (2018). Personality, marijuana norms, and marijuana outcomes among college students. *Addictive Behaviors*, 76, 291–297. [PubMed: 28889057]
- Phillips KT, Phillips MM, Lalonde TL, & Prince MA (2018). Does social context matter? An ecological momentary assessment study of marijuana use among college students. *Addictive Behaviors*, 83, 154–159. [PubMed: 29329753]
- Price Wolf J, Lipperman-Kreda S, & Bersamin M (2019). “It just depends on the environment”: Patterns and decisions of substance use and co-use by adolescents. *Journal of child & adolescent substance abuse*, 28(3), 143–149. [PubMed: 32313414]
- Raudenbush SW, & Bryk AS (2002). *Hierarchical linear models: Applications and data analysis methods* (Vol. 1): Sage.
- Reifman A, Watson W, & McCourt A (2006). Social networks and college drinking: probing processes of social influence and selection. *Personality and Social Psychology Bulletin*, 32(6), 820–832. doi:10.1177/0146167206286219 [PubMed: 16648206]
- Schulenberg JE, Johnston LD, O'Malley PM, Bachman JG, Miech RA, & Patrick ME (2019). Monitoring the Future national survey results on drug use, 1975–2018: Volume II, college students and adults ages 19–60. In.
- Simons JS, Gaher RM, Oliver MN, Bush JA, & Palmer MA (2005). An experience sampling study of associations between affect and alcohol use and problems among college students. *Journal of studies on alcohol*, 66(4), 459–469. [PubMed: 16240553]
- Singer JD, & Willett JB (2003). *Applied longitudinal data analysis: Modeling change and event occurrence*: Oxford university press.

- Subbaraman MS, & Kerr WC (2015). Simultaneous versus concurrent use of alcohol and cannabis in the national alcohol survey. *Alcoholism: Clinical and Experimental Research*, 39(5), 872–879.
- Suerken CK, Reboussin BA, Sutfin EL, Wagoner KG, Spangler J, & Wolfson M (2014). Prevalence of marijuana use at college entry and risk factors for initiation during freshman year. *Addictive Behaviors*, 39(1), 302–307. [PubMed: 24455784]
- White AM, Kraus CL, & Swartzwelder HS (2006). Many college freshmen drink at levels far beyond the binge threshold. *Alcoholism: Clinical and Experimental Research*, 30(6), 1006–1010.
- White HR, Kilmer JR, Fossos- Wong N, Hayes K, Sokolovsky AW, & Jackson KM (2019). Simultaneous alcohol and marijuana use among college students: patterns, correlates, norms, and consequences. *Alcoholism: Clinical and Experimental Research*, 43(7), 1545–1555.
- White HR, McMorris BJ, Catalano RF, Fleming CB, Haggerty KP, & Abbott RD (2006). Increases in alcohol and marijuana use during the transition out of high school into emerging adulthood: The effects of leaving home, going to college, and high school protective factors. *Journal of studies on alcohol*, 67(6), 810. [PubMed: 17060997]
- Windle M, Haardörfer R, Lloyd SA, Foster B, & Berg CJ (2017). Social influences on college student use of tobacco products, alcohol, and marijuana. *Substance use & misuse*, 52(9), 1111–1119. [PubMed: 28524716]

Public Health Significance:

Young adults report the highest rates of simultaneous alcohol and cannabis use. The present study examined the relationship between the composition of the social network and the co-use of alcohol and cannabis. Findings can be used in prevention and intervention studies to better address the high amount of exposure to alcohol and cannabis use from peers.

Author Manuscript

Author Manuscript

Author Manuscript

Author Manuscript

Table 1.

Participant Use of Alcohol and Cannabis at Time 1 and Time 2 (N = 1294).

	Time 1 (Fall) N (%)	Time 2 (Spring) N (%)
No use of either alcohol or cannabis	338 (26.1%)	313 (24.2%)
Alcohol use only	512 (39.6%)	476 (36.8%)
Cannabis use only	7 (0.5%)	12 (0.9%)
Concurrent use	102 (7.9%)	147 (11.4%)
Simultaneous use	335 (25.9%)	346 (26.7%)

Note. Concurrent use was defined as use of both alcohol and cannabis in the past month, but not in the same three-hour time period. Simultaneous use was defined as the use of both alcohol and cannabis in the same three-hour time period.

Table 2.

Number of drinking and cannabis use days of alcohol only users, concurrent users, and simultaneous users.

	Time 1 (Fall)		Time 2 (Spring)	
	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>
Alcohol use only				
Number of drinking days	4.80	2.99	4.36	2.95
Concurrent use				
Number of drinking days	5.99	3.45	4.92	2.82
Number of cannabis use days	2.00	1.41	2.71	2.89
Simultaneous use				
Number of drinking days	8.44	3.49	7.27	3.85
Number of cannabis use days	7.57	7.76	8.18	8.28

Author Manuscript

Author Manuscript

Author Manuscript

Author Manuscript

Table 3.

Social Network Differences at Time 1 and Time 2 Between Alcohol Only Users, Concurrent Users, and Simultaneous Users.

	Time 1 Mean (SD) or %			Time 2 Mean (SD) or %		
	Alcohol only	Concurrent	Simultaneous	Alcohol only	Concurrent	Simultaneous
Total number of peer nominations made	6.89 (2.99)	7.39 (2.86)	6.84 (3.11)	4.81 (2.92)	5.36 (2.94)	4.94 (3.03)
Among those nominated:						
Proportion of drinkers	0.79 ^a	0.84 ^a	0.91	0.82 ^a	0.84 ^a	0.92
Proportion of drinking buddies	0.59	0.68	0.82	0.64 ^a	0.68 ^a	0.83
Proportion of cannabis users	0.29	0.54 ^c	0.64 ^c	0.32	0.54	0.74
Proportion of cannabis buddies		0.25	0.46		0.35	0.57

Notes: Covariates: male sex, non-Hispanic-White ethnicity, athlete status, substance-free dorm residence, and intentions to join a fraternity/sorority. Categories that share the same superscript do **not** differ significantly:

^a indicates a nonsignificant difference between alcohol only and concurrent

^b indicates a nonsignificant difference between alcohol only and simultaneous

^c indicates a nonsignificant difference between concurrent and simultaneous.

Table 4. Odds Ratios (and 95% Confidence Limits) from Multilevel Multinomial Logistic Models of Participant’s Alcohol and Cannabis Use by the Proportion of their Friends Who Drink/Use and Participant Demographic Covariates (n = 1861)

Variable	Concurrent vs. Alcohol Only			Simultaneous vs. Alcohol Only			Simultaneous vs. Concurrent		
	OR	95% Confidence Limits		OR	95% Confidence Limits		OR	95% Confidence Limits	
		Lower	Upper		Lower	Upper		Lower	Upper
Intercept	0.20	0.12	0.34	0.43	0.28	0.65	1.75	1.12	2.72
Semester	1.57	1.13	2.17	0.87	0.66	1.16	0.58	0.42	0.82
Female Sex	0.77	0.54	1.11	0.51	0.36	0.74	0.72	0.49	1.05
Non-Hispanic White	0.91	0.63	1.32	0.97	0.68	1.39	1.07	0.73	1.57
Athlete	0.44	0.25	0.77	0.44	0.26	0.74	1.05	0.56	1.96
Substance-free Dorm	0.14	0.05	0.45	0.26	0.10	0.65	1.81	0.50	6.58
Greek Intentions (Maybe)	1.01	0.68	1.50	1.95	1.32	2.86	1.76	1.16	2.65
Greek Intentions (Yes)	0.71	0.31	1.65	2.76	1.39	5.50	3.31	1.44	7.60
Proportion Friend Drinkers	0.43	0.20	0.95	1.54	0.66	3.62	3.22	1.24	8.34
Proportion Friend Cannabis Users	12.72	6.86	23.59	91.15	47.80	173.80	5.98	3.02	11.85

Note. 95% confidence limits with bounds outside of 1.00 are reported in bold typeface. The reference value for Semester is “Fall.” The reference value for Greek Intentions is “No.”

Note: The *n* refers to the total number of observations used in this analysis. We used listwise deletion based on predictor variables, so if any covariate or focal predictor is missing, it is removed from the analysis.

Table 5. Odds Ratios (and 95% Confidence Limits) from Multilevel Multinomial Logistic Models of Participant’s Alcohol and Cannabis Use from the Proportion of Friends with whom they Drink (i.e., Drinking Buddies) and Participant Demographic Covariates (n = 1817)

Variable	Concurrent vs. Alcohol Only			Simultaneous vs. Alcohol Only		
	OR	Lower	Upper	OR	Lower	Upper
Intercept	0.24	0.14	0.40	0.78	0.52	1.17
Semester	1.81	1.31	2.50	1.09	0.83	1.43
Female Sex	0.71	0.49	1.02	0.41	0.28	0.60
Non-Hispanic White	0.82	0.57	1.18	0.89	0.62	1.29
Athlete	0.29	0.16	0.52	0.22	0.13	0.37
Substance-free Dorm	0.10	0.03	0.36	0.19	0.08	0.49
Greek Intentions (Maybe)	0.92	0.62	1.37	1.94	1.30	2.90
Greek Intentions (Yes)	0.70	0.30	1.60	2.66	1.31	5.43
Proportion Drinking Buddies	2.00	1.15	3.47	16.62	9.17	30.15

Note. 95% confidence limits with bounds outside of 1.00 are reported in bold typeface. The reference value for Semester is “Fall.” The reference value for Greek Intentions is “No.” Participants could not identify cannabis-use buddies if they did not use cannabis themselves. Thus, “Proportion Friend Cannabis Users” would not apply to the “Alcohol Only” category and was only relevant for the Simultaneous vs. Concurrent comparison (see Table 6).

Note: The difference in the n between Tables 4 and 5 reflects missingness on the proportion of drinking buddies variable.

Table 6.

Odds Ratios (and 95% Confidence Limits) from Multilevel Logistic Models of Participant’s Simultaneous or Concurrent Alcohol and Cannabis Use from the Proportion of Friends with whom they Drink and Use Cannabis (i.e., Drinking Buddies and Cannabis Buddies) and Participant Demographic Covariates (n = 851)

Variable	Simultaneous vs. Concurrent		
	OR	Lower	Upper
Intercept	58.31	14.34	237.14
Semester	0.61	0.19	1.93
Female Sex	0.97	0.29	3.21
Non-Hispanic White	1.05	0.31	3.48
Athlete	1.07	0.12	9.20
Substance-free Dorm	2.62	0.02	327.41
Greek Intentions (Maybe)	1.33	0.35	5.08
Greek Intentions (Yes)	2.15	0.14	32.39
Proportion Drinking Buddies	2.37	0.27	20.79
Proportion Cannabis Buddies	6.63	0.78	56.36

Note. 95% confidence limits with bounds outside of 1.00 are reported in bold typeface. The reference value for Semester is “Fall.” The reference value for Greek Intentions is “No.” In order to identify cannabis-use buddies, participants must have endorsed cannabis use themselves. Thus, the “Alcohol Only” category is not a viable comparison and is not included.

Note: The difference in the *n* between Tables 5 and 6 reflects missingness on the proportion of cannabis buddies variable. It is reduced because participants cannot have a cannabis buddy if they do not self-report cannabis use.

Table 7. The Distribution of Network Members' Self-Reported Substance Use by Substance Use of Participants at Time 1 and Time 2.

	Participant Report					
	Time 1			Time 2		
	Alcohol only users (n = 472)	Concurrent users (n = 99)	Simultaneous users (n = 316)	Alcohol only users (n = 296)	Concurrent users (n = 137)	Simultaneous users (n = 318)
Proportion of network members who self-reported:						
No substance use	17.2%	12.9%	6.8%	15.2%	12.2%	5.5%
Alcohol Only	50.9%	34.3%	30.5%	47.6%	32.9%	25.4%
Cannabis Only	0.2%	0.7%	0.5%	0.6%	0.6%	0.7%
Concurrent Use	7.6%	13.3%	9.8%	12.9%	20.7%	13.4%
Simultaneous Use	24.1%	38.8%	52.4%	23.7%	33.7%	55.0%

Note: The number of participants in Table 7 does not match the number of participants in Table 1. Participants who are not included in Table 7 did not nominate anyone in the socio-centric network (i.e., their nominations are 0), nominated peers who did not participate themselves, or nominated peers who were participants but did not provide any self-report data.