

PERCEPTIONS OF FRIENDS' SUBSTANCE USE VERSUS FRIENDS' SELF-
REPORTED SUBSTANCE USE: A SOCIAL NETWORK APPROACH

by

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(Under the Direction of

Adam S. Goodie)

ABSTRACT

Peer substance use is one of the strongest predictors of one's own substance use. Both perceptions of peers' substance use as well as peers' self-reported substance use independently predict individuals' substance use. However, there is a lack of literature on whether social network factors influence these perceptions, as well as a lack of understanding in how substance use is associated with social network outcomes. The current study utilized an egocentric social network approach, in which focal individuals enumerated the most important individuals in their lives, answered questions about the substance use of these individuals, and then indicated whether the network members knew one another. The current study went beyond the traditional egocentric network design and gathered self-report substance use from the network members. 114 focal individuals and 243 network members participated in the current study. Focal individuals significantly underestimated the frequency of network members' alcohol, heavy alcohol, and marijuana use. There was no significant tendency for focal individuals to overestimate or underestimate the frequency of network members' tobacco use. Social network characteristics did not moderate the relationship between perceptions and network members'

self-reported substance use. Supportive of the false consensus effect, across all substances, the relationship between focal individuals' perceptions of network members' substance use and focal individuals' substance use was stronger than the relationship between network members' and focal individuals' self-reported substance use. The moderating role of focal individuals' alcohol use on the relationship between network members' alcohol use and degree centrality did not differ when network members' alcohol use was operationalized as focal individuals' perceptions than when it was operationalized as network members' self-reported substance use. The same effect was evidenced when examining heavy alcohol use, but different interactions emerged for marijuana and tobacco use. This suggests that when utilizing a network approach to study alcohol and heavy alcohol use, it is not necessary to gather self-report data from the focal individuals' friends. However, for tobacco and marijuana use, because of the differential effects of perceptions and self-report on network characteristics, it may be useful for researchers to obtain tobacco and marijuana use from the network members themselves.

INDEX WORDS: SUBSTANCE USE, PERCEPTIONS, SOCIAL NETWORK ANALYSIS,
ACCURACY, EGOCENTRIC

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DEDICATION

I dedicate my dissertation to my family. I am so blessed to have such a great family, and I would not be here without their love and support.

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CHAPTER 1

INTRODUCTION

Epidemiological studies indicate that the prevalence of substance use is heightened during young adulthood, such that in the past year, approximately 75% of young adults consumed alcohol, 23% - 40% used tobacco, 36% used marijuana, and 20% used any illicit drug other than marijuana (Falk, Yi, & Hiller-Sturmhöfel, 2006; Johnston, O'Malley, Bachman, Schulenberg, & Miech, 2014). Furthermore, during this time period, younger adults are extremely susceptible to their peers' behavior, especially in the context of substance use, with peers significantly impacting the initiation and maintenance of one's own substance use (Borsari & Carey, 2001). Both perceptions of friends' substance use as well as friends' self-reported substance use affect younger adults' substance use (Iannotti & Bush, 1992). The aims of the current study were threefold. The first aim was to investigate individuals' accuracy with regard to their friends' substance use and to examine the moderating role of social network characteristics on this association. The second aim was to examine the differential associations of perceptions of the networks' substance use and networks' self-reported substance use with one's own self-reported substance use. Furthermore, I examined whether social network characteristics moderated these associations. The third and final aim was to examine the differential effects of perceptions of friends' substance use and friends' self-reported substance use on the structure of social networks. Relatedly, I examined if focal individuals' self-reported substance use moderated these effects.

Social factors and substance use

There is a robust literature examining the relationship between peer substance use and individuals' self-reported substance use. Although others are an important source of influence on one's substance use, studies vary in terms of how others are operationalized. Furthermore, these studies also differ in whether researchers gather self-report data from peers or whether peer substance use is based on focal individuals' perceptions. In general, these broad techniques fall into three distinct categories: the social norms approach, social networks, and a term, related to the second but different, social network analysis, with the majority of these studies examining perceptions and not peers' self-reported substance use.

The first major category is the social norms approach. Social norms theory indicates that two distinct perceptions influence behavior: injunctive and descriptive norms (Berkowitz, 2004; Cialdini, Reno, & Kallgren, 1990). Injunctive norms refer to the perceived approval of behavior among others; descriptive norms refer to the perceived prevalence of a behavior by others. In the social norms literature, the construct of others is operationalized as either close friends, friends, family members, or other students in general. According to social impact theory (Latanè, 1981), normative referents who are more proximal to the individual (e.g., close friends and friends) have a stronger influence on an individual's behavior than reference groups distally located (e.g., other students in general). Supporting this theory, in different domains of substance use, the association between self and close friends' descriptive norms is consistently stronger than the association between self and other students' descriptive norms (Baer, Stacy, & Larimer, 1991; Collins & Spelman, 2013; Kilmer et al., 2006; Meisel & Goodie, 2014; for a review see Borsari & Carey, 2003).

The major aim of the social norms approach is to identify and correct individuals' misperceptions of their peers' substance use. Although this technique is effective in reducing individuals' substance use, one major limitation in this area of research is that social norms refer to the collective; different members of the collective can have differential effects on one's behavior. Not all friends influence one's behavior to the same extent. There may be individuals who have more power and control over one's behavior than others.

Due to this limitation, there has been a collective rise in empirical research that has focused on the role of social networks on behavior. Social networks are different from social networking; social networks refer to an individual's close friends and family members, as well as other important people in the individual's life. In the literature that has examined the influence of social networks on behavior, social networks have been operationalized using the Important People Inventory (Clifford & Longabaugh, 1991), the Brief Alcohol Social Density Assessment (MacKillop et al., 2013), and other techniques in which focal individuals enumerate the most important individuals in their life. Furthermore, this literature differs on whether the networks' substance use is obtained through self-report data from the members of the network or if the networks' substance use is based on focal individuals' perceptions.

Social networks have been operationalized using the Important People Inventory (IPI: Clifford & Longabaugh, 1991). Although the IPI was originally developed for treatment seeking samples, this measure has been validated in young adult non-treatment seeking samples (Hallgren, Ladd, & Greenfield, 2013). The IPI has a three factor structure: a network substance use factor, a network support for substance use factor, and a broader network general support factor. Using this measure, self-reported alcohol use was concurrently related to perceptions of networks members' alcohol use and network support for alcohol, but not network general

support. Only self-reported alcohol-related problems were associated with perceptions of networks members' alcohol use (Hallgren et al., 2013). In another study that utilized the IPI, heavy drinkers had more network members who they consumed alcohol with, heavy drinkers' experienced greater encouragement to drink from network members, and heavy drinkers were more likely to engage in alcohol-related activities with their friends. Furthermore, they were more likely to perceive frequent and greater quantities of drinking among network members (Orford, Krishnan, Balaam, Everitt, & Van der Graaf, 2004).

The Brief Alcohol Social Density Assessment (BASDA; MacKillop et al., 2013) is a measure utilized to examine network members' alcohol consumption. In this method, individuals enumerate their four closest friends, and then they answer questions about their perceptions of each member's frequency of alcohol use and binge drinking as well as their quantity of alcohol use. Results with this measure have found that individuals who scored at least an 8 on the Alcohol Use Disorders Identification Test (AUDIT) perceived greater overall alcohol use among their friends than those who scored less than an 8 on the AUDIT (MacKillop et al., 2013).

Somewhat similar to the BASDA, other studies operationalize network use by having individuals enumerate the most important members of their social network, and then answer questions about the attributes of each network member. In a study that examined perceptions of network members' alcohol use, heavy drinkers perceived greater overall rates of drinking by network members as well as reported a greater proportion of network members who were considered "drinking buddies" as compared to regular and light drinkers. Furthermore, heavy and regular drinkers reported more problematic drinkers in their social networks than light drinkers. However, consistent with the previous research, heavy, regular, and light drinkers did not differ on network support (Leonard, Kearns, & Mudar, 2000).

Another survey operationalized network use as the focal individual's two closest friends (e.g. one same-sex and one opposite-sex). Whereas in the previous studies, the focal individual reported on the attributes of network members, in this study, the attributes of network members were obtained from the network members themselves (Andrews, Tildesley, Hops, & Li, 2002). That is, the focal individual self-reported his or her own use, and the focal individual's two best friends also self-reported their own use. In the study, focal individuals' use of different substances was concurrently related to network members' use of tobacco, alcohol, and marijuana as well as frequency of binge drinking (Andrews et al., 2002). However, focal individuals' use of hard drugs was not associated with network members' use of hard drugs (Andrews et al., 2002).

Overall, two general conclusions can be reached based on these findings. First, focal individuals' substance use is concurrently related to network members' substance use, in terms of the different substances used and the frequency of substance use. Second, the severity of substance use by the focal individual is concurrently related to the severity of substance use by the network. However, the majority of these studies are based on egos' perceptions of their network members' substance use, instead of self-report data obtained from friends. One aim of the current study was to obtain self-reported substance use from focal individuals as well as their friends.

Although these previous studies have examined social networks, these studies have ignored the structure of individuals' social networks. The structure of an individual's social network is based on the connections between network members; specifically, the presence or absence of relationships between network members. Examining the structure of the network allows researchers to examine the centrality and potential clustering of network members.

Social network analysis

Social network analysis (SNA) is a methodological technique, with a strong theoretical component, that can be utilized to examine structural aspects as well as compositional characteristics of individuals' social networks. SNA has been utilized in the different domains of substance use (Christakis & Fowler, 2008; Meisel et al., 2013; Rosenquist, Murabito, Fowler, & Christakis, 2010).

SNA can be subdivided into two distinct typologies: sociocentric and egocentric. In a sociocentric design, all members of some bounded network, such as a school, fraternity or sorority, or workplace, report on their own behaviors and their connections to other members of the network. Similar to a sociocentric design, in an egocentric design, an individual nominates a number of individuals based on some characteristic (e.g., important others or friends) to be a member of his or her social network. The individual subsequently reports on the behaviors of his or her network members and the connections (termed ties in SNA) among network members. Compared to sociocentric designs, the biggest limitation of egocentric designs is that the network members' behaviors and the connections among network members are based on the focal individual's perceptions, which may be different from reality.

SNA allows researchers to examine the centrality of network members. Although there are multiple measures of centrality, only one form of centrality will be discussed: degree centrality. However, in sociocentric SNA designs, degree centrality can be partitioned into two subtypes: indegree and outdegree centrality. Degree centrality refers to the total number of connections to other network members. Indegree centrality refers to the total number of times the focal individual has been nominated by others. Outdegree centrality refers to the total number of other people the focal individual nominates (Freeman, 1979). Personality traits are linked to

different measures of centrality (Selfhout et al., 2010). For example, individuals high on Agreeableness tend to have higher indegree centrality than those low on the trait and individuals high on Extraversion tend to have higher outdegree centrality than those low on the trait (Selfhout et al., 2010). Degree centrality has also been linked to power and prestige in the network (Freeman, 1979).

The majority of the empirical literature that investigates the relationship between centrality and substance use utilizes adolescent samples. Furthermore, the empirical literature is mixed, with some studies indicating a greater likelihood of lifetime substance use among the most popular members (Ennett et al., 2006; Valente, Unger, & Johnson, 2005), and other studies indicating greater levels of substance use among isolates (individuals disconnected from others in the network; Ennett & Bauman, 1993). However, Alexander and colleagues (2001) found that in schools with high overall rates of substance use, the most popular members used substances, but in schools with low overall rates of substance use, the most popular members did not use substances, indicating that researchers must take into consideration the overall rates of substance use by all network members (Alexander, Piazza, Mekos, & Valente, 2001). Furthermore, another complication to the literature is that different forms of substance use operate differentially in the network. For example, smokers tend to be more isolated in their networks compared to nonsmokers, but individuals who use marijuana and alcohol tend to be more connected (Osgood, Feinberg, Wallace, & Moody, 2014). Because of this variation in substance use, I examined the impact of substance use on social network characteristics, separately for alcohol, heavy alcohol, tobacco, and marijuana.

The current study utilized an egocentric SNA approach in which focal individuals (termed egos in SNA) enumerated 25 of their closest friends (termed alters) and the relationships

among alters. Furthermore, in a novel approach to egocentric SNA, self-reported substance use data was obtained from egos as well as alters. Obtaining self-report data from alters allowed the researcher to examine the accuracy of egos' perceptions of their network members' substance use.

Accuracy of perceptions

There is a plethora of research in the substance use literature that has examined the accuracy of individuals' perceptions. This literature can be fragmented into two separate smaller literatures: the accuracy of individuals' perceptions of their own substance use and the accuracy of individuals' perceptions of their friends' substance use.

In the literature that examines the accuracy of individuals' perceptions of their own substance use, collateral reports are obtained to verify focal individuals' self-reported substance use. Collaterals are individuals nominated by the focal individual, and in general, information is obtained from only one collateral per participant. A recent meta-analysis examining collateral/focal individual correspondence in college students found that 73% of collaterals underreported the focal individual's alcohol use (Borsari & Muellerleile, 2009). Furthermore, different moderators affecting correspondence have been examined. Specifically, these moderators include the frequency of contact between the individual and the collateral and the degree of collaterals' confidence in their assessments. The more contact the focal individual has with the collateral, the more likely the collateral will be to underestimate the focal individual's alcohol use. Similar results emerged for confidence. The meta-analysis also indicated that collaterals were more accurate in their estimates of the focal individual's frequency of drinking compared to their estimates of the focal individual's frequency of drinking heavily (Borsari & Muellerleile, 2009).

Adolescents as well as adults are generally inaccurate when estimating others' behavior. In the social norms literature, students overestimate others' substance use relative to their own (Larimer et al., 2011). Furthermore, students are more accurate in their perceptions as the students' similarity to the reference group increases. For example, a male Caucasian student is more accurate in his perceptions of other male Caucasian students' alcohol use than other students' alcohol use in general (Larimer et al., 2011). The current study had college students estimate the substance use of each of their friends separately, which should lead to more accurate estimates than in the social norms literature, where students estimate the substance use of all of their friends at the same time (e.g., what is the average substance use of friends) or estimate the substance use of individuals whom the student has never met (e.g., the typical student). One of the main aims of the current study was to examine whether students are accurate in their perceptions of their friends' substance use. Furthermore, there is a paucity of literature that has examined factors that might moderate the accuracy of individuals' perceptions. In the current study, I examined whether social network characteristics, such as density and degree centrality, moderated the strength of the relationship between focal individuals' perceptions and friends' self-reported substance use.

Perceptions versus self-reported substance use

There is a general consensus regarding the importance of perceptions of others' substance use as well as others' self-reported substance use on the focal individual's substance use. Furthermore, the effect of perceptions of others' substance use on one's own substance use appears to be larger than the effect of others' self-reported substance use on one's own substance use (Bauman & Fisher, 1986; Fisher & Bauman, 1988). This is supportive of the false consensus

effect, which is the tendency of individuals to project their own attitudes and behaviors onto others (Ross, Greene, & House, 1977). The false consensus effect suggests that substance users overestimate their friends' substance use, while nonsubstance users underestimate their friends' substance use (Marks & Miller, 1987; Mullen et al., 1985; Prinstein & Wang, 2005). Although perceptions are a stronger predictor of one's own substance use than peers' self-reported substance use, there is a paucity of literature on whether these effects operate any differently on outcomes. If these effects operate similarly on outcomes, then instead of gathering self-report data from friends, researchers can use perceptions as a proxy for friends' self-report data. This would save researchers the time and money gathering self-report data from friends.

Aims and Hypotheses

The aims of the study were threefold. First, I investigated the accuracy of individuals' perceptions of their friends' substance use. Because of the mixed literature, no hypotheses were posited. Relatedly, I examined whether social network characteristics moderated the strength of the association between perceptions and self-reported substance use. I hypothesized that network density would moderate the strength of the relationship between perceptions and self-reported substance use, because highly dense network provide consistent norms for behaviors (Granovetter, 1973; Burt, 2001; Haynie, 2001). If the network is dense, the strength of the relationship between perceptions and self-reported behavior should be stronger than if the network is sparse, because in dense networks, network members' behaviors should be less variable, resulting in similar and more accurate estimates by the focal individual. In sparse networks, network members' behaviors should be more variable, resulting in more inaccurate perceptions of alters' behaviors, because it will be more difficult for focal individuals to estimate their networks members' behaviors. I also posited that degree centrality would moderate the

effect of perceptions on self-reported substance use. Generally, network members who are central are more similar to the focal individual than network members who are isolates. This similarity should result in a stronger relationship between focal individuals' perceptions and alters' self-reported substance use for alters who are central.

Whereas the first aim investigated individuals' perceptions of each network members' substance use, the second aim examined the network as a whole. Specifically, I investigated whether network density moderated the association between individuals' perceptions of their networks' substance use and individuals' self-reported substance use. Focal individuals' perceptions of networks' substance use was calculated by averaging all of the focal individuals' perceptions of their network members' substance use. Relatedly, I examined whether network density moderated the relationship between networks' self-reported substance use and individuals' self-reported substance use. Networks' self-reported substance use was calculated by averaging all of the network members' substance use. No hypotheses were posited on whether density would moderate these effects.

The third aim of the study was to examine whether the effect of network members' substance use on degree centrality differed if network members' substance use was defined as individuals' perceptions of their network members' substance use or when it was defined as network members' self-reported substance use. I choose degree centrality as a relevant outcome because degree centrality is an indicator of power and influence in the network (Freeman, 1979). Therefore, it is important to examine if network members' substance use predicts degree centrality. Relatedly, I examined whether the focal individuals' self-reported substance use moderated this association. I hypothesized that egos who frequently used substances would have more central alters who also frequently used substances.

If the second and third aims indicate that there is no difference between focal individuals' perceptions of network members' substance use on outcomes and network members' self-reported substance use on outcomes, then perceptions can serve as a proxy for network members' self-reported substance use. Thus, it would be not worth the time and effort for researchers to obtain self-report data from the network members themselves.

CHAPTER 2

METHOD

Participants

114 undergraduates at a large Southeastern university participated in the current study as egos. Respondents were enrolled in lower-level psychology and sociology courses; they were compensated with course credit for their participation.

As part of the study (described in greater detail below), respondents (termed “egos” in SNA) identified 25 non-kin individuals (“alters”) who had the most significant impact on them in the past year. If possible, egos provided the email address for each alter. All alters who had email information provided were contacted and asked to participate in a 20-minute online survey. Egos’ inclusionary criteria for the current study was that at least one of their alters must have responded. Researchers were unable to contact at least one alter for 31 egos. Therefore, the final sample consisted of 83 egos (52 female), who predominately identified themselves as Caucasian (79.5%), followed by Asian (10.8%), Other (4.9%) and African American (4.8%). The age of the egos ranged from 18 to 23, with a mean age of 19.58 ($SD = 1.22$).

For each ego, an average of 2.50 ($SD = 1.65$; Min = 1; Max = 9) alters completed the survey, resulting in a total of 243 alters (179 female). The mean age of alters was 19.98 ($SD = 3.77$), with a range from 17 to 58. The majority of alters classified themselves as Caucasian (79.4%), followed by Asian (9.0%), African American (6.6%), and Other (5.0%). Most alters currently attended the same institution as the ego (87.2%), but others indicated that they never attended the school (10.7%), or once attended but graduated (2.1%)

Procedure

Egos signed up for a two part study on Sona Systems. This two part study consisted of an online portion as well as an on-campus laboratory portion. In the online part of the study, egos provided informed consent, completed a battery of assessments, and were debriefed. After completing the online portion, egos were instructed to sign up for the laboratory section. When egos came into the on-campus laboratory, research assistants informed them that they would be answering questions about their social network. Furthermore, they were asked to provide the email addresses for each alter enumerated. Egos completed the social network questionnaire in small groups on computers separated by partitions. To mitigate respondent bias, egos were given one five minute break halfway throughout the study. After completing the study, egos were thanked and debriefed.

Alters were emailed through Qualtrics asking for their participation in a 20-minute online survey. To facilitate participation, alters were informed that they would be entered into a drawing to win either one \$100 gift card, one of two \$75 gift cards, one of two \$50 gift cards, or one of two \$25 gift cards. Three attempts were made to contact alters by email. The study was approved by the University of Georgia Institutional Review Board.

Measures

Ego questionnaires.

Demographic Questionnaire. Egos provided their gender, age, year in school, race, and fraternity or sorority affiliation.

Substance use. Egos self-reported their frequency of alcohol, heavy alcohol, tobacco, and marijuana use during the last year on the following scale: *1) Not in the past year, 2) Monthly*

or less, 3) *Once a week*, 4) *Multiple times a week*, 5) *Daily*. Heavy alcohol use was defined as consuming five or more drinks in one sitting.

Alcohol Use Disorders Identification Test (AUDIT; Saunders, Aasland, Babor, de la Fuente, & Grant, 1993). This 10-item questionnaire assesses hazardous and harmful drinking.

Personality Inventory for DSM-5 (PID-5; Krueger, Derringer, Markon, Watson, & Skodol, 2012; Maples et al., 2015). I used the shortened 100-item version of the PID-5. This measure captures normal and abnormal personality traits. Egos indicate their level of agreement to 100 items on a 4-point scale ranging from *very false or often false* to *very true or often true*. Example items include “Plenty of people are out to get me” and “Others seem to think I’m quite odd or unusual”. The PID-5 contains 25 facets that load onto 5 higher-order dimensions. The 5 higher-order dimensions are Negative Affect, Detachment, Antagonism, Disinhibition, and Psychoticism.

Social Network Analysis Questionnaire. After naming 25 alters, egos next reported on the demographic characteristics of each alter, including gender and race, and relational characteristics such as how close the respondent felt to each alter and their relationship status (e.g., friend, past romantic partner, or current romantic partner). Third, egos disclosed each alter’s substance use. Specifically, egos reported on their perceptions of each alter’s alcohol, marijuana, and tobacco use, as well as how often each alter drinks heavily, on the following scale: 1) *Not in the past year*, 2) *Monthly or less*, 3) *Once a week*, 4) *Multiple times a week*, 5) *Daily*. Fourth, egos indicated their joint engagement with each alter in different domains, including alcohol, marijuana, tobacco, gambling, and heavy alcohol use. The scale ranges from *Not in the past year* to *Daily*. Fifth, egos reported on each alter’s personality traits, including the personality traits of manipulativeness, deceitfulness, callousness, hostility, irresponsibility,

impulsivity, and risk taking. Descriptions of the traits were also provided; these were adapted from the DSM-5 Clinicians Personality Trait Rating Form. Egos indicated their level of agreement to each statement on a 7-point Likert scale ranging from *Strongly disagree* to *Strongly agree*. Last, to create the network structure for each egocentric social network, each ego evaluated the closeness among alters in the network (termed ‘tie evaluation’). This is a labor-intensive task because each ego reports on 300 tie evaluations. For analytical reasons, I dichotomized a tie such that a tie is considered present if the alters are either *Very close* or *Moderately close* and a tie is considered absent if the alters are *Somewhat close*, *Not close at all*, or *Have never met*.

Alter questionnaires.

Demographic Questionnaire. Alters were asked to provide their gender, age, whether they attended the same university as the ego, race, and fraternity or sorority membership.

Substance use. Alters completed the same substance use questionnaire as egos.

Alcohol Use Disorders Identification Test (AUDIT; Saunders et al., 1993). Alters completed the same AUDIT as egos.

Personality Inventory for DSM-5 (PID-5; Krueger, Derringer, Markon, Watson, & Skodol, 2012; Maples et al., 2015). Alters completed the same 100-item version of the PID-5 as egos.

Perceptions of ego questionnaire. Alters reported on how close they felt to the ego, as well as their perceptions of the ego’s substance use. Specifically, alters reported on their perceptions of the ego’s alcohol use, marijuana use, and tobacco use, as well as how often the ego gambles and drinks heavily, on the following scale: 1) *Not in the past year*, 2) *Monthly or less*, 3) *Once a week*, 4) *Multiple times a week*, 5) *Daily*. Then, alters indicated their frequency of

engaging in different forms of substance use with the ego. For example, alters self-reported how frequently they drank with the ego, drank heavily with the ego, used tobacco with the ego, and used marijuana with the ego. These items were assessed on the following scale: 1) *Not in the past year*, 2) *Monthly or less*, 3) *Once a week*, 4) *Multiple times a week*, 5) *Daily*. Next, alters reported on the ego's personality traits, including the personality traits of manipulateness, deceitfulness, callousness, hostility, irresponsibility, impulsivity, and risk taking. Descriptions of the traits were also provided; these were adapted from the DSM-5 Clinicians Personality Trait Rating Form. For these personality traits, alters indicated their level of agreement to each statement on a 7-point Likert scale ranging from *Strongly disagree* to *Strongly agree*.

Data analysis

First, I conducted Chi-square and Mann-Whitney U tests to investigate differences between alters who completed the survey and those who did not. Second, I conducted Pearson correlations to examine the relationship between egos' frequency of substance use and total AUDIT scores with the maladaptive personality traits related to antisocial behavior.

To investigate whether egos' were accurate in their perceptions of alters' substance use, I calculated difference scores, in which alters' self-reported substance use was subtracted from egos' perceptions of alters' substance use. I calculated difference scores for tobacco, marijuana, alcohol, and heavy alcohol. Positive values indicated that egos' had overestimated the frequency of alters' substance use, and negative values indicated that egos' had underestimated the frequency of alters' substance use. One sample t-tests were conducted to investigate whether there was a significant tendency to overestimate or underestimate alters' substance use. Mean values closer to 0 indicated that egos' were accurate in their perceptions of alters' substance use.

Based on recommendations by Rosenthal and Rosnow (1991), effect sizes were calculated using the formula: $d = 2t / \sqrt{df}$.

Perceptions of network substance use was calculated by averaging ego's perceptions of their alters' substance use. Network self-reported substance use was calculated by averaging the self-reported substance use of each ego's alters. Once network substance use was generated (either based on egos' perceptions or alters' self-report), I conducted Pearson correlations to examine the relationship between these constructs and egos' substance use. This was possible because the variables were on the same level.

To test the other aims, because of the nested nature of the data (e.g., alters nested with egos), I utilized multilevel modeling with a "one-with-many design" (Kenny, Kashy, & Cook, 2006). Level-1 predictor variables were group-mean centered and level-2 predictor variables were grand-mean centered for analyses. For interaction analyses, simple slopes were generated 1 *SD* above and below the mean (Aiken & West, 1991; Cohen, Cohen, West, & Aiken, 2003). EgoNet (McCarty, 2004) and UCINET were utilized to gather social network data and generate network indices, respectively. Data were analyzed using SPSS 22.0.

CHAPTER 3

RESULTS

Sample description

Chi-square and Mann-Whitney U tests were conducted to investigate differences in demographic, relational, and behavior characteristics between alters who had their email information provided and those who did not. Furthermore, these same analyses were conducted to examine difference between alters who responded to the email and those who did not. Nonrespondent alters' data were obtained from the social network questionnaire, in which egos reported on the attributes of alters.

Female alters were more likely to have their email address provided than male alters ($\chi^2 = 48.34$, $df = 1$, $N = 2850$, $p < .001$). Egos felt closer to alters for whom they provided email addresses (both groups Mdn = 3, '*Moderately close*'; $U = 1110009$, $Z = 6.21$, $p < .001$). Egos perceived less tobacco (both groups Mdn = 1 '*Not in the last year*'; $U = 920368$, $Z = -3.96$, $p < .001$) and marijuana use (both groups Mdn = 1 '*Not in the last year*'; $U = 941663$, $Z = -2.29$, $p < .05$), but more alcohol use (both groups Mdn = 2 '*Monthly or less*'; $U = 1028084$, $Z = 2.21$, $p < .05$) for alters with email addresses information provided. No differences in perceptions of heavy alcohol use emerged (both groups Mdn = 2 '*Monthly or less*'; $U = 964426$, $Z = -0.87$, $p = .39$). Alters who had their email information provided tended to be more central than those who did not (both groups Mdn = 3; $U = 1064647$, $Z = 3.85$, $p < .001$).

Compared to alters who did not respond, alters who responded to the email were more likely female ($\chi^2 = 20.85$, $df = 1$, $N = 1683$, $p < .001$). Furthermore, egos' felt close to alters who

responded compared to those who did not respond (both groups Mdn = 3, '*Moderately close*'; $U = 193650$, $Z = 2.62$, $p < .01$). Egos' perceptions of alters' alcohol (both groups Mdn = 2 '*Monthly or less*'; $U = 165331$, $Z = -1.60$, $p = .11$), heavy alcohol (both groups Mdn = 2 '*Monthly or less*'; $U = 164372$, $Z = -1.79$, $p = .07$), marijuana (both groups Mdn = 1 '*Not in the last year*'; $U = 167821$, $Z = -1.48$, $p = .14$), and tobacco use (both groups Mdn = 1 '*Not in the last year*'; $U = 176087$, $Z = -.01$, $p = .99$) did not differ between alters who responded to the email and alters who did not respond. Degree centrality did not differ between alters who responded to the email (Mdn = 3) and those who did not (Mdn = 4; $U = 175813$, $Z = -.05$, $p = .96$).

Ego and alter characteristics

Table 1 displays egos and alters overall frequency of substance use. In the past year, 68.7% of egos consumed alcohol, 56.6% consumed alcohol heavily, 38.6% used marijuana, and 21.7% used tobacco. In the past year, 76.1% of alters consumed alcohol, 55.6% consumed alcohol heavily, 25.1% used marijuana, and 13.6% used tobacco. Table 2 displays descriptive statistics for egos and alters on the PID-5 scales and the AUDIT.

Table 3 displays the relationship between egos' substance use and alcohol-related problems with the maladaptive personality traits related to antisocial behavior. As indicated, egos' frequency of tobacco and marijuana use did not correlate with the PID-5 traits related to antisocial behavior. Risk taking and deceitfulness were significantly associated with alcohol use, heavy alcohol use, and total AUDIT score. Impulsivity and manipulateness were significantly associated with alcohol use and total AUDIT score, but not heavy alcohol use. Irresponsibility was significantly associated with total AUDIT score.

Aim 1: How accurate are egos' perceptions of alters' substance use? Do perceptions of alters' substance use predict alters' self-reported substance use? Are there social network variables that moderate this relationship, such as degree centrality and density?

First, I examined whether egos generally tend to overestimate or underestimate alters' substance use. One-sample t-tests indicated that egos significantly underestimated alters' alcohol ($t(242) = -3.62, p < .001; M = -.19, SD = .83; d = .47$), heavy alcohol ($t(242) = -2.10, p < .05; M = -.12, SD = .89; d = .27$), and marijuana use ($t(242) = -2.17, p < .05; M = -.09, SD = .62; d = .28$). There was no significant tendency for egos to overestimate or underestimate the frequency of alters' tobacco use ($t(242) = 0.48, p = .63; M = .02, SD = .53; d = .06$).

Then, I partitioned the sample into two separate groups: one 21 and over, and the other group 20 and under. These analyses were conducted to investigate whether the accuracy of egos' perceptions varied by alters' age. For alters under the age of 21, egos' were significantly likely to underestimate their alcohol ($t(189) = -3.18, p < .01; M = -.18, SD = .80; d = .46$), heavy alcohol ($t(189) = -2.25, p < .05; M = -.14, SD = .87; d = .33$), and marijuana use ($t(189) = -2.16, p < .05; M = -.09, SD = .57; d = .31$). No effect emerged for tobacco use ($t(189) = 1.12, p = .26; M = .04, SD = .45; d = .16$). For alters 21 and over, there were no significant tendencies for egos to overestimate or underestimate the frequency of alters' alcohol ($t(52) = -1.73, p = .09; M = -.23, SD = .95; d = .48$), heavy alcohol ($t(52) = -.29, p = .77; M = -.04, SD = .94; d = .08$), marijuana ($t(52) = -.70, p = .49; M = -.08, SD = .78; d = .19$), and tobacco use ($t(52) = -.55, p = .58; M = -.06, SD = .74; d = .15$). Although, the effect was nonsignificant for alcohol and marijuana, the effect sizes were approximately the same for alters under the age of 21 and alters 21 and over. In general, the frequency of alters' alcohol use was consistently underestimated.

Next, I calculated multiple intraclass correlations (ICC) to investigate the proportion of the total variance in alters' tobacco, marijuana, alcohol, and heavy alcohol use that can be explained by ego membership. A value near zero indicates a lack of dependency, thus, multilevel modeling is not necessary. However, if the ICC is at least .10 (Kahn, 2011), ordinary least squares (OLS) estimates may be biased. The ICC for alters' tobacco use was .20, indicating that differences across egos account for approximately 20% of the variability in alters' tobacco use. In other words, 20% of the variability in alters' tobacco use could be explained by ego membership. The ICC for alters' marijuana, alcohol, and heavy alcohol use were .33, .42, and .47, respectively. Taken together, because of the nested nature of the data, multilevel analyses were conducted.

Egos' perceptions of alters' tobacco use significantly predicted alters' self-reported tobacco use ($t(1,217) = 18.16, p < .001$). Network density and degree centrality did not moderate the relationship between perceptions and self-reported tobacco use ($t(1,151) = 0.02, p = .98$, and $t(1,203) = 1.07, p = .29$, respectively).

Egos' perceptions of alters' marijuana use significantly predicted alters' self-reported marijuana use ($t(1,212) = 19.55, p < .001$). Once again, network density and degree centrality did not moderate the effect of perceptions on marijuana use ($t(1,155) = 0.072, p = .94$ and $t(1,206) = 0.25, p = .80$, respectively).

Egos' perceptions of alters' alcohol use significantly predicted alters' self-reported alcohol use ($t(1,219) = 13.85, p < .001$). The association between ego's perceptions and alters' self-reported alcohol use was not moderated by network density ($t(1,161) = 0.654, p = .51$). No interaction emerged between alters' degree centrality and egos' perceptions of alters' alcohol use on alters' self-reported alcohol use ($t(1,206) = 0.60, p = .55$).

Egos' perceptions of alters' heavy alcohol use significantly predicted alters' self-reported heavy alcohol use ($t(1,239) = 10.11, p < .001$). Neither degree centrality nor network density moderated the association between egos' perceptions of alters' heavy alcohol use and alters' self-reported heavy alcohol use ($t(1,185) = -0.87, p = .39$ and $t(1,157) = 0.448, p = .66$, respectively).

Aim 2: What is the relationship between egos' perceptions of network use and egos' substance use? Is this association moderated by network density? What is the relationship between network members' self-reported substance use and egos' substance use? Is this association moderated by the network density?

Egos' perceptions of network use was significantly correlated with egos' substance use in the domains of tobacco ($r(83) = .28, p < .01$), marijuana ($r(83) = .62, p < .001$), alcohol ($r(83) = .66, p < .001$), and heavy alcohol ($r(83) = .68, p < .001$). Egos' perceptions of network tobacco use did not interact with network density to predict egos' tobacco use ($t(3,79) = -1.21, p = .23$). However, the interaction between egos' perceptions of network marijuana use and network density on egos' marijuana use was marginally significant ($t(3,79) = 1.81, p = .07$). Examination of simple slopes revealed significant effects of perceptions at both low and high density ($t(3,79) = 3.63, p < .001$ and $t(3,79) = 7.217, p < .001$, respectively); albeit, the effects were stronger when network density was high (see Figure 1). No significant moderating effects of network density emerged for alcohol and heavy alcohol use ($t(3,79) = 1.01, p = .32$ and $t(3,79) = -0.51, p = .62$, respectively).

Network self-reported substance use was significantly correlated with egos' substance use in the domains of tobacco ($r(83) = .24, p < .05$), marijuana ($r(83) = .53, p < .001$), alcohol ($r(83) = .56, p < .001$), and heavy alcohol ($r(83) = .48, p < .001$). Furthermore, network alcohol-related problems was significantly correlated with egos' alcohol-related problems ($r(75) = .47, p$

< .001). Although no significant moderator effects of density emerged, two effects were marginally significant. They were in the domains of tobacco ($t(3,79) = -1.76, p = .08$; see Figure 2) and marijuana ($t(3,79) = 1.75, p = .09$; see Figure 3). For tobacco use, simple slopes analyses revealed a significant effect at low density ($t(3,79) = 2.89, p < .01$), but not at high density ($t(3,79) = 1.55, p = .13$). For marijuana use, simple slopes analyses revealed significant effects at both low and high levels of network density ($t(3,79) = 2.44, p < .01$ and $t(3,79) = 5.76, p < .001$, respectively).

Aim 3: Is there a relationship between egos' perceptions of alters' substance use and degree centrality? Does egos' own substance use moderate this relationship? Is there a relationship between alters' self-reported substance use and degree centrality? Is this relationship moderated by egos' own substance use?

Egos' perceptions of alters' tobacco use did not significantly predict degree centrality ($t(1,161) = 0.74, p = .46$), and egos' perceptions of alters' marijuana use did not significantly predict degree centrality ($t(1,161) = 0.82, p = .42$). As shown in Table 4, egos' tobacco use did not moderate the former relationship ($t(1,161) = 0.63, p = .53$), and egos' marijuana use did not moderate the latter relationship ($t(1,161) = 1.08, p = .28$).

Egos' perceptions of alters' alcohol use and heavy alcohol use did not significantly predict degree centrality ($t(1,161) = 1.58, p = .12$ and $t(1,161) = 0.41, p = .68$, respectively). However, as shown in Figures 4 and 5, egos' alcohol use ($t(1,161) = 2.52, p < .05$) and egos' heavy alcohol use ($t(1,161) = 2.29, p < .05$) moderated the effect of perceptions on degree centrality. As shown in Table 4, there was a nonsignificant effect of egos' perceptions of alters' alcohol use on degree centrality at low levels of egos' alcohol use, but a significant effect arose at high levels of egos' alcohol use. There were nonsignificant effects of egos' perceptions of

alters' heavy alcohol use on degree centrality at both low and high levels of egos' heavy alcohol use; however, the effect of perceptions on degree centrality at high levels of egos' heavy alcohol use was marginally statistically significant (see Table 4).

Alters' tobacco use did not predict degree centrality ($t(1,235) = -0.115, p = .91$).

Although not statistically significant, egos' tobacco use marginally moderated the effect of alters' tobacco use on degree centrality (See Table 5 and Figure 6). Examination of simple slopes revealed no significant effects at low and high levels of alters' tobacco use. No significant association emerged between alters' marijuana use and degree centrality ($t(1,240) = 0.354, p = .72$). Although not statistically significant, egos' marijuana use marginally moderated the effect of alters' marijuana use on degree centrality (See Table 5 and Figure 7). Closer inspection of the interaction revealed that at low levels of egos' marijuana use, there was a marginally significant negative association between alters' marijuana use and degree centrality, but at high levels of egos' marijuana use, there was no relationship between alters' marijuana use and degree centrality.

There was no significant effect of alters' alcohol use on degree centrality ($t(1,241) = 0.69, p = .49$). However, as indicated in Table 5, egos' alcohol use moderated this relationship ($t(1,159) = 2.16, p < .05$). Similarly, alters' heavy alcohol use did not predict degree centrality ($t(1,236) = 0.60, p = .55$), but egos' heavy alcohol use moderated this effect ($t(1,159) = 2.40, p < .05$; see Table 4). There was no relationship between alters' total AUDIT scores and degree centrality ($t(1,226) = 0.78, p = .43$). However, replicating the previous alcohol findings, egos' total AUDIT scores moderated the effect of alters' total AUDIT scores on degree centrality (see Table 4). As displayed in Figures 8A, 8B, and 8C, there were significant effects of ego use on degree centrality at high levels of alter use. That is, alters who frequently consumed alcohol,

consumed alcohol heavily, and experienced alcohol-related problems were more central when the ego frequently consumed alcohol, consumed alcohol heavily, and experienced alcohol-related problems.

CHAPTER 4

DISCUSSION

The overarching goal of the current study was to investigate the relationship between perceptions, social network characteristics, and self-reported substance use. The current study utilized an egocentric social network design, in which respondents (egos) enumerated their closest friends (alters) and answered questions pertaining to their perceptions of alters' tobacco, marijuana, alcohol, and heavy alcohol use. Furthermore, in a novel approach to an egocentric social network design, self-reported substance use was obtained from not only egos, but alters as well. The aims of the current study were threefold. First, I investigated the accuracy of egos' perceptions of alters' substance use, and whether social network characteristics, such as density and degree centrality, moderated the relationship between perceptions and substance use. Second, I examined the relationship between ego and network substance use (operationalized as both egos' perceptions of network substance use and the networks' self-reported substance use), as well as the moderating effect of network density. Third, I examined the effects of alters' substance use (operationalized as both egos' perceptions and alters' self-report) on degree centrality, and the moderating role of ego substance use on this relationship.

Accuracy of perceptions of substance use

This was one of the first studies that utilized a social network design to investigate the accuracy of egos' perceptions of their network members' substance use. Self-reported substance use was obtained from egos as well as their network members. Overall, consistent with the empirical literature that utilizes collateral reports (Borsari & Muellerleile, 2009), but not with the

literature that utilizes a social norms approach (Borsari & Carey, 2003), egos' underestimated the frequency of alters' alcohol, heavy alcohol, and marijuana use, but there was a stronger effect size for alcohol than for heavy alcohol and marijuana use. However, there was no significant tendency for egos to underestimate or overestimate the frequency of alters' tobacco use. Furthermore, when examining whether egos' perceptions of alters' substance use significantly predicted alters' self-reported substance use, across all four different forms of substance use – alcohol, heavy alcohol, marijuana, tobacco - egos' perceptions of alters' substance use significantly predicted alters' substance use. Taken together, these two results suggest that perceptions predict self-reported substance use; however, egos' significantly underestimate the frequency of alters' alcohol, heavy alcohol, and marijuana use, but not tobacco use. One of my original hypotheses for why this effect occurred was that focal individuals may have underestimated their friends' alcohol, heavy alcohol, and marijuana use but not tobacco use, because the first three behaviors are illegal for the majority of the focal individuals. Ergo, they underreport their friends' alcohol, heavy alcohol, and marijuana use to avoid negative consequences. This effect has been posited in the literature (Borsari & Muellerleile, 2009; Walker & Cosden, 2007). Focal individuals did not underreport their friends' tobacco use, because the majority of friends were over 18 years old. Ergo, focal individuals could be accurate in their predictions of their friends' tobacco use. Post-hoc analyses revealed that regardless of whether the alter was over the age of 21 or under the age of 21, egos underestimated alters' frequency of alcohol use to the same extent (e.g., a medium effect). However, egos were more likely to underestimate their alters' frequency of heavy alcohol use if they were under the age of 21. These results suggest that regardless of age, there is a general tendency for individuals to underestimate their friends' frequency of alcohol use. Somewhat contradictory, individuals under

the age of 21 were significantly likely to underestimate their friends' frequency of heavy alcohol use, but individuals over the age of 21 exhibited no such bias. Regardless of the alters' age, egos generally underestimated alters' marijuana use, but displayed no tendency to underestimate or overestimate alters' tobacco use.

Next, I investigated whether social network characteristics, such as density and degree centrality, moderated the effect of egos' perceptions on alters' self-reported substance use. No significant interaction effects emerged for degree centrality and density. The latter finding is surprising because of the plethora of research which suggests that highly dense networks provide more consistent norms (Granovetter, 1973; Burt, 2001; Haynie, 2001). If the norm of the network is to consume alcohol or to not consume alcohol, individuals' perceptions of their friends behaviors should be more congruent than when there is not a well-defined and consistent norm. However, I found no support for this hypothesis. One reason this effect may not have emerged is because the mean density of all the networks was only .19, indicating that out of all the possible ties, only 19% of ties were present on average. The density of egos' networks may have been too sparse for consistent norms to emerge.

Perceptions of networks' substance use versus self-reported networks' substance use on egos' substance use

Consistent with previous findings (Andrews et al., 2002; Fortune et al., 2013; MacKillop et al., 2013), network substance use tended to reflect egos' own substance use. For each of the four different types of substance use (e.g., alcohol, heavy alcohol, marijuana, tobacco), egos' perceptions of their network members substance use as well as network members' self-reported substance use were both significantly correlated with egos' self-reported substance use.

However, the effects were stronger when network substance use was based on egos' perceptions

of their networks' substance use than on network members' self-report. Consistent with the false consensus effect (Henry, Kobus, & Schoeny, 2011; Prinstein & Wang, 2005), this suggests that focal individuals' project their own substance use onto their network members.

To extend the literature forward, I examined whether the moderating effect of network density operated differently if network substance use was defined as egos' perceptions of network substance use or if it was defined as network members' self-reported substance use. Network density did not interact with egos' perceptions of their networks' tobacco use to predict egos' tobacco use. However, a marginally significant interaction emerged when examining the interaction between network density and self-reported network tobacco use on egos' tobacco use. Specifically, at lower levels of network density, self-reported network tobacco use significantly predicted ego tobacco use, but at higher levels of network density, self-reported network and ego tobacco use were unrelated. This finding may have arisen because individuals who smoke tend to be more disconnected in their networks (Choi & Smith, 2013), resulting in more isolates in smokers' networks compared to nonsmokers.

Regardless of whether network marijuana use was based on egos' perceptions or on network members' self-report, the interaction between network density and network marijuana use resulted in similar effects. Specifically, the effect of network marijuana use on ego marijuana use was stronger at high levels of density compared to at low levels of density.

Regardless of whether network alcohol use and heavy alcohol use were based on egos' perceptions or on network members' self-report, density did not moderate the relationship between ego and network alcohol and heavy alcohol use. This is consistent with my previous findings that density did not interact with egos' perceptions to predict alter alcohol and heavy alcohol use. Once again, I posit that the networks, on average, were too sparse for consistent

norms and behaviors to emerge. These findings are also somewhat consistent with previous findings which have found that network position (e.g. liaison, member, isolate) did not moderate the effect of network alcohol use on individual alcohol use (Kobus & Henry, 2010). Regardless of how connected the friends are in the network, individuals are more likely to consume alcohol when more of their friends also consume alcohol.

Substance use and centrality

Individuals who are central in social networks tend to have more power and influence (Freeman, 1979). Therefore, it is important to understand what attributes predict centrality. In the current study, I examined if egos' perceptions of alters' substance use predicts degree centrality, and if alters' self-reported substance use predicts degree centrality. Regardless of the substance, both egos' perceptions of alters' substance use and alters' self-reported substance use did not predict degree centrality. This suggests that across younger adults' social networks, substance use is not a prominent predictor of centrality. However, I posited that egos' substance use might moderate the effect of alters' substance use on centrality, such that for egos' who frequently use substances, alters who also frequently use substances will be more central than alters who infrequently use substances. No hypotheses were posited on whether these interactions would operate similarly if alters' substance use was defined as alters' self-reported substance use compared to egos' perceptions of alters' substance use.

When alters' tobacco use was based on egos' perceptions, egos' tobacco use did not interact with alters' tobacco use to predict centrality. However, when alters' tobacco use was based on alters' self-report, a significant interaction emerged. Although not statistically significant, alters who infrequently used tobacco tended to be more central when egos also infrequently used tobacco. This is consistent with my previous findings that tobacco users tend to

have a lower number of connections in networks. Furthermore, even when the focal individual uses tobacco, network members' tobacco use does not predict degree centrality.

When alters' marijuana use was operationalized as egos' perceptions, no interaction was evidenced. However, when alters' marijuana use was based on alters' self-report, a marginally significant interaction was evidenced. Specifically, there was a marginal negative effect of alter marijuana use on degree centrality at low ego marijuana use. For egos who infrequently use marijuana, as the frequency of alters' marijuana use increases, alters tend to be less connected in the network.

Alters' alcohol use, based on self-report and perceptions, significantly interacted with egos' alcohol use to predict degree centrality. Specifically, alters who consumed alcohol frequently and who were perceived as consuming alcohol frequently tended to be more central in the networks of egos who also consumed alcohol frequently compared to egos who infrequently consumed alcohol. Similar interaction effects emerged for alters' heavy alcohol use, regardless of whether heavy alcohol use was based on alters' self-reports or egos' perceptions. Also, the same interaction effect emerged when examining self-reported alcohol-related consequences.

Taken together, regardless of whether alters' frequency of alcohol use and heavy alcohol use was collected from the alters themselves or if it was based on egos' perceptions, identical results emerged. Friends tended to be the most central when two conditions were met. First, friends were either perceived as or self-reported frequent alcohol and heavy alcohol use as well as problems with alcohol. Second, the focal individual frequently consumed alcohol, consumed alcohol heavily, and reported alcohol-related problems. These results have two major implications. First, it is not worth the time, cost, and effort to obtain self-report data from focal individuals' friends. The impact of alters' alcohol and heavy alcohol use on network

characteristics does not differ if friends' alcohol use and heavy alcohol use are gathered from friends or if they are based on egos' perceptions. This suggests that researchers can understand the impact of substance use on the structure of the network from only the focal individual. Specifically, if one is interested in examining network risk factors, self-report does not need to be obtained from the focal individuals' friends. Second, combined with previous findings which have found that at-risk drinkers tend to have higher rates of substance use in their networks (MacKillop et al., 2013; Leonard et al., 2000), the results of this study suggest that as the focal individuals' alcohol-related problem increases, friends' who report alcohol-related problems tend to be more central. These two findings suggest that network interventions should be conducted on individuals who experience alcohol-related problems. Specifically, these network interventions should target the friends who are the most central. Since centrality is a measure of importance and control, it may be incredibly beneficial to eliminate or reduce the focal individuals' interactions with those who are central in the network. If this is not plausible, network interventions aimed at reducing the most central friends' substance use may be not only beneficial for the focal individual but for his/her friends as well.

Interestingly, different results emerged when friends' frequency of tobacco and marijuana use were obtained from the friends themselves or when they were based on focal individuals' perceptions. This suggests that for these two substances it may be useful to gather self-report data from their friends, instead of using egos' perceptions as a proxy for alters' tobacco and marijuana use.

Limitations and future directions

One limitation of the current study is that because of the cross-sectional design, I am unable to determine whether the similarity between egos' and their networks' self-reported

substance use stems from social selection or social influence. Another limitation of the current study is the low response rates from the focal individuals' friends. There were significant differences between the friends who responded to the survey and those who did not. One future direction is to conduct network interventions with individuals who have substance use related problems. Specifically, these network interventions should target the most central friends in the focal individual's network. Another avenue for future research is to conduct a sociocentric social network study with only a portion of the members of the complete network. Past research indicates that degree centrality has a positive relationship with an individual's accuracy of the social network structure. Specifically, individuals who are more connected in the network tend to understand the patterns of relationships among other members of the network than those who are less connected (Casciaro, 1998). Combined with my findings that perceptions can serve as proxy for self-report alcohol and heavy alcohol use, it would be possible to conduct a large sociocentric study with only a fraction of the total network, if network data can be obtained from those who are the most central. Because it is difficult to know who are the most central members of the network before the network study is conducted, researchers could potentially conduct a small qualitative study as a pilot study. Because extraversion and self-monitoring are associated with degree centrality, another avenue would be to obtain extraversion and self-monitoring data from all of the network members, and then obtain information on network connections from only those who score high on those scales.

CHAPTER 5

CONCLUSION

Three different aims were examined. First, focal individuals' perceptions of their friends' substance predicted their friends' self-reported substance use; however, focal individuals underestimated their friends' alcohol, heavy alcohol, and marijuana use. Social network characteristics did not moderate focal individuals' perceptions. Second, focal individuals' substance use significantly correlated with perceptions of their network substance use as well as their network members' self-reported substance use, with stronger effects for perceptions compared to self-report. This suggests that there is a false consensus effect; individuals project their substance use onto others (Henry et al., 2011). Furthermore, for both alcohol and heavy alcohol use, no moderating effect of density emerged. For marijuana use, density moderated the effect of network marijuana use on ego marijuana use. The same interactions emerged when network marijuana use was based on egos' perceptions and self-report data from network members. For tobacco use, density moderated the effect of network members' self-reported tobacco use on egos' tobacco use, but did not moderate the effect of egos' perceptions of alters' tobacco use on egos' tobacco use. Third, focal individuals' perceptions of their friends' substance use did not predict centrality; however, focal individuals' substance use moderated this effect. Specifically, friends tended to be the most central when they frequently consumed alcohol (either at moderate amounts or heavily) and when the focal individual frequently consumed alcohol (either at moderate amounts or heavily). No significant interactions emerged for tobacco and marijuana use. Friends' self-reported substance use did not predict centrality; however, focal

individuals' substance use moderated this effect. Friends tended to be the most central when the ego and alter infrequently used tobacco. Friends tended to be the least central when the focal individual infrequently used marijuana but the friends frequently used marijuana. Lastly, friends tended to be the most central when they and the focal individual self-reported frequent alcohol and heavy alcohol use as well as problems with alcohol.

In sum, although focal individuals' underreported their friends' alcohol and heavy alcohol use, no network differences emerged when friends' alcohol use and heavy alcohol use were based on egos' perceptions compared to alters' self-report. This suggests that when utilizing a network approach to study alcohol and heavy alcohol use, it is not necessary to gather self-report data from the focal individuals' friends. However, for tobacco and marijuana use, because of the differential effects of perceptions and self-report on network characteristics, it may be useful for researchers to obtain self-report data from the focal individual's friends.

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Table 1. Egos' (N = 83) and alters' (N = 243) frequency of tobacco, marijuana, alcohol, and heavy alcohol use. All values are percentages.

| Ego Frequency | Tobacco | Marijuana | Alcohol | Heavy Alcohol |
|-------------------------|---------|-----------|---------|---------------|
| Not in past year | 78.3 | 61.4 | 31.3 | 43.4 |
| Monthly or less | 16.9 | 27.7 | 27.7 | 36.1 |
| Once a week | 0 | 2.4 | 19.3 | 8.4 |
| Multiple times per week | 1.2 | 4.8 | 20.5 | 12.0 |
| Daily | 3.6 | 3.6 | 1.2 | 0 |

| Alter Frequency | Tobacco | Marijuana | Alcohol | Heavy Alcohol |
|-------------------------|---------|-----------|---------|---------------|
| Not in past year | 86.4 | 74.9 | 23.9 | 44.4 |
| Monthly or less | 7.0 | 13.2 | 27.6 | 30.9 |
| Once a week | 1.6 | 2.9 | 26.3 | 14.4 |
| Multiple times per week | 2.9 | 6.2 | 21.4 | 10.3 |
| Daily | 2.1 | 2.9 | 0.8 | 0 |

Table 2. Descriptive statistics for egos and alters on the PID-5 traits and the AUDIT.

| | Ego | | Alter | |
|---------------------------------|----------|-----------|----------|-----------|
| | <i>M</i> | <i>SD</i> | <i>M</i> | <i>SD</i> |
| <i>PID-5 Traits</i> | | | | |
| Manipulativeness | 7.55 | 2.84 | 7.34 | 2.45 |
| Deceitfulness | 6.53 | 2.28 | 6.18 | 2.28 |
| Callousness | 5.30 | 2.16 | 4.57 | 1.19 |
| Hostility | 6.84 | 2.71 | 6.85 | 2.44 |
| Irresponsibility | 5.36 | 1.78 | 5.09 | 1.51 |
| Impulsivity | 6.78 | 2.70 | 7.01 | 2.31 |
| Risk taking | 7.29 | 2.52 | 6.87 | 2.35 |
| <i>Alcohol-related problems</i> | | | | |
| AUDIT | 5.23 | 5.39 | 4.78 | 4.55 |

Table 3. Correlation between egos' substance use, alcohol-related problems, and the PID-5 traits related to antisocial behavior.

| | Tobacco | Marijuana | Alcohol | Heavy Alcohol | AUDIT total |
|------------------|---------|-----------|---------|---------------|-------------|
| Manipulativeness | -0.07 | 0.05 | .230* | 0.163 | .231* |
| Deceitfulness | -0.009 | 0.063 | .289** | .218* | .288** |
| Callousness | -0.07 | 0.048 | 0.14 | 0.049 | 0.104 |
| Hostility | -0.102 | 0.049 | 0.098 | -0.038 | 0.009 |
| Irresponsibility | -0.036 | 0.113 | 0.102 | 0.118 | .252* |
| Impulsivity | -0.035 | 0.036 | .245* | 0.19 | .318** |
| Risk Taking | 0.015 | 0.178 | .310** | .288** | .410** |

* $p < .05$; ** $p < .01$

Table 4. Simple slopes, region of interests, and interaction terms in the prediction of degree centrality.

| | Tobacco | Marijuana | Alcohol | Heavy Alcohol |
|----------------------------------|---------|-----------|-----------|---------------------|
| Interaction | 0.1883 | 0.2921 | 0.7433 * | 0.8771 * |
| At low perceptions of alter use | -0.4303 | 0.0133 | -0.1504 | -0.1296 |
| At high perceptions of alter use | -0.2515 | 0.3243 | 0.7234 * | 0.8226 * |
| At low levels of ego use | 0.0319 | -0.2921 | -0.2671 | -0.9376 |
| At high levels of ego use | 0.3669 | 0.2563 | 1.5088 ** | 0.7807 ^φ |

^φ $p < .10$; * $p < .05$; ** $p < .01$

Table 5. Simple slopes, region of interests, and interaction terms in the prediction of degree centrality.

| | Tobacco | Marijuana | Alcohol | Heavy Alcohol | AUDIT |
|-----------------------------|----------|----------------|----------|---------------|---------------|
| Interaction | 0.5155 * | 0.3955 ϕ | 0.574 * | 0.8169 * | 0.0319 ϕ |
| At low levels of alter use | -0.6484 | -0.1112 | -0.1035 | -0.1384 | 0.0181 |
| At high levels of alter use | -0.0504 | 0.4369 | 0.7058 * | 0.8475 * | 0.2094 * |
| At low levels of ego use | -1.371 | -0.8761 ϕ | -0.6753 | -1.098 * | -0.2258 * |
| At high levels of ego use | 0.556 | -0.1134 | 0.6962 | 0.5023 | 0.1008 |

ϕ $p < .10$; * $p < .05$; ** $p < .01$

Figure 1. Marginally significant interaction between network density and egos' perceptions of network marijuana use on egos' marijuana use.

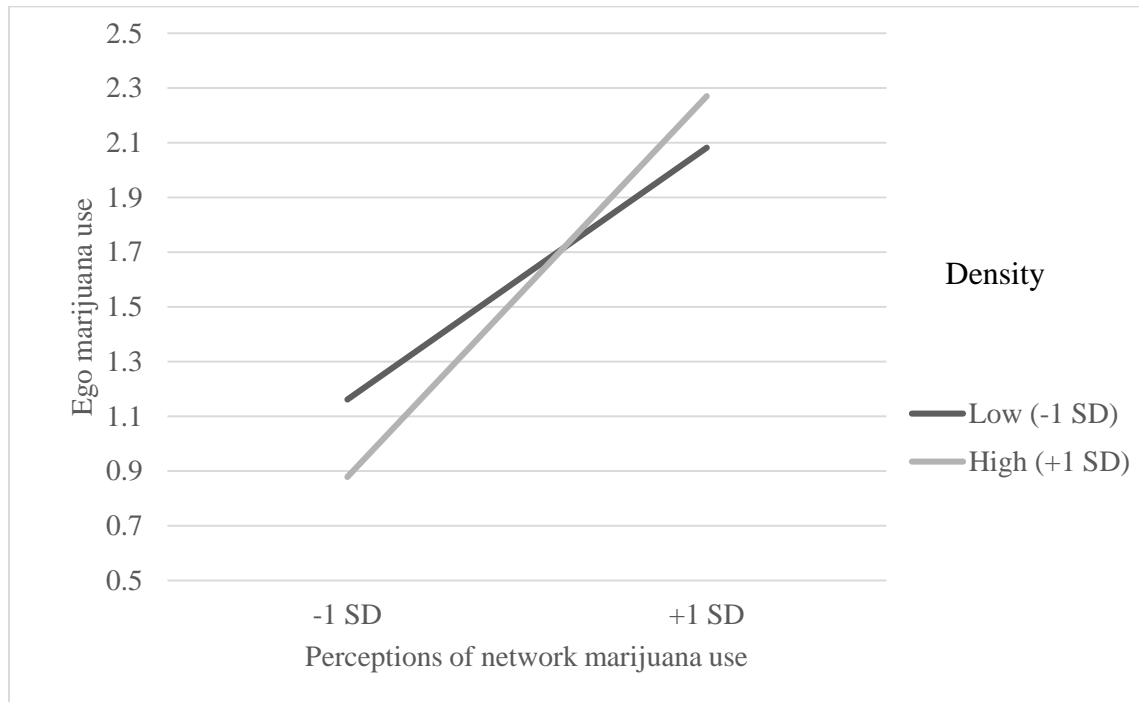


Figure 2. Marginally significant interaction between network density and self-reported network tobacco use on egos' tobacco use.

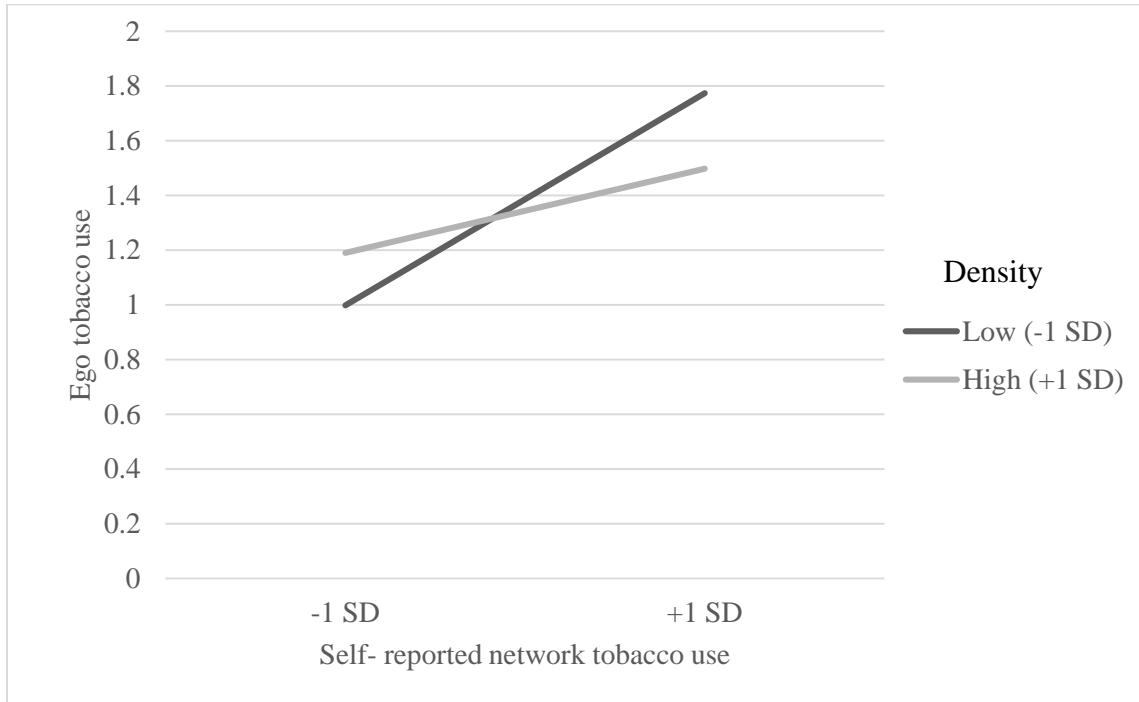


Figure 3. Marginally significant interaction between network density and self-reported network marijuana use on egos' marijuana use.

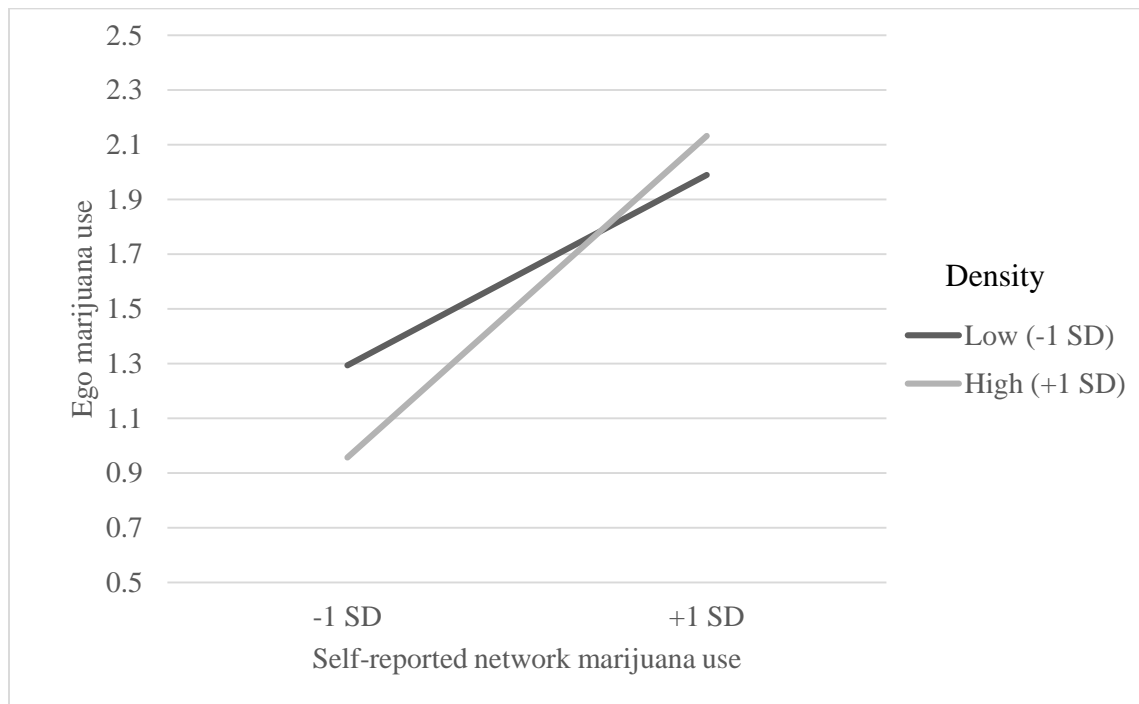


Figure 4. Moderation of egos' alcohol use on the association between perceptions of alters' use and degree centrality.

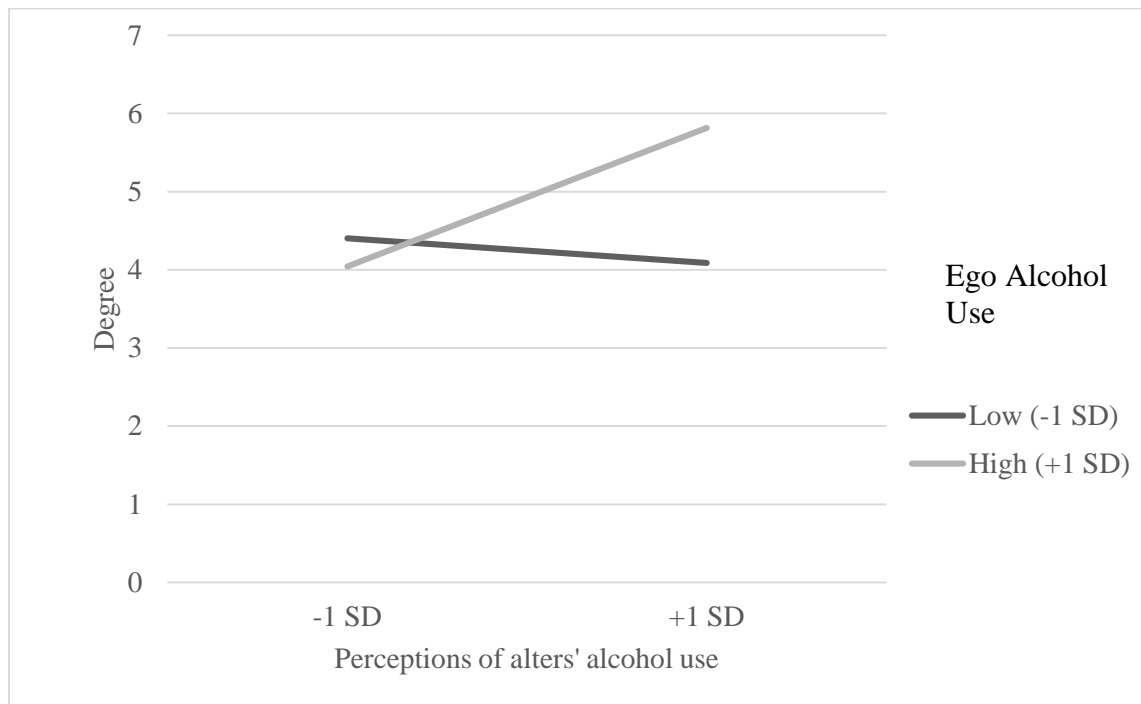


Figure 5. Moderation of egos' heavy alcohol use on the association between perceptions of alters' use and degree centrality.

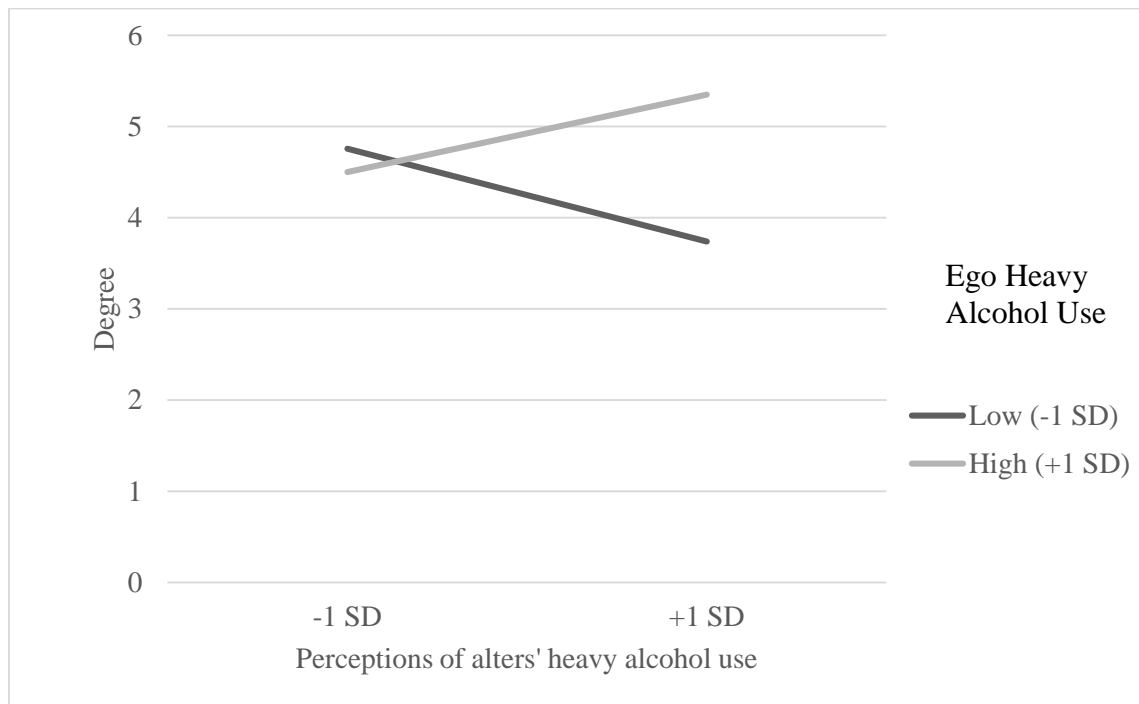


Figure 6. Marginally significant interaction between alters' tobacco use and egos' tobacco use on degree centrality.

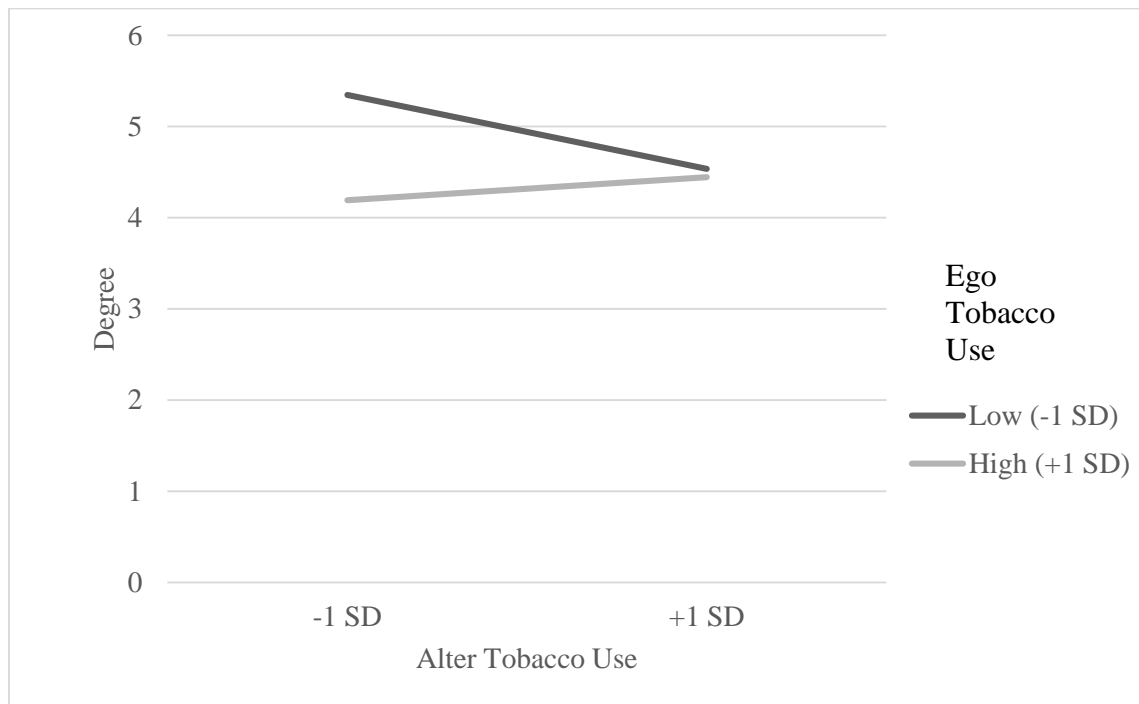


Figure 7. Marginally significant interaction between alters' and egos' marijuana use on degree centrality.

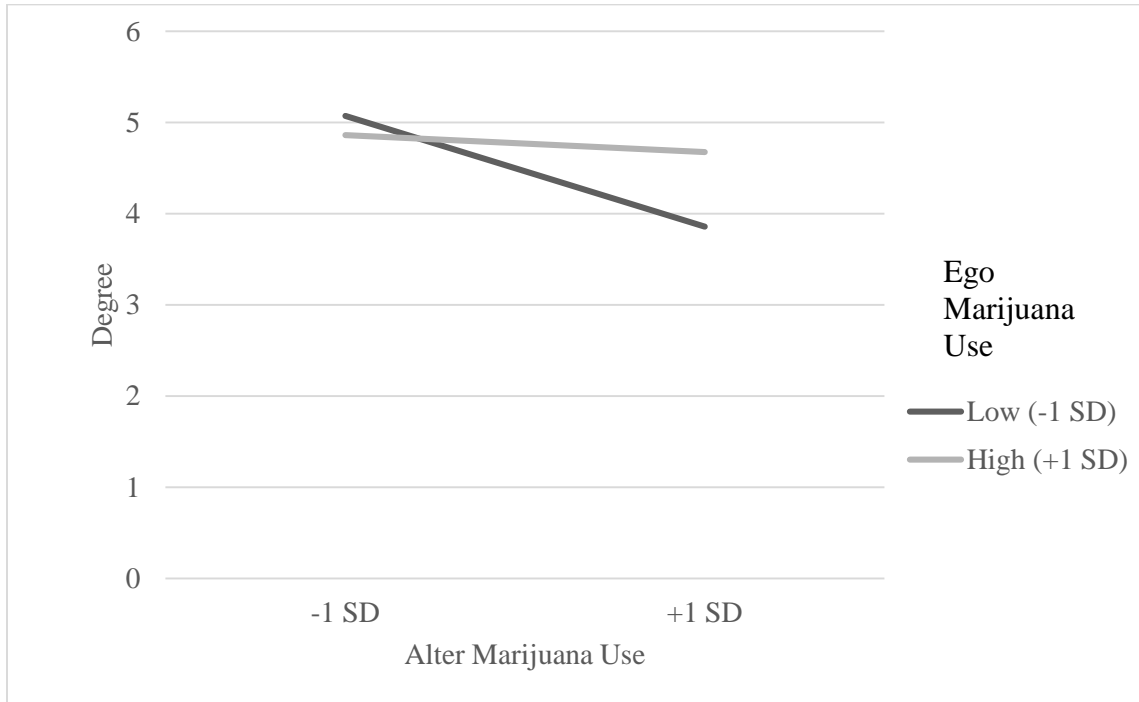


Figure 8. Interaction between egos' and alters' different forms of alcohol use on degree centrality.

