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Understanding the Association Between Social Networks, College Student Alcohol Use, and Protective Behavioral Strategy Use and Beliefs

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UNDERSTANDING THE ASSOCIATION BETWEEN SOCIAL NETWORKS, COLLEGE
STUDENT ALCOHOL USE, AND PROTECTIVE BEHAVIORAL STRATEGY USE AND
BELIEFS

by

Melissa Roberts Colangelo
B.S. May 2017, Old Dominion University

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ABSTRACT

UNDERSTANDING THE ASSOCIATION BETWEEN SOCIAL NETWORKS, COLLEGE STUDENT ALCOHOL USE, AND PROTECTIVE BEHAVIORAL STRATEGY USE AND BELIEFS

Melissa Roberts Colangelo
Old Dominion University, 2020
Director: Dr. Abby L. Braitman

Heavy drinking and alcohol-related problems are a growing concern for American college students (Jun, Agley, Huang, & Gassman, 2015). Social networks, or peer groups, have demonstrated predictive associations with college students' alcohol outcomes (Neighbors, Lee, Lewis, Fossos, & Larimer, 2007). Protective behavioral strategies (PBS), defined as behaviors used to reduce negative alcohol-related consequences, are often assessed as a mechanism of change and predictor of alcohol outcomes (Martens, Taylor, Damann, Page, Mowry, & Cimini, 2004). Still, the association between social networks' and college students' own PBS use has yet to be explored. The current study was designed to address this gap in the literature to better understand the association between social network members' drinking-related behaviors and college students' alcohol use. Participants ($n = 566$) were undergraduates who completed the web-based survey for research credit in participating psychology classes. Students were asked about their alcohol use, PBS use, and beliefs about PBS, as well as the perceived alcohol use and PBS use of five members of their social networks. Results show that a larger proportion of social network members reported as heavy drinkers was a significant predictor of higher alcohol quantity, higher peak alcohol use, and more alcohol-related problems by participants. A larger proportion of social network members reported as light drinkers or abstainers was a significant predictor of more PBS use by participants. Additionally, a larger proportion of high PBS using

social network members was a significant predictor of more PBS use and perceived importance of PBS by participants. Closeness (i.e., amount of time spent with the individual social network members) did not moderate any of these associations.

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This thesis is dedicated to the memory of
P. B. Roberts.

Though you are no longer here you continue to inspire me to be a better person.
Thank you for the love and happiness you brought to my life.

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CHAPTER I

INTRODUCTION

Alcohol use is common in the United States. Over 200 million adult Americans (86.4% of the population; 89.9% of males and 83.1% of females) have drunk alcohol in their lifetime and 170 million have reported drinking in the past year (Center for Behavioral Health Statistics and Quality, 2016). Alcohol consumption does not necessarily have a negative impact on all drinkers' lives. In a metanalysis, moderate drinkers (i.e., those who consume 2-4 alcoholic beverages per day) experienced better psychological and social well-being as compared to abstainers or heavy drinkers (5+ alcoholic beverages per day; Peele, & Brodsky, 2000). On average, moderate drinkers also had higher incomes and fewer work absences or disability claims than both abstainers and heavy drinkers. Drinking in moderation (NIAAA guidelines suggest no more than 4 drinks per day, and 14 drinks per week for men, and 3 drinks per day, and 7 drinks per week for women; Hoepfner, Paskausky, Jackson, & Barnett, 2013) may have physical benefits too. Moderate alcohol use has been shown to lower diabetes and cardiovascular risks compared to abstainers and heavy drinkers (Greenfield, Samaras, Hayward, Chisholm, & Campbell, 2005). However, many Americans drink in excess (i.e., beyond the threshold for moderate drinking) which negates these benefits of moderate alcohol use and is associated with health and other problems.

Of Americans age 18 and older, 65 million (26.9% of the population) have reported binge drinking (i.e., drinking five or more drinks [for males] or four or more drinks [for females] in a single occasion on one or more days) within the past month. Binge drinking is a manner of drinking that can increase blood alcohol concentration (BAC) to 0.08g/dL and can cause health and safety risks such as motor vehicle accidents, sexual assaults, and injuries (Center for

Behavioral Health Statistics and Quality, 2015). Furthermore, 17 million Americans have reported heavy drinking (i.e., binge drinking on five or more days) in the past month (Center for Behavioral Health Statistics and Quality, 2015). Long-term heavy drinking (i.e., heavy drinking that persists from young adulthood until at least middle age) can lead to an increased risk for a host of health issues including alcoholic liver disease, cardiomyopathy, heart arrhythmia, stroke, pancreatitis, and certain types of cancer (Askgaard, Grønbaek, Kjær, Tjønneland, & Tolstrup, 2015; Connor, 2017; Klatsky, 2015; Klatsky & Tran, 2016; Lu, Shu, Shen, Chen, & Zhang, 2017).

College students are one of the heaviest drinking segments of the population. Although daily drinking rates for full-time college students tend to be lower than the daily drinking rates of noncollege students or part-time college students of the same age, full-time college students are more likely to confine their drinking days to weekends when they tend to drink in large quantities (Johnston, O'Malley, Bachman, & Schulenberg, 2011). Full-time college students are more likely to consume alcohol and engage in binge drinking and heavy drinking than their same-aged peers (Center for Behavioral Health Statistics and Quality, 2015). According to a national survey consisting of in-person interviews and self-report questionnaires, 60% of American college students (ages 18 – 22) have consumed alcohol in the past month (Center for Behavioral Health Statistics and Quality, 2015). During their first year of college, 85.4% of nonabstaining college students exceed the NIAAA drinking guidelines (Hoeppe, Paskausky, Jackson, & Barnett, 2013). College student alcohol use is not without its consequences. Each year almost 700,000 students report being assaulted by a student who had been drinking and about 97,000 students report being the victim of alcohol-related sexual assault (Hingson, Heeren, Winter, & Wechsler, 2005). Alcohol-related injuries resulted in the deaths of 1,825 college

students (age 18 – 24) in 2005 (Hingson, Zha, & Weitzman, 2009). Unfortunately, college student drinking trends do not appear to be diminishing. College students have maintained high rates of binge drinking throughout the past several decades, whereas binge drinking rates have steadily declined for nonstudent peers (Johnston, O’Malley, Bachman, & Schulenberg, 2011).

Alcohol-Related Consequences among College Students

Students are more likely to experience negative alcohol-related consequences when binge and high intensity drinking (i.e., drinking ten or more drinks [for males] or eight or more drinks [for females] in a single occasion; Patrick, Cronce, Fairlie, Atkins, & Lee, 2016; Wechsler, Dowdall, Maenner, Gledhill-Hoyt, & Lee, 1998). These consequences can include missed classes, risky sexual behavior, physical injury, and in some cases death (Wechsler, Lee, Kuo, Seibring, Nelson, & Lee 2002). Moreover, solitary binge drinking (i.e., binge drinking while alone) can exacerbate anxious and depressive symptoms, and has been associated with behavioral changes in underage college drinkers such as heavy drinking in social settings and decreased study efforts that can negatively affect interpersonal relationships and academic standing, based on self-report surveys of underage college drinkers (Gonzalez, Collins, & Bradizza, 2009; Pedersen, 2013; Williams, Powell, & Wechsler, 2003).

Alcohol use disorder (AUD) is also a concern among college students. Symptoms of AUD include increased alcohol tolerance, alcohol withdrawal, using more alcohol than intended, alcohol use despite negative effects, and alcohol use despite consistent social or interpersonal problems, to name a few (Borges et al., 2015). In a longitudinal study of the offspring of alcoholic parents, the highest prevalence of AUD occurred between the ages of 18 and 29 (Sher & Gotham, 1999). It is estimated that up to 30% of American college students meet the *Diagnostic and Statistical Manual* (5th edition; American Psychiatric Association, 2013) criteria

for AUD (Hagman & Petry, 2017). Academic performance can be seriously negatively impacted by AUD. This may be due to poorer cognitive performance among heavy drinkers. Poorer episodic memory task scores over time have been seen in college students with heavier drinking patterns as compared to lighter drinking college students in a longitudinal study that took place over 24 months, where memory was assessed using the California Verbal Learning Test (Meda et al., 2018). Still, AUD is just one of the consequences college students may experience as a result of their alcohol use.

Many students who regularly drink alcohol (reporting alcohol use in the past 30 days) experience alcohol-related problems (American College Health Association, 2012). These problems include clumsiness, feeling depressed or guilty, getting into fights or arguments, becoming dependent on alcohol, experiencing withdrawal symptoms, and blackouts (Maddock, LaForge, Rossi, & O'Hare, 2001; White & Labouie, 1989; American College Health Association, 2012). A longitudinal study of incoming freshmen that took place over an academic year showed that college students tend to underestimate their risk for alcohol-related problems (Klein, Geaghan, & MacDonald, 2007). Students who underestimate their risk for experiencing serious problems when consuming alcohol are more likely to engage in risky behaviors (e.g., drinking on an empty stomach, drinking while tired, or playing drinking games) and experience alcohol-related problems (Dillard, McCaul, & Klein, 2006; Dillard, Midboe, & Klein, 2009).

Predictors of Alcohol Use

Protective behavioral strategies. In recent years, researchers have examined protective behavioral strategies (PBS) as a predictor of alcohol outcomes. PBS are behaviors used by an individual to reduce negative alcohol-related consequences while they are consuming alcohol (Martens et al., 2004). These strategies can be used to slow or limit alcohol consumption (e.g.,

alternating alcoholic and nonalcoholic beverages; Martens et al., 2004), avoid negative alcohol-related consequences (e.g., using a designated driver; Martens et al., 2004), or avoid alcohol consumption completely (e.g., participating in activities that do not include alcohol; Sugarman & Carey, 2007). Use of PBS has been shown to mediate the relationship between alcohol use and negative alcohol-related consequences in a self-report study among undergraduate collegiate athlete drinkers (Noble, Madson, Mohn, & Mandracchia, 2013). Students who report more PBS use experience fewer alcohol-related problems (Bernstein et al., 2018; Bravo, Prince, & Pearson, 2017; Linden, Lau-Barraco, & Milletich, 2014), even after controlling for alcohol consumption (Kenney & LaBrie, 2013; Voss, Soltis, Dennhardt, Martens, & Murphy, 2018). Higher PBS use is associated with fewer binge drinking days (i.e., days on which 4 or more drinks were consumed [for women] or 5 or more drinks [for men]) for college students (Magill et al., 2017), whereas less PBS use has shown the opposite effect. A secondary analysis of self-report data from 44 college campuses indicated that when students report higher BACs they also report less use of PBS on that drinking occasion (Barry & Merianos, 2018).

Multiple factors have been able to predict PBS use in previous research. Differences have been found between men and women's PBS use. Women tend to report higher PBS use (Kenney & LaBrie, 2013; Jongenelis et al., 2016; Bravo, Prince, & Pearson, 2017; DeMartini, Prince, & Carey, 2013). Additionally, a self-report study of undergraduates at a private university showed that women report using PBS more frequently than men (DeMartini, Palmer, et al., 2013). Differences in PBS use by race have also been shown. An integrative data analysis of multiple studies of undergraduate drinkers indicated that Asian students report the highest PBS use compared to White and African American students (Clarke, Kim, Ray, White, Jiao, & Mun, 2016). A self-report survey of White, non-Hispanic and African American undergraduate

drinkers revealed that White, non-Hispanic students experience greater reductions in alcohol consumption and alcohol-related consequence with PBS use compared to African American students (Madson & Zeigler-Hill, 2013). Drinking motives have predicted PBS use as well. College students who reported greater enhancement motives (e.g., drinking for excitement, for fun, or to feel good) and social motives (e.g., drinking to celebrate, to be sociable, or because it makes social gatherings more enjoyable) used PBS less often, however students who reported greater conformity motives (e.g., drinking to fit in with a group, to be liked, or so you won't feel left out) used PBS more frequently (Patrick, Lee, & Larimer, 2011). This demonstrates that reasons for drinking may partially explain levels of PBS use. Furthermore, age of onset of alcohol use has been shown to predict PBS frequency. College students who report first using alcohol at an earlier age also reported less frequent PBS use (Palmer, Corbin, & Cronce, 2010). However, taking these differences into consideration it is still uncertain as to why some students use more PBS than others.

Health Belief Model. The Health Belief Model was created to explain why some people fail to adopt healthy behaviors or disease prevention strategies (Prentice-Dunn & Rogers, 1986). The current version of the model uses six constructs to explain peoples' beliefs about health-related behaviors: Perceived susceptibility to the disease or illness, perceived severity of the disease or illness, perceived benefit of performing the health behavior, perceived barriers or obstacles to performing the health behavior, stimulus needed to trigger acceptance of the health behavior, and self-efficacy in ability to perform the behavior (Sharma, 2011). A metaanalysis of 46 Health Belief Model studies demonstrated that health beliefs can be used as a framework to understand alcohol and cigarette use, dieting, exercise, as well as other health behaviors using the Health Belief Model (Janz & Becker, 1984). This research shows that beliefs can influence

the implementation of health behaviors. However, beliefs about the use of PBS specifically have yet to be examined. Many facets of the Health Belief Model may be relevant for predicating PBS use, such as the perceived severity of the disease or illness (i.e., the importance of avoiding it) and the perceived benefit of performing the health behavior (i.e., the perceived effectiveness of the protective behavior). In particular, beliefs about how effective PBS use is for preventing unwanted consequences, and how important it is to use PBS may be relevant for college students making decisions about their own PBS use. Furthermore, the PBS use of the important people in college students' lives may play a role in how important and effective college students believe PBS use to be.

Social networks. One possible explanation for why some individuals use more PBS than others may be the association between social network members and college students' PBS use. Social networks are relationships or associations between a few people (Mason, Zaharakis, & Benotsch, 2014). Social network members are different from peers. Peers are people who share an identity in some capacity (e.g., age group, race, occupation). College students may view their classmates, coworkers, and dormmates as peers. Social networks are comprised of relationships that are valuable to the individual (Serrat, 2017). College students' social networks are made up of people who are important to them. Examining these close friend networks can provide insight into an individual's values, beliefs, behaviors, motives, and societal functions.

A survey of first-year college students who reported at least one binge drinking episode (i.e., five or more drinks on one occasion for men and four or more drinks on one occasion for women) in the previous month revealed that perceived peer acceptability of alcohol use was predictive of alcohol consumption, alcohol-related problems, and drinking motives (Neighbors, Lee, Lewis, Fossos, & Larimer, 2007). This association based on peer perceptions may suggest a

potential association between perceived attitudes of social network members and college student behaviors. Perceived quantity and frequency of the alcohol use of other students more broadly have also been associated with participant binge drinking behaviors among a random sample of students from thirteen universities (Jun et al., 2015), supporting that perceptions of peer behaviors can also have associations with student behavior.

Beyond the impact of broader peer groups, the perceived attitudes and behaviors of specific networks of close friends has shown a strong link with student behaviors. Perceived social network alcohol use has been associated with descriptive drinking norms (i.e., the perceived alcohol consumption of members of a culture) in a sample of undergraduates from a private college (Demartini, Prince, et al., 2013). Likewise, in a self-report survey the presence of heavy drinkers in college student social networks has been linked to higher weekly alcohol quantity among students who violated their residence halls' alcohol policies (Demartini, Palmer, et al., 2013). The authors suggest that their findings are the result of social learning theory and exposure to heavy drinkers influencing college student descriptive drinking norms. A study where college students who had violated their university's alcohol policy reported on their network members' alcohol use found that network members who are believed to drink larger amounts of alcohol are perceived to be less accepting of the student decreasing their alcohol use (Reid, Carey, Merrill, & Carey, 2014). In a similar self-report study where undergraduates reported on the alcohol consumption of their social networks, the likelihood of college students being identified as a hazardous drinker (Alcohol Use Disorders Identification Test [AUDIT] score > 8) increased tenfold when they reported having members in their social networks who consume alcohol (Mason Zaharakis, & Benotsch, 2014). Here, the research suggests that the

perceived drinking status of social network members is associated with college student behaviors.

Although peer behavior influences risky behavior (increased alcohol, cigarette, and marijuana use; Barnett et al., 2014), social networks can have protective health influences as well, such as promoting physical activity (Voorhees et al., 2005). A self-report survey examining the physical activity of adolescent girls and the perceived physical activity of same-aged friends in their social network showed a positive relationship between respondents' physical activity and social network members' physical activity (Voorhees et al., 2005). This association was strongest when the girls engaged in physical activity with their social network members. Protective behaviors can be transmitted through social networks over time. This idea is aligned with social norms prevention strategies. Social norms are the perceived thoughts (e.g., approval of alcohol use) and actions (e.g., typical alcohol use) of others in a group (Neighbors et al., 2007). Social norms theory postulates that the behavior of an individual is influenced by social norms (Hahn-Smith & Springer, 2005). For example, a student may drink more when they are in a situation where they believe heavy drinking to be normal (Hahn-Smith & Springer, 2005). Thus, light drinkers and abstainers in a social network can be beneficial to college students. Having abstainers or light drinkers in college student social networks decreases the likelihood of being identified as a hazardous drinker (AUDIT score > 8; Mason, Zaharakis, & Benotsch, 2014).

Additionally, perceived closeness to the members of the social network strengthens this association. Thus, the closer the college students felt to the abstainers or light drinkers in their social networks, the less hazardous drinking behavior the students exhibited in a self-report study of college undergraduates (Mason, Zaharakis, & Benotsch, 2014). In a study of the alcohol,

cigarette, and other substance use of high school students, the association between the perceived substance use of friends and respondents' substance use was stronger than the perceived substance use of same-aged peers (Morgan & Grube, 1991). Furthermore, the perceived substance use of "best friends" was a stronger predictor of participants' use than "other good friend". These findings illustrate that peer perceptions may matter more when the peers are considered "close", or that closeness is an important factor to consider for the associations between perceptions of social networks and one's own behavior.

Current Study

The association between social networks and college students' PBS use and their beliefs in the importance and effectiveness of PBS is currently unknown. The current study was designed to address this gap in the literature in hopes to gain a better understanding of the associations between social networks and college student PBS use. The information learned in this study could aid in the creation of a social network-based interventions to reduce the negative alcohol-related consequences experienced by college students, or the augmentation of existing interventions. The current study had several aims and hypotheses.

Aim 1. The first aim of this research was to examine the association between perceptions of alcohol use by social network members with college students' own alcohol use. Specifically, I hypothesized:

Hypothesis 1. The perceived alcohol use of individuals in college students' social networks would predict college students' own alcohol use such that a larger proportion of heavy drinkers in students' social networks would be associated with more alcohol use by participants.

Hypothesis 2. A larger proportion of heavy drinkers in students' social networks would be associated with more alcohol-related problems.

Aim 2. The second aim was to determine whether closeness (i.e., amount of time spent with the individual social network members) moderates the association between college students' social networks and their alcohol use.

Hypothesis 3. Closeness of students to the individuals in their social networks would moderate the association between students' social networks and their alcohol use such that more time spent with the heavy drinkers in students' social networks would strengthen the positive association with students' alcohol use.

Hypothesis 4. Closeness of students to the individuals in their social networks would moderate the association between students' social networks and the amount negative alcohol-related problems the student experiences such that more time spent with the heavy drinkers in students' social networks would strengthen the positive association with the amount negative alcohol-related problems the student experiences.

Aim 3. The third aim of this research was to examine the associations with perceptions of alcohol use by social network members and college student PBS use, beliefs about the importance of PBS use, and beliefs about the effectiveness of PBS use. Consistent with the Health Belief Model, I hypothesized:

Hypothesis 5. Larger proportions of light drinkers and abstainers in social networks would be associated with more PBS use.

Hypothesis 6. Larger proportions of light drinkers and abstainers in social networks would be associated with students perceiving PBS as more important.

Hypothesis 7. Larger proportions of light drinkers and abstainers in social networks would be associated with students perceiving PBS as more effective.

Aim 4. The fourth aim of this research was to examine the association between perceptions of PBS use by social network members and college students' own PBS use, beliefs about the importance of PBS use, and beliefs about the effectiveness of PBS use.

Hypothesis 8. The perceived PBS use of individuals in college student social networks would predict students' PBS use such that higher perceived PBS use in students' social network would be associated with more PBS use.

Hypothesis 9. The perceived PBS use of individuals in college student social networks would predict students' belief in the importance of PBS such that higher network PBS use would be associated with more belief in the importance of PBS use.

Hypothesis 10. The perceived PBS use of individuals in college student social networks would predict students' perceived effectiveness of PBS such that higher network PBS use would be associated with students perceiving PBS as more effective.

Aim 5. The fifth aim was to examine closeness (i.e., time spent with social network members) as a potential moderator of the association between college students' social networks and their PBS use, beliefs about the importance of PBS use, and beliefs about the effectiveness of PBS use.

Hypothesis 11. Closeness of students to the light drinkers and abstainers in their social networks would moderate student PBS use such that more time spent with the light drinkers and abstainers in their social networks would strengthen the positive association between proportion of light drinkers/abstainers and student PBS use.

Hypothesis 12. Closeness of students to the light drinkers and abstainers in their social networks would moderate students' perceived importance of PBS such that more time spent with the light drinkers and abstainers in their social networks would strengthen the positive association between proportion of light drinkers/abstainers and students' perceived importance of PBS.

Hypothesis 13. Closeness of students to the light drinkers and abstainers in their social networks would moderate students' perceived effectiveness of PBS such that more time spent with the light drinkers and abstainers in their social networks would strengthen the positive association between proportion of light drinkers/abstainers and students' perceived effectiveness of PBS.

Hypothesis 14. Closeness of students to high PBS using social network members would moderate students' PBS use such that more time spent with high PBS using social network members would strengthen the positive association between network PBS use and students' PBS use.

Hypothesis 15. Closeness of students to high PBS using social network members would moderate students' perceived importance of PBS such that more time spent with high PBS using social network members would strengthen the positive association between network PBS use and students' perceived importance of PBS.

Hypothesis 16. Closeness of students to high PBS using social network members would moderate students' perceived effectiveness of PBS such that more time spent with high PBS using social network members would strengthen the positive association between network PBS use and students' perceived effectiveness of PBS.

CHAPTER II

METHOD

Participants

Participants were undergraduates at a mid-sized, public university in the Southeastern United States. Of the final sample ($n = 566$), the majority of participants were female ($n = 430$, 76.0%). Fifty percent of participants identified as Caucasian or White ($n = 283$), 32.9% ($n = 186$) as African American or Black, 3.2% ($n = 18$) as Asian or Pacific Islander, 0.5% ($n = 3$) as Native American, and 3.4% ($n = 19$) participants endorsed Other. Furthermore, 9.9% ($n = 56$) of participants endorsed multiple racial identities, and 8.8% ($n = 50$) identified as Hispanic or Latino. Participants were between the ages of 18 and 49 ($M = 21.15$, $SD = 4.70$). See Table 1 for additional demographic information.

Table 1

Demographic Information

Variables	<i>n</i>	%
Gender		
Female	430	76.0
Male	130	23.0
Gender non-binary	4	0.7
Other	0	0.0
Missing	2	0.4
Sexual Orientation		
Exclusively Heterosexual	420	74.2
Bisexual or Non-Monosexual	112	19.8
Exclusively Homosexual	33	5.8
Other	0	0.0
Missing	1	0.2
Race		
Caucasian or White	283	50.0
African American or Black	186	32.9
Asian or Pacific Islander	18	3.2
Native American	3	0.5
Other	19	3.4
Multiracial	56	9.9
Missing	1	0.2
Ethnicity		
Non-Hispanic or Latino	515	91.0
Hispanic or Latino	50	8.8
Missing	1	0.2
Marital Status		
Single	467	82.5
Married	41	7.2
Engaged	18	3.2
Divorced	8	1.4
Other	32	5.7
Missing	0	0.0
Student Status		
Full-Time	512	90.5
Part-Time	54	9.5
Missing	0	0.0
Class Standing		
Freshman	213	37.6
Sophomore	114	20.1
Junior	115	20.3

Senior	112	19.8
Graduate	5	0.9
Non-Degree Seeking	5	0.9
Missing	2	0.4
Military		
Not a Member of the U.S. Military	534	94.3
Current or Former U.S. Military	32	5.7
Missing	0	0.0
Student Athlete		
Not a Student Athlete	548	96.8
Student Athlete	17	3.0
Missing	1	0.2
Greek Life Member		
Not a Member of a Sorority or Fraternity	513	90.6
Sorority or Fraternity Member	38	6.7
Currently Pledging	14	2.5
Missing	1	0.2
Disability Status		
No Disabling Medical Condition	524	92.6
Living with a Disabling Medical Condition	42	7.4
Missing	0	0.0

Procedure

Participants were recruited for the study via the psychological research participation system, Sona. An advertisement was included in the Sona system (see Appendix A). Interested students were able to see the eligibility criteria and click the link to participate. Informed consent was obtained before participants began the survey (see Appendix B). Eligible participants completed the web-based survey on a computer or handheld device of the student's choice. Participation in the current study was voluntary, and participants were free to withdraw from the study at any time. The median response time for participants who completed the questionnaire was 19.57 minutes. The students were compensated with half of a research credit that could be used in participating psychology classes. All possible efforts were made to minimize any foreseeable risks to the participants during the study. Information obtained from the participants was anonymous and research credit was distributed automatically by the Sona system upon completion of the survey. Furthermore, the study was certified as exempt by the relevant Institutional Review Board before data were collected, and APA ethical guidelines were followed throughout the duration of the study.

Measures

Social network. The Important People Instrument-5 (IP-5; Hallgren, Barnett, & Petry, 2016) was used to examine the drinking status, and perceived closeness (i.e., time spent together) of five important members of the participant's social networks with whom they have had frequent contact within the past year (see Appendix D). A total of 10 items per network member were assessed; therefore, the IP-5 consisted of 50 items. In the current study, participants were required to report information about exactly five important social network members. This was achieved by forcing responses to these items using the Qualtrics' validation options. The IP-5 is

a modified version of the Important People Interview (IPI; Clifford & Longabaugh, 1991) in which the IPI was shortened from requesting information on up to ten network members to requesting information on up to five network members. An assessment of the IP-5 found that the IP-5 yielded a similar distribution of scores and predictive ability as the full, 10-person IPI (Hallgren et al., 2016). It was concluded that limiting social networks to five members can increase the usability of the instrument in settings where survey length is a concern (Hallgren et al., 2016). Additionally, some of the items and response options were changed to better represent the drinking habits and social networks of college students (i.e., Relationship options “*child*”, and “*AA member*” were removed; items regarding reactions to the participants’ alcohol treatment were removed). The IP-5 also collects information on the amount of time the participant spends with each member of the network. The current study used a modified version of the IP-5’s ordinal scales to assess “Drinking status of person” with five response options (i.e., 1 = *No drinking at all [abstainer]*, 2 = *Occasional or light drinker [up to 1.2 drinks per day]*, 3 = *Moderate or average drinker [2.2 drinks per day]*, 4 = *Heavy drinker [3.5 drinks per day or more]*, and 5 = *Don’t know*). Cut off values for drinking status (Peele & Brodsky, 2000) reflecting alcoholic drinks per drinking occasion were added to help eliminate the subjectivity of the response options for this item. The IPI shows concurrent validity with drinking-related problems as measured by the Brief Young Adult Alcohol Consequences Questionnaire (B-YAACQ; Kahler, Strong, & Read, 2005) and all indices have satisfactory test-retest reliability (Hallgren, Ladd, & Greenfield, 2013). Two questions were added for the current study to assess the network members’ PBS use, and how confident the participant was in their knowledge of the network members’ PBS use. The first additional question (i.e., “How often does this network member use strategies to lessen or avoid negative consequences of drinking”) used response

options 1 = *Never*, 2 = *Rarely*, 3 = *Occasionally*, 4 = *Sometimes*, 5 = *Usually*, 6 = *Always*, or *This network member does not drink*. Strategies from all 20 items from the Protective Behavioral Strategies Scale-20 (PBSS-20; Treloar, Martens, & McCarthy, 2015) were listed below this question as examples of strategies. The second additional question (i.e., “Are you confident in your knowledge of this network member’s use of these strategies”) used a dichotomous response option (*no* versus *yes*). Confidence information was used purely descriptively in the current study.

A variable was created for proportion of heavy drinkers in the network by first dummy coding the drinker type variable for each network member listed into heavy drinkers versus all other drinkers (i.e., 1 = *Heavy drinker*, 0 = All other drinker types); “*Don’t know*” was treated as missing data so it would not be counted toward the calculated score (neither the numerator nor the denominator). Then the dummy coded heavy drinking variable was summed across network members to get the numerator and divided by the number of network members reported. For example, if two network members were heavy drinkers, and the participant listed drinking status for five network members, the proportion of heavy drinkers was 0.40 (or 40%). Likewise, a variable was created for proportion of light drinkers and abstainers by first dummy coding the drinker type variable for each network member into light drinkers/abstainers versus all other drinkers (i.e., 1 = *No drinking at all [abstainer] or Occasional or light drinker*, 0 = All other drinker types); “*Don’t know*” was treated as missing data so it would not be counted toward the calculated score (neither the numerator nor the denominator). Then the dummy coded light drinkers/abstainers variable was summed across network members to get the numerator and divided by the number of network members reported. For example, if one network member was an alcohol abstainer, one was a light drinker, and the participant listed drinking status for five

network members, the proportion of light drinkers/abstainers was 0.40 (or 40%). Closeness to social network members was assessed as time spent with network members during a typical week. Values reported were averaged across drinker type, with a closeness score for heavy drinkers (i.e., reflecting average hours spent together with heavy drinking network members), and a closeness score for light drinkers/abstainers. Network members' PBS use was created by recoding PBS use into high PBS use and low PBS use based on the sample median of 5 (i.e., 5 = *Usually*). Thus, high PBS using network members were reported as "*usually*" or "*always*" using PBS to lessen or avoid negative consequences of drinking. Then the proportion of high PBS users was calculated out of the network members the participants rated. The PBS use variable was first dummy coded for each network member listed (1 = *usually* or *always* uses PBS, 0 = less PBS use [*never* through *sometimes*]); The response option "*This network member does not drink*" was treated as missing data so it would not be counted toward the calculated score for network PBS use (either the numerator or denominator). Then the dummy coded high PBS use variable was summed across network members to get the numerator and divided by the number of network members reported. A closeness score was also created for network members who use high PBS (i.e., reflecting hours spent together with network members who use high PBS) by averaging time spent together across network members with higher PBS use.

Alcohol use. The current survey used a modified version of the Daily Drinking Questionnaire (DDQ; Collins, Parks, & Marlatt, 1985) to measure participants' general alcohol use (Appendix C). Participants entered a numeric value for the number of alcoholic beverages they consumed each day during a typical week for the past month. They also entered the number of hours they spent drinking each day during a typical week. Participants were shown a graphic depicting standard serving sizes of alcoholic beverages and were instructed to define one drink as

a 12-ounce bottle or can of beer, a 5-ounce glass of wine, a 1.5-ounce shot of hard liquor, or a mixed-drink containing a 1.5-ounce shot of hard liquor. The DDQ demonstrates strong convergent validity with the Drinking Practices Questionnaire which measures volume, frequency, and quantity of alcohol use ($r = .50$; Collins, Parks, & Marlatt, 1985). The grid variables were used to create summary variables for quantity (calculated by summing the number of alcoholic beverages participants reported consuming during a typical week), and peak alcohol use (i.e., the maximum number of alcoholic beverages participants reported consuming in one day).

Alcohol-related consequences. The B-YAACQ (Kahler, Strong, & Read, 2005) was used to assess negative alcohol-related consequences (Appendix E). The B-YAACQ is a modified version of the Young Adult Alcohol Consequences Questionnaire (YAACQ; Read, Kahler, Strong, & Colder, 2004). The B-YAACQ reduced the YAACQ's item pool from 48 to 24 items (e.g., "I have passed out from drinking" and "My drinking has gotten me into sexual situations I later regretted"). Respondents use dichotomous response options (*never* [0] versus *at least once* [1]) to indicate whether they have experienced each of the listed consequences in the past month. This measure has no subscales. A total score was calculated by summing all 24 items with possible scores ranging from zero to 24. Higher scores indicate more alcohol problems. The B-YAACQ demonstrates good internal consistency ($\alpha = .84$), and it is highly correlated with the original YAACQ, $r = .95$, and the Rutgers Alcohol Problem Index (White & Labouvie, 1989), $r = .78$, showing excellent concurrent validity (Kahler, Strong, & Read, 2005).

PBS. The PBSS-20 (Treloar, Martens, & McCarthy, 2015) was used to measure PBS use (Appendix F). The PBSS-20 is a modified version of the Protective Behavioral Strategies Scale (PBSS; Martens, Ferrier, Sheehy, Corbett, Anderson, & Simmons, 2005) in which Treloar,

Martens, and McCarthy added five items and replaced one item to increase the scale's content validity of the serious harm reduction subscale and internal consistency. Respondents use a 6-point response scale (i.e., 1 = *Never*, 2 = *Rarely*, 3 = *Occasionally*, 4 = *Sometimes*, 5 = *Usually*, and 6 = *Always*) to respond to each item. The PBSS-20 consists of three subscales: Stopping/limiting drinking (SLD), manner of drinking (MOD), and serious harm reduction (SHR). Seven items are included in the SLD subscale (e.g., "Determine not to exceed a set number of drinks" and "Have a friend let you know when you've had enough to drink") which measure the use of strategies that slow or limit alcohol consumption. The MOD subscale includes five items (e.g., "Avoid 'pregaming'" and "Drink slowly, rather than gulp or chug") that measure how alcohol is consumed. Finally, the SHR subscale includes eight items (e.g., "Avoid combining alcohol with marijuana" and "Refuse to ride in a car with someone who has been drinking") and examines reducing significant negative alcohol-related consequences. Subscales scores for the PBSS-20 are typically created by summing each subscale. For the purposes of the current study, a total score was calculated by summing all items ($\alpha = .87$). The PBSS-20's total score has a possible range from 20 to 120. Higher scores indicate more PBS use. The PBSS-20 has a test-retest reliability of $r = .67$ and improved internal consistency for the SHR ($\alpha = .86$) and MOD ($\alpha = .83$) subscales (Treloar et al., 2015). The SLD reliability did not change ($\alpha = .87$). The PBSS-20 subscales showed concurrent validity with drinking frequency, quantity, and heavy episodic drinking.

Perceived effectiveness of PBS. The instructions and response scale for the PBSS-20 were modified to measure how effective participants believe PBS are at reducing their alcohol use and alcohol related consequences (Appendix G). The instructions stated "In the past 30 days, when you used each strategy, how effective was it in helping you to reduce your alcohol

use and limit alcohol related consequences when using alcohol or partying”, and the response scale of the PBSS-20 was changed to reflect effectiveness (e.g., 1 = *Not very effective* to 5 = *Very effective*, 6 = *Did not use strategy*) for each item. The response option “*Did not use strategy*” was treated as missing for calculations. A total score was created by averaging all 20 items unless participants endorse “*Did not use strategy*”. Those items did not count toward the numerator or denominator of the average; thus, possible scores range from one to five. Lower scores indicate less perceived effectiveness of PBS use. Because this modified version of the scale has never before been published, there is currently no information on reliability or validity.

Importance of PBS. Belief in the importance of PBS use was measured using 10 items created by the research team (Appendix H). This measure has two subscales: Importance of PBS in general (5 items; e.g. “When drinking alcohol, people should use strategies to reduce harmful consequences”) and importance of PBS for the participant (5 items; e.g. “When drinking alcohol, I should take steps to make sure I stay in control of myself”). These items were rated using a 5-point Likert scale (e.g., 1 = *Not at all agree* to 5 = *Completely agree*). A total score was created by averaging all ten items ($\alpha = .91$). Possible scores for this measure range from one to five. Lower scores indicate less belief in the importance of PBS use.

Attention checks. Attention checks are items in a survey with obvious correct answers used to ensure scale validity (Kung, Kwok, & Brown, 2017). Four questions were included in the survey to identify participants who were not following the instructions or carefully reading all items (see Appendix I).

Analysis Approach

A series of three regressions included amount of time spent with heavy drinking individuals in social networks (via the IP-5), proportion of heavy drinkers in social networks, and

the interaction between the two, as well as relevant demographic covariates (see below). The first analysis included alcohol quantity (via the DDQ) as the outcome. The second regression included maximum amount of drinks during the reported week (peak via the DDQ) as the outcome. It was hypothesized that a higher proportion of heavy drinkers in social networks would be associated with greater alcohol quantities and peak drinks (Hypothesis 1, addressing Aim 1), and that time spent with the heavy drinkers in student social networks would moderate these associations (Hypothesis 3, addressing Aim 2) by strengthening them for individuals who spend more time together. The third regression included alcohol-related problems (via the BYAACQ) as the outcome. It was hypothesized that a higher proportion of heavy drinkers in student social networks would be associated with more alcohol-related problems (Hypothesis 2, addressing Aim 1), and that time spent with the heavy drinkers in student social networks would strengthen this association (Hypothesis 4, addressing Aim 2).

A series of three regressions included amount of time spent with light drinkers and abstainers in social networks (via the IP-5), proportion of light drinkers and abstainers in social networks, and the interaction between the two, as well as relevant covariates. The outcomes of interest were PBS use (via the PBSS-20), perceived importance of PBS, and perceived effectiveness of PBS. It was hypothesized that a higher proportion of light drinkers and abstainers in student social networks would be associated with greater PBS use (Hypothesis 5), perceived importance of PBS (Hypothesis 6), and perceived effectiveness of PBS (Hypothesis 7, all addressing Aim 3). It was also hypothesized that time spent with the light drinkers and abstainers in their social networks would moderate these associations (Hypothesis 11-13, addressing Aim 5) by strengthening them for individuals who spend more time together.

A final set of three regressions included amount of time spent with high PBS using social network members (via the IP-5), proportion of high PBS using social network members, and the interaction between the two, as well as relevant covariates. The outcomes of interest were PBS use (via the PBSS-20), perceived importance of PBS, and perceived effectiveness of PBS. It was hypothesized that a higher network PBS use would be associated with greater PBS use (Hypothesis 8), perceived importance of PBS (Hypothesis 9), and perceived effectiveness of PBS (Hypothesis 10, all addressing Aim 4). It was also hypothesized that time spent with high PBS using social network members would strengthen these association (Hypothesis 14-16, addressing Aim 5).

Previous research has demonstrated the robust associations between gender and race with PBS use (Bravo, Prince, & Pearson, 2017; Clarke et al., 2016) and alcohol use (Garcia, Fairlie, Litt, Waldron, & Lewis, 2018; Kalaydjian, 2009). For this reason, gender and race were included as covariates in all analyses. A Bonferroni correction was used to reduce the likelihood of type I error. Significance for all analyses was determined at $\alpha = .0056$ (i.e., $.05 / 9$ analyses). Interaction terms were created for all moderating variables and affiliated predictors of interest after centering the associated components; proportion of heavy drinkers in network, proportion of light/abstaining drinkers in network, time spent with network members, and perceived PBS use of network members were mean centered.

Power. A power analysis was conducted using G*Power to determine the number of participants needed for the current study. Analyses for most hypotheses in the current study had four predictors (i.e., a main effect and two covariates). However, this analysis was powered for the more restrictive moderation hypotheses (e.g., Hypothesis 14), which had five predictors (i.e., a main effect, a moderating variable, the interaction of the two, and two covariates). An a priori

power analysis for a linear multiple regression with fixed factors was used. Power was set at .80 and alpha was set at .0056, which was determined by the Bonferroni correction. Based on previous research, it is reasonable to expect a small-to-medium effect size. A study conducted by Reid, Carey, Merrill, and Carey (2015) assessing social network impact on students' drinking behaviors, which used effect size estimates expressed in standard deviations, found strengths of association of $\beta = 0.13$ and 0.18 . A similar study by Hallgren, Ladd, & Greenfield (2013) found alcohol quantity and alcohol outcomes were significantly and positively associated with network drinking behavior with strengths of association of $r = .34$ and $r = .26$, respectively. For these reasons, this analysis used an effect size of $f^2 = .06$. The power analysis indicated that 222 participants were needed to detect a small-to-medium effect size for the current study.

CHAPTER III

RESULTS

Data were checked to ensure that all participants meet eligibility criteria. Of the survey respondents ($n = 873$), only students who reported at least one drinking occasion in the past 30 days and were age 18 or older were eligible to participate, yielding an eligible sample of 857 participants. In addition, participants who selected incorrect answers for any of the attention checks ($n = 228$), who did not list five social network members ($n = 18$), or who completed the survey in under five minutes ($n = 43$) were excluded from the study. No participants entered impossible values in the DDQ grids (e.g., the participant indicated they consume 500 alcoholic beverages on the typical Friday night). However, two participants were removed for responding with unrealistically large values (i.e., 100,000,000 hours and 100,000 hours) to the question “During the past 30 days, how many waking hours in a typical week did you interact (in person) with this person” from the IP-5. The final sample consisted of 566 participants. All continuous variables were examined for outliers and normality of distribution prior to analysis.

Distributions were assessed graphically using histograms and statistically using skewness and kurtosis. See Tables 2 and 3 for correlations for the study variables and descriptive statistics. A square root transformation was used to address the non-normality of typical alcohol quantity (*skewness* = 3.27, *kurtosis* = 16.88 in the original metric). Outliers were detected using boxplots. Problematic outliers were Winsorized to reduce the extremeness of the score while maintaining rank. For typical alcohol quantity (square root transformed), two outliers were Winsorized, seven outliers were Winsorized for typical peak alcohol use, one outlier was Winsorized for B-YAACQ scores, and six outliers were Winsorized for Importance of PBS.

The dataset contained no missing data. However, some participants (2.1 - 4.8%; $n = 11 - 27$ across all network members) responded to an item from the IP-5 regarding the number of hours spent with members of their social networks with impossible values (e.g., 500, 650, 720). The item, “During the past 30 days, how many waking hours in a typical week did you interact (in person) with this person” was asked once for each of the participants’ five social network members. For the analyses, the impossible value responses were treated as missing data, so they were not counted toward the calculated score for closeness to social network members. See the Limitations section for a discussion of this.

Table 2

Correlations among Study Variables

	1	2	3	4	5	6	7	8	9	10	11	12	13	14
1. Quantity	--													
2. Peak Alcohol Use	<u>.860</u>	--												
3. Alcohol-Related Problems	<u>.408</u>	<u>.417</u>	--											
4. PBS Use	<u>-.283</u>	<u>-.285</u>	<u>-.286</u>	--										
5. Importance of PBS	<u>-.214</u>	<u>-.195</u>	<u>-.165</u>	<u>.357</u>	--									
6. Effectiveness of PBS	<u>-.189</u>	<u>-.203</u>	<u>-.199</u>	<u>.232</u>	<u>.280</u>	--								
7. Heavy Drinkers	<u>.284</u>	<u>.259</u>	<u>.227</u>	<u>-.126</u>	<u>-.046</u>	<u>-.105</u>	--							
8. Light Drinkers	<u>-.271</u>	<u>-.239</u>	<u>-.172</u>	<u>.146</u>	<u>.108</u>	<u>.103</u>	<u>-.476</u>	--						
9. PBS User	<u>-.073</u>	<u>-.078</u>	<u>-.150</u>	<u>.234</u>	<u>.188</u>	<u>.081</u>	<u>-.240</u>	<u>.187</u>	--					
10. Closeness to Heavy Drinkers	<u>.184</u>	<u>.181</u>	<u>.104</u>	<u>-.082</u>	<u>-.080</u>	<u>-.157</u>	<u>.526</u>	<u>-.266</u>	<u>-.112</u>	--				
11. Closeness to Light Drinkers	<u>-.056</u>	<u>.000</u>	<u>.011</u>	<u>.036</u>	<u>.089</u>	<u>.011</u>	<u>-.024</u>	<u>.056</u>	<u>-.014</u>	<u>.214</u>	--			
12. Closeness to PBS Users	<u>-.030</u>	<u>-.008</u>	<u>.013</u>	<u>.062</u>	<u>.082</u>	<u>.040</u>	<u>-.001</u>	<u>.023</u>	<u>.071</u>	<u>.241</u>	<u>.815</u>	--		
13. Gender	<u>.067</u>	<u>.041</u>	<u>.029</u>	<u>-.076</u>	<u>.042</u>	<u>-.043</u>	<u>.001</u>	<u>.001</u>	<u>.023</u>	<u>.034</u>	<u>.033</u>	<u>.040</u>	--	
14. Race	<u>.064</u>	<u>.087</u>	<u>.066</u>	<u>-.030</u>	<u>-.066</u>	<u>-.014</u>	<u>.004</u>	<u>-.032</u>	<u>-.013</u>	<u>.071</u>	<u>.009</u>	<u>-.022</u>	<u>.013</u>	--

Note. $N = 566$. Alcohol Quantity = the sum of the number of alcoholic beverages participants reported consuming during a typical week (square root transformed), Peak Alcohol Use = the maximum number of alcoholic beverages participants reported consuming in one day, Alcohol-Related Problems = The Brief Young Adult Alcohol Consequences Questionnaire (Kahler, Strong, & Read, 2005), PBS Use = Protective Behavioral Strategies Scale- 20 (Treloar, Martens, & McCarthy, 2015), Importance of PBS = the perceived importance of PBS use, Effectiveness of PBS = the perceived effectiveness of PBS use, Heavy Drinkers = proportion of heavy drinkers in the social network, Light Drinkers = proportion of abstainers and light drinkers in the social network, PBS Users = proportion of high PBS using social network members, Closeness to Heavy Drinkers = time spent (in hours) with the heavy drinkers in the social network, Closeness to Light Drinkers = time spent (in hours) with the abstainers and light drinkers in the social network, Closeness to PBS Users = time spent (in hours) with high PBS using social network members. Gender (0 = female, 1 = male) and race (0 = Caucasian, 1 = all other racial groups) were controlled for in all analyses. Significant correlations at the .05 level are bolded and underlined.

Table 3

Descriptive Statistics for Study Variables

	<i>M</i>	<i>SD</i>	<i>Skewness</i>	<i>Kurtosis</i>
Quantity	2.15	1.29	0.57	0.94
Peak Alcohol Use	3.22	2.66	1.27	1.57
Alcohol-Related Problems	4.91	4.17	1.21	1.50
PBS Use	63.97	16.72	-0.56	0.81
Importance of PBS	3.60	0.56	-1.61	1.83
Effectiveness of PBS	3.34	0.67	-0.49	0.94
Heavy Drinkers	0.00	0.16	1.09	5.39
Light Drinkers	0.00	0.27	-0.15	-0.81
PBS User	0.00	0.30	-0.64	-0.63
Closeness to Heavy Drinkers	0.00	25.66	1.20	5.72
Closeness to Light Drinkers	0.00	25.58	1.88	4.41
Closeness to PBS Users	0.00	24.69	1.83	4.22

Note. Alcohol Quantity = the sum of the number of alcoholic beverages participants reported consuming during a typical week (square root transformed), Peak Alcohol Use = the maximum number of alcoholic beverages participants reported consuming in one day, Alcohol-Related Problems = The Brief Young Adult Alcohol Consequences Questionnaire (Kahler, Strong, & Read, 2005), PBS Use = Protective Behavioral Strategies Scale- 20 (Treloar, Martens, & McCarthy, 2015), Importance of PBS = the perceived importance of PBS use, Effectiveness of PBS = the perceived effectiveness of PBS use, Heavy Drinkers = mean centered proportion of heavy drinkers in the social network, Light Drinkers = mean centered proportion of abstainers and light drinkers in the social network, PBS Users = mean centered proportion of high PBS using social network members, Closeness to Heavy Drinkers = mean centered time spent (in hours) with the heavy drinkers in the social network, Closeness to Light Drinkers = mean centered time spent (in hours) with the abstainers and light drinkers in the social network, Closeness to PBS Users = mean centered time spent (in hours) with high PBS using social network members.

Proportion of Social Network Heavy Drinkers and Alcohol Outcomes

Three regressions were used to analyze the proportion of heavy drinkers in the students' social networks and the interaction with closeness predicting alcohol use outcomes (see Table 4). The first regression tested whether the amount of time spent with heavy drinking individuals in social networks, proportion of heavy drinkers in social networks, and the interaction between the two were associated with alcohol quantity, with gender and race included as covariates. It was hypothesized that larger proportions of heavy drinkers in social networks would be associated with higher quantities of alcohol (Hypothesis 1, addressing Aim 1), and that more time spent with the heavy drinkers in students' social networks would strengthen this association (Hypothesis 3, addressing Aim 2). The results of the regression indicated that the proportion of heavy drinkers in social networks, $B = 1.88$, $\beta = 0.23$, $p < .001$, 95% CI [1.09, 2.68] was a significant predictor of alcohol quantity, such that a larger proportion of heavy drinkers in social networks was associated with more alcohol use by participants. However, neither the amount of time spent with heavy drinking individuals in social networks, $B = 0.00$, $\beta = 0.01$, $p = .924$, 95% CI [-0.01, 0.01], nor the interaction between the proportion of heavy drinkers in social networks and the amount of time spent with the heavy drinkers, $B = 0.02$, $\beta = 0.08$, $p = .241$, 95% CI [-0.02, 0.06], were significant predictors of alcohol quantity.

The second regression tested whether the amount of time spent with heavy drinking individuals in social networks, proportion of heavy drinkers in social networks, and the interaction between the two were associated with the maximum amount of drinks reported, with gender and race included as covariates. It was hypothesized that larger proportions of heavy drinkers in social networks would be associated with higher peak drinks (Hypothesis 1, addressing Aim 1), and that more time spent with the heavy drinkers in students' social networks

would strengthen this association (Hypothesis 3, addressing Aim 2). The results of the regression indicated that the proportion of heavy drinkers in social networks, $B = 3.86$, $\beta = 0.23$, $p < .001$, 95% CI [2.21, 5.51], was a significant predictor of peak alcohol use, such that a larger proportion of heavy drinkers in social networks was associated with higher peak alcohol use by participants. Yet, neither the amount of time spent with heavy drinking individuals in social networks, $B = 0.004$, $\beta = 0.03$, $p < .717$, 95% CI [-0.02, 0.02], nor the interaction between the proportion of heavy drinkers in social networks and the amount of time spent with the heavy drinkers, $B = 0.02$, $\beta = 0.03$, $p = .595$, 95% CI [-0.06, 0.10], were significant predictors of peak alcohol use.

The third regression tested whether the amount of time spent with heavy drinking individuals in social networks, proportion of heavy drinkers in social networks, and the interaction between the two were associated with alcohol-related problems, with gender and race included as covariates. It was hypothesized that a larger proportion of heavy drinkers in students' social networks would be associated with more alcohol-related problems (Hypothesis 2, addressing Aim 1), and that more time spent with the heavy drinkers in student social networks would strengthen this association (Hypothesis 4, addressing Aim 2). The results of the regression indicated that the proportion of heavy drinkers in social networks, $B = 4.96$, $\beta = 0.19$, $p < .001$, 95% CI [2.39, 7.53], was a significant predictor of alcohol-related problems, such that a larger proportion of heavy drinkers in social networks was associated with more alcohol-related problems. Additionally, neither the amount of time spent with heavy drinking individuals in social networks, $B = -0.01$, $\beta = -0.02$, $p = .769$, 95% CI [-0.04, 0.03], nor the interaction between the proportion of heavy drinkers and the amount of time spent with heavy drinking individuals in

social networks, $B = 0.03$, $\beta = 0.03$, $p = .646$, 95% CI [-0.09, 0.15], were significant predictors of alcohol-related problems.

Table 4

Proportion of Heavy Drinkers in the Social Network and Interaction with Closeness Predicting Alcohol Use Outcomes

	<i>B</i>	<i>SE</i>	β	<i>p</i>	<i>R</i> ²	<i>Partial r</i> ²	<i>95% CI</i>
<i>Outcome: Alcohol Quantity</i>				< .001**	.084		
Heavy Drinkers	1.88	0.41	0.23	< .001**		.201	[1.09, 2.68]
Closeness	0.00	0.01	0.01	.924		.004	[-0.01, 0.01]
Heavy Drinkers x Closeness	0.02	0.02	0.08	.241		.052	[-0.02, 0.06]
Gender	0.001	0.001	0.07	.095		.074	[0.000, 0.003]
Race	0.001	0.001	0.04	.410		.036	[-0.001, 0.003]
<i>Outcome: Peak Alcohol Use</i>				< .001**	.072		
Heavy Drinkers	3.86	0.84	0.23	< .001**		.199	[2.21, 5.51]
Closeness	0.004	0.01	0.03	.717		.016	[-0.02, 0.02]
Heavy Drinkers x Closeness	0.02	0.04	0.03	.595		.024	[-.05, 0.10]
Gender	0.002	0.002	0.04	.336		.043	[-0.002, 0.005]
Race	0.002	0.003	0.04	.409		.037	[-0.003, 0.007]
<i>Outcome: Alcohol-Related Problems</i>				.001**	.040		
Heavy Drinkers	4.96	1.31	0.19	< .001**		.165	[2.39, 7.53]
Closeness	-0.01	0.02	-0.02	.769		-.013	[-0.04, 0.03]
Heavy Drinkers x Closeness	0.03	0.06	0.03	.646		.020	[-0.09, 0.15]
Gender	0.002	0.003	0.03	.454		.033	[-0.003, 0.008]
Race	0.002	0.004	0.02	.695		.017	[-0.01, 0.01]

Note. Heavy Drinkers = proportion of heavy drinkers in the social network, Closeness = time spent (in hours) with the heavy drinkers in the social network, Alcohol Quantity = the sum of the number of alcoholic beverages participants reported consuming during a typical week (square root transformed, $n = 516$), Peak Alcohol Use = the maximum number of alcoholic beverages participants reported consuming in one day ($n = 516$), Alcohol-Related Problems = The Brief Young Adult Alcohol Consequences Questionnaire (Kahler, Strong, & Read, 2005; $n = 516$). Gender (0 = female, 1 = male) and race (0 = Caucasian, 1 = all other racial groups) were controlled for in all analyses.

* $p < .05$; ** $p < .0056$.

Proportion of Social Network Abstainers/Light Drinkers and PBS Outcomes

Three regressions were used to analyze the proportion of abstainers and light drinkers in college students' social networks and the interaction with closeness predicting protective behavioral strategy outcomes (see Table 5). The first regression tested whether the amount of time spent with light drinkers and abstainers in social networks, the proportion of light drinkers and abstainers in social networks, and the interaction between the two were associated with PBS use, with gender and race included as covariates. It was hypothesized that a larger proportion of light drinkers and abstainers in student social networks would be associated with more PBS use (Hypothesis 5, addressing Aim 3), and that more time spent with the light drinkers and abstainers in students' social networks would strengthen this association (Hypothesis 11, addressing Aim 5). The results of the regression indicated that the proportion of light drinkers and abstainers in social networks, $B = 7.97$, $\beta = 0.13$, $p = .003$, 95% CI [2.72, 13.22], was a significant predictor of PBS use, such that a larger proportion of light drinkers and abstainers in social networks was associated with more PBS use by participants. Yet, neither the amount of time spent with light drinkers and abstainers in social networks, $B = 0.004$, $\beta = 0.01$, $p = .875$, 95% CI [-0.05, 0.06], nor the interaction between the light drinkers and abstainers in social networks and the amount of time spent with light drinkers and abstainers, $B = -0.06$, $\beta = -0.02$, $p = .600$, 95% CI [-0.26, 0.15], were significant predictors of PBS use.

The second regression tested whether the amount of time spent with light drinkers and abstainers in social networks, the proportion of light drinkers and abstainers in social networks, and the interaction between the two were associated with the perceived importance of PBS, with gender and race included as covariates. It was hypothesized that a larger proportion of light drinkers and abstainers in student social networks would be associated with more perceived

importance of PBS (Hypothesis 6, addressing Aim 3), and that more time spent with the light drinkers and abstainers in students' social networks would strengthen this association (Hypothesis 12, addressing Aim 5). The results of the regression indicated that the proportion of light drinkers and abstainers in social networks, $B = 0.19$, $\beta = 0.09$, $p = .041$, 95% CI [0.01, 0.37], was a significant predictor of perceived importance of PBS, such that a larger proportion of light drinkers and abstainers in social networks was associated with more perceived importance of PBS. However, this association was not significant at the Bonferroni corrected alpha of .0056. Furthermore, neither the amount of time spent with light drinkers and abstainers in social networks, $B = 0.002$, $\beta = 0.07$, $p = .116$, 95% CI [0.000, 0.003], nor the interaction between the light drinkers and abstainers in social networks and the amount of time spent with light drinkers and abstainers, $B = 0.00$, $\beta = -0.001$, $p = .977$, 95% CI [-0.007, 0.007], were significant predictors of perceived importance of PBS.

The third regression tested whether the amount of time spent with light drinkers and abstainers in social networks, the proportion of light drinkers and abstainers in social networks, and the interaction between the two were associated with the perceived effectiveness of PBS, with gender and race included as covariates. It was hypothesized that a larger proportion of light drinkers and abstainers in student social networks would be associated with more perceived effectiveness of PBS (Hypothesis 7, addressing Aim 3), and that more time spent with the light drinkers and abstainers in students' social networks would strengthen this association (Hypothesis 13, addressing Aim 5). The results of the regression indicated that the proportion of light drinkers and abstainers in social networks, $B = 0.28$, $\beta = 0.11$, $p = .012$, 95% CI [0.06, 0.49], was a significant predictor of perceived effectiveness of PBS, such that a larger proportion of light drinkers and abstainers in social networks was associated with more perceived

effectiveness of PBS. However, this regression was not significant at the Bonferroni corrected alpha of .0056. Additionally, neither the amount of time spent with light drinkers and abstainers in social networks, $B = 0.00$, $\beta = 0.01$, $p = .797$, 95% CI [-0.002, 0.003], nor the interaction between the proportion of light drinkers and abstainers in social networks and the amount of time spent with light drinkers and abstainers in social networks, $B = 0.004$, $\beta = 0.04$, $p = .368$, 95% CI [-0.01, 0.01], were found to be significant predictors of perceived effectiveness of PBS.

Table 5

Proportion of Abstainers and Light Drinkers in the Social Network and Interaction with Closeness Predicting Protective Behavioral Strategy Outcomes

	<i>B</i>	<i>SE</i>	β	<i>p</i>	<i>R</i> ²	<i>Partial r</i> ²	95% CI
<i>Outcome: PBS Use</i>				.022*	.025		
Light Drinkers	7.97	2.67	0.13	.003**		.131	[2.72, 13.22]
Closeness	0.004	0.03	0.01	.875		.007	[-0.05, 0.06]
Light Drinkers x Closeness	-0.06	0.11	-0.02	.600		-.023	[-0.26, 0.15]
Gender	-0.02	0.01	-0.08	.064		-.082	[-0.044, 0.001]
Race	0.01	0.02	0.02	.706		.017	[-0.02, 0.04]
<i>Outcome: Importance of PBS</i>				.143	.016		
Light Drinkers	0.19	0.09	0.09	.041*		.090	[0.01, 0.37]
Closeness	0.002	0.001	0.07	.116		.069	[0.000, 0.003]
Light Drinkers x Closeness	0.00	0.004	-0.001	.997		-.001	[-0.01, 0.01]
Gender	0.00	0.00	0.04	.348		.042	[0.000, 0.001]
Race	0.00	0.001	-0.01	.778		-.012	[-0.001, 0.001]
<i>Outcome: Effectiveness of PBS</i>				.162	.015		
Light Drinkers	0.28	0.11	0.11	.012*		.111	[0.06, 0.49]
Closeness	0.00	0.001	0.01	.797		.011	[-0.002, 0.003]
Light Drinkers x Closeness	0.004	0.004	0.04	.368		.040	[-0.01, 0.01]
Gender	0.00	0.00	0.004	.298		-.046	[-0.001, 0.000]
Race	0.00	0.001	-0.05	.930		.004	[-0.001, 0.001]

Note. Light Drinkers = proportion of abstainers and light drinkers in the social network, Closeness = time spent (in hours) with the abstainers and light drinkers in the social network, PBS Use = Protective Behavioral Strategies Scale-20 (Treloar, Martens, & McCarthy, 2015; $n = 516$), Importance of PBS = the perceived importance of PBS use ($n = 516$), Effectiveness of PBS = the perceived effectiveness of PBS use ($n = 516$). Gender (0 = female, 1 = male) and race (0 = Caucasian, 1 = all other racial groups) were controlled for in all analyses.

* $p < .05$; ** $p < .0056$.

Proportion of Social Network PBS Users and PBS Outcomes

Three regressions were used to analyze the proportion of high PBS using social network members and interaction with closeness predicting protective behavioral strategy outcomes (see Table 6). The first regression tested whether the amount of time spent with high PBS using social network members, proportion of high PBS using social network members, and the interaction between the two were associated with PBS use, with gender and race included as covariates. It was hypothesized that higher network PBS use would be associated with more PBS use (Hypothesis 8, addressing Aim 4), and that more time spent with high PBS using social network members would strengthen this association (Hypothesis 14, addressing Aim 5). The results of the regression indicated that the proportion of high PBS using social network members, $B = 11.45$, $\beta = 0.21$, $p < .001$, 95% CI [6.71, 16.20], was a significant predictor of PBS use, such that a larger proportion of high PBS using social network members was associated with more PBS use by participants. Furthermore, neither the amount of time spent with high PBS using social network members, $B = 0.02$, $\beta = 0.03$, $p = .522$, 95% CI [-0.04, 0.08], nor the interaction between the time spent with high PBS using social network members and the proportion of high PBS using social network members, $B = -0.16$, $\beta = -0.07$, $p = .095$, 95% CI [-0.35, 0.03], were found to be significant predictors of PBS use.

The second regression tested whether the amount of time spent with high PBS using social network members, proportion of high PBS using social network members, and the interaction between the two were associated with perceived importance of PBS, with gender and race included as covariates. It was hypothesized that higher network PBS use would be associated with more perceived importance of PBS (Hypothesis 9, addressing Aim 4), and that more time spent with high PBS using social network members would strengthen this association

(Hypothesis 15, addressing Aim 5). The results of the regression indicated that the proportion of high PBS using social network members, $B = 0.33$, $\beta = 0.17$, $p < .001$, 95% CI [0.16, 0.49], was a significant predictor of perceived importance of PBS, such that a larger proportion of high PBS using social network members was associated with more perceived importance of PBS.

Furthermore, neither the amount of time spent with high PBS using social network members, $B = 0.001$, $\beta = 0.06$, $p = .207$, 95% CI [-0.001, 0.003], nor the interaction between the time spent with high PBS using social network members and the proportion of high PBS using social network members, $B = -0.003$, $\beta = -0.04$, $p = .370$, 95% CI [-0.010, 0.004], were found to be significant predictors of perceived importance of PBS.

The third regression tested whether the amount of time spent with high PBS using social network members, proportion of high PBS using social network members, and the interaction between the two were associated with perceived effectiveness of PBS, with gender and race included as covariates. It was hypothesized that higher network PBS use would be associated with more perceived effectiveness of PBS (Hypothesis 10, addressing Aim 4), and that more time spent with high PBS using social network members would strengthen this association (Hypothesis 16, addressing Aim 5). The results of the regression indicated that neither the amount of time spent with high PBS using social network members, $B = 0.001$, $\beta = 0.03$, $p = .444$, 95% CI [-0.001, 0.003], nor the proportion of high PBS using social network members, $B = 0.17$, $\beta = 0.08$, $p = .081$, 95% CI [-0.02, 0.37], nor the interaction between the two, $B = 0.00$, $\beta = 0.002$, $p = .966$, 95% CI [-0.01, 0.01], were found to be significant predictors of perceived effectiveness of PBS.

Table 6

Proportion of High Protective Behavioral Strategy Using Social Network Members and Interaction with Closeness Predicting Protective Behavioral Strategy Outcomes

	<i>B</i>	<i>SE</i>	β	<i>p</i>	<i>R</i> ²	<i>Partial r</i> ²	95% CI
<i>Outcome: PBS Use</i>				< .001**	.063		
PBS Users in Network	11.45	2.42	0.21	< .001**		.204	[6.71, 16.20]
Closeness	0.02	0.03	0.03	.522		.028	[-0.04, 0.08]
PBS Users x Closeness	-0.16	0.10	-0.07	.095		-.073	[-0.35, 0.03]
Gender	-0.02	0.01	-0.09	.048*		-.087	[-0.05, 0.00]
Race	0.01	0.02	0.02	.693		.017	[-0.03, 0.04]
<i>Outcome: Importance of PBS</i>				.001**	.042		
PBS Users in Network	0.33	0.08	0.17	< .001**		.171	[0.16, 0.49]
Closeness	0.001	0.001	0.06	.207		.056	[-0.001, 0.003]
PBS Users x Closeness	-0.003	0.003	-0.04	.370		-.040	[-0.010, 0.004]
Gender	0.00	0.00	0.04	.387		.038	[0.000, 0.001]
Race	0.00	0.001	-0.01	.811		-.011	[-0.001, 0.001]
<i>Outcome: Effectiveness of PBS</i>				.422	.010		
PBS Users in Network	0.17	0.10	0.08	.081		.077	[-0.02, 0.37]
Closeness	0.001	0.001	0.03	.444		.034	[-0.001, 0.003]
PBS Users x Closeness	0.00	0.004	0.002	.966		.002	[-0.01, 0.01]
Gender	-0.001	0.00	-0.05	.274		-.048	[-0.001, 0.000]
Race	0.00	0.001	0.003	.950		.003	[-0.001, 0.001]

Note. PBS Users in Network = proportion of high PBS using social network members, Closeness = time spent (in hours) with the heavy drinkers in the social network, PBS Use = Protective Behavioral Strategies Scale-20 (Treloar, Martens, & McCarthy, 2015; $n = 520$), Importance of PBS = the perceived importance of PBS use ($n = 520$), Effectiveness of PBS = the perceived effectiveness of PBS use ($n = 520$). Gender (0 = *female*, 1 = *male*) and race (0 = *Caucasian*, 1 = *all other racial groups*) were controlled for in all analyses.

* $p < .05$; ** $p < .0056$.

CHAPTER IV

DISCUSSION

The current study had three aims addressing main effects between qualities of student social network and their own outcomes (i.e., Aim 1: proportion of heavy drinking social network members and students' drinking; Aim 3: proportion of abstaining or light drinking social network members and students' PBS use and beliefs about PBS; and Aim 4: proportion of high PBS using social network members and students' PBS use and beliefs about PBS). These aims were partially supported by the analyses. Support was found for proportion of heavy drinkers and student drinking (i.e., alcohol quantity, peak alcohol use, and alcohol-related problems), proportion of light drinkers and abstainers and PBS use (but beliefs about PBS did not reach Bonferroni-corrected significance levels), and proportion of high PBS using social network member and PBS use and perceived importance of PBS (but not perceived effectiveness of PBS). Two additional aims (Aims 2, 5) examined whether closeness moderated these associations. These two aims were not supported.

Network Members' and Students' Alcohol Use

Aim 1 of this research was to examine the association between perceptions of alcohol use by social network members with college students' own alcohol use. Alcohol use by participants was operationalized in terms of total quantity of alcohol reported by participants during a typical week, peak amount of alcohol reported during a single day, and number of alcohol-related problems experienced. The hypotheses that larger proportions of heavy drinkers in students' social networks would be associated with higher quantities of alcohol, higher peak drinks, and more alcohol-related problems were supported by the analysis. These results are consistent with previous research that suggests exposure to heavy drinkers influences college student drinking

due to descriptive drinking norms as a result of social learning theory. The presence of heavy drinkers in college students' social networks has been linked to higher weekly alcohol quantity (Demartini, Palmer, et al., 2013). Likewise, network members who are thought to drink larger amounts of alcohol are believed to be less accepting of students decreasing their own alcohol use (Reid, Carey, Merrill, & Carey, 2015).

Network Members' Alcohol Use and Students' Protective Behavioral Strategy Use

Aim 3 of this research was to examine the associations between perceptions of alcohol use by social network members and college student PBS use, beliefs about the importance of PBS use, and beliefs about the effectiveness of PBS use. The hypothesis that larger proportions of light drinkers and abstainers in students' social networks would be associated with more PBS use was supported by the analysis. The hypotheses that larger proportions of light drinkers and abstainers in students' social networks would be associated with more perceived importance of PBS and more perceived effectiveness of PBS were also supported by the analysis but not at the Bonferroni corrected alpha level. These results are consistent with previous research on the benefits of light drinkers and abstainers in college students' social networks. Students who perceive lower levels of alcohol use by their peers are less likely to engage in binge drinking than students who perceive higher levels of alcohol use by their peers (Jun et al., 2015).

Additionally, college students with abstainers or light drinkers in their social networks have a decreased likelihood of being identified as a hazardous drinker (Mason, Zaharakis, & Benotsch, 2014). The current study expands beyond these findings such that perceptions of lower alcohol use by peers is not just linked to less hazardous drinking, but is also linked to greater PBS use, and perceptions about the importance and effectiveness of PBS.

Network Members' and Students' Protective Behavioral Strategy Use

Aim 4 of this research was to examine the association between perceptions of PBS use by social network members and college students' own PBS use, beliefs about the importance of PBS use, and beliefs about the effectiveness of PBS use. The hypotheses that larger proportions of high PBS using social network members would be associated with more PBS use and more perceived importance of PBS were supported by the analysis. Inclusion of beliefs about the importance and effectiveness of PBS is a critical addition to the literature, as the Health Belief Model states that the perceived benefit of performing a health behavior explains why people are inclined to adopt healthy behaviors (Prentice-Dunn & Rogers, 1986). Further, previous research has indicated that the perceived attitudes about health behaviors of college students' social network members are associated with college students' own behaviors (Neighbors et al., 2007), suggesting if college students believe their friends have positive attitudes toward PBS use, they will themselves have positive attitudes toward PBS use. Thus, this idea is consistent with the finding that the PBS use of college students' social network members plays a role in both college students' use of PBS and how important they believe PBS use to be.

The hypothesis that a larger proportion of high PBS using social network members would be associated with more perceived effectiveness of PBS was not supported. The results from this analysis suggest that beliefs about effectiveness may be based on personal experiences rather than socially influenced. For instance, a student may firmly believe that using a designated driver can reduce harmful consequences while drinking even if members of their social network may not share this level of belief in that particular PBS. If the student's belief in the utility of using a designated driver is strong enough, their belief in the effectiveness of this PBS will probably not change just because some of their social network members do not use designated drivers.

Closeness as a Moderator for Network Members' and Students' Behaviors and Beliefs

Aim 2 was to determine whether closeness moderates the association between college students' social networks alcohol use and their own alcohol use. Closeness was quantified by the number of waking hours students spent with the relevant individuals in their social networks. The hypotheses that time spent with the heavy drinkers in the social networks would moderate the associations between proportions of heavy drinkers and students' alcohol quantity, peak alcohol use, and alcohol-related problems were not supported.

Aim 5 was to examine closeness as a potential moderator of the association between college students' social networks and their PBS use, beliefs about the importance of PBS use, and beliefs about the effectiveness of PBS use. The hypotheses that more time spent with the light drinkers and abstainers in students' social networks would moderate the associations between proportions of light drinkers and abstainers and PBS use, perceived importance of PBS, and perceived effectiveness of PBS were not supported by the analysis. In addition, the hypotheses that more time spent with high PBS using social network members would strengthen the associations between proportions of high PBS using social network members and students' PBS use, perceived importance of PBS, and perceived effectiveness of PBS were not supported by the analysis.

The results of the moderation analyses show that closeness operationalized as time spent with social network members did not moderate any associations between college students' social networks' perceived alcohol/PBS use and their own alcohol/PBS use or beliefs about PBS use. It may be that time spent with the members of the social network might not be the best way to measure closeness. A better operational definition of closeness may be perceived emotional closeness, or how connected the students feel to the members of their social networks. Previous

research has indicated that perceived emotional closeness has been shown to strengthen the associations between perceptions of social networks substance use and students' substance use (Mason, Zaharakis, & Benotsch, 2014). Emotional closeness is also used to assess the closeness of couples as an important predictor of relationship quality, interdependence, and beliefs about their relationships (Kearns & Leonard, 2004; Murray, Bellavia, Rose, & Griffin, 2003). It is often examined in on-going relationships because it is believed to be one reason people seek out interpersonal relationships (Reis & Rusbult, 2004). Moreover, specific roles of social network members may be a better indicator of closeness than time spent with the social network members. The perceived substance use of "best friends" has been shown to be a stronger predictor of students' substance use than the perceived substance use of same-aged peers and "other good friends" (Morgan & Grube, 1991).

Limitations and Future Directions

An unexpected limitation was revealed during the analysis of the data. The impossible value responses to the question "During the past 30 days, how many waking hours in a typical week did you interact (in person) with this person" are a substantial limitation and must be considered when examining the implications of this study. This question from the IP-5 appeared five times in the social network section of the survey (i.e., once for each of the participants' social network members). Participants were expected to respond with values between zero and 168 since there are 168 hours in a week. However, some participants across the five questions (2.1 - 4.8%; n = 11 - 27) responded with impossible values (e.g., 500, 650, 720).

One probable explanation for these responses could be that some participants mistakenly entered the number of hours in a 30-day period they interacted with the members of their social network. This seems likely since the highest value responses were 720 and there are exactly 720

hours in 30 days. The confusion may have come from the fact that the question referenced both “the past 30 days” and “a typical week”. Ultimately, responses higher than 168 were treated as missing data and were not counted toward the calculated score for closeness to social network members. However, for values of 168 or less it is impossible to know whether participants were reporting time spent with network members for the week or for the month. Since this question seems to have been interpreted by participants in differing ways the validity of these responses cannot be guaranteed. Thus, the score calculated from this item may not have captured participants’ time spent with the members of their social networks in an interpretable way.

In the future, placing an upper limit on the value of the response in Qualtrics would ensure that participants could not enter values greater than 168. However, the question must also be rephrased to further emphasize that it is referring to the number of hours in a typical week. Including examples of possible values and reminding participants that there are 168 hours in a week would further help guarantee that participants understand what the question is asking. Additionally, it would still be important to remind participants to respond with information about a typical week in the past 30 days since the rest of the survey is referencing their past 30-day activity. This is necessary because the participants are college students and the members of their social networks may be friends or family members that they do not regularly interact with during the school year. Consequently, it is important to remind them to report the number of hours in a typical week for the past 30 days, since their interaction with this network member several months ago may not be as impactful on their past-month alcohol use.

This study had other limitations as well. First, participants in this study were not randomly sampled. The participants came from a convenience sample of college students who completed the survey for research credit. This could create an issue with students not taking the

survey seriously or rushing through it. In order to address this concern, the current study did include attention check questions. Participants who did not answer the attention checks correctly were removed, as were students who completed the survey very quickly. Second, the survey was conducted using self-report measures. Recall bias can be an issue when self-report measures are used to assess alcohol use. It may be difficult for participants to accurately recall how many drinks they had in the past 30 days. Third, this study used a cross-sectional design which cannot provide information about trends over time or show cause and effect. Fourth, participants reported on their perception of their network members' alcohol use and use of PBS which may not reflect the network members' actual behavior. College students tend to overestimate the alcohol use and behaviors of their peers (Carey, Borsari, Carey, & Maisto, 2006). Moreover, participants could have conflated their own alcohol and PBS use with their network members' alcohol and PBS use. College students often misperceive the alcohol use of their close friends to be similar to their own drinking behaviors (McAlaney & John McMahon, 2007). For instance, heavy drinking college students frequently overestimate the heavy drinking of their peers (Cox et al., 2019). Participants in the current study may have similarly misperceived the behaviors of their network members. If this were the case, the highly correlated variables could introduce multicollinearity which would make it difficult to detect other effects such as gender and race. However, it is possible that the participants are only influenced by their perceptions of their network members' alcohol and PBS use anyway. Also, participants were asked if they were confident in their knowledge of the PBS use of each of their network members. Of the 2,830 responses (5 network members across 566 participants), 2,652 (93.7%) indicated that the participants were confident in their knowledge of PBS use of the individual members of their social networks.

Finally, the two scales used to collect information about PBS beliefs (i.e., Perceived Effectiveness of PBS and Perceived Importance of PBS) have never before been published and their psychometric properties are unknown. Perceived Importance of PBS has good internal consistency in the current data; however, extensive psychometric examination is needed to confirm the reliability, validity, dimensionality, and interpretability of these scales, such as if participants understand the distinction between perceived importance, perceived effectiveness, and actual use of PBS.

Further research is needed to address these limitations. To address the issues with the cross-sectional design, future research should use a longitudinal design to examine if changes in the outcomes of interest (i.e., individual drinking levels) follow after changes in social networks over time. Ecological momentary assessment should also be considered. Collecting data in real time using something such as a phone app could curtail concerns about participants not being able to accurately recall the exact amount of alcohol they have consumed. Moreover, collecting repeated measures data would also allow for participants to report who they are drinking with on a given day and how close they are to this network member at a daily level. The data could be examined using more appropriate multilevel modeling techniques, allowing the exploration of daily associations between social network characteristics and same-day alcohol use. In order to have the most accurate information about the social network members' alcohol use and use of PBS, a complete network design would be needed. Changing the design of the study would allow for all members within the network to report their own alcohol and PBS use. This would also eliminate any potential issues of multicollinearity created by participants reporting on their own alcohol and PBS use and the alcohol and PBS use of their network members.

Finally, due to the lack of evidence for closeness as a moderator of the association between social networks and college students' PBS use and their beliefs in the importance and effectiveness of PBS, time spent with social network members may not be an important variable to consider when examining these outcomes. A more relevant variable to study when exploring this association may be relationship to the network members. Relationships to the network member such as "best friend" and "good friend" are stronger predictor of participants' substance use than other network members with "best friend" being the strongest predictor (Morgan & Grube, 1991). However, it is possible that closeness moderates the association between social network members and college students' alcohol use, but time spent may not be the best metric for measuring closeness. Other operational definitions for closeness to social network members should be explored.

Implications

The results of this study support previous research that suggests college students' social networks can influence their alcohol use through descriptive drinking norms as a result of social learning theory (Demartini, Palmer, et al., 2013). The current study also provides insight into the association between social network members' PBS use and college students' own PBS use which has not been widely examined. The implications of these results suggest that norms-based interventions focusing on PBS use may be an effective tool to increase student PBS use and in turn reduce the negative alcohol-related consequences experienced while drinking alcohol (Martens et al., 2004).

However, the results for closeness of students to the members of their social network moderating their own alcohol use, PBS use, and beliefs about PBS may have the most imperative implications of this study. Research has shown that social network-based interventions can be

beneficial for addressing the substance use of college students; however, many of these programs focus on closeness within the social network (Mason, Zaharakis, & Benotsch, 2014). Yet, none of the closeness moderations in the current study were found to significantly moderate students' alcohol use, PBS use, or beliefs about PBS. These findings imply that the operational definition being used to measure closeness to social network members (i.e., time spent together) may be flawed. This information can be used to improve upon social network-based interventions used to reduce the negative alcohol-related consequences experienced by college students. Social network-based interventions may not need to make the closeness of peer-mentors to students a focus of the program. Instead, these programs could examine the types of relationships in the social networks.

Conclusion

The current study examined the association between social networks and college students' alcohol use, PBS use, and their beliefs in the importance and effectiveness of PBS. Closeness, defined as the amount of time spent with individual members of the social networks, was also assessed as a potential moderator of these associations. Results indicated that students reported higher alcohol quantities, higher peak drinks, and more alcohol-related problems if they had larger proportions of heavy drinkers in their social networks. Students with larger proportions of light drinkers and abstainers in their social networks reported more PBS use, but this did not significantly predict perceived importance of PBS or perceived effectiveness of PBS after adjusting alpha to correct for the number of analyses conducted. Furthermore, students with larger proportions of high PBS using social network members reported more PBS use and perceived PBS as being more important than students with social network members who do not use as much PBS. Yet, higher network PBS use was not found to be a significant predictor of

perceived effectiveness of PBS. Furthermore, time spent with network members was not found to moderate any of these associations. With these results in mind, social network-based interventions might consider switching their focus from the closeness of peer-mentors to students, and instead set their attention on the types of relationships within the social networks. Universities should consider using norms-based interventions focused on PBS to increase students' PBS use as well. A focus of future research should be to identify the best method of measuring closeness to network members.

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APPENDIX A

Psychology Research Participation System Advertisement

Study Name	OFF- Social Networks and Alcohol Use
Study Type	Online External Study This study is an online study located on another website. Participants are not given access to the study URL until after they sign up for the study.
Duration	25 minutes
Credits	0.5 credits
Abstract	This study consists of an online assessment focusing on alcohol use and social networks.
Description	The current study investigates perceptions of social network members and college students' health behaviors. You must be at least 18 years old to be eligible for this study. In addition, you must have consumed at least 1 alcoholic drink within the past 30 days.

APPENDIX B

Informed Consent Document

Old Dominion University

PROJECT TITLE: Social Networks and Alcohol Use

INTRODUCTION

The purposes of this form are to give you information that may affect your decision whether to say YES or NO to participation in this research, and to record the consent of those who say YES. Social Networks and Alcohol Use assess alcohol health behaviors and social networks. This study is conducted online.

RESEARCHERS

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DESCRIPTION OF RESEARCH STUDY

Several studies have been conducted looking into the subject of student health behaviors related to drinking. The current study investigates the effects of social networks on student drinking behaviors. If you decide to participate, then you will join a study involving assessment of your own health behaviors. If you say YES, then you will complete a computerized survey (approximately 25 minutes) assessing your current health behaviors. This study is an online study. Approximately 250 ODU students will be participating in this study.

EXCLUSIONARY CRITERIA

You must be at least 18 years old to be eligible for this study. In addition, you must have consumed at least 1 alcoholic drink within the past 30 days. If you have not consumed alcohol within the past 30 days, you are not eligible for this study.

RISKS AND BENEFITS

RISKS: If you decide to participate in this study, it is possible you may experience some discomfort answering questions regarding your behaviors and actions. If you would like to speak to someone at Counseling Services you may call 757-683-4401 or go to 1526 Webb Center. Additionally, the research involves using a computer, so the risks involved with that are similar to typical computer use. The researcher tried to reduce these risks by limiting the length of the survey. If you are using public computers owned and operated by ODU there may be the possibility of institutional monitoring of your responses. And, as with any research, there is some possibility that you may be subject to risks that have not yet been identified.

BENEFITS: There are no direct benefits for participating in this study.

COSTS AND PAYMENTS

The researchers want your decision about participating in this study to be absolutely voluntary. Yet they recognize that your participation may pose some inconvenience. In order to compensate your time, you will receive half of a SONA research credit that may be used in participating psychology classes. Equivalent research credits may be obtained in other ways. Students do not have to participate in this study, or any Psychology Department study, in order to obtain research credit.

NEW INFORMATION

If the researchers find new information during this study that would reasonably change your decision about participating, then they will give it to you.

CONFIDENTIALITY

This survey is anonymous and no identifiable information will be collected during the survey. Your Sona ID will be collected in a separate survey in order to compensate you for your participation. Your survey responses will not be able to be linked to your Sona ID. The results of this study may be used in reports, presentations, and publications; but the researcher will not identify you. Of course, your records may be subpoenaed by court order or inspected by government bodies with oversight authority.

WITHDRAWAL PRIVILEGE

It is OK for you to say NO. Even if you say YES now, you are free to say NO later, and walk away or withdraw from the study at any time. Your decision will not affect your relationship with Old Dominion University, or otherwise cause a loss of benefits to which you might otherwise be entitled.

COMPENSATION FOR ILLNESS AND INJURY

If you say YES, then your consent in this document does not waive any of your legal rights. However, in the event of harm arising from this study, neither Old Dominion University nor the researchers are able to give you any money, insurance coverage, free medical care, or any other compensation for such injury. In the event that you suffer injury as a result of participation in any research project, you may contact Dr. Abby Braitman at abraitma@odu.edu or Dr. Tancy Vandecar-Burdin the current IRB chair at 757-683 3802 at Old Dominion University, or the Old Dominion University Office of Research at 757-683-3460 who will be glad to review the matter with you.

VOLUNTARY CONSENT

By clicking the arrow button below, you are saying several things. You are saying that you have read this form or have had it read to you, that you are satisfied that you understand this form, the research study, and its risks and benefits. The researchers should have answered any questions you may have had about the research. If you have any questions later on, then the researchers should be able to answer them:

Abby L. Braitman, Ph.D., abraitma@odu.edu

Melissa Colangelo, B.S., mcolange@odu.edu

If at any time you feel pressured to participate, or if you have any questions about your rights or this form, then you should call Dr. Tancy Vandecar-Burdin, the current IRB chair, at 757 683 3802, or the Old Dominion University Office of Research, at 757 683 3460.

And importantly, by clicking the arrow “→” button below, you are telling the researcher YES, that you agree to participate in this study. You may print a copy of this form for your records.

APPENDIX C

Alcohol Use

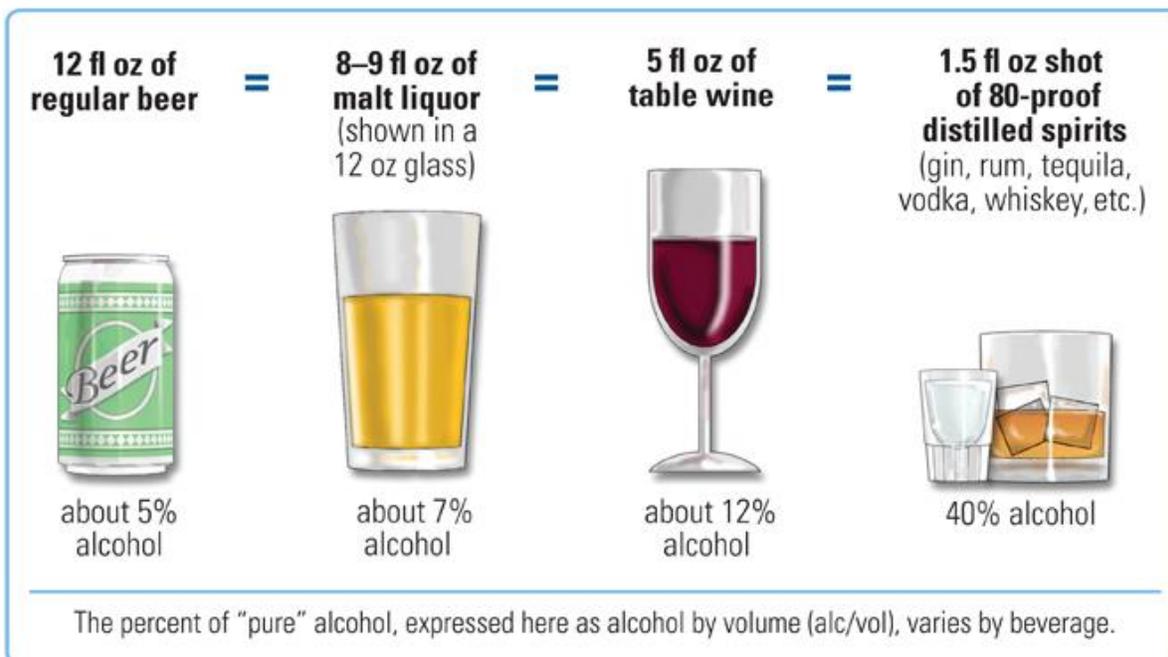
The following questions refer to the previous 30 days.

Did you consume alcohol within the previous 30 days? () yes () no

On how many days of the past 30 days did you consume alcohol? _____

Please keep in mind that one "standard" drink contains roughly 14 grams of pure alcohol, which is found in:

- 12 ounces of regular beer, which is usually about 5% alcohol
- 5 ounces of wine, which is typically about 12% alcohol
- 1.5 ounces of distilled spirits, which is about 40% alcohol



Use your best estimate of drinks based on this definition.

In the past 30 days, how many times have you consumed five or more drinks (if you are male) or four or more drinks (if you are female) on a single occasion? _____

Think of the one day you consumed the most alcohol in the past 30 days; How many standard drinks did you consume on that day? _____

On this heaviest drinking day, approximately how many hours passed from the beginning of the first drink to the finishing of the last? _____

We ask that you fill in the following grid with the number of standard drinks you consumed each day for a *typical week* in the past 30 days. Please also indicate how many hours typically pass while you are drinking. Enter a “0” to indicate days on which you do not drink.

Typical Week

Personal Alcohol Use	Mon	Tues	Wed	Thurs	Fri	Sat	Sun
How many standard drinks did you consume each day during this week?							
How many hours passed during this drinking occasion?							

We ask that you fill in the following grid with the number of standard drinks you consumed each day for a *heavy drinking week* in the past 30 days. Please also indicate how many hours typically pass while you are drinking. Enter a “0” to indicate days on which you do not drink.

Heavy Week

Personal Alcohol Use	Mon	Tues	Wed	Thurs	Fri	Sat	Sun
How many standard drinks did you consume each day during this week?							
How many hours passed during this drinking occasion?							

APPENDIX D

Social Network

This next group of questions is about the **FIVE** people who have been important to you during the past year. This might include people you socialized with or regularly had fun with during your free time during the past 30 days. These people may be family members, friends, people from work, or anyone that you see as having had a significant impact on your life and have regular face-to-face contact with, regardless of whether or not you liked them.

In the space below, please fill in the **FIRST NAME** and **LAST INITIAL** of these **FIVE people who are important to you, and with whom you spend your free time**. Then answer the following questions about each person.

1. Name (first name, last initial)
2. What is the age of this person? (in years)
3. What is the gender of this person?

0 = Male

1 = Female

2 = Gender non-binary

4. Was this person your:

1 = Friend

2 = Significant other

3 = Sibling

4 = Co-worker

5 = Parent

6 = Extended family (e.g., aunt, cousin, grandparent)

7 = Other

5. How long have you known this person?

1 = 0 to 6 months

2 = 7 to 12 months

3 = 1 to 2 years

4 = 3 to 4 years

5 = 5 to 10 years

6 = More than 10 years

6. During the past 30 days, how many waking hours in a typical week did you interact (in person) with this person?

7. Which category best describes this person's general drinking pattern during the past year?

1 = No drinking at all (abstainer)

2 = Occasional or light drinker (up to 1.2 drinks per drinking day)

3 = Moderate or average drinker (2.2 drinks per drinking day)

4 = Heavy drinker (3.5 drinks per drinking day or more)

5 = Don't know

8. During the past year, on how many days did you drink with this person in a typical 30-day period? (Enter number 0 to 30; if never, write "0")

9. How often does this network member use strategies to lessen or avoid negative consequences of drinking (see examples below)?

Examples of strategies:

Use a designated driver

Determine not to exceed a set number of drinks

Alternate alcoholic and nonalcoholic drinks

Have a friend let them know when they've had enough to drink

Avoid drinking games

Leave the bar/party at a predetermined time

Make sure that they go home with a friend

Know where their drink has been at all time

Stop drinking at a predetermined time

Drink water while drinking alcohol

Put extra ice in your drink

Avoid mixing different types of alcohol

Drink slowly, rather than gulp or chug

Avoid trying to keep up or out-drink others

Refuse to ride in a car with someone who has been drinking

Only go out with people they know and trust

Avoid combining alcohol with marijuana

Avoid "pregaming" (i.e., drinking before going out)

Make sure they drink with people who can take care of them if they drink too much
and/or

Eat before or during drinking

1 = Never

2 = Rarely

3 = Occasionally

4 = Sometimes

5 = Usually

6 = Always

10. Are you confident in your knowledge of this network member's use of these strategies?

1 = No

2 = Yes

APPENDIX E

Alcohol-related Consequences

The next set of questions concerns whether you have experienced any of the following problems due to drinking in the past 30 days. Please select all that apply.

- _____ (1) While drinking, I have said or done embarrassing things.
- _____ (2) I have had a hangover (headache, sick stomach) the morning after I had been drinking.
- _____ (3) I have felt very sick to my stomach or thrown up after drinking.
- _____ (4) I often have ended up drinking on nights when I had planned not to drink.
- _____ (5) I have taken foolish risks when I have been drinking.
- _____ (6) I have passed out from drinking.
- _____ (7) I have found that I needed larger amounts of alcohol to feel any effect, or that I could no longer get high or drunk on the amount that used to get me high or drunk.
- _____ (8) When drinking, I have done impulsive things I regretted later.
- _____ (9) I've not been able to remember large stretches of time while drinking heavily.
- _____ (10) I have driven a car when I knew I had too much to drink to drive safely.
- _____ (11) I have not gone to work or missed classes at school because of drinking, a hangover, or illness caused by drinking.
- _____ (12) My drinking has gotten me into sexual situations I later regretted.
- _____ (13) I have often found it difficult to limit how much I drink.
- _____ (14) I have become very rude, obnoxious, or insulting after drinking.
- _____ (15) I have woken up in an unexpected place after heavy drinking.
- _____ (16) I have felt badly about myself because of my drinking.

- _____ (17) I have had less energy or felt tired because of my drinking.
- _____ (18) The quality of my work or school work has suffered because of my drinking.
- _____ (19) I have spent too much time drinking.
- _____ (20) I have neglected my obligations to family, work, or school because of drinking.
- _____ (21) My drinking has created problems between myself and my
boyfriend/girlfriend/spouse, parents, or other near relatives.
- _____ (22) I have been overweight because of drinking.
- _____ (23) My physical appearance has been harmed by my drinking.
- _____ (24) I have felt like I needed a drink after I'd gotten up (that is, before breakfast).

APPENDIX F**Protective Behavioral Strategies**

Please indicate the degree to which you engage in the following behaviors when using alcohol or “partying”, where

1 = Never

2 = Rarely

3 = Occasionally

4 = Sometimes

5 = Usually

6 = Always

_____ (1) Use a designated driver

_____ (2) Determine not to exceed a set number of drinks

_____ (3) Alternate alcoholic and nonalcoholic drinks

_____ (4) Have a friend let you know when you’ve had enough to drink

_____ (5) Avoid drinking games

_____ (6) Leave the bar/party at a predetermined time

_____ (7) Make sure that you go home with a friend

_____ (8) Know where your drink has been at all time

_____ (9) Stop drinking at a predetermined time

_____ (10) Drink water while drinking alcohol

_____ (11) Put extra ice in your drink

_____ (12) Avoid mixing different types of alcohol

- _____ (13) Drink slowly, rather than gulp or chug
- _____ (14) Avoid trying to keep up or out-drink others
- _____ (15) Refuse to ride in a car with someone who has been drinking
- _____ (16) Only go out with people you know and trust
- _____ (17) Avoid combining alcohol with marijuana
- _____ (18) Avoid “pregaming” (i.e., drinking before going out)
- _____ (19) Make sure you drink with people who can take care of you if you drink too much
- _____ (20) Eat before or during drinking

APPENDIX G**Perceived Effectiveness of PBS**

In the past 30 days, when you used each strategy, how effective was it in helping you to reduce your alcohol use and limit alcohol related consequences when using alcohol or “partying”, where

1 = Not very effective

2 =

3 = Neutral

4 =

5 = Very effective

6 = Did not use strategy

_____ (1) Use a designated driver

_____ (2) Determine not to exceed a set number of drinks

_____ (3) Alternate alcoholic and nonalcoholic drinks

_____ (4) Have a friend let you know when you’ve had enough to drink

_____ (5) Avoid drinking games

_____ (6) Leave the bar/party at a predetermined time

_____ (7) Make sure that you go home with a friend

_____ (8) Know where your drink has been at all time

_____ (9) Stop drinking at a predetermined time

_____ (10) Drink water while drinking alcohol

_____ (11) Put extra ice in your drink

_____ (12) Avoid mixing different types of alcohol

- _____ (13) Drink slowly, rather than gulp or chug
- _____ (14) Avoid trying to keep up or out-drink others
- _____ (15) Refuse to ride in a car with someone who has been drinking
- _____ (16) Only go out with people you know and trust
- _____ (17) Avoid combining alcohol with marijuana
- _____ (18) Avoid “pregaming” (i.e., drinking before going out)
- _____ (19) Make sure you drink with people who can take care of you if you drink too much
- _____ (20) Eat before or during drinking

APPENDIX H

Importance of PBS

Please rate the degree to which you agree with the following statements, where

1 = Not at all Agree

2 = Slightly Disagree

3 = Neutral

4 = Slightly Agree

5 = Completely Agree

___ (1) When drinking alcohol, people should use strategies to reduce harmful consequences.

___ (2) When drinking alcohol, people should make sure to avoid annoying aftereffects like hangovers.

___ (3) When drinking alcohol, people should take steps to make sure they stay in control of themselves.

___ (4) When drinking alcohol, people should use strategies to make sure they don't drink too much.

___ (5) When drinking alcohol, people should control their drinking so that they don't experience any problems later.

___ (6) When drinking alcohol, I should use strategies to reduce harmful consequences.

___ (7) When drinking alcohol, I should make sure to avoid annoying aftereffects like hangovers.

___ (8) When drinking alcohol, I should take steps to make sure I stay in control of myself.

___ (9) When drinking alcohol, I should use strategies to make sure I don't drink too much.

___ (10) When drinking alcohol, I should control my drinking so that I don't experience any problems later.

APPENDIX I**Attention Checks**

1. Which is the LARGEST number?

1 = 13

2 = 27

3 = 68

4 = 89

2. Select *Rarely* for this question.

1 = Never

2 = Rarely

3 = Occasionally

4 = Sometimes

5 = Usually

6 = Always

3. Select *Did not use strategy* for this question.

1 = Not very effective

2 =

3 = Neutral

4 =

5 = Very effective

6 = Did not use strategy

4. Select *Slightly Agree* for this question.

1 = Not at all Agree

2 = Slightly Disagree

3 = Neutral

4 = Slightly Agree

5 = Completely Agree

APPENDIX J**Demographic Information**

How old are you (in years)?

What is your weight (in pounds)?

What is your height?

Feet:

Inches:

What racial group best describes you? (select all that apply)

1 = African American or Black

2 = Asian or Pacific Islander

3 = Caucasian or White

4 = Native American

5 = Other

If Other is selected for race:

Describe Other for race.

Are you Hispanic or Latino?

1 = Yes

2 = No

What is your gender?

1 = Male

2 = Female

3 = Gender non-binary

4 = Other

If Other is selected for gender:

Describe Other for gender.

What is your marital status?

1 = Single

2 = Married

3 = Divorced

4 = Engaged

5 = Other

If Other is selected:

Describe Other for marital status.

What is your student status?

1 = Full-time

2 = Part-time

What is your class standing?

1 = Freshman

2 = Sophomore

3 = Junior

4 = Senior

5 = Graduate

6 = Non-Degree Seeking

VITA

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Addiction Research & Theory, 1-8. doi: 10.1080/16066359.2020.1751129.

Experience

Graduate Research Assistant 2018 – 2019

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- Coordinated data collection
- Managed and trained undergraduate research assistants
- Created didactic presentations for the undergraduate research assistants
- Managed participant scheduling and tracked study participation
- Sent text message and email reminders to participants
- Contributed to manuscripts, conducted literature reviews, and analyzed data

Graduate Teaching Assistant 2018 – 2019

Old Dominion University, Norfolk, VA

- Psychology 363 - Psychology of Sex
Fall 2017 (online), Spring 2018 (online)
- Psychology 408 - The Psychology of Personality
Spring 2018 (online)