Social Group Membership and Risk-Taking Behaviors Among College Students with ADHD Symptoms

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Abstract

Young adults with attention-deficit/hyperactivity disorder (ADHD) symptoms are more likely than their peers to engage in risk-taking behaviors, including harmful alcohol use, consumption of illicit drugs, and risky sexual behaviors. These behaviors become more common in the general population of young adults as they enter college, particularly for those who join social groups such as Greek life and athletics. It is unclear whether the presence of significant ADHD symptoms is related to engagement in risky behaviors particularly among students who participate in various social activities. We examined: (a) the degree to which inattentive and hyperactive-impulsive symptoms predict risk-taking behavior for a sample of 395 college students, and (b) whether the relationship between ADHD symptoms and risk-taking behavior is moderated by participation in social activities. Results indicated that more significant ADHD symptoms are associated with increased risk-taking behaviors, including harmful alcohol consumption, illicit drug use, and risky sexual behavior. Additionally, social group membership was predictive of increased risk-taking in some cases, particularly for students affiliated with Greek organizations. Findings demonstrate the need for universities to implement preventive programs for students with ADHD symptoms and those in social groups, especially Greek life, to minimize the likelihood of negative outcomes associated with risk-taking.

Keywords: Attention-deficit/hyperactivity disorder, college students, risk-taking behavior, social organizations

Attention-deficit/hyperactivity disorder (ADHD), estimated to affect 5% of the population, is a condition characterized by developmentally atypical levels of inattention, hyperactivity, and/or impulsivity (American Psychiatric Association, 2013; Willcutt, 2012). Behaviors associated with the disorder become apparent in early childhood, and symptoms tend to persist across adolescence and adulthood (Barkley, 2002; Biederman et al., 2006; Bussing, Mason, Bell, Porter, & Garvan, 2010). Individuals with clinically significant ADHD symptoms experience difficulties across several domains of functioning, including social and emotional impairments. For example, they may struggle to maintain prolonged reciprocal interactions, which is perceived as being unaware of their peers' feelings and needs and leads to difficulties in developing friendships (Cordier, Bundy, Hocking, & Einfeld, 2010a, 2010b). Children with ADHD often have difficulty with sharing, cooperation, turn taking, and other play behaviors, which is viewed by peers as intrusive, overbearing, or disinterested (Barkley, 2002). These social challenges in childhood often translate to more problematic social behaviors in young adulthood.

ADHD and Risk-Taking Behavior among Young Adults

Some of the common features of ADHD, such as failing to consider consequences before taking action or having difficulty following rules, are associated with risk-taking behaviors among young adults with ADHD. One such behavior is illegal and dangerous

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use of alcohol and other drugs. Research regarding alcohol and drug use among young adults with ADHD has yielded mixed results. Some studies, for example, have found that youth with ADHD initiate use of alcohol and drugs, such as marijuana or cocaine, earlier than their peers (Bidwell, Henry, Willcutt, Kinnear, & Ito, 2014; Dunne, Hearn, Rose, & Latimer, 2014). Young adults with ADHD also are more likely to report underage consumption of alcohol, use of marijuana, and experimentation with other drugs (Bidwell et al., 2014; Dunne et al., 2014; Lee, Humphreys, Flory, Liu, & Glass, 2011). Further, research has demonstrated an association between symptom severity and alcohol and marijuana use, with individuals exhibiting greater ADHD symptom severity engaging in more substance use (Molina & Pelham, 2003; Upadhyaya & Carpenter, 2008). Alternatively, other research has found no significant impact of ADHD symptoms on substance use (Baker, Prevatt, & Proctor, 2012; Bussing et al., 2010). Janusis and Weyandt (2010) found mixed results in a college sample; students with ADHD were less likely to use alcohol, but more likely to use or misuse prescription stimulant medication than peers without significant symptoms.

Although it is unclear whether young adults with ADHD are more likely to consume alcohol underage or use drugs, several studies have suggested that these individuals engage in more problematic drinking behaviors and have more negative alcohol-related consequences. College students with ADHD are more likely than their peers to have difficulty limiting their alcohol consumption after they have started, drink to the point of blacking out, drive after drinking or using drugs, suffer a physical injury while under the influence, and have more alcohol-related conflict with their significant other (Baker et al., 2012; Lee et al., 2011; Rooney, Chronis-Tuscano, & Yoon, 2012; Wilens & Biederman, 2006). Heavier alcohol use among college students with ADHD tends to be predictive of overall impairment, as well as problems with social relationships, ability to carry out daily activities, and in sexual interactions (Langberg, Dvorsky, Kipperman, Molitor, & Eddy, 2014).

In addition to risk-taking by using illicit drugs and alcohol, young adults with significant ADHD symptoms are more likely than their peers to engage in risky sexual behavior (Brown et al., 2010). Elevated ADHD symptoms are predictive of earlier initiation of sexual activity (Barkley, 2002; Flory, Molina, Pelham Jr., Gnagy, & Smith, 2006; Galéra et al., 2010) as well as having a higher number of sexual partners and more frequent casual sexual encounters (Flory et al., 2006; Hosain, Berenson, Tennen, Bauer, & Wu, 2012).

Elevated Risk-Taking Among College Students

College is a unique developmental period when young adults are expected to take on increased responsibility with decreased support from parents and educators. In contrast to the highly structured routine of high school, the college setting allows individuals to make more choices about their academic, social, and personal activities. This can be particularly difficult for students with ADHD, whose symptoms influence how they cope with more intensive academic and social demands, less parental support, and higher expectations for self-management (Weyandt et al. 2013; Wolf, Simkowitz, & Carlson, 2009). In addition to the new academic world all college students face as they begin their undergraduate career, they enter a new social world as well. One choice all college students must make is the types of social commitments in which they would like to become involved, including Greek life, athletics, or other social groups.

Research has found an association between involvement in particular college social groups and increased likelihood of risk-taking behavior. Students in Greek organizations engage in underage alcohol use more frequently, drink more heavily, and are more likely to use illicit drugs than students who are not in Greek organizations (Bartholow, Sher, & Krull, 2003; Caudill et al., 2006; Dussault & Weyandt, 2013; Larimer, Anderson, Baer, & Marlatt, 2000; Scott-Sheldon, Carey, & Carey, 2008; Wechsler, Kuh, & Davenport, 2009). Similarly, college athletes participate in underage binge drinking more often than non-athletes (Ford, 2007; Green, Nelson, & Hartmann, 2014; Lisha & Sussman, 2010; Martens, Dams-O'Connor, & Beck, 2006). Research regarding illicit drug use among college athletes is mixed, with some studies finding them to be more likely than non-athletes to use drugs and others showing they are less likely than their peers to do so (Lisha & Sussman, 2010). In contrast to findings on Greek life and athletics, there is some evidence that being in a committed relationship can act as a protective factor against risk-taking for college students. Those in committed relationships in college tend to binge drink less often, have fewer sexual partners, and report fewer mental health problems than students who are not in relationships (Braithwaite, Delevi, & Fincham, 2010). The current study will assess whether it could benefit professionals working with college students with ADHD symptoms to identify social groups that may serve as "red flags" (e.g., Greek life) versus those that are hypothesized to be protective factors (e.g., relationship status), based on current research.

There may be differences in risk-taking behavior between males and females in college social groups.

Studies have found that males in fraternities tend to drink more than females in sororities (Capone, Wood, Borsari, & Laird, 2007; Iwamoto, Cheng, Lee, Takamatsu, & Gordon, 2011; Larimer et al., 2000) and male athletes consume more alcohol and binge drink more frequently than female athletes (Yusko, Buckman, White, & Pandina, 2008). Gender effects must be explored further in research involving college students, including the degree to which social group membership influences the relationship between gender and risk-taking.

The Current Study

It is clear that participation in risky activities is a normative part of the college experience, especially for students in certain social groups (e.g., Greek life, athletics). Past research has demonstrated that adolescents and young adults with ADHD symptoms are prone to engaging in risk-taking behaviors, but it remains unclear what factors, other than their core symptoms, influence them to do so. As such, the current study aimed to address these gaps through two research questions:

1. How well does ADHD symptom frequency predict risk-taking behaviors (i.e., sexual risk-taking, alcohol use, and illicit drug use) among college students? Based on prior literature (e.g., Brown et al., 2010; Upadhyaya & Carpenter, 2008), it was hypothesized that that higher symptom frequency would predict increased risk-taking.
2. In what ways does participation in social activities (i.e., Greek life, sports teams, and committed relationships) moderate the relationship between ADHD symptom frequency and risk-taking behaviors in college students? Based on existing research support (e.g., Bartholow et al., 2003; Ford, 2007), it was hypothesized that higher symptom frequency would interact with engagement in Greek life or sports teams to predict increased risk-taking across all three risky behaviors of interest. Conversely, it was hypothesized that the interaction between being in a committed relationship and symptom frequency would predict lower risk-taking across all three risky behaviors based on prior research by Braithwaite and colleagues (2010).

Method

Participants

Participants for this study were recruited through the Trajectories Related to ADHD in College (TRAC) project, a longitudinal study examining the experiences of college students with and without ADHD. First-year student participants were assessed annually over four years of college. Two waves of participants were recruited across two years, resulting in the total sample. Data from Year 2 for each cohort were used for the current study because that is the year in which students typically have established their membership in certain social groups, such as Greek life. The original TRAC project sample included 456 college students from nine colleges and universities, with 228 students each in the original ADHD and comparison groups (see Anastopoulos et al., 2016 for details regarding sample characteristics). There were 395 students who returned to the study in Year 2; those students served as the sample for the current study, for which the sample consisted of 207 females (52.4%) and was primarily Caucasian (71.9%). Participants ranged in age from 18 to 23 years old ($M = 19.23$; $SD = 0.55$).

Procedures

College students were recruited through fliers, Facebook posts, freshman orientation sessions, office of disability service referrals, and visits to speak with freshman classes. Recruitment efforts elicited self-referrals from students who believed they may meet criteria for the study. A formal diagnosis was not required. During Year 1 for each cohort, students who expressed interest in the study participated in a screening assessment with a research assistant to determine eligibility for the ADHD or comparison group. Following screening assessments, a panel of four experts reviewed participant responses to determine group designation. The panel included the three primary investigators and another expert in the field with extensive knowledge of adult ADHD. Eligible students then met with a research assistant one to two more times to complete questionnaires, interviews, and tasks.

Screening Measures

ADHD rating scales. Three different versions of the same questionnaire were administered to obtain the participant's ratings of his or her ADHD symptoms in childhood and over the past 6 months, as well as the participant's parent's ratings of the participant's ADHD symptoms as a child and over the past 6 months. Parent data were gathered via rating scales sent to participants' parents' homes in the mail.

The ADHD Rating Scale-IV (DuPaul, Power, Anastopoulos, & Reid, 1998) was originally developed to collect parent and teacher ratings of a child or adolescent's ADHD symptoms. The scale was adapted for the purposes of the current study to serve a new purpose as a self-report measure, in addition to one of its original purposes as a parent report measure. Possible eligibility for the ADHD group was indicated by endorsement of four or more symptoms of inattention, hyperactivity-impulsivity, or both. Both categories of symptoms had to be present in childhood (prior to age 12) and currently (in the past 6 months at the time of data collection). Students were eligible for the control group if they reported three or fewer symptoms in both categories in childhood and in the past 6 months. Cronbach's alpha coefficients for the current sample ranged from 0.75 to 0.96 for the two symptom categories across versions of the scale.

Semi-Structured ADHD interview. A semi-structured interview was created to evaluate the presence of ADHD symptoms and their impact on the student's life. This measure consisted of two sets of nine questions, one assessing inattention symptoms and one assessing hyperactivity-impulsivity symptoms, and for each symptom the potential impact on daily functioning was assessed. Initial criteria for the ADHD group were six or more symptoms in either or both symptom categories, and the presence of symptoms prior to age 12. The criteria changed for the second cohort of participants when the DSM-5 was released; at that point, participants met criteria for the ADHD group if they reported five or more symptoms and the presence of symptoms prior to age 12. Because DSM-5 criteria are less stringent than DSM-IV-TR criteria, all participants in the ADHD group met DSM-5 criteria for ADHD. The criterion for the control group was no more than 3 symptoms indicated on both sets of questions.

Structured Clinical Interview for DSM Disorders (SCID-I; First, Spitzer, Gibbon, & Williams, 1996). The SCID-I was used to examine the presence of clinical disorders other than ADHD. Interview findings and supplemental notes from graduate student assistants were reviewed by the same panel of four experts who reviewed the initial screening measures. A potential participant would be excluded from the study if it was believed that their ADHD symptoms could be better explained by another disorder (e.g., generalized anxiety disorder, major depression).

Predictor and Outcome Variables

Demographic form. Participants reported demographic information, including age, gender, race, and ethnicity during their initial assessments each year. Gender was included as a covariate in the current study.

Conners' Adult ADHD Rating Scale – Self Report: Long Version (CAARS). The CAARS (Conners, Erhardt, & Sparrow, 1999) is a rating scale designed to assess ADHD symptom frequency in adults. The measure contains 66 items rated by participants on a 4-point Likert scale, ranging from 0 (not at all/never) to 3 (very much/very frequently) intended to capture how often the rater demonstrates certain ADHD symptoms. According to the CAARS manual, the scale has adequate factorial, discriminant, and construct validity. The CAARS contains eight subscales; the *DSM-IV* Inattentive (IN) and *DSM-IV* Hyperactive-Impulsive (HI) Symptoms subscales were used as independent variables for the current study. Participant responses resulted in the following internal consistency reliability coefficients: (1) *DSM-IV* Inattentive Symptoms: 0.81 for males, 0.84 for females, (2) *DSM-IV* Hyperactive-Impulsive Symptoms: 0.64 for males, 0.75 for females.

Social history interview. A social history interview developed by the researchers was used to learn about participants' involvement in social activities, including Greek life participation, sports team involvement, and relationship status. Participants' answers to "current" items (three separate responses of "yes" or "no", indicating presence or absence of participation in each activity over the past year; e.g., "Are you currently in a fraternity or sorority?") were included in this study as moderator variables.

Alcohol, Smoking, and Substance Involvement Screening Test (ASSIST). The ASSIST (W.H.O. Group, 2002) is a structured interview designed to gather information regarding lifetime and current use of 10 types of substances. All substances on the scale except tobacco were examined in the study as dependent variables. Two separate dependent variables were created using the ASSIST, (1) the total score for all items related to alcohol and (2) the sum of the seven total scores for illicit drugs measured on the ASSIST (cannabis, cocaine, amphetamine type stimulants, inhalants, sedatives, hallucinogens, and opioids). It should be noted that the ASSIST variables in the current study reflect not only the quantity and frequency substance use, but also the degree of problematic use of alcohol and illicit drugs.

Sexual Risk Survey (SRS). The SRS (Turchik & Garske, 2009; Turchik, Walsh, & Marcus, 2015) is a 23-item questionnaire used to evaluate sexual risk-taking behaviors among college students. Respondents completing the scale report the number of times they have engaged in certain sexual risk behaviors over the past 6 months. Frequencies are coded into five ordinal categories of 0 to 4 using the coding procedures recommended by Turchik et al. (2015) to avoid positively skewed data. A total risk score was

calculated by totaling responses to all the items, with a higher score indicating more engagement in risky sexual behaviors. The internal consistency for the scale is adequate, with a Cronbach's alpha of 0.90.

Data Analytic Procedure

First, descriptive statistics for all measures were calculated. Assumptions were checked before analyses, including normality using skewness and kurtosis, linearity using tolerance and VIF measures, and outliers using Cook's *D* and studentized residuals. A post-hoc power analysis using G-Power3 software (Faul, Erdfelder, Lang, & Buchner, 2007) indicated that the sample size allowed sufficient power (.80) to detect a medium effect size.

Research question 1. Simultaneous multiple linear regression was used to answer the first research question regarding the degree to which inattentive and hyperactive/impulsive symptoms predict risk-taking behaviors. Independent variables for this analysis were the CAARS *DSM-IV* Inattentive Symptoms and *DSM-IV* Hyperactive-Impulsive Symptoms subscale *T*-scores. Dependent variables were the total ASSIST alcohol score, the sum of the seven ASSIST illicit drug total scores, and the total score from the SRS. Gender was included as a covariate.

Research question 2. Hierarchical regression analyses were used to answer the second research question regarding the extent to which participation in social activities moderates the relationship between ADHD symptom frequency and risk-taking behaviors. Six different analyses were conducted to evaluate the interactions between the two symptom categories with the three social activity moderators. The independent and dependent variables were the same as those used for the first research question. Gender was also included as a covariate. Variables were entered in the following order: ADHD symptoms (CAARS inattentive or hyperactive/impulsive symptoms) and gender at Step 1, the moderating variable (Greek life, sports team, or committed relationship) at Step 2 to evaluate main effects, and the interaction term of each moderator (e.g., Greek life x inattentive symptoms) at Step 3. Six interaction terms were created to reflect interactions between each of the two ADHD symptom categories and each of the three social activities. Independent variables were centered to ensure invariance of slope coefficients and reduce multicollinearity of predictor variables.

Results

First, the distributional properties of all continuous independent and dependent variables were explored to evaluate the normality of the data. Skewness and kurtosis were in the recommended range of -2.00 to +2.00 (Lomax, 2001) for the CAARS IN T-score, CAARS HI T-score, and SRS total score. Skewness was outside of the recommended range for the ASSIST illicit drug score (2.88), and kurtosis was outside of the recommended range for both the ASSIST alcohol (3.71) and the ASSIST illicit drug (9.59) scores. Thus, a log+1 transformation, based on recommendations by Winer (1971), was used for both the ASSIST alcohol and ASSIST illicit drug scores. Skewness and kurtosis were in the acceptable range for both transformed variables, and the latter were used for all analyses.

Frequency data for each moderator variable found that 29.7% of participants endorsed involvement in Greek life, 25.6% endorsed sports team membership, and 33.5% reported being in a committed relationship at the time of data collection. It should be noted that there were only 20 students, 5.3% of the sample, who reported current participation in varsity sports. Thus, a new variable was created including students who reported any current sports team involvement, including varsity, club, and intramural teams (*n* = 97). The latter variable was used in analyses.

Linearity was examined for all predictor variables using tolerance and VIF measures, with all found to be in the acceptable range. Data for the outcome variables (ASSIST alcohol total, ASSIST illicit drug total, and SRS total) were tested for outliers, with Cook's *D* larger than 1.00 and studentized residuals outside of the -2.00 to +2.00 range considered indicative of outliers (Cook, 1977). All Cook's *D* statistics were in the acceptable range. There were studentized residuals outside of the recommended range for all three outcome variables, including six alcohol score data points, 11 illicit drug score data points, and 18 SRS total data points. Cases with outlier values remained in the data set because there were so few relative to the larger sample, and because students with the most extreme scores were of particular interest.

ADHD Symptoms and Risky Behavior

Simultaneous multiple linear regression was used to answer the first research question to assess the degree to which each predictor variable within a set of predictors contributed to a single outcome variable, with all predictors considered to be of similar importance in answering the research question. See Table 1 for more detailed results of initial model regression analyses.

Risky alcohol consumption. The regression model including gender, IN, and HI as independent variables was found to predict 6.8% of the variance in risky alcohol use, which is a significant amount of the variance explained ($p < .001$). Gender was the only significant predictor ($p = .009$) when the other independent variables were held constant. Males reported riskier alcohol consumption than females (transformed ASSIST alcohol total means: males = 0.72, females = 0.59; original ASSIST alcohol total means: males = 6.99, females = 4.67).

Illicit drug use. The regression model predicted 13.6% of the variance in risky illicit drug use, also a significant amount of variance explained ($p < .001$). IN symptom frequency significantly predicted drug use ($p = .012$) when HI and gender were held constant ($\beta = 0.176$; B = 0.006). This regression weight indicates that drug use increased as IN symptom frequency increased. HI did not predict drug use when IN and gender were held constant. Gender was also a significant predictor of drug use ($p < .001$) when IN and HI were held constant. Males reported riskier illicit drug use than females (transformed ASSIST illicit drug total means: males = 0.56, females = 0.30; original ASSIST illicit drug total means: males = 7.19, females = 2.77).

Sexual risk-taking. The regression model predicted 15.4% of the variance in sexual risk-taking, which is a significant amount of variance explained ($p < .001$). IN symptom frequency did not significantly predict sexual risk-taking, but HI symptom frequency did ($p < .001$; $\beta = 0.319$; B = 0.277), which is significant at the p = .01 level indicating that sexual risk-taking behavior increased as HI symptoms were more frequent. Gender also predicted sexual risk-taking ($p < .001$) when IN and HI symptom scores were held constant. Males ($M = 17.11$) reported a higher sexual risk-taking on the SRS than females ($M = 10.77$).

Social Moderators of ADHD and Risky Behavior

Next, moderators were added to the model and evaluated using hierarchical regression. Results in this section are broken down by risk-taking behaviors within each social group.

Greek life. First, all three risk-taking behaviors were analyzed based on Greek life status along with the independent variables and covariate assessed in the first research question (IN, HI, and gender). No significant interactions effects were found for any Greek life moderator analyses. Other results are reported below. See Table 2 for more detailed results.

Risky alcohol consumption. Without the interaction effect, the model including IN, gender, and Greek life participation significantly predicted risky alcohol consumption ($p < .001$), accounting for 13.7% of the variance. Each independent variable also significantly predicted risky alcohol consumption when the other predictors were held constant.

The model including only HI, gender, and Greek life significantly predicted alcohol scores ($p < .001$), accounting for 13.0% of the variance. Each independent variable in the HI model also significantly predicted risky alcohol consumption when the other independent variables were held constant.

Illicit drug use. The model excluding interaction effects found that, together, IN, gender, and Greek life participation significantly predicted drug use ($p < .001$), accounting for 14.9% of the variance. All predictors were also significant when the other predictors were held constant.

The model including only HI symptoms, gender, and Greek life significantly predicted 13.1% of the variance in drug use ($p < .001$). Within the model, each variable was also a unique predictor of drug use.

Sexual risk-taking. After removing the interaction effect, the model including IN, gender, and Greek life predicted 16.7% of the variance in sexual risk-taking, which is a significant amount of variance predicted ($p < .001$). All three independent variables were significant for predicting sexual risk-taking when the other two independent variables were held constant.

Excluding the interaction effect, the model with HI symptoms, gender, and Greek life significantly predicted sexual risk-taking ($p < .001$). This model predicted 20.0% of the variance. Again, all three independent variables were significant predictors when the others were held constant.

Sports teams. Each risk-taking behavior was then evaluated in regard to ADHD symptom dimension (IN and HI), gender, and sports team participation. No significant interaction effects were found with sports team participation as a moderator. Other results of sports team analyses are outlined below. See Table 3 for more detailed results.

Risky alcohol consumption. The model with only IN symptoms, gender, and sports team status significantly predicted risky alcohol consumption ($p < .001$), accounting for 9.0% of the variance. IN symptoms and sports team participation were both unique predictors at the $p < .001$ level when other variables in the model were held constant.

The model including HI symptoms, gender, and sports team participation accounted for 8.4% of the variance in risky alcohol use, which is a significantly amount of variance explained ($p < .001$). HI symptoms and sports involvement both significantly predicted alcohol use when the other predictors were held constant.

Illicit drug use. There was no significant main effect of sports team participation on drug use. The model excluding the interaction term and sports involvement, including only IN symptoms and gender, significantly predicted illicit drug use ($p < .001$), accounting for 12.7% of the variance. In the model with only the two significant predictors, IN symptoms and gender both significantly predicted illicit drug use when controlling for the other predictor.

Sports participation alone was also not a significant predictor of illicit drug use. Without the interaction term or sports team status, the model including only HI symptoms and gender accounted for 10.6% of the variance in drug use, which is a significant amount of variance explained ($p < .001$). HI symptoms and gender were both found to uniquely predict illicit drug use.

Sexual risk-taking. Findings for athletics and sexual-risk taking were similar to findings for athletics and illicit drug use. Sports participation alone was not a significant predictor of risky sexual behavior. The model with only IN symptoms and gender significantly predicted sexual risk-taking ($p < .001$), accounting for 10.5% of the variance explained. IN symptoms and gender were both significant predictors of risky sexual activity when controlling for the other predictor in the model.

Sports involvement alone did not significantly predict risky sexual behavior. The model including only HI symptoms and gender significantly predicted sexual risk-taking ($p < .001$), accounting for 14.5% of the variance. HI symptoms and gender both significantly predicted sexual risk-taking when the other predictor was held constant.

Committed relationships. The final social activity that was evaluated as a moderator of ADHD symptoms and risk-taking behavior was involvement in committed relationships. Results in this area are provided for all interaction effects tested, as there was one significant interaction effect found. See Table 4 for more detailed results of committed relationship analyses.

Risky alcohol consumption. The interaction term for IN symptoms and relationship status did not significantly predict alcohol use. The model with only IN symptoms, gender, and relationship status significantly predicted alcohol consumption ($p < .001$), accounting for 7.7% of the variance. IN, gender, and relationship status were all significant predictors of alcohol use when controlling for the other variables.

The interaction between HI symptoms and relationship involvement was also not a significant predictor of risky alcohol use. The model excluding the interaction term, with only HI symptom frequency, gender, and relationship status predicted 7.6% of the variance in alcohol use, a significant proportion of variance explained ($p < .001$). Within that model, each variable was also a unique significant predictor of risky alcohol consumption.

Illicit drug use. The interaction between IN symptoms and relationship status was not found to significantly predict drug use. Relationship status alone was also not a significant predictor. Without the interaction effect or relationship status, the model including only IN symptoms and gender significantly predicted illicit drug use ($p < .001$), accounting for 12.8% of the variance. IN symptom frequency and gender were both uniquely significant predictors of drug use when controlling for the other variable.

The interaction term for HI symptom frequency and relationship involvement, and relationship involvement alone both did not significantly predict illicit drug use. The model with only HI symptoms and gender accounted for 11.0% of the variance in drug use, a significant proportion of variance explained ($p < .001$). HI symptoms and gender both individually predicted drug use when the other predictor was held constant.

Sexual risk-taking. The interaction between IN symptoms and relationship status was not a significant predictor of risky sexual behavior. There also was no significant main effect of relationship involvement alone. Without the interaction effect or relationship status, the model including only IN symptom frequency and gender significantly predicted sexual risk-taking ($p < .001$), accounting for 11.2% of the variance. IN symptoms and gender were both unique significant predictors when controlling for the other predictor.

Finally, there was a significant interaction between HI symptoms and relationship status for predicting sexual risk-taking ($p = .015$). A means comparison found that single students with low HI symptoms reported engaging in less sexual risk-taking than students in relationships with low HI symptoms. However, single students with high HI symptoms reported more frequent risky sexual behavior than students in relationships with high HI symptoms. Relationship status alone did not significantly predict sexual risk-taking when controlling for the HI X Relationship interaction, HI symptoms, and gender. HI symptoms and gender both independently predicted risky sexual behavior at the $p < .001$ level when the other predictor variables were held constant.

Discussion

Findings Regarding ADHD and Risky Behavior

The model with the two ADHD symptom dimensions and gender predicted a significant amount of the variance in both alcohol consumption and illicit drug use. Males reported more extreme use of alcohol, and males as well as those with higher IN symptoms reported more dangerous use of illicit substances. These findings expand upon the large body of research suggesting that adolescents with more severe ADHD symptoms engage in more risk-taking related to alcohol and drug use than their peers with lower ADHD symptoms (Bidwell et al., 2014; Dunne et al., 2014; Lee, Humphreys, Flory, Liu, & Glass, 2011), indicating that this risk-taking pattern persists into young adults' college years.

Alternatively, these findings only partially support findings by Upadhyaya and Carpenter (2008) suggesting that more severe ADHD symptoms are associated with increased alcohol and drug use. For the college student sample in the current study, gender was a more significant predictor of risky alcohol consumption than ADHD symptoms, and only IN (not HI) symptoms were uniquely predictive of illicit drug use. This finding contradicts the expectation that students with high impulsivity would engage in more drug use because they would presumably act without considering the consequences of substance use. Perhaps the reason students with higher IN symptoms are more likely to use drugs is related to the theory offered by Diamond (2005), proposing that individuals with higher levels of inattention often feel understimulated by their environment and seek ways to feel more stimulated, in this case through illicit drug use.

The model also accounted for a significant amount of the variance in sexual risk-taking, with gender and HI symptoms being two unique significant predictors. Being male and having more frequent HI symptoms were predictive of increased reported risky sexual behavior. This supports past findings by Flory et al. (2006) and Monawar Hosain et al. (2012) suggesting that higher ADHD symptoms are associated with increased sexual risk-taking. Additionally, this study found that HI symptoms in particular are most highly predictive of risky sexual behavior.

Findings Regarding Social Moderators of ADHD and Risky Behavior

For risky alcohol consumption as an outcome, the percentage of variance accounted for increased by adding all three social moderators (Greek life participation, sports team involvement, and relationship status) to the original regression model. Students who reported higher alcohol use were those in Greek life, those playing on sports teams, and those who were single. When illicit drug use was added to each model, the percentage of variance accounted for slightly increased for Greek life, and decreased for sports team involvement and relationship status. Individuals in Greek life reported more illicit drug use than those not in Greek life.

The findings on Greek life confirm the large existing body of research on risky alcohol and illicit drug use in students with Greek life affiliations (e.g., Bartholow, Sher, & Krull, 2003; Scott-Sheldon, Carey, & Carey, 2008; Wechsler, Kuh, & Davenport, 2009). The largest change in variance explained for moderators of alcohol use was for students in Greek life organizations, suggesting that although it is important to consider several factors as predictors of dangerous alcohol use, Greek life may play the largest role in predicting risky alcohol-related behaviors in college students. Regression weights for illicit drug use were smaller for Greek life than for ADHD symptoms or gender, indicating that Greek life is a less important factor when predicting the likelihood of college students engaging in illicit drug use. Taking these results into consideration along with prior findings that students in Greek life use illicit substances more than their peers (Dussalt & Weyandt, 2013; Janusis & Weyandt, 2010; Scott-Sheldon et al., 2008), it seems that college students affiliated with Greek life are more still more likely than their peers to use illicit drugs, but that ADHD symptoms and gender are stronger predictors in this case.

Relative to the original models, Greek life affiliation increased the variance explained and sports team participation decreased the variance explained in sexual risk-taking. Students in Greek life reported more frequent risky sexual behavior than students not in Greek life. Sexual risk-taking analyses showed that Greek life, IN symptoms, HI symptoms, and gender were all relatively equivalent predictors of risky sexual behavior. This is a new finding in the literature, as most existing studies have conceptualized sexual risk-taking as a negative outcome of alcohol and drug consumption, rather than as an outcome of other factors, such as ADHD symptoms, gender, or social group membership. It seems that there are factors other than alcohol and drug use that university leaders should consider in initiatives targeting risk-taking in college students.

Also, sexual-risk taking analyses demonstrated an interaction effect for HI symptoms and relationship status. Single participants with low HI reported engaging in less frequent risky sexual behavior than participants in committed relationships with low HI

symptoms. Alternatively, single participants with high HI symptoms reported engaging in more sexual risk-taking than participants in relationships with high HI symptoms. This aligns with the hypothesis that being in a committed relationship would serve as a protective factor against risky sexual behavior for students with significant ADHD symptoms. This demonstrates that Braithwaite and colleagues' (2010) research applies particularly well to students presenting with higher levels of hyperactive-impulsive symptoms. Professionals working with college students with ADHD symptoms can use these findings to recognize potential protective factors and possible "red flags" in assessing the likelihood of those students engaging in sexual risk-taking. Future research should seek to better understand risky sexual behaviors in college students with ADHD symptoms to determine the needs of these students and to encourage safe sex practices.

In sum, results of the current study suggest that increased symptom frequency is predictive of increased risk-taking behavior in college students, with varying predictive strength across predictor-outcome pairs assessed. Alcohol consumption is the major outcome most strongly impacted by social group participation, particularly for students in Greek life and single students. It appears that the association between Greek life affiliation and alcohol use is exceptionally strong, which could be a result of the assumption college students may have that heavy alcohol use is the norm for students in Greek life. Both types of ADHD symptoms and gender were important predictors of some types of risk as well. Alternatively, illicit drug use was found to be more strongly predicted by ADHD symptoms (both IN and HI) and gender than by social group participation. Sexual risk-taking appears to be equally impacted by Greek life membership, ADHD symptoms, and gender.

A unique contribution of this study is the consideration of the independent impact of IN and HI symptoms to behavior in the first research question, versus the analysis of the two symptom types in tandem for the second research question. Both IN and HI presented as unique predictors of all types of risk assessed when analyzed separately in moderator analyses, as opposed to the first research question, which found that IN and HI symptoms were not significant predictors of risk. Results suggest that ADHD as a unitary concept is more strongly predictive of alcohol use than the two symptom dimensions separately, whereas the opposite is the case for illicit drug use and sexual risk-taking. This is an important distinction that represents the necessity of evaluating IN and HI symptoms separately in research to allow for a more complete understanding of the unique impact of both symptom types on behavior.

Implications for Practice

College students with more frequent ADHD symptoms are more likely than their peers to engage in all risky behaviors evaluated in the current study. Thus, students who are identified as having significant symptoms may benefit from risk prevention efforts or programs that teach safe practices for college students, similar to secondary level risk prevention practices universities currently use to target students affiliated with Greek life. This may include targeted efforts such as incorporating interventions into one-on-one coaching or counseling, or universal efforts such as university-wide programs for incoming students. Also, findings of this study demonstrate the importance of universities offering services to help students effectively manage their ADHD symptoms, which should in turn reduce dangerous or risk behaviors.

Notably, students affiliated with Greek life organizations are at greatest risk, even when controlling for ADHD symptom severity and gender. Although this is not a new finding, as it has been demonstrated in numerous prior studies, the current study demonstrates the ongoing need for universities to develop and test programs for preventing dangerous behaviors in Greek life communities at colleges and universities. Further, it should be noted that ADHD symptoms and gender were also significant predictors of risk when controlling for Greek life status; thus, efforts could focus on these risk factors as well. For example, college-based service providers may give special consideration to preventing risky behaviors in students with ADHD, and university initiatives may focus more on male students than female students within Greek life communities.

Limitations and Future Directions

Findings of the current study should be interpreted in light of the study's limitations. First, the transformation of alcohol and illicit drug variables limits the degree to which some results can be interpreted, though it can be noted that the non-transformed means were included in the comparison of means for each follow-up analysis for significant results and always aligned with the patterns found with the transformed data (e.g., transformed and non-transformed alcohol variable means were both higher for males than for females). Next, the TRAC Project, the larger study from which data for the current study were taken, dichotomized participants into ADHD and control groups. Students who were found to have only some ADHD symptoms, but not enough to be

considered clinically significant, were ineligible for the TRAC Project such that the sample excludes an important group of students those with subclinical ADHD symptoms. Also, participants were recruited in a way that created a relatively equal distribution of males and females in the ADHD and control groups (e.g., when the number of male participants recruited equaled approximately 50% of the goal number of ADHD participants, only female participants were accepted into the ADHD group). As such, the sample is not representative of population estimates of males and females with ADHD; population estimates vary across studies, but generally show a significantly higher likelihood of diagnosis in males versus females (Fayyad et al., 2007).

All data were self-report, which may impact the reliability and validity data based on the participants' understanding of interview questions and questionnaire items, and the degree to which participants accurately remembered their past behaviors. Additionally, the data only included students in their second year of college. The results can only be assumed to represent that group of students, not those who are new to college or those in their later years of college. Perhaps students who are new to social groups (often in their second year of college) behave differently than those who have been active in social groups for a year or two. Further, researchers should continue to explore other potential predictors of risk-taking, including pre-college functioning (e.g., binge drinking in high school), college life variables (e.g., living in a fraternity/sorority house versus other campus housing), and other individual factors (e.g., presence of comorbid disorders). The research base can continue to expand to include the effect of treatment on outcomes assessed in the current study. Perhaps certain forms of treatment can reduce the likelihood of risk-taking, even with the impact of important predictors, such as ADHD symptomatology or Greek life membership.

Conclusions

Prior research has found that young adults with significant ADHD symptoms are more likely than their peers to engage in risk-taking, including high alcohol consumption, illicit drug use, and risky sexual behavior. This is the first study to focus specifically on IN and HI symptoms separately as predictors of risk-taking in college students, with additional consideration of the effects of social activities on risky behavior. Findings showed that gender is a significant predictor of risky alcohol use, gender and IN symptoms predict illicit substance use, and gender and HI symptoms predict sexual risk-taking. Greek life presented as the social group with the most sig-

nificant impact on risk-taking, particularly for alcohol use. A notable interaction was found in which being in a committed relationship was a protective factor against risky sexual behavior for students in relationships with high HI symptoms, which was not the case for those with low HI symptoms. Findings of the current study can be applied to efforts by universities to minimize risk-taking and associated negative outcomes for students. Initiatives can be focused on groups found to be at the greatest risk, including those with high IN and HI symptoms, males, and students in Greek life. Future research can replicate and expand upon findings of this study and examine the best methods for preventing risky behaviors among college students, particularly those with significant ADHD symptomology.

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Table 1

Analyses of ADHD Symptoms and Gender as Predictors of Risk-Taking Behavior

Outcome	Multiple R^2	*F*(df)	*p*-value	Predictors	Unstd. Reg. Weight	Std. Reg. Weight	*p*-value
Alcohol Use	.068	9.333 (3)	< .001	IN	.003	.109	.132
				HI	.003	.116	.107
				Gender	.108	.130	.009
Illicit Drug Use	.136	20.073 (3)	< .001	IN	.006	.176	.012
				HI	.004	.121	.082
				Gender	.214	.209	< .001
Sexual Risk-Taking	.154	23.055 (3)	< .001	IN	-.022	-.029	.671
				HI	.277	.319	< .001
				Gender	5.491	.224	< .001

Table 2

Analyses of ADHD Symptoms and Gender as Predictors of Risk-Taking Behavior

Outcome	Multiple R^2	F(df)	*p*-value	Predictors	Unstd. Reg. Weight	Std. Reg. Weight	*p*-value
AlcoholxIN	.137	19.615 (3)	< .001	Interaction	-.002	.003	.342
				Greek	.255	.283	< .001
				IN	.004	.171	< .001
				Gender	.089	.107	.028
AlcoholxHI	.130	18.515 (3)	< .001	Interaction	-.004	-.087	.162
				Greek	.251	.278	< .001
				HI	.004	.151	.002
				Gender	.093	.112	.022
IllicitxIN	.149	21.631 (3)	< .001	Interaction	-.006	-.105	.076
				Greek	.156	.140	.004
				IN	.008	.260	< .001
				Gender	.203	.199	< .001
IllicitxHI	.131	18.629 (3)	< .001	Interaction	-.003	-.046	.461
				Greek	.148	.133	.007
				HI	.008	.223	< .001
				Gender	.211	.207	< .001
SRSxIN	.167	24.528 (3)	< .001	Interaction	-.019	-.015	.798
				Greek	6.683	.248	< .001
				IN	.139	.186	< .001
				Gender	5.309	.216	< .001
SRSxHI	.200	30.566 (3)	< .001	Interaction	-.021	-.015	.807
				Greek	6.197	.230	< .001
				HI	.227	.262	< .001
				Gender	5.187	.211	< .001

Note. The only data from Model 3 (which includes the interaction effect) of each analysis provided are the regression weights and *p*-value for the interaction effects. All other data are from Model 2 (which includes Greek life, IN/HI, and gender).

Table 3

Analyses of Sports Team Involvement as a Moderator Between ADHD Symptoms and Risk-Taking Behaviors

Outcome	Multiple R^2	*F*(df)	*p*-value	Predictors	Unstd. Reg. Weight	Std. Reg. Weight	*p*-value
AlcoholxIN	.090	12.123 (3)	< .001	Interaction	< .001	-.002	.974
				Sports	.180	.191	< .001
				IN	.005	.205	< .001
				Gender	.069	.084	.101
AlcoholxHI	.084	11.220 (3)	< .001	Interaction	-.002	-.033	.559
				Sports	.171	.181	< .001
				HI	.006	.188	< .001
				Gender	.074	.089	.082
IllicitxIN	.128	18.020 (3)	< .001	Interaction	-.001	-.012	.830
				Sports	.021	.018	.711
				IN	.008	.271	< .001
				Gender	.206	.202	< .001
IllicitxHI	.099	14.594 (3)	< .001	Interaction	-.001	-.013	.819
				Sports	.005	.004	.930
				HI	.008	.225	< .001
				Gender	.215	.212	< .001
SRSxIN	.111	15.252 (3)	< .001	Interaction	-.052	-.034	.550
				Sports	2.284	.082	.102
				IN	.154	.211	< .001
				Gender	5.124	.212	< .001
SRSxHI	.150	21.606 (3)	< .001	Interaction	.013	.007	.900
				Sports	2.156	.078	.113
				HI	.247	.290	< .001
				Gender	4.980	.206	< .001

Note. The only data from Model 3 (which includes the interaction effect) of each analysis provided are the regression weights and *p*-value for the interaction effects. All other data are from Model 2 (which includes Greek life, IN/HI, and gender).

Table 4

Analyses of Relationship Status as a Moderator Between ADHD Symptoms and Risk-Taking Behaviors

Outcome	Multiple R^2	F(df)	p-value	Predictors	Unstd. Reg. Weight	Std. Reg. Weight	p-value
AlcoholxIN	.077	10.281 (3)	< .001	Interaction	.003	.066	.310
				Relationship	-.125	-.143	.005
				IN	.005	.204	< .001
				Gender	.086	.103	.042
AlcoholxHI	.076	10.148 (3)	< .001	Interaction	.001	.014	.816
				Relationship	-.123	-.141	.005
				HI	.006	.201	< .001
				Gender	.086	.103	.042
IllicitxIN	.128	18.121 (3)	< .001	Interaction	< .001	-.007	.907
				Relationship	-.026	-.024	.617
				IN	.008	.267	< .001
				Gender	.210	.206	< .001
IllicitxHI	.110	15.202 (3)	< .001	Interaction	.001	.012	.840
				Relationship	-.022	-.020	.681
				HI	.008	.229	< .001
				Gender	.214	.211	< .001
SRSxIN	.107	15.705 (3)	< .001	Interaction	-.051	-.045	.483
				Relationship	-1.099	-.044	.379
				IN	.153	.212	< .001
				Gender	5.557	.232	< .001
SRSxHI	.155	18.495 (4)	< .001	Interaction	-.209	-.144	.015
				Relationship	-1.143	-.045	.345
				HI	.320	.378	< .001
				Gender	5.209	.218	< .001

Note. The only data from Model 3 (which includes the interaction effect) of each analysis provided are the regression weights and *p*-value for the interaction effects. All other data are from Model 2 (which includes Greek life, IN/HI, and gender).