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Different pathways explain alcohol related problems in female and male college students

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Abstract

Objectives—Comprehensive models elucidating the intricate associations of depressive symptoms, coping motives, alcohol use, alcohol-related problems (ARP) and gender among young adults have been scarcely examined. This study investigated relationships among these variables and the effect of gender on these pathways.

Methods—College students ($N = 163$; 49.7% female) completed self-report measures on alcohol consumption, depressive symptoms, coping motives, and ARPs.

Results—Structural equation modeling showed that the association between depressive symptoms and ARPs was mediated by coping motives in both females and males. However, frequency of heavy alcohol use mediated the association between depressive symptoms and ARPs in females but not in males.

Conclusions—Different models explain the association between depressive symptoms and ARPs in male and female college students. Prevention programs aimed at reducing ARPs should focus on increasing alcohol screening among students with depressive symptoms, teaching coping skills, and emphasizing moderation in alcohol consumption.

Keywords

Gender; depression; alcohol problems

Introduction

The college years represent a critical period of role transition and adjustment that is characterized by a new level of independence and increased pressures and responsibilities.¹ Many college students experience depressive symptoms; approximately 10% of individuals meet criteria for Major Depressive Disorder² (MDD) and 30% report feeling so sad at least once in the previous year that they were unable to function³. Depressive symptoms constitute a significant risk factor for various health-compromising behaviors, including heavy episodic drinking (defined as consuming 4 standard drinks for women and 5 for men,⁴ and “binge drinking” constitutes this level of consumption within a 2-hour period⁵). Heavy alcohol use among college students constitutes an issue of great public health significance due to its association in this population with an array of adverse consequences including physical injuries, unsafe sex, sexual assaults, academic problems, and even death.^{6,7} The

rates of heavy episodic drinking among individuals with depressive symptoms are high. Almost 50% of students with depressive symptoms (even if subclinical) engage in heavy alcohol use⁸ and have increased odds of experiencing alcohol-related problems (ARPs).^{9–11} The high prevalence of heavy alcohol use and the potential for hazardous consequences among college students with depressive symptoms warrants an in-depth understanding of the factors that account for the association between depressive symptoms and ARPs.

Coping motives as mediators of depressive symptoms and ARPs

Coping motives (or drinking to cope) are among the most widely-researched variables to explain the relation between depression and ARPs. Coping motives are hypothesized to operate on the basis of negative reinforcement. This framework posits that individuals drink alcohol to escape negative affect.^{12,13} The association between depressive symptoms and coping motives has been supported in a number of studies.^{11,14} A large body of research has also shown a clear relation between coping motives and an increased risk for ARPs.^{9, 15–17} Moreover, two studies have shown that the association between depressive symptoms and ARPs is mediated by coping motives, even when controlling for amount of alcohol consumed.^{11,18}

Depression, coping motives, alcohol consumption and ARPs

The role of heavy alcohol consumption in the relationship between depression, coping and ARPs is unclear. While, heavy alcohol consumption has shown to be consistently associated with higher risk for ARPs^{19–21}, findings on the association between heavy drinking and depressive symptoms have been mixed. One study showed that higher depressive symptoms were associated with higher daily alcohol use among college students,²³ another reported the opposite effect,⁸ and a third one did not find an association.²⁴ Higher alcohol use has shown a direct association with coping motives^{25,26} and coping motives have shown to be directly related to ARPs, as well as indirectly through alcohol consumption.^{15,27} This findings suggest that students who drink to cope with negative affect may consume more alcohol and, as a result, experience increased ARPs. However, a direct association between coping motives and heavier alcohol use has not been observed in other studies,^{7, 28, 29} and in a longitudinal study the association between coping motives and ARPs was not mediated by alcohol use.³⁰ Finally, Read and colleagues²⁸ examined a motivational model that included drinking motives variables, alcohol use, and ARPs in a path analysis. The best-fit model showed a significant path from negative affect to coping motives and one from coping motives to ARPs. However, results did not demonstrate a path from coping motives to heavy alcohol use.

To date, research suggests the presence of direct and indirect associations among depressive symptoms, drinking to cope, alcohol use and ARPs that ought to be further studied. Currently, there are no comprehensive models testing a path from depressive symptoms to ARPs including both coping motives and heavy alcohol consumption. Therefore, it is unclear whether depressive symptoms are associated with higher ARPs via coping motives and heavier alcohol use and/or whether coping motives mediates the association independently from alcohol use. Most of current interventions to prevent alcohol-related problems have as the primary focus reduction of alcohol use. It is thus important to

determine the role of coping motives to improve upon current alcohol prevention and treatment programs.

Sex differences in depressive symptoms, coping motives, heavy alcohol use, and ARPs

A major hindrance to the understanding of pathways to ARPs in college students is that most studies have not considered the role of gender. Therefore, it is not possible to discern the extent to which the associations previously observed are applicable to both genders. This lack of clarity may be in part contributing to some of the contradictory associations between depression, coping motives, heavy alcohol use and ARPs. As an example of the gender differences, depressive symptoms tend to be more common among female than among male undergraduate students.^{31,32} Conversely, male college students drink more heavily and more often than female college students.^{4,33} Moreover, coping motives show gender differences. Park and colleagues⁹ observed that in a sample of 260 college students consuming alcohol, a greater proportion of male relative to female college students reported drinking to cope (55.4% vs 43%, respectively). Information on the effect of gender on the association between depressive symptoms and coping motives and ARPs is very limited. Park and colleagues⁹ showed that depressive symptoms were associated with ARPs in women but not male students. Conversely, evidence is accruing that suggests a differential relationship between negative affect and ARPs by gender, such that psychological distress, including higher levels of negative affect, may be more strongly associated with ARPs among male than female students. For example, Geisner and colleagues³⁴ documented that college students with higher psychological distress reported a significantly greater number of ARPs than those with lower distress and that this association was stronger in men than women. Similarly, in a sample of 191 students, Park and colleagues³⁵ observed a stronger association between negative affect and ARPs in men than in women ($r = .36; p < 0.01$ vs $r = .23; p < 0.05$). While Park and colleagues³⁵ controlled for alcohol consumption, Geisner and colleagues³⁴ did not. These findings warrant exploration regarding the generalizability of these results to the relationship between depressive symptoms and ARPs.

Further, the relationship between coping motives and ARP also appears to be differentially influenced by gender such that coping motives have a stronger association with ARPs in female than male students. Park and colleagues⁹ conducted bivariate correlations between coping motives and ARPs and they observed stronger associations in female students than in male students ($r = .35; p < 0.001$ vs $r = .21; p < .05$). In a path analysis, LaBrie and colleagues¹⁷ found that coping motives directly predicted ARPs in female but not male college students.

Collectively, studies in this area are limited and provide a disjointed picture. Specifically, it appears that the association between depressive symptoms and ARPs may be stronger in males than in females, that males tend to drink to cope more relative to females, and that coping motives may lead to ARPs in females more so than males. These findings may be due to the fact that the associations among depressive symptoms, coping motives, alcohol use and ARPs in female and male college students have been examined in a bivariate fashion and not in a comprehensive model. Therefore, the current study aimed to replicate and extend previous findings on models of ARPs by examining 1) the associations between

depressive symptoms and ARPs in male and in female college students, and 2) whether coping motives and heavy alcohol use differentially mediate these relationships by gender. We hypothesized that students with depressive symptoms would have higher ARPs and that this association will be explained by greater coping motives and higher heavy alcohol use. Given previously inconsistent findings we did not have specific hypotheses about the role of gender.

Methods

Participants

Participants were students in their freshman year at a large public university in the mid-Atlantic region of the US ($N = 163$), all of whom were between 18 and 20 years old ($M = 18.13$, $SD = .38$). The sample consisted of a comparable number of male and female students ($n = 81$ female students, 49.69%), and most participants identified as White/Caucasian (71.2%) and non-Hispanic (92%).

Procedure

This study was part of a larger investigation that assessed problematic drinking in college students. Participants were recruited over the course of three months through on-campus flyers as well as via community contacts. All prospective research participants completed a brief pre-screening telephone interview to determine eligibility for the research study. Those who met the following inclusion criteria – 18–19 years old and a freshman in college -- were invited to complete testing at the Institution where they provided their informed consent prior to engaging in any research activities. Completion of all study measures (see elsewhere for details)³⁶ occurred in a counterbalanced manner. Assessment sessions lasted approximately 1.5–2 hours. Participants received up to \$40 in remuneration if they completed all study components. The study received approval by the College's Internal Review Board.

Measures

Demographics—Participants provided information regarding age, sex, race, ethnicity, and education level.

Center for Epidemiologic Studies - Depression Scale (CES-D).³⁷—Current depressive symptoms were assessed with the CES-D. This scale was designed for use in non-psychiatric settings and is appropriate for use with this population. It includes six components: depressed mood; feelings of guilt and worthlessness; feelings of helplessness and hopelessness; psychomotor retardation; loss of appetite; and sleep disturbance. Respondents indicate how often within the last week they experienced the symptom in question, responding: “rarely or none of the time” (0); “some or little of the time” (1); “occasionally or a moderate amount of time” (2); and “most or all of the time” (3). The scores for the 20 items are added, resulting in a range of possible total scores from 0 to 60. The measure has very good internal consistency and satisfactory test–retest reliability over a 2- to 8-week period.^{37,38} Additionally, both convergent and construct validity have been established.³⁵ In the present study the Cronbach's Alpha for the CESD was .72.

The Brief Young Adult Alcohol Consequences Questionnaire (B-YAACQ).³⁹—

The B-YAACQ was used to assess drinking-related problems in the past year and past 30 days. The B-YAACQ is a brief unidimensional measure with good internal consistency and test-retest reliability^{39,40} that assesses dichotomously (yes/no) the occurrence of alcohol's impact on social and health functioning. Item examples include “not gone to work or missed classes at school,” “have said or done embarrassing things,” and “have driven a car when I knew I had too much to drink.” Higher scores indicate greater number of alcohol related problems. In our study the Chronbach's alpha for the B-YAACQ was .89.

Customary Drinking and Drug Use Record (CDDR).⁴¹—The CDDR is a research-focused, structured interview that measures alcohol and other drug use consumption and involvement for both recent (prior 3 months) and lifetime periods. Psychometric studies provide evidence that the CDDR is reliable over time and across interviewers (average one-week test-retest coefficients for all major content domains is .91), discriminates community youths from substance-abusing youths, and converges with alternate measures. In clinical settings, the CDDR aids in identifying substance involvement patterns. We computed frequency of heavy drinking, one of our variables of interest, on the bases of information collected with the CDDR. Heavy drinking was defined as consuming four standard drinks for women and five standard drinks for men in two hours during a drinking episode. The variable frequency of heavy drinking corresponded to the frequency of reported heavy drinking episodes in the past 30 days and higher numbers corresponded to higher frequency.

The Drinking Motives Questionnaire (DMQ).⁴²—The DMQ is a well-validated scale that measure drinking motives.⁴³ The scale includes four subscales: Coping, Social, Enhancement, and Conformity. Participants are asked to rate on a 5-point scale from almost never/never to almost always/always how frequently each of a list of 20 reasons motivates them to drink alcoholic beverages. The drinking to cope subscale has been validated by several studies and has good internal reliability.^{43,44} Examples of items in the drinking to cope subscale are: “to forget your worries”, “because it helps when you feel depressed or nervous”, “to cheer up when you are in a bad mood”, “because you feel more self confident and sure of yourself” and “to forget about your problems”. In our study the Cronbach's Alpha of the drinking to cope subscale of the DMQ was .78.

Data analyses

We first conducted t-tests to examine differences across gender on demographic information, and variables of interest including CESD, frequency of heavy drinking, and drinking motives. Subsequently we examined bivariate correlations among our variables of interest.

Path analyses

Structural equation modeling (SEM) procedures using Mplus statistical software package was employed to examine our hypothesized model (Figure 1). We examined two models: the first model grouped male and female students together (Figure 1), and the second model grouped male and female students separately.

Results

Table 1 illustrates differences on demographic variables and on the study variables in male and female college students. There were no significant differences on the demographic variables between men and women. Similarly, there were no significant differences between genders in severity of depressive symptoms, levels of coping motives, frequency of heavy alcohol use and number of ARPs.

Table 2 illustrates the bivariate simple correlations between ARPs, frequency of heavy alcohol use, depressive symptoms and coping motives in men and in women. The number of ARPs in the previous month was significantly associated with all of the variables of interest, with correlations ranging between .36 and .48 for men and between .31 and .66 for women. For both men and women, severity of depressive symptoms was associated with coping motives but not with frequency of heavy alcohol use. Finally, a significant association between coping motives and frequency of heavy alcohol use was present in women, but not among men.

Evaluation of model fit

We evaluated the model fit for the overall model and for the models grouping male and female separately using omnibus chi-square test and goodness of fit and comparative fit indices. We followed standard guidelines for model fit.⁴⁵ As such, a model is considered a good fit if the model χ^2 is non-significant, the Root Mean Square Error of Approximation (RMSEA) is not rejected and is lower than .05, the Comparative Fit Index (CFI) is greater than .95, and the Standardized Root Mean Square Residual (SRMR) is less than .08. Finally, we examined differences by gender in the indirect path, as well as, specific regression slopes within the second model (See table 3 for fit statistics). Finally, we assessed the possibility of multicollinearity in the predictor variables and confirmed that the variance inflation factors were below the critical value of 3.

Structural Path Model Analysis

The overall model was found to have good fit indices, χ^2 (df = 4) = 4.076, p = 0.3959, CFI = .99, RMSEA = 0.011 (90% C.I. = .000 – .119; probability <.05 = .59), SRMR = .03. The model's χ^2 was non-significant, which suggests good fit and significantly better than the baseline model χ^2 (df = 10) = 160.255, p < .001. The other fit indices also suggest that the overall model has good fit. Next we examined the paths in the overall model (Table 4). In the overall model, there was a significant direct path between depressive symptoms and coping motives (β = .41, p < .001) but the path between depressive symptoms and ARPs was not significant (β = .15, p > .05). The paths between coping motives and heavy alcohol use (β = .20, p < .05) and ARPs (β = .38, p < .001) were significant. Additionally, there was a significant path between heavy alcohol use and ARPs (β = .47, p < .001). The indirect path from depressive symptoms to ARPs through coping motives and heavy alcohol use was not significant (β = .05, p > .05), however, the indirect path through coping motives only was significant (β = .15, p < .001).

Pathways by gender

The second model examined the structural paths grouped by gender (Table 4). This model was also found to have good fit: χ^2 (df = 2) = .603, p = 0.7395, CFI = 1.00, RMSEA = 0.000 (90% C.I. = .000 – .153; probability <.05 = .78), SRMR = .016. The model's χ^2 was non-significant, so the exact-fit hypothesis is retained, which suggests that the model may have good fit and better than the baseline model which has a significant χ^2 ((df = 12) = 155.549, p < .000). Similar to the overall model, there were significant direct paths between depressive symptoms and coping motives, between coping motives and ARPs, and between ARPs and heavy alcohol use in both female and male students. However, there were important gender differences; there was a significant direct path between coping motives and heavy alcohol use in females (β = .30, p < .01) but not in males (β = .11, p > .05). We compared the standardized slopes between models of sex differences to examine which slope increase was higher. By examining slopes between males and females it appears that the paths from depressive symptoms to coping motives and from heavy alcohol use to ARPs in the model with female students was stronger compared to the model with male students. Finally, gender differences emerged in the indirect path from depressive symptoms to ARPs. Specifically, the indirect path through coping motives was significant for both males and females. In contrast, the indirect path through coping and drinking was significant for females but not for males.

Comments

The current study sought to extend understanding of the association between depressive symptoms, heavy alcohol use, coping motives and ARPs in college students. A primary aim of the study was to evaluate gender differences on the pathways to ARPs. Using structural equation modeling, we examined an overall model and one model grouped by gender. As anticipated, we observed some common pathways in males and females, yet important differences emerged. The association between depressive symptoms and ARPs was mediated by coping motives for males and females. However, a mediating path from depressive symptoms to coping motives to frequency of heavy alcohol use to ARPs was present in females but not males. These findings suggest that women with depressive symptoms may experience more ARPs due to drinking to cope with their negative mood that is associated with more frequent heavy drinking. This in turn, may result in ARPs. Women with depressive symptoms who consume alcohol as a strategy to cope with distress drink heavily more often, which may place them at greater risk for ARPs. Depressive symptoms in males were also associated with greater coping motives which showed a relation with greater ARPs. However, frequency of heavy drinking did not mediate the association between coping motives and ARPs. Thus, male students with depressive symptoms experience problems due to coping with their depressive symptoms by drinking alcohol, but the association between depressive symptoms and ARPs is not explained by more frequent heavy alcohol use.

Women with depressive symptoms who drink to cope, may drink heavily more frequently and may experience ARPs associated with the physiological sequelae of higher alcohol consumption. For example, they may experience hangover, falling, sleep problems, or doing

things that they later regret (because of lower inhibition). In the context of heavy alcohol consumption, female students with depressive symptoms may experience an overall worsening of their motivation, which in turn may contribute to more ARPs. Moreover, higher frequency of alcohol use may be associated with drinking during the week, which may be associated with poorer academic performance (failing tests, be late for classes).⁴⁶

As previously noted, males with depressive symptoms who drink to cope, similarly to females, experience greater ARPs. However, in men this association is not due to higher frequency of heavy alcohol use and thus may occur via a different pathway than the one observed in women. Drinking to cope is characterized by avoidance where individuals report a desire to relax, and to forget worries by drinking rather than problem-solve their distressing situation. Male students with depressive symptoms who drink to cope may opt to consume alcohol as an avoidance behavior and not address the causes of their distress. However, this avoidance may worsen the environmental problems that are occurring (i.e. not completing homework for a class where they are performing poorly, not going to work after having had problems). Merrill and Read's²⁷ observation that coping motives have a direct effect, independent on alcohol use, on specific ARPs including academic/occupational problems, risky behaviors and poor self-care, may support this interpretation of associations among male students. Moreover, alcohol consumption may exacerbate negative affect or irritability more so in male than female students and increase the risk for altercations or fights. Previously, we had reported a higher association between alcohol problems and irritability among male students with depressive symptoms relative to female students.⁴⁷ Finally, many variables have been found to increase ARPs in college students including impulsivity⁴⁸, poor adjustment¹⁷, influence of beliefs about alcohol's role in the college experience⁴⁹, perception of others' drinking⁵⁰, and personal goals.⁵¹ These variables may be potential mediators of the association between depressive symptoms and ARPs in male students. Additionally, male and female students report different types of ARPs^{19,51} which may explain why different pathways explain the association between depressive symptoms and ARPs between males and females.

Another gender difference observed is that the associations between depressive symptoms, coping motives and ARPs were stronger in female than male students. Similarly, Park and colleagues⁹ found a stronger association between depressive symptoms and ARPs in women but not in men. Conversely, Geisner and colleagues³⁴ found that psychological distress was associated with higher ARPs in male students relative to female and Park and colleagues³⁵ observed that negative consequences were associated with negative affect in male students but not in female students. Importantly, these studies include methodological differences that may explain this discrepancy. We employed a well-validated measure inquiring about a comprehensive list of ARPs (including 24 negative consequences) pertinent to college students³⁹ whereas Park and colleagues³⁵ inquired about a list of 12 different ARPs. The list of ARPs is relevant as it has been shown that women experience more problems in the personal realm but not in the social realm, and men report problem in both realms⁵³. Moreover, while the current study employed the CES-D³⁷ a widely validated of depression, Park and colleagues³⁵ employed the Positive and Negative Affective Scale⁵⁴ which assesses several components of negative affect including fear, hostility, and depressive symptoms. Similarly, Geisner and colleagues³⁴ evaluated psychological distress with the Brief

Symptom Inventory (BSI)⁵⁵ which includes nine symptoms subscales assessing depression as well as anxiety, hostility, phobic anxiety, paranoid ideation, somatization, obsessive-compulsive, interpersonal sensitivity, and psychoticism. Therefore, a more specific measure for depression such as the CES-D³⁷ may be able to better capture depressive mood separate from other negative states.

Treatment implications

Currently, only a minority of colleges are conducting systematic screenings of alcohol use among students.⁵⁶ Our findings of associations between depressive symptoms and alcohol-related problems in both male and female students is consistent with previous studies and underline the critical importance of screenings for heavy drinking among students with depressive symptoms who may present at student's health centers or counseling centers. With regard to treatment, evidence is accumulating suggesting that interventions targeting heavy alcohol use in college students are not as effective in students with co-occurring psychological symptoms. Merrill and colleagues⁵⁷ observed that Brief Motivational Intervention (BMI), a common treatment for heavy alcohol use in young adults, is less effective in reducing alcohol consumption for female students with depressive symptoms. Thus, it is important to determine factors that may be associated with drinking and ARPs among depressed students that may guide interventions for this population. Our findings suggest that students with depressive symptoms may experience more alcohol-related problems due to their tendency to cope with their negative affect by consuming alcohol, in particular female students. Thus, clinicians treating female and male students with depressive symptoms may focus on providing skills to cope with negative affect to reduce the risk of experiencing ARPs. Treatments like Cognitive Behavioral Therapy⁵⁸ improve emotion regulation skills⁵⁹ and may provide students with coping skills alternative to drinking.⁶⁰ Our findings also suggest that, given that different pathways lead to ARPs, clinicians ought to consider the gender of the patients when choosing how to approach treatment for heavy drinking. For example, treatment for female students with depressive symptoms may emphasize the importance of reducing heavy drinking to prevent ARPs and include information about the higher risk for ARPs in the context of consuming alcohol to cope with negative affect. Our findings, suggest that among male students with depressive symptoms factors other than more frequent heavier alcohol use may explain ARPs. Thus, clinicians treating male students with depressive symptoms may emphasize the risks associated with heavy alcohol use but also carefully analyze other behaviors that may put them at risk for ARPs.

Limitations

There are important limitations to the current study. First, given that the study utilized a cross-sectional design, it is not possible to determine causal relationship between the study variables. We examined whether the pathway between depressive symptoms and alcohol related problems was explained by drinking to cope and heavy episodic drinking and hypothesized that higher depressive symptoms would be associated with higher drinking to cope and heavier drinking and that these behaviors would lead to higher ARPs. However, some studies have shown that presence of heavy alcohol use among adolescents predicts later development of depression and there is some support for a bidirectional association

between depressive symptoms and heavy drinking in young adults (see summary in Pedrelli et al., 2016).⁶¹ Future prospective studies may further investigate causal paths between these variables. Second, our study included a convenience sample of freshmen students, thus findings may not generalize to non-freshmen students and to students in other colleges with dissimilar characteristics to the current sample. While the first year of college represents a time where many young adults start to drink or when alcohol use peak significantly,^{62–66} undergraduate students decrease their alcohol consumption over time.⁶⁷ Thus, different factors may be associated with heavy drinking and alcohol-related problems among freshmen students and among more senior students. However, several of our findings were consistent with those reported in studies including students in different years. Future studies may investigate which of the mechanisms at the bases of alcohol problems are stable throughout the college years and which ones are typical of specific years. Similarly, our sample was of convenience and it may have not been representative of the student body of the campus where the study was conducted. Our sample was similar to the student body of the campus where the study was conducted with regard to ethnic representation, gender distribution, living situation and typical alcohol use. Third, the small size of the study's sample is an additional limitation that must be considered. It is possible that our study did not have sufficient power to detect further relationships among the variables of interest. Future studies with larger samples ought to be conducted to determine whether our results will be replicated. Fourth, Students may have underreported their alcohol use for fear of social or legal consequences, or to respond in a more socially desirable way.⁶⁸ However, there is consistent support suggesting that self-report alcohol use among college students is not misrepresent.^{69,70} Fifth, we examined frequency of heavy drinking as a predictor of ARPs, however others have argued that weekly drinking may be a better predictor of problems.⁷¹ We examined the same model including weekly drinks instead of frequency of heavy drinking and the model had poor fit. Moreover, the magnitude of the associations between ARPs and frequency of heavy drinking and between ARPs and weekly drinking were similar suggesting that in this population frequency of heavy drinking may be an appropriate predictor of ARPs.

Conclusions

In summary, the current study extends prior research by indicating that the association between depressive symptoms and ARPs is mediated by different variables in male and female students. While greater coping motives and heavy alcohol use explain higher ARPs in female college students with depressive symptoms only coping motives explain ARPs in male college students with depressive symptoms. Findings suggest that prevention programs aiming at reducing ARPs should be gender-specific and should provide skills to cope with depressive symptoms alternative to consuming alcohol. Given the severe consequences associated with heavy alcohol use in college students, identifying factors associated with ARPs among college students has critical public health relevance. Moreover, given differences in alcohol use and in prevalence of depressive symptoms in male and female college students the role of gender ought to be examined when investigating pathways to ARPs in this population.

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References

1. Arnett JJ. Emerging adulthood. A theory of development from the late teens through the twenties. *Am Psychol*. 2000 May; 55(5):469–80. [PubMed: 10842426]
2. Dawson DA, Grant BF, Stinson FS, Chou PS. Psychopathology associated with drinking and alcohol use disorders in the college and general adult populations. *Drug Alcohol Depend*. 2005; 77(2):139–150. [PubMed: 15664715]
3. American College Health Association. American College Health Association-National College Health Assessment II: Undergraduate Reference Group Executive Summary. Hanover, MD: American College Health Association; Spring. 2012
4. Wechsler H, Davenport A, Dowdall G, Moeykens B, Castillo S. Health and behavioral consequences of binge drinking in college. A national survey of students at 140 campuses. *JAMA*. 1994; 272:1672–1677. [PubMed: 7966895]
5. Alcoholism, N.I.o.A.A.a. Moderate & Binge Drinking. 2013.
6. Hingson RW, Zha W, Weitzman ER. Magnitude of and trends in alcohol-related mortality and morbidity among U.S. college students ages 18–24, 1998–2005. *J Stud Alcohol Drugs*. 2009; 16:12–20.
7. Rosenberg H, Mazzola J. Relationships among self-report assessments of craving in binge-drinking university students. *Addict Behav*. 2007; 32:2811–2818. [PubMed: 17524566]
8. Cranford JA, Eisenberg D, Serras AM. Substance use behaviors, mental health problems, and use of mental health services in a probability sample of college students. *Addict Behav*. 2009; 34(2):134–45. [PubMed: 18851897]
9. Park CL, Levenson MR. Drinking to cope among college students: prevalence, problems and coping processes. *J Stud Alcohol Drugs*. 2002; 63:486–497.
10. Dennhardt AA, Murphy JG. Associations between depression, distress tolerance, delay discounting, and alcohol-related problems in European American and African American college students. *Psychol Addict Behav*. 2011; 25(4):595–604. [PubMed: 21988480]
11. Gonzalez VM, Bradizza CM, Collins R. Drinking to cope as a statistical mediator in the relationship between suicidal ideation and alcohol outcomes among underage college drinkers. *Psychol Addict Behav*. 2009; 23(3):443–451. [PubMed: 19769428]
12. Baker TB, Piper ME, McCarthy DE, Majeskie MR, Fiore MC. Addiction motivation reformulated: an affective processing model of negative reinforcement. *Psychol Rev*. 2004; 111(1):33–51. Review. [PubMed: 14756584]
13. Solomon RL, Corbit JD. An opponent-process theory of motivation. I. Temporal dynamics of affect. *Psychol Rev*. 1974; 81(2):119–45. [PubMed: 4817611]
14. Ralston TE, Palfai TP. Depressive symptoms and the implicit evaluation of alcohol: the moderating role of coping motives. *Drug Alcohol Depend*. 2012; 122(1–2):149–51. [PubMed: 21968339]
15. Carey KB, Correia CJ. Drinking motives predict alcohol-related problems in college students. *J Stud Alcohol Drugs*. 1997; 58(1):100–105.
16. Kenney SR, Paves AP, Grimaldi EM, LaBrie JW. Sleep quality and alcohol risk in college students: examining the moderating effects of drinking motives. *J Am Coll Health*. 2014; 62(5):301–8. [PubMed: 24588270]
17. LaBrie JW, Ehret PJ, Hummer JF, Prenovost K. Poor adjustment to college life mediates the relationship between drinking motives and alcohol consequences: a look at college adjustment, drinking motives, and drinking outcomes. *Addict Behav*. 2012; 37:379–386. [PubMed: 22177614]
18. Gonzalez VM, Reynolds B, Skewes MC. Role of impulsivity in the relationship between depression and alcohol problems among emerging adult college drinkers. *Exp Clin Psychopharmacol*. 2011; 19(4):303–13. [PubMed: 21480733]

19. Barnett NP, Clerkin EM, Wood M, Monti PM, O'Leary Tevyaw T, Corriveau D, Fingeret A, Kahler CW. Description and predictors of positive and negative alcohol-related consequences in the first year of college. *J Stud Alcohol Drugs*. 2014 Jan; 75(1):103–14. [PubMed: 24411802]
20. Park CL. Positive and negative consequences of alcohol consumption in college students. *Addict Behav*. 2004; 29(2):311–21. [PubMed: 14732419]
21. Read JP, Wardell JD, Bachrach RL. Drinking consequence types in the first college semester differentially predict drinking the following year. *Addict Behav*. 2013; 38(1):1464–71. [PubMed: 23017734]
22. Wechsler H, Nelson TF. Relationship between level of consumption and harms in assessing drink cut-points for alcohol research: Commentary on "Many college freshmen drink at levels far beyond the binge threshold" by White et al*. *Alcoholism: Clinical and Experimental Research*. 2006; 30:922–927.
23. Pedrelli P, Farabaugh AH, Zisook S, Tucker D, Rooney K, Katz J, Fava M. Gender, depressive symptoms and patterns of alcohol use among college students. *Psychopathology*. 2011; 44(1):27–33. [PubMed: 20980785]
24. Valentiner D, Mounts N, Deacon B. Panic attacks, depression and anxiety symptoms, and substance use behaviors during late adolescence. *Journal of Anxiety Disorders*. 2004; 18(5):573–585. [PubMed: 15275940]
25. Foster DW, Young CM, Steers M, Quist MC, Bryan JL, Neighbors C. Tears in your beer: Gender differences in coping drinking motives, depressive symptoms and drinking. *Int J Ment Health Addict*. 2014; 12(6):730–746. [PubMed: 25525419]
26. Lyvers M, Hasking P, Hani R, Rhodes M, Trew E. Drinking motives, drinking restraint and drinking behaviour among young adults. *Addict Behav*. 2010; 35(2):116–22. [PubMed: 19775821]
27. Merrill JE, Read JP. Motivational pathways to unique types of alcohol consequences. *Psychol Addict Behav*. 2010; 24:705–711. [PubMed: 20822194]
28. Read JP, Wood MD, Kahler CW, Maddock JE, Palfai TP. Examining the role of drinking motives in college student alcohol use and problems. *Psychol Addict Behav*. 2003; 17(1):13–23. [PubMed: 12665077]
29. Kenney SR, Lac A, Labrie JW, Hummer JF, Pham A. Mental health, sleep quality, drinking motives, and alcohol-related consequences: a path-analytic model. *J Stud Alcohol Drugs*. 2013; 74(6):841–51. [PubMed: 24172110]
30. Merrill JE, Wardell JD. Drinking motives in the prospective prediction of unique alcohol-related consequences in college students. *J Stud Alcohol Drugs*. 2014 Jan; 75(1):93–102. [PubMed: 24411801]
31. Barrios LC, Everett SA, Simon TR, Brener ND. Suicide ideation among US college students: Associations with other injury risk behaviors. *J Amer Coll Health*. 2000; 48:229–233. [PubMed: 10778023]
32. Ibrahim AK, Kelly SJ, Adams CE, Glazebrook C. A systematic review of studies of depression prevalence in university students. *J Psychiatr Res*. 2013; 47(3):391–400. [PubMed: 23260171]
33. Substance Abuse and Mental Health Services Administration. Results from the 2013 National Survey on Drug Use and Health: Summary of National Findings. Rockville, MD: Substance Abuse and Mental Health Services Administration; 2014. NSDUH 23 Series H-48, HHS Publication No. (SMA) 14-4863
34. Geisner I, Larimer ME, Neighbors C. The relationship among alcohol use, related problems, and symptoms of psychological distress: Gender as a moderator in a college sample. *Addict Behav*. 2004; 29(5):843–848. [PubMed: 15219328]
35. Park CL, Grant C. Determinants of positive and negative consequences of alcohol consumption in college students: alcohol use, gender, and psychological characteristics. *Addict Behav*. 2005; 30(4):755–765. [PubMed: 15833579]
36. MacPherson L, Calvin NT, Richards JM, Guller L, Mayes LC, Crowley MJ, Lejuez CW. Development and preliminary validation of a behavioral task of negative reinforcement underlying risk-taking and its relation to problem alcohol use in college freshmen. *Alcoholism: Clinical & Experimental Research*. 2012; 36(6):426–433.

37. Radloff LS. The CES-D Scale: A self-report depression scale for research in the general population. *Applied Psychological Measurement*. 1997; 1(3):385–401.
38. Stockings E, Degenhardt L, Lee YY, Mihalopoulos C, Liu A, Hobbs M, Patton G. Symptom screening scales for detecting major depressive disorder in children and adolescents: a systematic review and meta-analysis of reliability, validity and diagnostic utility. *J Affect Disord*. 2015 Mar 15;174:447–63. [PubMed: 25553406]
39. Kahler CW, Strong DR, Read JP. Toward efficient and comprehensive measurement of the alcohol problems continuum in college students: The Brief Young Adult Alcohol Consequences Questionnaire. *Alcoholism: Clinical and Experimental Research*. 2005; 29(7):1180–1189.
40. Read JP, Kahler CW, Strong DR, Colder CR. Development and preliminary validation of the Young Adult Alcohol Consequences Questionnaire. *J Studies on Alcohol*. 2006; 67(1):169–177. [PubMed: 16536141]
41. Brown SA, Myers MG, Lippke L, Tapert SF, Stewart DG, Vik PW. Psychometric evaluation of the Customary Drinking and Drug Use Record (CDDR): A measure of adolescent alcohol and drug involvement. *J Stud Alcohol Drugs*. 1998; 59(4):427–438.
42. Cooper ML. Motivations for Alcohol Use Among Adolescents: development and Validation of a Four-Factor Model. *Psychological Assessment*. 1994; 6(2):117–128.
43. MacLean MG, Lecci L. A comparison of models of drinking motives in a university sample. *Psychol Addict Behav*. 2000; 14(1):83–7. [PubMed: 10822750]
44. Lac A, Donaldson CD. Higher-Order and Bifactor Models of the Drinking Motives Questionnaire: Examining Competing Structures Using Confirmatory Factor Analysis. *Assessment*. 2015 Sep 3.
45. Kline, RB. Principles and practice of structural equation modeling. 3. New York: Guilford Press; 2011.
46. Singleton RA. Collegiate alcohol consumption and academic performance. *J Studies Alcohol and Drugs*. 2007; 68(4):548–55.
47. Pedrelli P, Nyer M, Holt D, Bakow BR, Fava M, Baer L, Cassiello C, Mulligan M, Cusin C, Farabaugh A. Correlates of irritability in college students with depressive symptoms. *J Nerv Ment Dis*. 2013 Nov; 201(11):953–8. [PubMed: 24177482]
48. Jones KA, Chryssanthakis A, Groom MJ. Impulsivity and drinking motives predict problem behaviours relating to alcohol use in university students. *Addict Behav*. 2014; 39(1):289–96. [PubMed: 24176824]
49. LaBrie JW, Kenney SR, Napper LE, Miller K. Impulsivity and alcohol-related risk among college students: examining urgency, sensation seeking and the moderating influence of beliefs about alcohol's role in the college experience. *Addict Behav*. 2014; 39(1):159–64. [PubMed: 24120644]
50. Yankelevitz RL, Mitchell SH, Zhang Y. Gender differences in factors associated with alcohol drinking: delay discounting and perception of others' drinking. *Drug Alcohol Depend*. 2012; 123(1–3):273–6. [PubMed: 22154359]
51. Lecci L, MacLean MG, Croteau N. Personal goals as predictors of college student drinking motives, alcohol use and related problems. *J Stud Alcohol*. 2002; 63(5):620–30. [PubMed: 12380859]
52. Clarke N, Kim SY, White HR, Jiao Y, Mun EY. Associations between alcohol use and alcohol-related negative consequences among black and white college men and women. *J Stud Alcohol Drugs*. 2013 Jul; 74(4):521–31. [PubMed: 23739015]
53. Norberg MM, Olivier J, Alperstein DM, Zvolensky MJ, Norton AR. Adverse consequences of student drinking: the role of sex, social anxiety, drinking motives. *Addict Behav*. 2011; 36:821–828. [PubMed: 21481541]
54. Watson D, Clark LA, Tellegen A. Development and validation of brief measures of positive and negative affect: The PANAS scales. *J Pers Soc Psychol*. 1988; 54(6):1063–1070. [PubMed: 3397865]
55. Derogatis L, Melisaratos N. The Brief Symptom Inventory: An introductory report. *Psychol Medicine*. 1983; 13:595–605.
56. Winters KC, Toomey T, Nelson TF, Erickson D, Lenk K, Miazga M. Screening for alcohol problems among 4-year colleges and universities. *Journal of American College Health*. 2011; 59(5):350–7. [PubMed: 21500052]

57. Merrill JE, Wardell JD, Read JP. Drinking motives in the prospective prediction of unique alcohol-related consequences in college students. *J Stud Alcohol Drugs*. 2014; 75(1):93–102. [PubMed: 24411801]
58. Beck, Aaron T.; Rush, A John; Shaw, Brian F.; Emery, Gary. *Cognitive Therapy of Depression*. New York: The Guilford Press; 1979. p. 11
59. Radkovsky A, McArdle JJ, Bockting CL, Berking M. Successful emotion regulation skills application predicts subsequent reduction of symptom severity during treatment of major depressive disorder. *J Consult Clin Psychol*. 2014; 82(2):248–62. [PubMed: 24564219]
60. Moos RH. Theory-based active ingredients of effective treatments for substance use disorders. *Drug Alcohol Depend*. 2007 May 11; 88(2–3):109–21. [PubMed: 17129682]
61. Pedrelli P, Shapero B, Archibald A, Dale C. Alcohol use and Depression During Adolescence and Young Adulthood: a Summary and Interpretation of Mixed Findings. *Current Addiction Reports*. 2016
62. White AM, Kraus CL, Swartzwelder H. Many college freshmen drink at levels far beyond the binge threshold. *Alcohol Clin Exp Res*. 2006 Jun; 30(6):1006–10. [PubMed: 16737459]
63. Cranford JA, McCabe SE, Boyd CJ, Lange JE, Reed MB, Scott MS. Effects of residential learning communities on drinking trajectories during the first two years of college. *J Stud Alcohol Drugs Suppl*. 2009 Jul.(16):86–95. [PubMed: 19538916]
64. Huh J, Huang Z, Liao Y, Pentz M, Chou CP. Transitional life events and trajectories of cigarette and alcohol use during emerging adulthood: latent class analysis and growth mixture modeling. *J Stud Alcohol Drugs*. 2013 Sep; 74(5):727–35. [PubMed: 23948532]
65. Bewick BM, Mulhern B, Barkham M, Trusler K, Hill AJ, Stiles WB. Changes in undergraduate student alcohol consumption as they progress through university. *BMC Public Health*. 2008 May 19.8:163. [PubMed: 18489734]
66. Nguyen N, Walters ST, Wyatt TM, DeJong W. Use and correlates of protective drinking behaviors during the transition to college: analysis of a national sample. *Addict Behav*. 2011 Oct; 36(10): 1008–14. [PubMed: 21719203]
67. Carter AC1, Brandon KO, Goldman MS. The college and noncollege experience: a review of the factors that influence drinking behavior in young adulthood. *J Stud Alcohol Drugs*. 2010 Sep; 71(5):742–50. [PubMed: 20731981]
68. Davis CG, Thake J, Vilhena N. Social desirability biases in self-reported alcohol consumption and harms. *Addict Behav*. 2010 Apr; 35(4):302–11. [PubMed: 19932936]
69. Borsari B, Muellerleile P. Collateral Reports in the College Setting: A Meta-Analytic Integration. *Alcoholism: Clinical and Experimental Research*. 2009; 33(5):826–838.
70. Hagman BT, Cohn AM, Noel NE, Clifford PR. Collateral informant assessment in alcohol use research involving college students. *J Am Coll Health*. 2010; 59(2):82–90. [PubMed: 20864433]
71. Borsari B, Neal DJ, Collins SE, Carey KB. Differential utility of the three indexes of risky drinking for predicting alcohol problems in college students. *Psychol Addict Behav*. 2001 Dec; 15(4):321–4. [PubMed: 11767264]

Figure 1.
Model of pathways between depressive symptoms and alcohol-related problems.

Table 1

Demographic and clinical variables

	Males (N=82)M (SD)	Females (N=81)M (SD)	<i>t</i> (df)	<i>p</i>
Age	18.17 (.41)	18.10 (.34)	1.22 (1,156)	.224
B-YAACQ	3.89 (3.92)	4.27 (5.16)	.53 (1, 149)	.60
DMQ-Coping	9.17 (3.88)	10.12 (4.88)	-1.38 (1, 152)	.17
CES-D	11.21 (7.44)	13.15 (8.74)	-1.53 (1, 161)	.13
Heavy Drinking	4.13 (3.90)	3.26 (4.21)	1.38 (1, 161)	.17

Note: B-YAACQ=Brief Young Adult Alcohol Consequences Questionnaire; CES-D= Center for Epidemiologic Studies-Depression Scale; DMQ-Coping= Drinking Motives Questionnaire, drinking to cope subscale.

Table 2

Intercorrelations between Study Variables, by Gender

	CES-D	Coping	Heavy Drinking	ARPs
CES-D	—	.30***	.06	.36*
DMQ-Coping	.47***	—	.11	.48***
Heavy Drinking	.07	.30**	—	.42***
B-YAACQ	.31**	.57***	.66***	—

Note: Correlations for male participants are above the dividing line and correlations for female participants are below the dividing line. N = 163.

* $p < .05$.

** $p < .01$.

*** $p < .001$.

B-YAACQ= Brief Young Adult Alcohol Consequences Questionnaire; CES-D= Center for Epidemiologic Studies-Depression Scale; DMQ-Coping= Drinking Motives Questionnaire, drinking to cope subscale.

Table 3

Values of Fit Statistics for Path Model

	<u>Overall Path Model</u>	<u>Path Model by Gender</u>
χ^2_m	4.076	0.603
df_m	4	0.2
p	0.3959	0.7395
RMSEA (90% CI)	.011 (.000–.119)	.000 (.000–.153)
CFI	0.99	1.00
SRMR	0.03	0.016
χ^2_b	160.255	155.549
df_b	10	12

Note: CFI=Comparative fit index; RMSEA= Root Mean Square Error of Approximation; SRMR= Standardized Root Mean Square Residual

Table 4

Maximum Likelihood Estimate for Structural Regression Model

Parameter	Overall Model			Female			Male		
	Unstand	SE	Stand	Unstand	SE	Stand	Unstand	SE	Stand
Direct Paths									
CESD→ DMQ-Coping	0.22	0.05	.41***	.26	.06	.47***	.15	.06	.30**
CESD → B-YAACQ	0.09	0.05	.15	.06	.06	.11	.12	.07	.23
DMQ-Coping→ Heavy Drinking	0.18	0.08	.20*	.26	.10	.30**	.11	.12	.11
DMQ-Coping →B-YAACQ	0.39	0.07	.38***	.38	.10	.36***	.38	.10	.37***
Heavy Drinking → B-YAACQ	0.52	0.07	.47***	.67	.11	.55***	.37	.08	.37***
Mediation from CESD to B-YAACQ									
Total	0.19	0.05	.35***	.21	.08	.35**	.18	.07	.35**
Indirect with DMQ-Coping	0.09	0.02	.15***	.10	.04	.17**	.06	.03	.11*
Indirect with DMQ-Coping and Heavy Drinking	0.02	0.01	.04	.05	.02	.08*	.01	.01	.01
Direct	0.09	0.05	.09	.06	.06	.11	.12	.07	.23

* $p < .05$,

**

 $p < .01$,

 $p < .001$

Note: B-YAACQ= Brief Young Adult Alcohol Consequences Questionnaire; CES-D= Center for Epidemiologic Studies-Depression Scale; DMQ-Coping= Drinking Motives Questionnaire, drinking to cope subscale.