Cluster Analysis of Undergraduate Drinkers Based on Alcohol Expectancy Scores

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ABSTRACT. Objective: Expectancies of alcohol's effects have been associated with problem drinking in undergraduates. If subgroups can be classified based on expectancies, this may facilitate identifying those at highest risk for problem drinking. **Method:** Undergraduates ($N = 612$) from two state universities completed a web-based survey. Responses to the Comprehensive Effects of Alcohol scale were analyzed using k -means cluster analysis separately within each university sample. **Results:** Hartigan's heuristic was used to determine that five was the optimal number of clusters in each sample. Clusters were distinguishable based on their overall magnitude of expectancy endorsement and by a tendency to endorse stronger positive than negative expectancies. Subsequent analyses were conducted to compare clusters on alcohol involvement and trait disinhibition. A cluster characterized by endorsement of positive and

negative expectancies ("strong expectancy") was associated with a particularly problematic risk profile, specifically concerning difficulties with self-control (i.e., trait disinhibition and impaired control over alcohol use). A cluster with higher positive and lower negative expectancies reported frequent heavy drinking but appeared to be at lower risk than the strong expectancy cluster in a number of respects. Negative expectancy endorsement appeared to represent added risk above and beyond positive expectancies. **Conclusions:** Results suggest that both the magnitude and combination of expectancies endorsed by subgroups of undergraduate drinkers may relate to their risk level in terms of alcohol involvement and personality traits. These findings may have implications for interventions with young adult drinkers. (*J. Stud. Alcohol Drugs*, 73, 238–249, 2012)

YOUNG ADULT HEAVY DRINKING is prevalent and deleterious (U.S. Department of Health and Human Services, 2000). According to the National Epidemiologic Survey on Alcohol and Related Conditions, 39% of 18- to 25-year-olds reported monthly heavy episodic drinking (Harrison et al., 2008). Alcohol use at this level is associated with negative consequences, such as traffic accidents (Hingson et al., 2005; Yi et al., 2004). Although many young adults "mature out" of heavy use by their mid-20s, a minority will continue heavy use and be at risk for clinically significant problems (Jackson et al., 2001). Thus, further research is needed to address risk factors for problem drinking in young adults, such as alcohol-related expectancies.

Alcohol-related expectancies

According to expectancy theory, "direct and indirect experience with alcohol and alcohol paraphernalia" (Jones et

al., 2001, p. 59, emphasis in original) affects beliefs about alcohol's effects, which then influence drinking behavior. Relationships between alcohol use and expectancies are reciprocal given that beliefs may be formed a priori and influence drinking behavior, but beliefs may also be influenced by actual alcohol use (Jones et al., 2001).

Findings have shown consistently that positive expectancies (i.e., beliefs that alcohol produces reinforcing effects) are related to greater alcohol use in young adults (Fromme et al., 1993; Wiers et al., 1997; Wood et al., 2001). In contrast, negative expectancies (i.e., beliefs that alcohol produces adverse effects) either tend not to be related significantly to alcohol use (Neighbors et al., 2007; Read and O'Connor, 2006; Werner et al., 1993) or are related to lower levels of use in young adults (Anderson et al., 2003; Fromme et al., 1993; Leigh and Stacy, 1993). These findings are consistent with learning theory (Jones et al., 2001). Specifically, positive expectancies are equated with reinforcement and should be associated with increased responding, with the opposite for negative expectancies.

Negative expectancies have been associated with alcohol-related problems (i.e., negative consequences and dependence symptoms; White and Labouvie, 1989) in young adults (Leeman et al., 2009b; Neighbors et al., 2007; Read and O'Connor, 2006; but see Ham, 2009; Ham and Hope, 2006; Thompson et al., 2009; and Werner et al., 1993, for nonsignificant findings). Significant relationships between positive expectancies and alcohol-related problems have been reported in models including both types of expectancies (Ham, 2009;

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Ham and Hope, 2006; but for nonsignificant results, see Leeman et al., 2009b; Neighbors et al., 2007). In another study, positive expectancies, although significant, were weaker predictors of alcohol-related problems than negative expectancies (Werner et al., 1993). In contrast, most young adult studies reporting significant relationships between positive expectancies and alcohol-related problems tested models omitting negative expectancies (Fearnow-Kenny et al., 2001; Vik et al., 2000; Wood et al., 2001). Thus, one cannot determine whether positive expectancies were unique predictors of alcohol-related problems. In summary, results regarding alcohol-related problems are less clear than for alcohol use. Relationships between negative expectancies and alcohol-related problems appear stronger than relationships between negative expectancies and alcohol use. Although there is evidence for relationships between positive expectancies and alcohol-related problems, there are caveats and these relationships may not be as strong as relationships between positive expectancies and alcohol use.

Findings regarding relationships between positive and negative expectancies have also been equivocal. Significant positive (Ham, 2009; Ham and Hope, 2006; Leeman et al., 2009b), significant negative (Ham, 2009; Leigh and Stacy, 1993), and nonsignificant correlations have been reported (Anderson et al., 2003; Thompson et al., 2009).

At this stage, a data-driven approach may be the most useful method for learning more about relationships between positive and negative expectancies and ramifications for risk level. Also, a person-centered analytic approach may have value. The small-to-moderate effect sizes in relationships between expectancies and alcohol use (Jones et al., 2001) and the equivocal findings relating positive to negative expectancies could be due in part to individual differences, which could be revealed using a person-centered approach.

Cluster analysis

Cluster analysis is an analytic tool for identifying groupings of cases (Morrall et al., 1997), which can be examined to assess whether they form discernable subgroups. One previous study cluster analyzed expectancy scores using a person-centered approach (Koposov et al., 2005). As a result, three clusters of Russian male juvenile delinquents were uncovered: (a) low positive and moderate negative expectancies, (b) elevated positive and low negative expectancies, and (c) elevated positive and negative expectancies. The latter group had the strongest risk profile in terms of alcohol-related problems and personality traits. The present study differs from Koposov et al. (2005) in its lower risk sample and use of a more common expectancies measure.

Trait disinhibition

Trait disinhibition, which has been related to both expectancies and alcohol involvement, has been defined as a tendency to focus on and pursue reward even in the face of punishment (Anderson et al., 2003; McCarthy et al., 2001a; 2001b; Patterson and Newman, 1993). Moreover, "trait disinhibition has been theorized to be the mechanism underlying impulsive, sensation-seeking and risk-taking behavior" (Anderson et al., 2003, p. 384). Young adults are particularly likely to be trait disinhibited because higher-order self-regulatory processes often do not develop fully until well into one's 20s (Chambers et al., 2003). Findings have linked trait disinhibition to problem drinking (Leeman et al., 2009a).

The acquired preparedness model (Anderson et al., 2003; Corbin et al., 2011; McCarthy et al., 2001a, 2001b) offers an empirically supported, theoretical account for relationships between facets of trait disinhibition (e.g., impulsivity, sensation seeking) and positive expectancies. According to this model, when trait-disinhibited people drink, they focus on alcohol's positive effects and form strong positive expectancies. These expectancies act as a mechanism underlying relationships between trait disinhibition and alcohol involvement. There is also theoretical and empirical support for a link between trait disinhibition and negative expectancies. A relationship between negative expectancies and alcohol-related problems entails a decision to continue alcohol use despite firsthand knowledge of its negative effects and the experience of alcohol-related problems. This type of decision appears indicative of poor self-control and follows the definition of trait disinhibition (i.e., pursuit of reward despite possible punishment). Accordingly, scores on the attentional and nonplanning subscales of the Barratt Impulsiveness Scale, Version 11 (Patton et al., 1995), have been correlated significantly with cognitive/behavioral impairment expectancies on the Comprehensive Effects of Alcohol (CEOA; Fromme et al., 1993) scale (Balodis et al., 2009; but for nonsignificant results, see Anderson et al., 2003).

Aggression has been equated with behavioral disinhibition (Bond, 1998) and impulsivity, particularly hostile aggression (i.e., aggression with the ultimate goal of inflicting harm) (Anderson and Bushman, 2002). Aggression has also been included in tests of the acquired preparedness model as an aspect of trait disinhibition with the view that aggressive individuals also tend to focus on and pursue reward (Barnow et al., 2004). Thus, like impulsive and sensation-seeking individuals, trait-aggressive individuals would be expected to form particularly strong positive expectancies of alcohol. Positive expectancies mediated relationships between aggression and quantity/frequency of alcohol consumption in adolescents (Barnow et al., 2004) and partially mediated relationships between delinquency and alcohol involvement in another adolescent sample (Meier et al., 2007). Thus, the

inclusion of aggression with other aspects of trait disinhibition is theoretically and empirically justified.

Impaired control over alcohol use

It may also be valuable to consider issues with self-control that relate directly to alcohol use. Impaired control (i.e., difficulty adhering to limits on alcohol use; Heather et al., 1993) has been viewed as a hallmark of substance dependence (Levine, 1978; O'Brien et al., 2006) and is pertinent to young drinkers given its relatively early emergence (Chick and Duffy, 1979; Chung and Martin, 2002, 2005; Langenbucher and Chung, 1995; Leeman et al., in press). Self-reported impaired control is predictive of alcohol-related problems, cross-sectionally (Leeman et al., 2007; Nagoshi, 1999; Patock-Peckham et al., 2001) and prospectively (Leeman et al., 2009b), and heavy episodic drinking cross-sectionally in undergraduates (Leeman et al., 2007). Leeman et al. (2009b) reported significant, positive correlations between impaired control and both positive and negative expectancies of alcohol's disinhibiting effects. Evidence and conceptual arguments suggest that impaired control is related to—but distinct from—trait impulsivity (Leeman et al., in press). Impaired control entails an intention to limit drinking, whereas impulsive individuals often avoid placing limitations on themselves (Bickel and Marsch, 2001). In undergraduates, correlations between impaired control and impulsivity were small to moderate (Chung and Martin, 2002; Nagoshi, 1999; Patock-Peckham and Morgan-Lopez, 2006).

Objectives of study

We conducted cluster analyses in samples of undergraduates from two state universities and then compared clusters on alcohol involvement and trait disinhibition. Conducting analyses in two samples and comparing clusters on variables not involved in the grouping procedure are two means of establishing the validity of clusters (Morrall et al., 1997).

It is impossible to know the composition of the resulting clusters beforehand, making a priori prediction tentative. Nonetheless, we expected that clusters defined by strong endorsement of positive expectancies would be associated with heavy drinking because positive expectancies are equated with reinforcement and increased responding. Relationships with impulsivity, sensation seeking, and aggression were also expected based on the acquired preparedness model. Because of probable issues with self-control among those endorsing both positive and negative expectancies, stronger endorsement of alcohol-related problems and impaired control over alcohol use than in other clusters was predicted. Clusters with high positive and negative expectancies were expected to be higher in trait aggression than positive-expectancy-only clusters

because negative affect underlies aggression (Giancola et al., 2010) and certain negative expectancies (Fromme et al., 1993).

Method

Participants and procedures

Data were collected from two state universities in the United States: a moderate-sized university in the Northeast and a large university in the South. This study was approved by the human subjects' boards at both universities and at Yale School of Medicine. At both universities, participants were at least 18 years of age, participated to fulfill a research participation requirement for introductory psychology courses, and were recruited through a website advertising studies enrolling research participants. At the northeastern university, flyers and brief presentations during classes also were used. Only participants reporting lifetime alcohol exposure were included in the analyses (see Table 1 for sample demographics).

Most procedural aspects were the same at both sites. Data collection took place online at a secure website and data were password protected. All participants indicated informed consent. Participants were identified in the survey itself by identification numbers only; thus, no personally identifying information was required. At the northeastern university, participation was anonymous. At the southern university, the manner in which credit for research participation was attributed precluded anonymity; however, participation was confidential and responses were protected by a certificate of confidentiality.

Measures

The CEOA scale (Fromme et al., 1993) was used to assess expectancies. Participants rated on a 4-point scale (from *disagree* to *agree*) the extent to which they expected 38 different effects when they drink. The measure yields four positive expectancy subscales: (a) social facilitation ($\alpha = .90$), (b) tension reduction ($\alpha = .74$), (c) liquid courage ($\alpha = .90$), and (d) sexual enhancement ($\alpha = .83$); and three negative expectancy subscales: (a) cognitive-behavioral impairment ($\alpha = .88$), (b) risk taking/aggression ($\alpha = .82$), and (c) negative self-evaluation ($\alpha = .88$). Means were taken of the individual items in each subscale.

The Daily Drinking Questionnaire-Revised (DDQ-R) was used to estimate drinks per drinking day. The DDQ-R, adapted from the original DDQ (Collins et al., 1985), assesses typical drinking behavior in the prior 3 months with the use of two questions: (a) for each day of the week, participants reported the number of times in the prior 13 weeks they consumed any alcohol, and (b) on a typical day of the week when drinking took place, they reported the number of standard drinks they

TABLE 1. Sample descriptives

Variable	Northern university (<i>n</i> = 368)	Southern university (<i>n</i> = 244)	Entire sample (<i>N</i> = 612)
Age, <i>M</i> (<i>SD</i>)	19.03 (2.12)	20.56 (2.19)**	19.64 (2.27)
Female, %	73.0	74.6	73.6
Race/ethnicity, %			
White	86.8	86	86.3
African American	5.3	6.6	6
Asian	0.5	4.1	2.5
Hispanic	4.7	1.2	2.8
Other	2.6	2.1	2.3
Family history positive, ^a %	33.9	40.7	37.9
Alcohol involvement variables, <i>M</i> (<i>SD</i>)			
Drinks per drinking day	5.41 (4.17)	4.55 (3.19)	5.06 (3.83)
Weekly frequency of heavy drinking within 2 hours ^b	1.20 (1.29)	1.00 (1.19)	1.12 (1.26)
RAPI score, out of a possible 23	5.23 (5.05)	4.23 (4.23)	4.83 (4.76)
Impaired Control Scale score, out of 40	9.40 (7.16)	7.81 (6.32)	8.77 (6.88)

Notes: For purposes of analysis, drinks per drinking day, heavy episodic (“binge”) drinking, and Rutgers Alcohol Problem Index (RAPI) scores were log transformed; impaired control scale score was square root transformed. Raw scores are presented for ease of interpretation. ^aFamily history positive was defined as having at least two first-order or one first- and one second-order relative with an alcohol-related problem; ^bheavy drinking within 2 hours was defined as five or more drinks for men (four for women) in 2 hours or less.

***p* < .001.

tended to have. Drinks per drinking day were calculated by multiplying the quantity estimate for each day of the week by the frequency estimate, adding the seven resulting products, and dividing by total frequency.

For heavy episodic drinking, participants were asked to report the number of times in the past 3 months that they had consumed five or more alcoholic beverages (four or more for women) in a 2-hour period (National Institute on Alcohol Abuse and Alcoholism, 2004). These 3-month reports were converted to estimates of episodes per week. This type of heavy episodic drinking is sometimes referred to as “binge drinking” and through the remainder of this article will be referred to as “heavy drinking within 2 hours.”

The Rutgers Alcohol Problem Index (RAPI; White and Labouvie, 1989) is a valid, reliable, unidirectional, and unidimensional measure of 23 adverse alcohol-related events (e.g., “not able to do your homework or study for a test”). Each event that occurred at least once in the past 3 months as a result of alcohol use was scored 1, and these were totaled to yield an overall score ($\alpha = .88$).

Part 2 of the Impaired Control Scale (ICS; Heather et al., 1993) is a reliable, valid measure consisting of 10 statements regarding ability to control alcohol use (e.g., “I have found it difficult to limit the amount I drank”). A 3-month time frame was used. Items were rated on a 0 (*never*) to 4 (*always*) scale and summed ($\alpha = .81$), with higher scores indicating greater difficulty controlling alcohol use.

Participants also reported demographics and family history of alcohol problems. Participants were asked whether any of their relatives ever “had a significant problem with alcohol or drugs, one that either led to treatment or should have led to treatment.” This definition was taken from the

Addiction Severity Index (McLellan et al., 1992). Those reporting that at least two first-order or one first- and one second-order relative had a significant problem with alcohol were considered family history positive.

Three aspects of trait disinhibition were assessed: impulsivity, sensation seeking, and aggression. The Barratt Impulsiveness Scale, Version 11 (Patton et al., 1995), is a 30-item measure with items rated on a four-point scale, including subscales measuring attentional ($\alpha = .79$), motor ($\alpha = .67$), and nonplanning impulsiveness ($\alpha = .75$). In the disinhibition subscale of the Sensation Seeking Scale, Form V (Zuckerman, 1994), participants report which of two descriptions pertains most closely to them (e.g., “I like wild, uninhibited parties” or “I prefer quiet parties with good conversation”). Each response indicating sensation seeking was scored 1, and the sum was taken. Two items pertaining directly to alcohol were removed (Darkes et al., 1998), leaving eight items ($\alpha = .67$). The Buss–Perry Aggression Questionnaire (1992) contains 29 items on a five-point scale with hostility ($\alpha = .84$), anger ($\alpha = .83$), verbal aggression ($\alpha = .77$), and physical aggression ($\alpha = .86$) subscales.

Data analysis

We conducted *k*-means cluster analyses of scores on the seven CEOA subscales separately in each university sample. Each time, a particular number of clusters was forced. We began with two clusters and continued until the optimal number was reached. *K*-means cluster analysis works by defining a distance between all pairs of data points. The *k*-means algorithm then determines a partition of all data points into the specified *k* number of clusters. The partition

minimizes the total sum of squared distances of each member of the cluster from the cluster center (Johnson and Wichern, 2002). This is accomplished in SPSS Version 16 (SPSS Inc., Chicago, IL) with Euclidean distance calculations. In SPSS, cluster centers are chosen with maximum separation to maximize variability between clusters. Hartigan's (1975) heuristic was used to determine the optimal number of clusters. K number of clusters is compared with $k + 1$ by using the sum of squared (SS) distances from objects to their respective cluster centers, using the following calculation: (SS within k groups / SS within $[k + 1]$ groups $- 1) \times (N - k - 1)$. If the result is 10 or greater, $k + 1$ clusters are preferable. Chiang and Mirkin (2007) reported experimental results supporting Hartigan's as the method that produces the most accurate number of clusters.

An important issue was whether the same number of clusters was reached in each university sample. With this established, we graphed and examined mean CEOA subscale scores by cluster to discern whether there were unique patterns of endorsement in each cluster. We used chi-square to determine whether the proportion of participants assigned to each cluster differed by university, family history, or gender. If cluster assignment was found to differ significantly based on any of these variables, we planned to include those in subsequent models and test for interactions with cluster assignment. Next, we assessed heterogeneity across clusters in CEOA subscale scores, using multivariate analysis of variance (MANOVA) with the seven subscale scores as the observed variables and cluster grouping as an independent variable. Significant omnibus effects of cluster were expected because this would indicate heterogeneity in subscale scores across clusters.

Analyses were also planned to assess differences across clusters in alcohol involvement (i.e., drinks per drinking day, heavy drinking within 2 hours, alcohol-related problems, and impaired control), again using MANOVA. In the event of a significant omnibus effect, follow-up univariate analyses were planned to determine which clusters differed by which alcohol variables. A similar approach was used for the trait disinhibition variables.

Although the research questions addressed in this study were theoretically motivated, our approach to these analyses was simply to assess differences across clusters. Our use of MANOVA does not imply that pattern of expectancy endorsement within clusters caused alcohol involvement or trait disinhibition. An α level of .01 was set given multiple comparisons.

Results

Preliminary analyses

After lifetime abstainers and those with missing data on one or more CEOA subscales were removed, the sample

size was reduced from 641 to 612. Demographics and descriptives for alcohol variables for the sample overall and by university are given in Table 1. There were no significant differences between universities for any alcohol variables. Men averaged 6.50 ($SD = 4.16$) drinks per drinking day compared with 4.54 ($SD = 3.56$) for women, $t(607) = 4.88$, $p < .001$, and 1.38 ($SD = 1.33$) weekly instances of heavy drinking within 2 hours, compared with 1.02 ($SD = 1.21$) for women, $t(599) = 3.21$, $p = .001$. There were also significant gender differences on the social facilitation subscale of the CEOA, sensation seeking, and physical aggression, with men scoring higher on the latter two. Several variables had distributions that deviated from normality (i.e., skewness ≥ 3), necessitating transformations (Tables 1 and 2).

Identification of clusters and their descriptions

According to Hartigan's heuristic, a five-cluster solution was optimal in both samples. After determining four clusters was preferred over three, which was preferable to two, five clusters was compared with four. In the southern data, SS within groups (four clusters) = 63.57, SS within groups (five clusters) = 53.65. Thus, $(63.57 / 53.65 - 1) \times (244 - 4 - 1) = 44.19$, which is greater than 10, making five clusters preferable to four. In the northern data, SS within groups (four clusters) = 122.39, SS within groups (five clusters) = 108.03. Thus, $(122.39 / 108.03 - 1) \times (368 - 4 - 1) = 48.25$, which is greater than 10, making five clusters preferable to four. Six clusters were then compared with five. In the southern data, SS (six clusters) = 54.11, thus $(53.65 / 54.11 - 1) \times (244 - 5 - 1) = -2.02$; thus, six clusters did not offer an advantage over five. In the northern data, SS (six clusters) = 106.19, thus $(108.03 / 106.19 - 1) \times (368 - 5 - 1) = 6.27$; thus, six clusters did not offer an advantage over five.

CEOA subscale scores in each of the five clusters by university are depicted in Figures 1a–1e. All five clusters collapsed across university are depicted in Figure 2. One cluster was characterized by low mean scores overall, particularly on the negative subscales (i.e., "light positive/low negative"). Another (i.e., "variable expectancy") had primarily low scores with somewhat higher scores on two positive (i.e., social facilitation and tension reduction) and one negative subscale (i.e., cognitive-behavioral impairment). Other clusters were characterized by moderate and high scores (i.e., "strong expectancy") on all subscales, and the last cluster was characterized by relatively high scores on positive expectancies and relatively low scores on negative expectancies (i.e., "higher positive/lower negative"). This cluster endorsed all four positive expectancy subscales and one negative expectancy subscale more strongly than the "moderate expectancy" cluster and had lower scores than the "strong expectancy" cluster on all subscales but one.

Chi-square analyses were used to compare cluster breakdown by university, gender, and family history. Cluster

FIGURE 1a–1e. Mean Comprehensive Effects of Alcohol (CEOA) subscale scores (with standard errors) within each cluster by university (1a: light positive/low negative, 1b: variable expectancy, 1c: moderate expectancy, 1d: strong expectancy, and 1e: higher positive/lower negative). Mean score on y axis, subscales on x axis: social facilitation (soc fac), tension reduction (tens red), liquid courage (liq cour), sexual enhancement (sex enh), cognitive-behavioral impairment (c/b imp), risk taking/aggression (risk/agg) and negative self-evaluation (neg se). *Significant difference between universities at $p < .01$; **significant difference between universities at $p < .001$.

FIGURE 2. Mean Comprehensive Effects of Alcohol (COEA) subscale scores in all five clusters collapsed across university. Soc fac = social facilitation; tens red = tension reduction; liq cour = liquid courage; sex enhance = sexual enhancement; c/b imp = cognitive-behavioral impairment; risk/agg = risk taking/aggression; neg se = negative self-evaluation; light pos/low neg = light positive/low negative; moderate expect = moderate expectancy; strong expect = strong expectancy; variable expect = variable expectancy; higher pos/lower neg = higher positive/lower negative.

breakdown differed significantly by university, $\chi^2(4, N = 612) = 29.29, p < .001, V_c = 0.22$. Cluster n by university can be found in Figure 1a–1e. A higher proportion of southern than northern students belonged to the light positive/low negative cluster (13.9% vs. 5.7%), with the reverse being true for the variable expectancy cluster (4.5% vs. 13.9%). There were significant family history status differences across clusters as well, $\chi^2(4, N = 612) = 15.77, p = .003, V_c = 0.16$. The percentage of family history–positive participants in each cluster was as follows: variable expectancy (51.7%), strong expectancy (43%), higher positive/lower negative (40.6%), moderate expectancy (33%), and light positive/low negative (20.4%). Cluster membership did not differ by gender. Therefore, university and family history were included in subsequent models but gender was not.

MANOVA was conducted to assess heterogeneity in CEOA subscale scores by cluster, university, and family history, along with all possible interactions. Omnibus effects of cluster and university, as well as the Cluster $\times$ University interaction, were significant—cluster: Wilks' $\lambda = .13, F(28, 2074.61) = 55.51, p < .001, \eta^2 = .87$;

university: Wilks' $\lambda = .96, F(7, 575) = 3.59, p = .001, \eta^2 = .04$; Cluster $\times$ University: Wilks' $\lambda = .61, F(28, 2074.61) = 11.06, p < .001, \eta^2 = .39$. Neither the omnibus effect of family history nor any other interactions were significant. Subsequent univariate analyses indicated that the omnibus effect of cluster applied to all CEOA subscale scores. The omnibus effect and observation of differing endorsement patterns across clusters suggested the clusters formed discernable subgroups.

Regarding the omnibus effect of university, subsequent univariate analyses found a significant main effect on only cognitive-behavioral impairment scores with southern scores ($M = 3.35, SE = 0.05$) higher than northern scores ($M = 3.06, SE = 0.04$). The significant interaction suggested differences in the makeup of the clusters between universities; however, this effect was much smaller than the effect of cluster. The Cluster $\times$ University interaction applied to all subscales except sexual enhancement, according to subsequent univariate analyses. To follow up on the significant interaction, separate MANOVAs were conducted within each cluster to test for differences between universities on the remaining

six CEOA subscale scores. Subscale scores for which there were significant differences between universities are indicated in Figure 1a–1e. There was similarity overall, and most significant differences were relatively small. The variable expectancy cluster was an exception because the pattern of endorsement appeared to differ noticeably between universities. Given the overall similarity in cluster patterns between universities and the smaller interaction effect compared with the cluster main effect, we conducted all subsequent analyses within the entire sample. The Cluster $\times$ University interaction was included in all models.

Comparison of alcohol involvement variables across clusters

MANOVA was conducted to assess cluster differences in alcohol variables. The omnibus effect of cluster was significant, Wilks' $\lambda = .93$, $F(16, 1729.80) = 2.70$, $p < .001$, $\eta^2 = .07$; however, no other effects were significant. Subsequent univariate analyses indicated that the significant omnibus effect applied to heavy drinking within 2 hours, $F(4, 569) = 4.08$, $p = .003$, $\eta^2 = .03$; RAPI, $F(4, 569) = 5.85$, $p < .001$, $\eta^2 = .04$; and ICS score, $F(4, 569) = 5.77$, $p < .001$, $\eta^2 = .04$; but not to drinks per drinking day, $F(4, 569) = 1.29$, $p = .271$, $\eta^2 = .01$. According to post hoc least significant differences tests, the strong expectancy, moderate expectancy, and higher positive/lower negative clusters reported significantly more frequent heavy drinking within 2 hours than light positive/low negative and variable

expectancy. Results were similar for RAPI score, except that variable expectancy did not differ significantly from either the moderate or higher positive/lower negative clusters. For ICS scores, the strong expectancy cluster reported significantly higher scores than all others.

Significant differences in RAPI and ICS scores may have been not only due to differences in expectancies but also to differences in heavy drinking. To address this, separate analyses of covariance were conducted with RAPI and ICS scores as the observed variable and cluster as the independent variable, holding constant heavy drinking within 2 hours. There were significant cluster main effects for RAPI, $F(4, 595) = 4.93$, $p = .001$, $\eta^2 = .02$, and ICS, $F(4, 595) = 7.44$, $p < .001$, $\eta^2 = .04$, suggesting that differences among clusters were not primarily due to differences in heavy drinking.

Comparison of trait disinhibition variables across clusters

MANOVA was conducted to assess differences in trait disinhibition. Omnibus effects of cluster, Wilks' $\lambda = .81$, $F(32, 1970.49) = 3.53$, $p < .001$, $\eta^2 = .19$, and university, Wilks' $\lambda = .94$, $F(8, 534) = 4.25$, $p < .001$, $\eta^2 = .06$, were significant, but no other effects were. Univariate analyses indicated main effects of cluster for all variables except verbal aggression (Table 2). There was a main effect of university for two variables: nonplanning impulsiveness and sensation seeking (Table 2). The strong expectancy cluster reported the highest scores on each variable. Notably, this

TABLE 2. Mean scores on trait disinhibition measures by university and cluster and significance tests for cluster main effects

Trait disinhibition variable	University		Expectancy cluster					Tests of cluster main effects			
	North	South	1. Light + / low –	2. Variable	3. Moderate	4. Strong	5. High + / low –	F	p	η^2	Significant differences among clusters
BIS-11 subscale scores											
Attentional (8–32)	16.79 (0.29)	16.62 (0.37)	14.71 (0.64)	15.71 (0.76)	17.43 (0.32)	18.72 (0.42)	16.94 (0.35)	10.23	<.001	.07	3, 4 & 5 > 1 & 2; 4 > 5
Nonplanning (11–44)	24.22 ^b (0.35)	22.88 ^a (0.45)	22.18 (0.77)	22.41 (0.92)	24.22 (0.39)	25.08 (0.51)	23.86 (0.43)	4.39	.002	.03	4 > 1, 2, & 5
Motor (11–44)	21.37 (0.28)	21.26 (0.36)	20.09 (0.62)	19.85 (0.74)	21.64 (0.32)	23.38 (0.41)	21.65 (0.32)	7.84	<.001	.05	4 > all others; 3 & 5 > 1 & 2
Sensation seeking (0–8)	3.38 ^b (0.13)	2.68 ^a (0.16)	2.37 (0.28)	2.02 (0.33)	3.18 (0.14)	3.80 (0.19)	3.79 (0.15)	10.92	<.001	.07	3, 4 & 5 > 1 & 2; 4 & 5 > 3
Buss–Perry Aggression Questionnaire subscale scores											
Physical aggression (9–45)	19.02 (0.49)	16.96 (0.63)	15.40 (1.08)	16.71 (1.28)	18.31 (0.55)	20.82 (0.72)	18.73 (0.59)	3.94	.004	.03	4 > all others; 5 > 1
Verbal aggression (5–25)	12.81 (0.30)	13.07 (0.38)	11.12 (0.65)	13.32 (0.78)	13.18 (0.33)	14.05 (0.43)	13.03 (0.36)	2.30	.058	.02	not significant
Anger (7–35)	15.05 (0.39)	13.89 (0.49)	11.99 (0.85)	14.21 (1.01)	15.45 (0.43)	16.58 (0.56)	14.13 (0.47)	5.76	<.001	.04	3, 4 & 5 > 1; 4 > 2 & 5
Hostility (8–40)	18.94 (0.45)	17.59 (0.58)	14.82 (0.99)	16.94 (1.18)	19.52 (0.50)	21.24 (0.66)	18.82 (0.54)	8.68	<.001	.06	4 > all others; 3 & 5 > 1

Notes: The range of possible scores is given in parentheses after each variable name. Standard error is in parentheses below each mean score. Different superscript letters (^a ^b) letters indicate significant differences at $p \leq .01$. For purposes of analysis, attentional impulsiveness, verbal aggression, and hostility were square-root transformed and motor impulsiveness, physical aggression, and anger were log transformed; however raw scores are presented here for ease of interpretation. Light + / low – = light positive/low negative; variable = variable expectancy; moderate = moderate expectancy; strong = strong expectancy; high + / low – = higher positive/lower negative; BIS-11 = Barratt Impulsiveness Scale, Version 11.

cluster had a significantly higher score than all other clusters on motor impulsiveness, physical aggression, and hostility and higher scores than all other clusters except moderate expectancy on attentional and nonplanning impulsiveness and anger. The higher positive/lower negative cluster had particularly high sensation-seeking scores.

Analyses of covariance were used to assess the extent to which the significant differences by cluster could still be observed when holding constant heavy drinking within 2 hours, RAPI, and ICS scores. Of the seven significant differences in the prior analysis, six remained significant. The earlier difference in nonplanning impulsiveness was no longer significant. *F* values (4, 544) for the significant tests ranged from 3.34 to 7.04, *p* values ranged from .01 to < .001, and η^2 ranged from .02 to .05.

Discussion

Overview of findings

The goal of this study was to assess patterns of endorsement of positive and negative expectancies within subgroups of students and to explore relationships between these patterns of endorsement and alcohol and personality trait-related risk. We conducted cluster analyses in samples of undergraduate drinkers from two universities in different regions of the United States. Clusters were distinguished with regard to magnitude of expectancy endorsement and type of expectancies endorsed. Cluster differences in alcohol involvement collectively were significant and had a medium effect size with significant, small effects for individual alcohol variables. Cluster differences in trait disinhibition variables collectively were significant and had a large effect size with significant, small to medium effects for individual disinhibition variables.

Regarding continuity, patterns of CEOA subscale endorsement within each cluster were similar between the two universities, which supports the validity of the subgroupings (Morral et al., 1997). Even statistically significant differences tended to be relatively small, with the exception of the variable expectancy cluster. There were no significant Cluster $\times$ University interactions for trait disinhibition or alcohol involvement, suggesting that the nature of the relationships between cluster assignment and these risk factors was similar in the two samples.

Our findings suggest that it is common for undergraduate drinkers to endorse both positive and negative expectancies (i.e., the moderate and strong expectancy clusters). The strong expectancy cluster was associated with the highest risk levels for impaired control over alcohol use and trait disinhibition. Another cluster (higher positive/lower negative) endorsed primarily positive expectancies. This cluster reported relatively frequent heavy drinking within 2 hours, as predicted, given that positive expectancies are typically

equated with reinforcement and, consequently, higher responding. Alcohol-related problems were relatively high in this cluster. This cluster also scored higher than one or more of the others on multiple trait disinhibition variables, as predicted by the acquired preparedness model (Anderson et al., 2003; Corbin et al., 2011; McCarthy et al., 2001a, 2001b). These findings suggest that endorsement of positive expectancies is associated with some risk related to alcohol involvement and personality, even without strong negative expectancy endorsement.

Other findings, however, suggested somewhat lower risk for the higher positive/lower negative compared with the strong expectancy cluster. The former had lower scores on impaired control over alcohol use, all impulsiveness subscales, and three out of four aggression subscales. Given that the strong expectancy cluster endorsed both stronger positive and negative expectancies than the higher positive/lower negative cluster, it is difficult to attribute their higher level of risk definitively to a particular type of expectancy. Findings suggested that the added level of risk in the strong expectancy cluster may have related more closely to their negative expectancy endorsement. A comparison of the moderate and higher positive/lower negative clusters is illustrative. Although these clusters differed on only one negative expectancy subscale, the higher positive/lower negative cluster had higher scores on all four positive expectancy subscales. Considering alcohol involvement and trait disinhibition, these clusters differed only in sensation seeking, suggesting that strong positive expectancies in the higher positive/lower negative group were not associated with a great deal of added risk. It is possible, then, that differences in positive expectancies did not translate to an elevated risk level for the strong expectancy compared with the higher positive/lower negative cluster, either. Also, differences in negative expectancies were larger than differences in positive expectancies between these two clusters.

Added risk in the strong expectancy cluster was most readily observable on impaired control over alcohol use and trait disinhibition, two variables concerning difficulties with self-control. Elevated impaired control and trait disinhibition in strong expectancy drinkers were still observable when holding constant alcohol involvement variables.

Based on this pattern of findings and the definition of trait disinhibition as pursuit of reward despite potential punishment (Anderson et al., 2003), it seems probable that trait-disinhibited individuals have experienced strong negative effects of alcohol and, accordingly, expect these effects. At the same time, they are willing to overlook negative effects in pursuit of alcohol-related reward. Their continued use of alcohol despite its negative effects may contribute to a sense of impaired control over alcohol use.

There were some parallels between the present findings and Koposov et al. (2005). In both studies, there was a

cluster with strong endorsement of positive and negative expectancies (also the cluster with the most severe risk profile) and a cluster with relatively strong endorsement of positive expectancies and low endorsement of negative expectancies (associated with somewhat lower risk in both studies). These parallels suggest further the risk associated with endorsement of both positive and negative expectancies.

Clinical implications

Our results suggest that it may be beneficial to consider overall magnitude of expectancy endorsement and combinations of expectancies endorsed when considering interventions for young adult drinkers. Those who endorse positive and negative expectancies may be in need of interventions that enhance self-control, both generally and with respect to alcohol use. Regarding the latter, there is evidence supporting the efficacy of interventions such as Brief Alcohol Screening and Intervention for College Students (Dimeff et al., 1999), which aim to enhance drinking control and reduce problematic drinking (Carey et al., 2007).

Strengths and limitations

The present study had multiple strengths. Cluster analysis is a unique approach to the study of expectancies. The use of samples from two universities enabled us to conduct two sets of analyses, thus enhancing the validity of the clusters (Morral et al., 1997) and potentially increasing the representativeness of the findings. The relatively large number of participants also was beneficial. The sample was well suited to the study's goals given the high rates of heavy drinking and considerable proportion of family history-positive students. This is notable given the significant relationship between family history and cluster assignment. Alcohol involvement and trait disinhibition were assessed in a multifaceted manner, which is particularly important to the study of trait disinhibition, given that the constructs of impulsivity (Dick et al., 2010) and disinhibition (Leeman et al., 2009a) are both heterogeneous.

Several limitations must be noted. First, our study was cross-sectional; therefore, we were unable to speculate about causation or change over time. Second, we used a convenience sample of undergraduates. Third, our sample was primarily White, which might affect generalizability. Evidence suggests there are racial differences in alcohol use among young people (Johnston et al., 2010). Fourth, the sample was mostly women; however, there were no significant gender differences in cluster assignment, and women in this study tended to drink heavily.

Conclusions

Our results add to the literature by suggesting that subgroups of undergraduate alcohol drinkers differ according to their overall magnitude of expectancy endorsement and the combinations of expectancies they endorse. Both magnitude and combinations of endorsement relate to risk level. Negative expectancy endorsement appears to represent added risk above and beyond risk associated with positive expectancies. Endorsement of strong positive and negative expectancies appears to be related to difficulties with self-control in general (i.e., trait disinhibition) and with regard to alcohol use (i.e., impaired control). These results may have implications for interventions with young adults.

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References

- Anderson, C. A., & Bushman, B. J. (2002). Human aggression. *Annual Review of Psychology*, 53, 27–51.
- Anderson, K. G., Smith, G. T., & Fischer, S. F. (2003). Women and acquired preparedness: Personality and learning implications for alcohol use. *Journal of Studies on Alcohol*, 64, 384–392.
- Balodis, I. M., Potenza, M. N., & Olmstead, M. C. (2009). Binge drinking in undergraduates: Relationships with sex, drinking behaviors, impulsivity, and the perceived effects of alcohol. *Behavioural Pharmacology*, 20, 518–526.
- Barnow, S., Schultz, G., Lucht, M., Ulrich, I., Preuss, U.-W., & Freyberger, H.-J. (2004). Do alcohol expectancies and peer delinquency/substance use mediate the relationship between impulsivity and drinking behaviour in adolescence? *Alcohol and Alcoholism*, 39, 213–219.
- Bickel, W. K., & Marsch, L. A. (2001). Toward a behavioral economic understanding of drug dependence: delay discounting processes. *Addiction*, 96, 73–86.
- Bond, A. J. (1998). Drug-induced behavioural disinhibition: Incidence, mechanisms and therapeutic implications. *CNS Drugs*, 9, 41–57.
- Buss, A. H., & Perry, M. (1992). The aggression questionnaire. *Journal of Personality and Social Psychology*, 63, 452–459.
- Carey, K. B., Scott-Sheldon, L. A. J., Carey, M. P., & DeMartini, K. S. (2007). Individual-level interventions to reduce college student drinking: A meta-analytic review. *Addictive Behaviors*, 32, 2469–2494.
- Chambers, R. A., Taylor, J. R., & Potenza, M. N. (2003). Developmental neurocircuitry of motivation in adolescence: A critical period of addiction vulnerability. *American Journal of Psychiatry*, 160, 1041–1052.
- Chiang, M. M.-T., & Mirkin, B. (2007). Experiments for the number of clusters in k-means. In J. Neves, M. F. Santos, & J. M. Machado (Eds.), *Progress in artificial intelligence: 13th Portuguese conference on artificial intelligence, EPIA 2007* (pp. 395–405). Berlin, Germany: Springer-Verlag.
- Chick, J., & Duffy, J. C. (1979). Application to the alcohol dependence syndrome of a method of determining the sequential development of symptoms. *Psychological Medicine*, 9, 313–319.
- Chung, T., & Martin, C. S. (2002). Concurrent and discriminant validity of DSM-IV symptoms of impaired control over alcohol consumption in adolescents. *Alcoholism: Clinical and Experimental Research*, 26, 485–492.

- Chung, T., & Martin, C. S. (2005). What were they thinking?: Adolescents' interpretations of DSM-IV alcohol dependence symptom queries and implications for diagnostic validity. *Drug and Alcohol Dependence, 80*, 191–200.
- Collins, R. L., Parks, G. A., & Marlatt, G. A. (1985). Social determinants of alcohol consumption: The effects of social interaction and model status on the self-administration of alcohol. *Journal of Consulting and Clinical Psychology, 53*, 189–200.
- Corbin, W. R., Iwamoto, D. K., & Fromme, K. (2011). A comprehensive longitudinal test of the acquired preparedness model for alcohol use and related problems. *Journal of Studies on Alcohol and Drugs, 72*, 602–610.
- Darkes, J., Greenbaum, P. E., & Goldman, M. S. (1998). Sensation seeking–disinhibition and alcohol use: Exploring issues of criterion contamination. *Psychological Assessment, 10*, 71–76.
- Dick, D. M., Smith, G. T., Olausson, P., Mitchell, S. H., Leeman, R. F., O'Malley, S. S., & Sher, K. J. (2010). Understanding the construct of impulsivity and its relationship to alcohol use disorders. *Addiction Biology, 15*, 217–226.
- Dimeff, L. A., Baer, J. S., Kivlahan, D. R., & Marlatt, G. A. (1999). *Brief Alcohol Screening and Intervention for College Students (BASICS): A harm reduction approach*. New York, NY: Guilford Press.
- Fearnow-Kenny, M. D., Wyrick, D. L., Hansen, W. B., Dyreg, D., & Beau, D. B. (2001). Normative beliefs, expectancies, and alcohol-related problems among college students; Implications for theory and practice. *Journal of Alcohol and Drug Education, 47*, 31–44.
- Fromme, K., Stroot, E. A., & Kaplan, D. (1993). Comprehensive effects of alcohol: Development and psychometric assessment of a new expectancy questionnaire. *Psychological Assessment, 5*, 19–26.
- Giancola, P. R., Josephs, R. A., Parrott, D. J., & Duke, A. A. (2010). Alcohol myopia revisited: Clarifying aggression and other acts of disinhibition through a distorted lens. *Perspectives on Psychological Science, 5*, 265–278.
- Ham, L. S. (2009). Positive social alcohol outcome expectancies, social anxiety, and hazardous drinking in college students. *Cognitive Therapy and Research, 33*, 615–623.
- Ham, L. S., & Hope, D. A. (2006). Incorporating social anxiety into a model of college problem drinking: Replication and extension. *Psychology of Addictive Behaviors, 20*, 348–355.
- Harrison, E. L., Desai, R. A., & McKee, S. A. (2008). Nondaily smoking and alcohol use, hazardous drinking, and alcohol diagnoses among young adults: Findings from the NESARC. *Alcoholism: Clinical and Experimental Research, 32*, 2081–2087.
- Hartigan, J. A. (1975). *Clustering algorithms*. New York, NY: J. Wiley & Sons.
- Heather, N., Tebbutt, J. S., Mattick, R. P., & Zamir, R. (1993). Development of a scale for measuring impaired control over alcohol consumption: A preliminary report. *Journal of Studies on Alcohol, 54*, 700–709.
- Hingson, R., Heeren, T., Winter, M., & Wechsler, H. (2005). Magnitude of alcohol-related mortality and morbidity among U.S. college students ages 18–24: Changes from 1998 to 2001. *Annual Review of Public Health, 26*, 259–279.
- Jackson, K. M., Sher, K. J., Gotham, H. J., & Wood, P. K. (2001). Transitioning into and out of large-effect drinking in young adulthood. *Journal of Abnormal Psychology, 110*, 378–391.
- Johnson, R. A., & Wichern, D. W. (2002). *Applied multivariate statistical analysis* (5th ed.). Upper Saddle River, NJ: Prentice Hall.
- Johnston, L. D., O'Malley, P. M., Bachman, J. G., & Schulenberg, J. E. (2010). *Monitoring the Future national survey results on drug use, 1975–2009. Volume II: College students and adults ages 19–50* (NIH Publication No. 10-7585). Rockville, MD: National Institute on Drug Abuse.
- Jones, B. T., Corbin, W., & Fromme, K. (2001). A review of expectancy theory and alcohol consumption. *Addiction, 96*, 57–72.
- Koposov, R. A., Ruchkin, V. V., Eisemann, M., & Sidorov, P. I. (2005). Alcohol expectancies in relation to personality and aggression among juvenile delinquents in Northern Russia. *Journal of Drug Education, 35*, 111–130.
- Langenbucher, J. W., & Chung, T. (1995). Onset and staging of DSM-IV alcohol dependence using mean age and survival-hazard methods. *Journal of Abnormal Psychology, 104*, 346–354.
- Leeman, R. F., Fenton, M., & Volpicelli, J. R. (2007). Impaired control and undergraduate problem drinking. *Alcohol and Alcoholism, 42*, 42–48.
- Leeman, R. F., Grant, J. E., & Potenza, M. N. (2009a). Behavioral and neurological foundations for the moral and legal implications of intoxication, addictive behaviors and disinhibition. *Behavioral Sciences & the Law, 27*, 237–259.
- Leeman, R. F., Patock-Peckham, J. A., & Potenza, M. N. (in press). Impaired control over alcohol use: An under-addressed risk factor for problem drinking in young adults? *Experimental and Clinical Psychopharmacology*.
- Leeman, R. F., Toll, B. A., Taylor, L. A., & Volpicelli, J. R. (2009b). Alcohol-induced disinhibition expectancies and impaired control as prospective predictors of problem drinking in undergraduates. *Psychology of Addictive Behaviors, 23*, 553–563. Correction published in vol. 24, p. 435.
- Leigh, B. C., & Stacy, A. W. (1993). Alcohol outcome expectancies: Scale construction and predictive utility in higher order confirmatory models. *Psychological Assessment, 5*, 216–229.
- Levine, H. G. (1978). The discovery of addiction: Changing conceptions of habitual drunkenness in America. *Journal of Studies on Alcohol, 39*, 143–174.
- McCarthy, D. M., Kroll, L. S., & Smith, G. T. (2001a). Integrating disinhibition and learning risk for alcohol use. *Experimental and Clinical Psychopharmacology, 9*, 389–398.
- McCarthy, D. M., Miller, T. L., Smith, G. T., & Smith, J. A. (2001b). Disinhibition and expectancy in risk for alcohol use: Comparing black and white college samples. *Journal of Studies on Alcohol, 62*, 313–321.
- McLellan, A. T., Kushner, H., Metzger, D., Peters, R., Smith, I., Grissom, G., . . . Argeriou, M. (1992). The fifth edition of the Addiction Severity Index. *Journal of Substance Abuse Treatment, 9*, 199–213.
- Meier, M. H., Slutske, W. S., Arndt, S., & Cadoret, R. J. (2007). Positive alcohol expectancies partially mediate the relation between delinquent behavior and alcohol use: Generalizability across age, sex, and race in a cohort of 85,000 Iowa schoolchildren. *Psychology of Addictive Behaviors, 21*, 25–34.
- Morral, A. R., Iguchi, M. Y., Belding, M. A., & Lamb, R. J. (1997). Natural classes of treatment response. *Journal of Consulting and Clinical Psychology, 65*, 673–685.
- Nagoshi, C. T. (1999). Perceived control of drinking and other predictors of alcohol use and problems in a college student sample. *Addiction Research & Theory, 7*, 291–306.
- National Institute on Alcohol Abuse and Alcoholism. (2004). NIAAA council approves definition of “binge drinking.” In *NIAAA Newsletter: Winter* (NIH Publication No. 04–5346, p.3). Retrieved from http://pubs.niaaa.nih.gov/publications/Newsletter/winter2004/Newsletter_Number3.pdf
- Neighbors, C., Lee, C. M., Lewis, M. A., Fossos, N., & Larimer, M. E. (2007). Are social norms the best predictor of outcomes among heavy-drinking college students? *Journal of Studies on Alcohol and Drugs, 68*, 556–565.
- O'Brien, C. P., Volkow, N., & Li, T.-K. (2006). What's in a word? Addiction versus dependence in DSM-V. *American Journal of Psychiatry, 163*, 764–765.
- Patock-Peckham, J. A., Cheong, J., Balhorn, M. E., & Nagoshi, C. T. (2001). A social learning perspective: A model of parenting styles, self-regulation, perceived drinking control, and alcohol use and problems. *Alcoholism: Clinical and Experimental Research, 25*, 1284–1292.
- Patock-Peckham, J. A., & Morgan-Lopez, A. A. (2006). College drinking behaviors: Mediation links between parenting styles, impulse control,

- and alcohol-related outcomes. *Psychology of Addictive Behaviors*, 20, 117–125.
- Patterson, C. M., & Newman, J. P. (1993). Reflectivity and learning from aversive events: Toward a psychological mechanism for the syndromes of disinhibition. *Psychological Review*, 100, 716–736.
- Patton, J. H., Stanford, M. S., & Barratt, E. S. (1995). Factor structure of the Barratt Impulsiveness Scale. *Journal of Clinical Psychology*, 51, 768–774.
- Read, J. P., & O'Connor, R. M. (2006). High- and low-dose expectancies as mediators of personality dimensions and alcohol involvement. *Journal of Studies on Alcohol*, 67, 204–214.
- Thompson, M. P., Spitler, H., McCoy, T. P., Marra, L., Sutfin, E. L., Rhodes, S. D., & Brown, C. (2009). The moderating role of gender in the prospective associations between expectancies and alcohol-related negative consequences among college students. *Substance Use & Misuse*, 44, 934–942.
- U.S. Department of Health and Human Services. (2000). *Healthy People 2010: Conference edition, Volume II* (pp. 26–29). Washington, DC: U.S. Government Printing Office. Retrieved from <http://www.eric.ed.gov/PDFS/ED443795.pdf>
- Vik, P. W., Carrello, P., Tate, S. R., & Field, C. (2000). Progression of consequences among heavy-drinking college students. *Psychology of Addictive Behaviors*, 14, 91–101.
- Werner, M. J., Walker, L. S., & Greene, J. W. (1993). Alcohol expectancies, problem drinking, and adverse health consequences. *Journal of Adolescent Health*, 14, 446–452.
- White, H. R., & Labouvie, E. W. (1989). Towards the assessment of adolescent problem drinking. *Journal of Studies on Alcohol*, 50, 30–37.
- Wiers, R. W., Hoogveen, K.-J., Sergeant, J. A., & Boudewijn Gunning, W. (1997). High- and low-dose alcohol-related expectancies and the differential associations with drinking in male and female adolescents and young adults. *Addiction*, 92, 871–888.
- Wood, M. D., Read, J. P., Palfai, T. P., & Stevenson, J. F. (2001). Social influence processes and college student drinking: The mediational role of alcohol outcome expectancies. *Journal of Studies on Alcohol*, 62, 32–43.
- Yi, H., Williams, G. D., & Smothers, B. A. (2004). *Trends in alcohol-related fatal traffic crashes: United States, 1977–2002. Surveillance Report No. 69*. Bethesda, MD: National Institute on Alcohol Abuse and Alcoholism.
- Zuckerman, M. (1994). *Sensation seeking: Beyond the optimum level of arousal*. Mahwah, NJ: Lawrence Erlbaum.