Psychological Assessment

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Psychometric Validation of the Anticipated Effects of Alcohol Mixed With Energy Drinks Scale

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Young people are increasingly consuming alcohol mixed with energy drinks (AmEDs). As coingestion of these beverages results in greater adverse consequences than from drinking alcohol alone, we need to understand what factors contribute to and deter coingestion. Existing studies in this area have not utilized a theoretically based or empirically validated measure of outcome expectancies for drinking AmEDs. Our study modified Morean, Corbin, and Treat's (2012) Anticipated Effects of Alcohol Scale to assess the expected effects of drinking AmEDs. We evaluated the factor structure and concurrent validity of the Anticipated Effects of Alcohol Mixed with Energy Drinks (AEAMEDS) among 549 university students, aged 18–25, who had a lifetime history of consuming alcohol (231 had consumed AmEDs in the past 90 days). Exploratory and confirmatory factor analysis supported a 4-factor structure. Consistent with hypotheses, stronger high arousal/positive expectancies and weaker low arousal/negative expectancies were associated with greater AmED use. At the bivariate level, stronger low arousal/positive expectancies were associated with greater quantities of AmED use, but this relationship disappeared when taking into account other outcome expectancies. Moreover, students expected low arousal/positive expectancies to be less intense when consuming AmEDs than alcohol alone, but ratings for all other AmED expectancies were equivalent to consuming alcohol alone. These findings contribute to our knowledge of risk and protective factors for AmED use.

Public Significance Statement

Students expected that mixing energy drinks with alcohol would result in less intense feelings of calmness, relaxation, and mellowness than from drinking alcohol alone; yet, the more intense they expected these feelings to be after consuming alcohol mixed with energy drinks, the more they consumed these beverages. When taking into account students' biological sex and race, believing that consumption of alcohol mixed with energy drinks leads to happiness and having fun was associated with more frequent coingestion, while believing that drinking these beverages will lead to motor impairment was associated with less frequent use.

Keywords: alcohol expectancies, college student drinking, energy drinks, intention, university student drinking

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Alcohol use, including the practice of coingesting caffeinated energy drinks, and alcohol-related negative consequences are particularly prevalent among college students and their college-aged counterparts (e.g., Dawson, Grant, Stinson, & Chou, 2005; Grucza, Norberg, & Bierut, 2009; McKetin, Coen, & Kaye, 2015; Vida & Rácz, 2015). Alcohol mixed with energy drinks (referred to as AmEDs) may pose unique public health concerns given that the stimulant properties in energy drinks could facilitate heavier and longer bouts of drinking behavior. Research indicates that AmEDs lead to high rates of negative alcohol-related consequences, above and beyond the effects of typical alcohol use (e.g., Mallett, Marzell, Scaglione, Hultgren, & Turrisi, 2014; O'Brien, McCoy, Rhodes, Wagoner, & Wolfson, 2008; Patrick & Maggs, 2014). Given evidence that consumption of AmEDs is rising in popularity and is associated with greater negative consequences than alcohol use alone, there is an urgent need for research aimed at understanding variables contribut-

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ing to AmED use. Therefore, the present study focused on the measurement of AmED expectancies, or beliefs about the effects of AmEDs, that could explain AmED use behaviors.

Very few researchers have examined AmED expectancies, with more devoting attention to motives for AmED use. Though the two concepts are closely interrelated, they are not identical. Alcohol expectancies pertain to the likely consequences or effects of drinking, whereas drinking motives are the specific reasons that individuals drink. Thus, individuals can hold expectancies that do and do not motivate drinking (Cooper, 1994; Leigh, 1990). For example, an individual might expect that drinking alcohol will lead to becoming socially disinhibited, feeling sexually aroused, and tension reduction (alcohol expectancies); yet, that individual may only drink to release tension (a drinking motive). As such, motives research can inform expectancy research, but motives research cannot give us insight into factors that may deter AmED use.

According to Social Learning Theory (Bandura, 1977), the expected consequences of an action and the value assigned to those consequences determine whether that action is performed. If individuals expect that a particular action will lead to outcomes they value, they will be motivated to perform the action; whereas individuals will be less likely to perform an action if they expect it will lead to negatively valued outcomes. Individuals develop outcome expectancies by observing others' experiences and through their own personal experiences. Moreover, expectancies are altered over time with additional experience, such that children derive most of their alcohol expectancies from external sources (e.g., the media, parents, prevention programs), which tend to be negative; but with direct experience in adolescence and beyond, these expectancies are refined and often become more positive as people age (Miller, Smith, & Goldman, 1990; Johnson & Johnson, 1995; Gillmore et al., 1998).

Individuals are capable of holding multiple expectancies, both positive and negative, for a single action (e.g., expecting to feel social pleasure from drinking and also expecting to feel hungover the next day). These expectancies and the motivational value ascribed to them combine additively to inform the decision to drink (Cox & Klinger, 2011). Thus, individuals will be more likely to drink alcohol if they anticipate that drinking will lead to a net positive outcome, whereas they will be less likely to drink alcohol if they expect a net negative outcome. Prior research generally has shown that positive expectancies of heightened physiological arousal, social and physical pleasure, social assertion, tension reduction, sexual enhancement, and global positive change predict increased alcohol consumption (see Ham & Hope, 2003). Common negative outcome expectancies include depression, cognitive and behavioral impairment, and acting aggressively. Theoretically speaking, greater expectancy for negatively valued consequences should predict less drinking; yet, prior studies have not always supported this assumption. Negative expectancies have predicted less alcohol use in some studies (Ham, Stewart, Norton, & Hope, 2005; Leigh, 1987), more in others (Mann, Chassin, & Sher, 1987; McMahon et al., 1994), or have been unrelated to drinking behavior (Ham & Hope, 2006; Fromme et al., 1993). These inconsistencies may be attributable to expectancies being both a cause and the result of drinking. Higher negative expectancies simply can reflect more experience with drinking large amounts of alcohol and the resulting negative effects (McMahon et al., 1994). Along these lines, some studies have found the heaviest drinkers endorse both high positive and high negative expectancies (Grube & Agostinelli, 1999).

Likewise, both positive and negative expectancies for caffeine are related to greater caffeine intake for individuals who meet criteria for caffeine use disorder (Schott, Beiglbock, & Neuendorff, 2016); however, among the general population, stronger expectancies for positive outcomes are associated with more caffeine use, while stronger expectancies for negative outcomes are associated with less caffeine use (Irons et al., 2014). Regular consumers believe that caffeine consumption will result in work, social, and mood enhancement; increased energy; appetite suppression and weight control; anxiety-related physical effects; sleep disturbance; and dependence and withdrawal (Heinz, Kassel, & Smith, 2009; Huntley & Juliano, 2012). Of the above, the expectancies most often related to caffeine use (and thus motives for use) are expectancies for social/mood enhancement, increased energy, and for managing dependence and withdrawal (Graham, 1988; Heinz et al., 2009; Huntley & Juliano, 2012; Irons et al., 2014). Moreover, those who mix alcohol with caffeine have been shown to hold greater social/mood enhancement motives for caffeine than those who do not mix these beverages (Huntley & Juliano, 2012).

Combining alcohol with energy drinks or other caffeinated beverages has been shown to change behavioral outcomes. Their combined consumption predicts less self-reported fatigue, headache, dry-mouth, and motor-coordination impairment, and greater stimulation, alertness, and urge to drink alcohol than does consuming alcohol alone (Ferreira, de Mello, Pompeia, & de Souza Formigoni, 2006; Marczinski, Fillmore, Henges, Ramsey, & Young, 2012; McKetin & Coen, 2014). Moreover, experimental studies comparing AmEDs with placebo-AmEDs (i.e., alcohol mixed with placebo caffeine) using objective performance measures have shown that caffeine and energy drinks can counteract alcohol-induced decrements in attention and memory and can produce tolerance to alcohol-induced psychomotor performance deficits, but that caffeine and energy drinks do not offset decrements in reaction time (RT), information-processing, or motor-coordination (see McKetin et al., 2015, for a review). The degree to which individuals believe that the depressant effects of drinking alcohol will be offset by simultaneously consuming caffeine may influence whether they consume AmEDs. Using nonstandardized expectancy and motives measures, a handful of studies have shown that college students drink AmEDs to get drunk, enhance their buzz, and to not feel tired and party longer (Johnson, Alford, Verster, & Stewart, 2016; Mallett et al., 2014; Marczinski, 2011; Peacock et al., 2015; Varvil-Weld, Marzell, Turrisi, Mallett, & Cleveland, 2013).

Given the recent increase in AmED consumption and AmED-related accidents among young people (Substance Abuse & Mental Health Service Administration, 2011), there is a need for a standardized, reliable, and comprehensive measure of AmED expectancies to improve our understanding of the relationship between expectancies and AmED consumption. Most work in this area has not utilized theoretically based or empirically validated expectancy scales (Attila & Çakir, 2011; Mallett et al., 2014; Marczinski, 2011; Malinauskas, Aeby, Overton, Carpenter-Aeby, & Barber-Heidal, 2007; O'Brien et al., 2008; Varvil-Weld et al., 2013) or has assessed motives for use (Droste et al., 2014; Johnson et al., 2016; Patrick, Macuada, & Maggs, 2016; Peacock, Bruno, & Martin, 2012; Peacock et al., 2015; Skewes, Decou, & Gonzalez, 2013; Verster, Benson, & Scholey, 2014). The only empirically validated measure of combined use expectancies is the Caffeine + Alcohol Combined Effects Questionnaire (CACEQ; MacKillop et al., 2012). However, the CACEQ has limitations that prevent its widespread use. First, one of its two subscales (intoxication enhancement) has poor internal reliability ($\alpha < .70$). Second, it does not comprehensively cover the range of possible AmED expectancies. For example, the CACEQ does not assess negative expectancies and thus does not give us insight on how to deter AmED use.

A recently developed alcohol expectancy measures holds promise for application to AmED expectancy measurement. In 2012, Morean, Corbin, and Treat developed and found psychometric support for scores from the Anticipated Effects of Alcohol Scale (AEAS). This measure is based on Social Learning Theory and incorporates items that vary in valence (positive vs. negative) and arousal (high vs. low) level. This level of specificity seems extremely important for assessing AmED expectancies as AmED use often results in varying and sometimes opposing pharmacological effects compared with using caffeine and alcohol on their own. Furthermore, Morean et al. developed and evaluated AEAS versions that are specific to sex (i.e., number of drinks consumed in the instructions vary to account for sex differences in alcohol absorption and elimination) and to limbs of the Blood Alcohol Concentration (BAC) curve (i.e., the ascending or descending limbs). Considering each limb of the BAC curve could provide a more accurate and nuanced understanding of AmED expectancies since AmED consumers often report drinking AmEDs so that they can drink alcohol for a longer period of time (Mallett et al., 2014; Peacock et al., 2015; Varvil-Weld et al., 2013). In their 2012 study, Morean et al. consistently found that high arousal/positively valenced expectancies (e.g., feeling lively, sociable) were reliably associated with increased alcohol use, whereas low arousal/negatively valenced expectancies (e.g., feeling wobbly, dizzy) were consistently associated with less alcohol use. High arousal/negatively valenced expectancies (e.g., feeling rude, aggressive) and low arousal/positively valenced expectancies (e.g., feeling mellow, relaxed) were less consistently associated with use. Low arousal/positively valenced expectancies were associated with less frequent binge drinking, but only for the ascending limb of the BAC. High arousal/negatively valenced expectancies were associated with more frequent binge drinking for both limbs of the BAC and also with greater maximum quantities of alcohol, but only for the ascending limb of the BAC. In sum, these findings suggest that high arousal expectancies are more likely to be associated with greater alcohol use, whereas low arousal expectancies are associated with less use.

Current Study

The primary purpose of the present study was to address the need for an empirically based measure of AmED expectancies that includes items varying in both valence and arousal. To do so, we modified the instructions provided within the AEAS (Morean et al., 2012) so that we could assess AmED outcome expectancies. We then evaluated its factor structure and concurrent validity. Our concurrent validity hypotheses (H2–H5) were based on research showing that individuals drink AmEDs to deal with tiredness and to party longer (Johnson et al., 2016; Mallett et al., 2014; Marczinski, 2011; Peacock et al., 2015; Varvil-Weld et al., 2013).

H1: We expected to replicate the factor structure identified by Morean et al. (2012). Specifically, we hypothesized that there would be four internally consistent factors: high arousal/positive valence (HIGH+); high arousal/negative valence (HIGH−); low arousal/positive valence (LOW+); and low arousal/negative valence (LOW−).

H2: We hypothesized that the HIGH+ subscale would be associated positively with greater AmED use.

H3: We hypothesized that the LOW− subscale would be associated negatively with greater AmED use.

H4: We expected that AmED drinkers would obtain greater HIGH+ subscale scores for AmEDs than for alcohol alone.

H5: We expected that AmED drinkers would obtain lower LOW+ and LOW− subscale scores for AmEDs than for alcohol alone.

Method

Participants

Participants were 549 students aged 18–25 (M_{age} = 19.21, SD = 1.46; 70% women) enrolled in an introductory psychology unit at a 4-year Australian university. These individuals were drawn from a larger sample of 850 students who reported lifetime alcohol use and provided consent to use their data outside of a class project (approximately 75% of students enrolled in the psychology unit). Of the 850 students, 34 students were excluded for not completing the survey, 15 were excluded because they were missing data on the expectancy scales or on the alcohol/AmED use items, 170 participants were excluded because of inconsistent/random responding on at least one item, and 82 were excluded because they did not report their age or reported they were younger than 18 or older than 25 years of age. We restricted the sample to 18–25 year olds as this age group is representative of most university students at 4-year universities (e.g., Ham, Wang, Kim, & Zamboanga, 2013; O'Brien et al., 2008) and is the group with the highest proportion of AmED consumers (e.g., Huntley & Juliano, 2012; Trapp et al., 2014). Participant demographics are presented in Table 1.

Measures

Alcohol expectancies. The Anticipated Effects of Alcohol Scale (AEAS; Morean et al., 2012) was administered to assess alcohol expectancies. The AEAS consists of 22 items assessing the perceived likelihood of experiencing specific effects of alcohol following consumption of four drinks (for women) or five drinks (for men) in a 2-hr period on a 0 (*not at all*) to 10 (*extremely*) scale. The AEAS has versions for the ascending and descending BAC limbs, in which participants provide ratings for their expectancies for "immediately after drinking" four/five drinks (women/men) within a 2-hr period (ascending limb) and also for "90 minutes after finishing" their final drink (descending limb). Morean et al. found support for four Arousal × Valence factors: high arousal/

Table 1
Participant Demographics

Variable	Full Sample (N = 549) *M*	*SD*	AmED + (n = 231) *M*	*SD*	AmED − (n = 317) *M*	*SD*	AmED + vs. AmED − t or χ^2 (df)
Age	19.21	1.46	19.19	1.42	19.22	1.49	.240 (546)
	n	%	*n*	%	*n*	%	
Sex							.798 (1)
Male	163	29.7	73	31.6	89	28.1	
Female	386	70.3	158	68.4	228	71.9	
Ethnicity							5.349 (1)*
Anglo Australian	316	57.6	146	63.2	169	53.3	
Asian	92	16.8	30	13.0	62	19.6	
European	61	11.1	21	9.1	40	12.6	
Middle Eastern	26	4.7	13	5.6	13	4.1	
Other	52	9.5	20	8.7	32	10.1	
Prefer not to answer	2	.4	1	.4	1	.3	
Relationship status							.012 (1)
Single	314	57.2	133	57.6	181	57.1	
Casually dating	52	9.5	24	10.4	28	8.8	
Committed relationship	177	32.2	74	32.0	102	32.2	
Married	1	.2	0	.0	1	.3	
Prefer not to answer	5	.9	0	.0	5	1.6	
Year in school							.110 (1)
1st year	441	80.3	187	81.0	253	79.8	
2nd year	80	14.6	30	13.0	50	15.8	
3rd–5th year	26	4.7	13	5.6	13	4.1	
Prefer not to answer	2	.4	1	.4	1	.3	
Sexual orientation							.036 (1)
Heterosexual/Straight	510	92.9	214	92.6	295	93.1	
Gay/Lesbian/Queer	7	1.3	4	1.7	3	.9	
Bisexual	24	4.4	11	4.8	13	4.1	
Asexual	1	.2	1	.4	0	.0	
Prefer not to answer	7	1.3	1	.4	6	1.9	

Note. AmED + = Endorsed one or more occasions of AmED use in the past 90 days; AmED − = Denied use of AmEDs in the past 90 days.
* $p < .05$.

positive valence (HIGH+; 9 items); high arousal/negative valence (HIGH−; 5 items); low arousal/positive valence (LOW+; 3 items); and low arousal/negative valence (LOW−; 5 items). Morean et al. provided evidence supporting the internal consistency, convergent validity, discriminant validity, test-criterion validity, and test–retest reliability of the AEAS.

AmED expectancies. We administered a modified version of the AEAS, the Anticipated Effects of Alcohol Mixed with Energy Drinks Scale (AEAMEDS), to measure the expected effects of AmEDs. The measure was identical to the AEAS, aside from the instructions regarding alcohol consumption. Specifically, the AEAS instructions were revised so that participants were asked to rate each effect, for each limb of the BAC curve, after four (women) or five (men) vodka Redbulls consumed within a 2-hr period.

Alcohol and AmED use. Participants were asked to report on their alcohol (not mixed with caffeine) and AmED use over the past 90 days. For both alcohol and AmEDs, participants were asked to indicate the number of days they drank each type of drink, the typical number of drinks consumed on each drinking occasion for each drink type, and the maximum number of drinks consumed on a single day in the 90 days for each drink type. Participants were shown a standard drinks image to assist with their reporting. This image displayed one midstrength beer (3.5% alcohol), 30 ml of hard liquor, and 100 ml of wine as equivalent to one standard drink. When reporting on energy drink usage, participants were shown images of a 250 ml can (1 drink), a 350 ml bottle (1.7 drinks), and a 500 ml can (2 drinks). AmEDs were defined as 30 ml of spirits mixed with one energy drink.

Demographics and random responding. Participants reported on their biological sex, ethnicity, relationship status, year in school, and sexual orientation. Items to detect random responding, such as “Please select ‘B’ if you are reading this item,” were scattered throughout the survey.

Procedures

Participants were recruited from an introductory psychology unit. This unit requires students to participate in a research project so that the data can be used for teaching statistics and also for students to write a research report. During a tutorial, students were presented with an online information statement that described the dual purpose of the survey (i.e., class and researcher driven). After reading the information statement, participants completed the online survey if they had a history of consuming alcohol. After the last item, participants were asked to provide consent for their data to be used by the researchers (i.e., outside of unit requirements) and then were provided with an online debriefing statement. The survey was administered through Qualtrics® and all aspects of the study were approved by the university's human ethics research committee.

Analytic Approach

With regard to examining the factor structure of the measures, random assignment was used to split the sample to run both an exploratory factor analysis (EFA) and a confirmatory factor analysis (CFA) on items from the ascending limb of AEAMEDS. The ascending limb was chosen for comparability to the Morean et al. (2012) study and because the ascending limb is more proximal to substance use. Then, CFAs were run on the full sample for both BAC limb versions of the AEAMEDS to examine comparability across the limbs. All factor analyses were run in Mplus Version 7 (Muthén & Muthén, 2012) using the MLR estimator because item ratings were treated as continuous given there were 11 choices and item responses were not normally distributed. For the EFAs, the best fitting model was determined by examining eigenvalues, model fit indices, interpretability of the identified factors, and consistency with the expected factor structure based on the theoretical basis presented in Morean et al. (2012). Although chi-square tests are reported for the CFAs, these results were not weighted heavily in comparison with the other fit statistics, as the chi-square test is very sensitive to sample size and can result in rejecting models in which the model misfit is trivial (Stevens, 2009). The following fit indices and associated criteria were used to evaluate model fit: Bentler's comparative fit index (CFI) and Tucker-Lewis index (TFI) greater than .95 (Hu & Bentler, 1999), upper limit of the 90% confidence interval of the root-mean-square error of approximation (RMSEA) of less than .08 (Brown, 2006; Newsom, 2005), and standardized root-mean-square residual (SRMR) of less than 0.08 (Hu & Bentler, 1999; Newsom, 2005). Internal consistency was examined by computing Cronbach's alpha and composite reliability (Raykov, 1997) based on the identified factors. Composite reliability was computed using an online calculator (Colwell, 2016).

Measurement invariance across limbs of the blood alcohol curve and across the AEAS and AEAMEDS was evaluated. Configural, metric, and scalar invariance were evaluated as evidence of invariance is necessary prior to making comparisons between the measures. Multi-Group CFA models with increasing constraints were used to evaluate the three types of invariance. These analyses were conducted in Mplus (Muthén & Muthén, 2012) according to the process described in the Mplus short course (Muthén & Muthén, 2009) and are consistent with the procedures used by Morean and colleagues (2012) to evaluate measurement invariance in the AEAS.

To test concurrent validity, we conducted negative binomial regression analyses for both limbs of the BAC. Biological sex, race, and the four subscales of each measure served as predictors of frequency of use, typical quantity of use, and maximum quantity of use. Biological sex was included as a covariate given previously established relationships between gender and alcohol expectancies (Morean et al., 2012; Morean, Corbin, & Treat, 2015; Morean, Zellers, Tamler, & Krishnan-Sarin, 2016). Race was included as a covariate because, in this sample, Anglo Australians were more likely to report use of AmEDs in the past 90 days that individuals of other races (see Table 1). A total of six regression analyses were run.

To test hypotheses related to differential scoring on the AEAS and AEAMEDS among AmED drinkers, we conducted a series of related-samples Wilcoxon signed-ranks test.

Results

Descriptive statistics for the whole sample and separated by those who do and do not consume AmEDs are provided in Table 2. On average, students drank four or five alcoholic drinks once per week, but consumed AmEDs less than once a month and typically consumed two AmEDs per occasion. The results of independent samples Mann–Whitney *U* tests indicated that those who consumed AmEDs drank alcohol more frequently ($p < .001$) and in larger quantities ($ps < .001$) than those who did not consume AmEDs.

Factor Structure of the AEAMEDS

In general, the results of the EFA of the items on the AEAMEDS were consistent with the factor structure Morean et al. (2012) identified for the AEAS. Examination of the eigenvalues suggested a four-factor solution and model fit indices were acceptable (CFI = .951; TLI = .923; RMSEA = .062; 90% CI of RMSEA = .052 to .072; SRMR = .024). However, "anxious" loaded on both the HIGH− and LOW− factors with no meaningful difference in the magnitude of the two loadings and "drunk" had a crossloading > .30 (see Table 3). The EFA was then rerun with these items removed. After these item were removed, model fit remained acceptable (CFI = .951; TLI = .920; RMSEA = .066; 90% CI of RMSEA = .055 to .077; SRMR = .023). Factor loadings were comparable to those with "anxious" and "drunk" included in the model, and no items loaded strongly on more than one factor (see Table 4).

The CFA on the other half of the sample indicated that the model with the "anxious" and "drunk" items removed fit modestly well ($\chi^2(164) = 463.625$, $p < .001$; CFI = .911; TLI = .897; RMSEA = .082; 90% of RMSEA = .073 to .090; SRMR = .066). Modification indices indicated that the loading of the "carefree" item on the Low + factor was contributing the most to model misfit, so this item was removed and the CFA was rerun. This reduced model fit slightly better ($\chi^2(146) = 400.459$, $p < .001$; CFI = .920; TLI = .907; RMSEA = .080; 90% of RMSEA = .070 to .089; SRMR = .063). Next, CFAs including all participants were run on both the ascending and descending versions of the AEAMEDS with the "anxious," "carefree," and "drunk" items removed. For the ascending version, the data fit the model modestly well ($\chi^2(146) = 552.608$, $p < .001$; CFI = .926; TLI = .913; RMSEA = .071; 90% of RMSEA = .065 to .078; SRMR = .058). The data from the descending version fit the model well ($\chi^2(146) = 436.663$, $p < .001$; CFI = .952; TLI = .944; RMSEA = .060; 90% of RMSEA = .054 to .067; SRMR = .058). Factor loadings for the AmED versions are listed in Table 5. Cronbach's alpha and

Table 2
Descriptive Statistics for Alcohol and AmED Variables

Variable	α	Com. Rel.	Full sample (N = 549)[a] *M*	*SD*	AmED+ (n = 231)[b] *M*	*SD*	AmED− (n = 317)[c] *M*	*SD*
Frequency of alcohol use	—	—	13.30	13.80	17.97	14.12	9.85	12.52
Typical alcohol use quantity	—	—	4.81	3.34	5.76	3.20	4.00	3.26
Maximum alcohol use quantity	—	—	9.00	5.51	10.88	4.83	7.38	5.56
AEAS Asc. high+	.94	.94	7.37	1.84	7.72	1.61	7.13	1.97
AEAS Asc. high−	.81	.81	2.74	1.94	2.67	1.91	2.79	1.96
AEAS Asc. low+	.66	.65	5.10	2.03	5.09	2.00	5.10	2.05
AEAS Asc. low−	.88	.88	5.27	2.65	4.92	2.71	5.52	2.59
AEAS Desc. high+	.95	.95	6.42	2.11	6.86	1.87	6.10	2.22
AEAS Desc. high−	.89	.89	3.10	2.32	2.98	2.28	3.19	2.34
AEAS Desc. low+	.78	.77	5.13	2.12	5.13	2.13	5.14	2.12
AEAS Desc. low−	.92	.92	5.30	2.85	5.02	2.81	5.50	2.87
Frequency of AmED use	—	—	2.08	4.30	4.93	5.46	.0	.0
Typical AmED use quantity	—	—	2.35	1.49	2.35	1.49	n/a	n/a
Maximum AmED use quantity	—	—	3.40	2.52	3.40	2.52	n/a	n/a
AEAMEDS Asc. high+	.95	.95	7.26	1.98	7.58	1.76	7.03	2.10
AEAMEDS Asc. high−	.89	.89	3.14	2.39	2.81	2.30	3.38	2.43
AEAMEDS Asc. low+	.79	.79	3.73	2.31	3.86	2.33	3.64	2.30
AEAMEDS Asc. low−	.90	.90	5.24	2.78	4.64	2.79	5.69	2.70
AEAMEDS Desc. high+	.96	.96	6.37	2.28	6.93	2.05	5.97	2.36
AEAMEDS Desc. high−	.91	.91	3.39	2.52	3.00	2.34	3.66	2.61
AEAMEDS Desc. low+	.81	.81	4.05	2.28	4.26	2.31	3.89	2.26
AEAMEDS Desc. low−	.93	.93	5.44	2.84	4.86	2.74	5.87	2.85

Note. AEAS = Anticipated Effects of Alcohol Scale; AEAMEDS = Anticipated Effects of AmEDs Scale; AmED = alcohol mixed with energy drinks; Asc. = Ascending; Desc. = Descending; High+ = high arousal/positive expectancies; High− = high arousal/negative expectancies; Low+ = low arousal/negative expectancies; Low− = low arousal/negative expectancies; Com. Rel. = Composite Reliability.
[a] For a given variable, n with data for a given variable ranged from 231 (Typical and Maximum AmED Use Quantity) to 549. [b] For a given variable, n with data for a given variable ranged from 219 (AEAS Asc. High +) to 231. [c] For a given variable, n with data for a given variable ranged from 269 (Typical and Maximum Alcohol Use Quantity) to 317. Typical and Maximum quantity of use data was only collected for participants who reported drinking alcohol in the past 90 days; 48 AmED- participants denied drinking in the past 90 days.

composite reliability estimates were good to excellent for all subscales (see Table 2).[1]

Measurement Invariance Models

Results of the measurement invariance models are presented in Table 6. Fit of the configural models was evaluated using the criteria for the CFA models. The configural model then served as the comparison model for the metric model, which in turn served as the comparison model for the scalar model. Measurement invariance was tested across the limbs of the AEAS and AEAMEDS and between corresponding limbs of the AEAS and AEAMEDS. All four configural models fit the data well. Chen (2007) suggested that lack of factor loading invariance (i.e., metric invariance) exists if there is "a change of ≥ −.010 in CFI, supplemented by a change of ≥ .015 in RMSEA or a change of ≥ .030 in SRMR" (p. 501). For scalar invariance, Chen recommended that invariance is indicated by "a change of ≥ −.010 in CFI, supplemented by a change of ≥ .015 in RMSEA or a change of ≥ .010 in SRMR" (p. 501). Based on this information, support for metric and scalar invariance across all four models was found.

Validity of the AEAMEDS

Results of the negative binomial regressions examining the concurrent validity of the AEAMEDS subscales are presented in Table 7.[2] Results indicated that female participants reported fewer AmED drinking occasions over the past 90 days than male participants, and that individuals who identified their race as Anglo Australian drank AmEDs more frequently than those who identified with another race. The hypothesis that the HIGH+ subscale would be associated positively with AmED use was supported for frequency of use for both BAC limbs. The hypothesis that LOW− subscale would be associated negatively with AmED use also was supported for frequency of use for both limbs. Neither subscale was related to quantity of use. HIGH− and LOW+ expectancies were not associated with any of the AmED use variables; however, when examining bivariate relationships (see Appendix B in the

[1] Because the items assessing feeling "carefree," "anxious," and "drunk" were removed from the AEAMEDS as a result of the factor analysis results, an EFA was also run on the AEAS to determine whether the dual loading of these items were attributable to shifting the focus to AmEDs or to sample/population differences. In general, the results of the factor analyses examining the AEAS supported removal of the "anxious" item as well and possibly "drunk" but not "carefree" (see Appendix A in the online supplemental materials).

[2] Because the "carefree," "anxious," and "drunk" items were removed from the both the AEAS and AEAMEDS for the purposes of this paper, regression analyses were also conducted for the AEAS (see Appendices C & D). These analyses showed that HIGH+ expectancies were reliably associated with greater alcohol use in all but one analysis, whereas LOW− expectancies were reliably associated with less alcohol use. Greater LOW+ expectancies for the ascending BAC were associated with lower frequency of alcohol use.

Table 3
EFA Factor Loadings for AEAMEDS Ascending Version (n = 275)

Item	High+	High−	Low+	Low−
Sociable	**.767***	.024	−.004	−.063
Carefree	**.596***	−.018	.201*	.094
Fun	**.874***	−.024	.068	−.036
Lively	**.874***	.029	−.044	−.007
Attractive	**.556***	.197*	.100	.029
Funny	**.815***	−.007	.006	.097*
Talkative	**.866***	.018	−.097*	.108*
Confident	**.888***	.115*	−.064	−.019
Happy	**.834***	−.052	.101	−.046
Moody	−.063	**.773***	.054	.068
Demanding	.089*	**.802***	.003	.022
Rude	.061*	**.876***	−.017	.000
Aggressive	.064*	**.849***	.011	−.047
Anxious	−.142*	**.433***	−.150*	.432*
Mellow	−.008	.240*	**.629***	−.002
Relaxed	.157*	−.057	**.701***	.050
Calm	−.075	.025	**.775***	−.053
Woozy	.014	.005	.154*	**.796***
Dizzy	.050	−.015	.000	**.863***
Ill	−.093	.198*	−.007	**.691***
Wobbly	.077*	.048	.042	**.875***
Drunk	.330*	−.047	−.020	**.652***
Factor correlations	**High+**	**High−**	**Low+**	
High−	.142*			
Low+	.197*	−.084		
Low−	.233*	.427*	.030	

Note. AEAMEDS = Anticipated Effects of Alcohol Mixed with Energy Drinks Scale. High+ = high arousal/positive expectancies; High− = high arousal/negative expectancies; Low+ = low arousal/negative expectancies; Low− = low arousal/negative expectancies. Bold values indicate the factor the item was predicted to load upon based on the Morean et al. (2012) article.
* $p < .05$.

online supplemental materials), LOW+ expectancies were positively associated with typical and maximum quantity for both limbs.

AEAS Versus AEAMEDS

Mean AEAS and AEAMEDS subscale scores for those who used AmEDs are presented in Table 2, and statistical comparisons are displayed in Table 8. These individuals obtained higher HIGH+ scores on the ascending limb of the AEAS than they did on the descending limb of the AEAS, but higher HIGH− scores on the descending limb of the AEAS than on the ascending limb on the AEAS. This same pattern of results was replicated on the AEAMEDS. However, individuals who used AmEDs also achieved higher LOW+ scores on the descending limb of the AEAMEDS than they did on the ascending limb of the AEAMEDS. LOW+ scores were the only scores to statistically differ when directly comparing the AEAS to the AEAMEDS. For both the ascending and descending limbs of the BAC, individuals who used AmEDs obtained higher LOW+ scores on the AEAS than they did on the AEAMEDS. Thus, our hypotheses that AmED drinkers would obtain greater HIGH+ subscale scores in the AEAMEDS than on the AEAS and lower LOW+ and LOW− scores on the AEAMEDS than on the AEAS was only partially supported.

Discussion

The overarching aim of the current study was to provide empirical support for a theoretically based expectancy measure for AmEDs use. As hypothesized, we found the AEAMEDS had the same four factor structure as its predecessor, the AEAS; however, we deleted three items (anxiety, drunk, carefree) to improve model fit. We then examined the associations these four factors had with AmED use variables to provide support for the concurrent validity of the AEAMEDS. We found partial support for the hypotheses that the HIGH+ subscale (e.g., feeling lively, happy, and having fun) would be associated positively with AmED use and the LOW− subscale (e.g., feeling dizzy, ill) would be would be associated negatively with AmED use. When controlling for other expectancies, HIGH+ scores were associated with greater frequency of AmED use for both BAC limbs, whereas LOW− scores were associated with less frequent use. Lastly, we expected that AmED drinkers would obtain greater HIGH+ subscale scores, but lower LOW+ and LOW− subscale scores for AmEDs than for alcohol alone. However, we only found that LOW+ expectancy scores differed across beverage types. Individuals who reported

Table 4
EFA Factor Loadings for AEAMEDS Ascending Version (n = 275) with "Anxious" and "Drunk" Items Excluded

Item	High+	High−	Low+	Low−
Sociable	**.769***	.022	.000	−.067
Carefree	**.599***	−.007	.192*	.083
Fun	**.878***	−.026	.067	−.037
Lively	**.873***	.019	−.048	.002
Attractive	**.550***	.198*	.101	.020
Funny	**.815***	−.013	.001	.102*
Talkative	**.862***	.009	−.102*	.114*
Confident	**.882***	.113*	−.065	−.019
Happy	**.841***	−.054	.103	−.050
Moody	−.091*	**.751***	.042	.087
Demanding	.055	**.795***	−.009	.031
Rude	.021	**.894***	−.036	.004
Aggressive	.027	**.862***	−.003	−.045
Mellow	.004	.234*	**.625***	−.004
Relaxed	.181*	−.058	**.688***	.051
Calm	−.050	.025	**.778***	−.059
Woozy	.002	−.013	.123*	**.816***
Dizzy	.034	−.030	−.031	**.878***
Ill	−.110*	.176*	−.023	**.698***
Wobbly	.060	.040	.011	**.877***
Factor correlations	**High+**	**High−**	**Low+**	
High−	.189*			
Low+	.168*	−.062		
Low−	.258*	.440*	.064	

Note. AEAMEDS = Anticipated Effects of Alcohol Mixed with Energy Drinks Scale; High+ = high arousal/positive expectancies; High− = high arousal/negative expectancies; Low+ = low arousal/negative expectancies; Low− = low arousal/negative expectancies. Bold values indicate the factor the item was predicted to load upon based on the Morean et al. (2012) article.
* $p < .05$.

Table 5
CFA Factor Loadings for AEAMEDS Ascending and Descending Versions (n = 549)

Item by subscale	Ascending version Estimate	*SE*	Est./*SE*	StdY	Descending version Estimate	*SE*	Est./*SE*	StdY
High+								
Confident	1.000			.904	1.000			.924
Sociable	.820	.034	23.941	.810	.863	.030	28.514	.837
Fun	.917	.038	24.438	.892	.924	.026	35.254	.893
Lively	.858	.041	20.784	.853	.950	.032	29.819	.885
Attractive	.859	.039	21.875	.640	.814	.033	24.311	.713
Funny	.945	.033	28.382	.839	.890	.029	30.837	.848
Talkative	.969	.025	38.152	.914	.954	.027	35.118	.900
Happy	.983	.027	35.797	.875	1.023	.023	45.280	.911
High−								
Rude	1.000			.893	1.000			.914
Demanding	1.020	.047	21.628	.818	.981	.039	25.155	.856
Moody	.838	.050	16.744	.707	.920	.043	21.415	.792
Aggressive	.964	.035	27.569	.834	.923	.030	30.565	.843
Low+								
Calm	1.000			.772	1.000			.854
Mellow	.837	.066	12.626	.642	.720	.051	14.073	.635
Relaxed	1.148	.105	10.923	.812	.974	.063	15.512	.800
Low−								
Wobbly	1.000			.910	1.000			.925
Woozy	.873	.028	31.452	.823	.903	.030	30.065	.853
Dizzy	.933	.032	29.573	.863	.991	.024	42.010	.909
Ill	.841	.036	23.063	.750	.911	.032	28.825	.796
Factor Corr.								
High+/High−	.907	.239	3.801	.183	−.189	.288	−.658	−.031
High+/Low+	1.310	.235	5.582	.302	1.906	.299	6.381	.347
High+/Low−	1.510	.335	4.508	.246	.434	.351	1.237	.063
High−/Low+	.036	.284	.126	.007	.220	.311	.707	.038
High−/Low−	3.200	.330	9.709	.468	3.680	.345	10.657	.510
Low+/Low−	1.074	.333	3.227	.179	.997	.354	2.819	.152

Note. AEAMEDS = Anticipated Effects of Alcohol Mixed with Energy Drinks Scale; High+ = high arousal/positive expectancies; High− = high arousal/negative expectancies; Low+ = low arousal/negative expectancies; Low− = low arousal/negative expectancies; Corr. = Correlations. Bolded items were the factor metric items. *SE* = standard error; Est./*SE* = a ratio of the factor estimate and the standard error; StdY = standardized factor loading.

drinking AmEDs expected to feel less mellow, calm, and relaxed when drinking AmEDs than when drinking alcohol alone. Notably, these individuals expected to feel more relaxed, calm, and mellow during the descending limb of the BAC curve than during the ascending limb.

We identified a four-factor structure for the AEAMEDS. This is not surprising because the original measure, the AEAS, was specifically developed to target four theoretically possible affective quadrants (high arousal/negative valence; high arousal/positive valence; low arousal/negative valence; low arousal/positive valence). In the current study, we found that "anxiety" and "drunk" loaded on two factors in the EFA, while "carefree" contributed to model misfit in the CFA. As a result, we checked the factor structure of the AEAS to understand whether this anomaly was due to our focus on AmEDs or sample/population differences. Anxiety and drunk cross-loaded on the AEAS, but we found no indication that carefree should be removed from the AEAS. As we found evidence of measurement invariance between the AEAS and AEAMEDS after excluding these three items, indicating that the factor structure, factor loadings, and origins for the items did not vary significantly across the two measures, we were able to make comparisons across measures. Despite removing these three items and testing the AEAS in an Australian sample, we replicated Morean et al.'s findings (see Appendix D in the online supplemental materials), albeit HIGH− scores were not associated positively with quantity of use in the current sample. This may be attributable to Morean et al.'s sample consuming slightly higher maximum quantities of alcohol (7.58 American standard drink units) than the current sample (9.0 Australian standard drink units = 6.43 American standard drink units). Morean et al.'s sample may have demonstrated a relationship between HIGH− scores and quantity of use as a consequence of their experience with drinking high amounts of alcohol.

Much like findings regarding drinking alcohol alone in both the current study and in the Morean et al. (2012) study, we found that greater HIGH+ expectancies and lower LOW− expectancies were associated with more frequent AmED use. Thus, believing that consumption of AmEDs will lead to liveliness, sociability, and high degrees of fun may be a risk factor for drinking AmEDs, while believing that drinking AmEDs will result in feeling high degrees of dizziness, wooziness, and drunkenness may be a protective factor. We also found that students who expected stronger low arousal positive effects (e.g., feeling relaxed, calm) reported greater typical and maximum quantities of AmED use at the bivariate level, but that these relationships disappeared when examined in the context of other expectancies. LOW+ AEAS scores were not related at the univariate or multivariate level to quantity of use in the current sample or that of Morean et al. (2012). These

Table 6
Measurement Invariance Model Results

Invariance model	χ^2 (*df*)	RMSEA (90% CI)	CFI	TLI	SRMR
AEAS Ascending and AEAS Descending					
Configural	1477.100 (292)	.086 (.082 to .090)	.918	.904	.063
Metric	1504.806 (307)	.084 (.080 to .089)	.917	.908	.066
Scalar	1669.197 (322)	.087 (.083 to .091)	.907	.901	.068
AEAMEDS Ascending and AEAMEDS Descending					
Configural	1285.885 (292)	.079 (.074 to .083)	.941	.931	.058
Metric	1310.253 (307)	.077 (.073 to .081)	.941	.934	.060
Scalar	1418.458 (322)	.079 (.075 to .083)	.935	.931	.063
AEAS Ascending and AEAMEDS					
Configural	1451.502 (292)	.085 (.081 to .089)	.919	.905	.059
Metric	1498.600 (307)	.084 (.080 to .088)	.917	.907	.063
Scalar	1630.032 (322)	.086 (.082 to .090)	.909	.903	.065
AEAS Descending and AEAMEDS Descending					
Configural	1311.484 (292)	.080 (.075 to .084)	.940	.930	.062
Metric	1341.255 (307)	.078 (.074 to .083)	.940	.933	.065
Scalar	1413.459 (322)	.079 (.074 to .082)	.936	.932	.066

Note. AEAMEDS = AEAS = Anticipated Effects of Alcohol Scale; Anticipated Effects of Alcohol Mixed with Energy Drinks Scale; RMSEA = root mean square error of approximation; CFI = comparative fit index; TLI = Tucker-Lewis Index; SRMR = standardized root mean square residual; all χ^2 values are significant at $p < .001$.

low arousal positive effects correspond to the calming effects of alcohol. While Social Learning Theory predicts that these expectancies should be related to more alcohol use as they are positively valenced, past AmED research has not identified that individuals expect AmEDs to make them feel relaxed, calm, or mellow. In fact, prior research has identified the opposite trend, reporting that most young people drink AmEDs to feel more energy and to party longer (Peacock et al., 2012; Peacock et al., 2015).

Our undergraduate sample expected that drinking four/five AmEDs would make them feel less-laid back during both the ascending and descending limb of intoxication than if they drank four/five alcohol-only beverages. Moreover, they expected to feel

Table 7
Negative Binomial Regression Analyses Examining Concurrent Validity of the AEAMEDS Subscales

Predictor	90-day frequency of AmED use (n = 531)		90-day typical AmED quantity (n = 224)		90-day maximum AmED quantity (n = 224)	
	B	χ^2	*b*	χ^2	*b*	χ^2
AEAMEDS Ascending version	(n = 531)		(n = 224)		(n = 224)	
Sex	−.248	4.244*	−.105	.367	−.246	2.225
Race	−.290	6.237*	.071	.170	.088	.286
High+	.250	54.053***	.052	1.174	.047	1.116
High−	.001	.003	.027	.467	.036	.924
Low+	.026	1.108	.032	.866	.054	2.751
Low−	−.153	40.145***	−.038	1.276	−.041	1.737
Model χ^2		121.584 (6)***		4.152 (6)		9.763 (6)
AEAMEDS Descending version	(n = 531)		(n = 223)		(n = 223)	
Sex	−.182	2.204	−.093	.280	−.224	1.812
Race	−.321	7.704**	.046	.075	.072	.194
High+	.204	56.110***	.040	.994	.050	1.763
High−	.039	2.096	.026	.415	.028	.591
Low+	.037	1.869	.037	1.041	.057	2.643
Low−	−.158	41.667***	−.030	.758	−.030	.877
Model χ^2		132.011 (6)***		3.805 (6)		9.794 (6)

Note. AEAMEDS = Anticipated Effects of Alcohol Mixed with Energy Drinks Scale; High+ = high arousal/positive expectancies; High− = high arousal/negative expectancies; Low+ = low arousal/negative expectancies; Low− = low arousal/negative expectancies. Coding of sex: 0 = Male, 1 = Female. Coding of race: 0 = Anglo Australian, 1 = Other.
* $p < .05$. ** $p < .01$. *** $p < .001$.

Table 8
Related-Samples Wilcoxon Signed Rank Tests Comparing AEAS and AEAMEDS Subscales for Participants Who Consumed AmEDs in the Past 90 Days

Versions and arms	Subscale	*z*	*p*	*r*
AEAS Ascending vs. AEAS Descending	High+	−6.853	<.001	−.327
	High−	−2.761	.006	−.129
	Low+	−.019	.985	−.001
	Low−	−.470	.743	−.022
AEAMEDS Ascending vs. AEAMEDS Descending	High+	−5.071	<.001	−.239
	High−	−2.301	.021	−.107
	Low+	−2.499	.012	−.117
	Low−	−1.333	.183	−.062
AEAS Ascending vs. AEAMEDS Ascending	High+	−.586	.558	−.028
	High−	−.698	.485	−.033
	Low+	−7.748	<.001	−.362
	Low−	−1.718	.086	−.081
AEAS Descending vs. AEAMEDS Descending	High+	−1.008	.313	−.048
	High−	−.623	.533	−.029
	Low+	−6.477	<.001	−.302
	Low−	−1.358	.174	−.064

Note. AEAS = Anticipated Effects of Alcohol Scale; AEAMEDS = Anticipated Effects of AmEDs Scale; AmED = alcohol mixed with energy drinks; High+ = high arousal/positive expectancies; High− = high arousal/negative expectancies; Low+ = low arousal/negative expectancies; Low− = low arousal/negative expectancies. $p < .003$ considered significant based on Bonferroni correction.

more laid-back on the descending limb than the ascending limb after consuming AmEDs. Yet, they drank more AmEDs when they expected stronger feelings of calmness. These combined findings suggest that undergraduates may not drink high quantities of AmEDs to achieve calmness, but end up consuming many AmEDs because they believe that energy drinks will delay this effect, which tend to be more pronounced on the descending limb. As the relationship between LOW+ scores and quantity of use disappears at the multivariate level, this expectancy may not be a strong motivator of use. Future research on motives for use should explore the possibility that students may consume AmEDs to feel laid-back, but not sedated, on the descending limb of intoxication.

This study is limited by a handful of factors, such as being cross-sectional in nature and solely focused on self-report, a somewhat high quantity of AmEDs (four/five drinks), and on current consumers. As such, future research should evaluate the predictive validity of the AEAMEDS by conducting longitudinal and experimental research to examine how expectancies predict AmED use over time. Moreover, future research should compare young people's expected effects for one or two AmEDs to four AmEDs to help us understand how and when caffeine consumption influences perceptions of feeling laid-back and its relationship with quantity of use. Additionally, the current findings would be expanded if researchers examine experience with AmEDs on a continuum. According to Social Learning Theory (Bandura, 1977), expectancies should change over time as people have more of their own experiences with drinking AmEDs. Thus, someone who has only consumed alcohol once (e.g., a current user) may hold quite different expectancies from someone who has consumed AmEDs numerous times. To pursue this line of research, researchers will need to establish if participants can reliably report on the number of occasions that they have consumed AmEDs.

Despite our study's limitations, extending the AEAS to assess AmED expectancies advances the literature in several important ways. First, the AEAMEDS is the first comprehensive, theoretically driven measure of AmED expectancies. Second, we ensured our ability to meaningfully interpret differences across the BAC limbs of the AEAS and AEAMEDS and between corresponding limbs of the AEAS and AEAMEDS. By removing anxiety, drunk, and carefree from the original AEAS were able to find a new measure that works for both limbs and types of beverages. Third, we established that for both the AEAS and AEAMEDS, HIGH+ expectancies were stronger for the ascending limb, while HIGH− expectancies were stronger for the descending limb. LOW+ expectancies were weaker for the AEAMEDS than the AEAA for both BAC limbs, and LOW+ expectancies were stronger for the descending limb than the ascending limb of the BAC curve for the AEAMEDS. Fourth, we found that HIGH+ expectancies may be a risk factor for AmED use, while LOW− expectancies may be a protective factor against use. These findings indicate utility for discriminating AmED expectancies based on arousal and valence and for using Social Learning Theory to understand AmED use.

References

Attila, S., & Çakir, B. (2011). Energy-drink consumption in college students and associated factors. *Nutrition, 27,* 316–322. http://dx.doi.org/10.1016/j.nut.2010.02.008

Bandura, A. (1977). *Social learning theory*. Englewood Cliffs, NJ: Prentice Hall.

Brown, T. A. (2006). *Confirmatory factor analysis for applied research*. New York, NY: Guilford Press.

Chen, F. F. (2007). Sensitivity of goodness of fit indexes to lack of measurement invariance. *Structural Equation Modeling, 14,* 464–504. http://dx.doi.org/10.1080/10705510701301834

Colwell, S. R. (2016). The composite reliability calculator [Tech. Rep. No.]. http://dx.doi.org/10.13140/RG.2.1.4298.088

Cooper, M. L. (1994). Motivations for alcohol use among adolescents: Development and validation of a four-factor model. *Psychological Assessment, 6,* 117–128. http://dx.doi.org/10.1037/1040-3590.6.2.117

Cox, W. M., & Klinger, E. (2011). A motivational model of alcohol use: Determinants of use and change. In W. M. Cox & E. Klinger (Eds.), *Handbook of motivational counseling: Goal-based approaches to assessment and intervention with addiction and other problems*. Chichester, UK: Wiley, Ltd. http://dx.doi.org/10.1002/9780470979952.ch6

Dawson, D. A., Grant, B. F., Stinson, F. S., & Chou, P. S. (2005). Psychopathology associated with drinking and alcohol use disorders in the college and general adult populations. *Drug and Alcohol Dependence, 77,* 139–150. http://dx.doi.org/10.1016/j.drugalcdep.2004.07.012

Droste, N., Tonner, L., Zinkiewicz, L., Pennay, A., Lubman, D. I., & Miller, P. (2014). Combined alcohol and energy drink use: Motivations as predictors of consumption patterns, risk of alcohol dependence, and experience of injury and aggression. *Alcoholism: Clinical and Experimental Research, 38,* 2087–2095. http://dx.doi.org/10.1111/acer.12438

Ferreira, S. E., de Mello, M. T., Pompéia, S., & de Souza-Formigoni, M. L. (2006). Effects of energy drink ingestion on alcohol intoxication. *Alcoholism: Clinical and Experimental Research, 30,* 598–605. http://dx.doi.org/10.1111/j.1530-0277.2006.00070.x

Fromme, K., Stroot, E., & Kaplan, D. (1993). Comprehensive effects of alcohol: Development and psychometric assessment of a new expectancy questionnaire. *Psychological Assessment, 5,* 19–26. http://dx.doi.org/10.1037/1040-3590.5.1.19

Gillmore, M. R., Wells, E. A., Simpson, E. E., Morrison, D. M., Hoppe, M. J., & Wilsdon, A. (1998). Children's beliefs about drinking. *The*

American Journal of Drug and Alcohol Abuse, 24,* 131–151. http://dx.doi.org/10.3109/00952999809001703

Graham, K. (1988). Reasons for consumption and heavy caffeine use: Generalization of a model based on alcohol research. *Addictive Behaviors, 13,* 209–214. http://dx.doi.org/10.1016/0306-4603(88)90015-9

Grube, J. W., & Agostinelli, G. E. (1999). Perceived consequences and adolescent drinking: Nonlinear and interactive models of alcohol expectancies. *Psychology of Addictive Behaviors, 13,* 303–312. http://dx.doi.org/10.1037/0893-164X.13.4.303

Grucza, R. A., Norberg, K. E., & Bierut, L. J. (2009). Binge drinking among youths and young adults in the United States: 1979–2006. *Journal of the American Academy of Child & Adolescent Psychiatry, 48,* 692–702. http://dx.doi.org/10.1097/CHI.0b013e3181a2b32f

Ham, L. S., & Hope, D. A. (2003). College students and problematic drinking: A review of the literature. *Clinical Psychology Review, 23,* 719–759. http://dx.doi.org/10.1016/S0272-7358(03)00071-0

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. http://dx.doi.org/10.1037/0893-164X.20.3.348

Ham, L. S., Stewart, S. H., Norton, P. J., & Hope, D. A. (2005). Psychometric assessment of the Comprehensive Effects of Alcohol Questionnaire: Comparing a brief version to the original full scale. *Journal of Psychopathology and Behavioral Assessment, 27,* 141–158. http://dx.doi.org/10.1007/s10862-005-0631-9

Ham, L. S., Wang, Y., Kim, S. Y., & Zamboanga, B. L. (2013). Measurement equivalence of the brief comprehensive effects of alcohol scale in a multiethnic sample of college students. *Journal of Clinical Psychology, 69,* 341–363. http://dx.doi.org/10.1002/jclp.21904

Heinz, A. J., Kassel, J. D., & Smith, E. V. (2009). Caffeine expectancy: Instrument development in the Rasch measurement framework. *Psychology of Addictive Behaviors, 23,* 500–511. http://dx.doi.org/10.1037/a0016654

Hu, L., & Bentler, P. M. (1999). Cutoff criteria for fit indexes in covariance structure analysis: Conventional criteria versus new alternatives. *Structural Equation Modeling, 6,* 1–55. http://dx.doi.org/10.1080/10705519909540118

Huntley, E. D., & Juliano, L. M. (2012). Caffeine Expectancy Questionnaire (CaffEQ): Construction, psychometric properties, and associations with caffeine use, caffeine dependence, and other related variables. *Psychological Assessment, 24,* 592–607. http://dx.doi.org/10.1037/a0026417

Irons, J. G., Heinz, A. J., Bassett, D. T., Correia, C. J., Babson, K. A., Boden, M. T., . . . Bonn-Miller, M. O. (2014). Development and Initial Validation of the Caffeine Motives Questionnaire. *Journal of Caffeine Research, 4,* 49–55. http://dx.doi.org/10.1089/jcr.2014.0002

Johnson, H. L., & Johnson, P. B. (1995). Children's alcohol-related cognitions: Positive versus negative alcohol effects. *Journal of Alcohol and Drug Education, 40,* 1–12.

Johnson, S. J., Alford, C., Verster, J. C., & Stewart, K. (2016). Motives for mixing alcohol with energy drinks and other non-alcoholic beverages and its effects on overall alcohol consumption among UK students. *Appetite, 96,* 588–597. http://dx.doi.org/10.1016/j.appet.2015.10.007

Leigh, B. C. (1987). Beliefs about the effects of alcohol on self and others. *Journal of Studies on Alcohol, 48,* 467–475. http://dx.doi.org/10.15288/jsa.1987.48.467

Leigh, B. C. (1990). Alcohol expectancies and reasons for drinking: Comments from a study of sexuality. *Psychology of Addictive Behaviors, 4,* 91–96. http://dx.doi.org/10.1037/h0080578

MacKillop, J., Howland, J., Rohsenow, D. J., Few, L. R., Amlung, M. T., Metrik, J., & Calise, T. V. (2012). Initial development of a measure of expectancies for combinations of alcohol and caffeine: The Caffeine + Alcohol Combined Effects Questionnaire (CACEQ). *Experimental and Clinical Psychopharmacology, 20,* 466–472. http://dx.doi.org/10.1037/a0030539

Malinauskas, B. M., Aeby, V. G., Overton, R. F., Carpenter-Aeby, T., & Barber-Heidal, K. (2007). A survey of energy drink consumption patterns among college students. *Nutrition Journal, 6,* 35–35. http://dx.doi.org/10.1186/1475-2891-6-35

Mallett, K. A., Marzell, M., Scaglione, N., Hultgren, B., & Turrisi, R. (2014). Are all alcohol and energy drink users the same? Examining individual variation in relation to alcohol mixed with energy drink use, risky drinking, and consequences. *Psychology of Addictive Behaviors, 28,* 97–104. http://dx.doi.org/10.1037/a0032203

Mann, L. M., Chassin, L., & Sher, K. J. (1987). Alcohol expectancies and the risk for alcoholism. *Journal of Consulting and Clinical Psychology, 55,* 411–417. http://dx.doi.org/10.1037/0022-006X.55.3.411

Marczinski, C. A. (2011). Alcohol mixed with energy drinks: Consumption patterns and motivations for use in U.S. college students. *International Journal of Environmental Research and Public Health, 8,* 3232–3245. http://dx.doi.org/10.3390/ijerph8083232

Marczinski, C. A., Fillmore, M. T., Henges, A. L., Ramsey, M. A., & Young, C. R. (2012). Effects of energy drinks mixed with alcohol on information processing, motor coordination and subjective reports of intoxication. *Experimental and Clinical Psychopharmacology, 20,* 129–138. http://dx.doi.org/10.1037/a0026136

McKetin, R., & Coen, A. (2014). The effect of energy drinks on the urge to drink alcohol in young adults. *Alcoholism: Clinical and Experimental Research, 38,* 2279–2285. http://dx.doi.org/10.1111/acer.12498

McKetin, R., Coen, A., & Kaye, S. (2015). A comprehensive review of the effects of mixing caffeinated energy drinks with alcohol. *Drug and Alcohol Dependence, 151,* 15–30. http://dx.doi.org/10.1016/j.drugalcdep.2015.01.047

McMahon, J., Jones, B. T., & O'Donnell, P. (1994). Comparing positive and negative alcohol expectancies in Male and female social drinkers. *Addiction Research, 1,* 349–365. http://dx.doi.org/10.3109/16066359409005202

Miller, P. M., Smith, G. T., & Goldman, M. S. (1990). Emergence of alcohol expectancies in childhood: A possible critical period. *Journal of Studies on Alcohol, 51,* 343–349. http://dx.doi.org/10.15288/jsa.1990.51.343

Morean, M. E., Corbin, W. R., & Treat, T. A. (2012). The Anticipated Effects of Alcohol Scale: Development and psychometric evaluation of a novel assessment tool for measuring alcohol expectancies. *Psychological Assessment, 24,* 1008–1023. http://dx.doi.org/10.1037/a0028982

Morean, M. E., Corbin, W. R., & Treat, T. A. (2015). Evaluating the accuracy of alcohol expectancies relative to subjective response to alcohol. *Addictive Behaviors, 51,* 197–203. http://dx.doi.org/10.1016/j.addbeh.2015.07.027

Morean, M. E., Zellers, S., Tamler, M., & Krishnan-Sarin, S. (2016). Psychometric validation of measures of alcohol expectancies, retrospective subjective response, and positive drinking consequences for use with adolescents. *Addictive Behaviors, 58,* 182–187. http://dx.doi.org/10.1016/j.addbeh.2016.02.036

Muthén, L. K., & Muthén, B. O. (2009). *Mplus short courses topic 1: Exploratory factor analysis, confirmatory factor analysis, and structural equation modeling for continuous outcomes*. Retrieved from https://www.statmodel.com/download/Topic%201.pdf

Muthén, L. K., & Muthén, B. O. (2012). *Mplus* (Version 7) [Computer software]. Los Angeles, CA: Author.

Newsom, J. T. (2005). *Some clarifications and recommendations on fit indices*. Retrieved from http://www.upa.pdx.edu/IOA/newsom/semclass/ho_fit.pdf

O'Brien, M. C., McCoy, T. P., Rhodes, S. D., Wagoner, A., & Wolfson, M. (2008). Caffeinated cocktails: Energy drink consumption, high-risk drinking, and alcohol-related consequences among college students.

Academic Emergency Medicine, 15, 453–460. http://dx.doi.org/10.1111/j.1553-2712.2008.00085.x

Patrick, M. E., Macuada, C., & Maggs, J. L. (2016). Who uses alcohol mixed with energy drinks? Characteristics of college student users. *Journal of American College Health, 64,* 74–79. http://dx.doi.org/10.1080/07448481.2015.1042877

Patrick, M. E., & Maggs, J. L. (2014). Energy drinks and alcohol: Links to alcohol behaviors and consequences across 56 days. *Journal of Adolescent Health, 54,* 454–459. http://dx.doi.org/10.1016/j.jadohealth.2013.09.013

Peacock, A., Bruno, R., & Martin, F. H. (2012). The subjective physiological, psychological, and behavioral risk-taking consequences of alcohol and energy drink co-ingestion. *Alcoholism: Clinical and Experimental Research, 36,* 2008–2015. http://dx.doi.org/10.1111/j.1530-0277.2012.01820.x

Peacock, A., Droste, N., Pennay, A., Miller, P., Lubman, D. I., & Bruno, R. (2015). Typology of alcohol mixed with energy drink consumers: Motivations for use. *Alcoholism: Clinical and Experimental Research, 39,* 1083–1092. http://dx.doi.org/10.1111/acer.12729

Raykov, T. (1997). Estimation of composite reliability for congeneric measures. *Applied Psychological Measurement, 21,* 173–184. http://dx.doi.org/10.1177/01466216970212006

Schott, M., Beiglbock, W., & Neuendorff, R. (2016). Translation and validation of the Caffeine Expectancy Questionnaire (CaffEQ). *International Journal of Mental Health and Addiction, 14,* 514–525. http://dx.doi.org/10.1007/s11469-015-9606-6

Skewes, M. C., Decou, C. R., & Gonzalez, V. M. (2013). Energy drink use, problem drinking and drinking motives in a diverse sample of Alaskan college students. *International Journal of Circumpolar Health, 72,* 21204. http://dx.doi.org/10.3402/ijch.v72i0.21204

Stevens, J. P. (2009). *Applied multivariate statistics for the social sciences* (5th ed.). New York, NY: Routledge.

Substance Abuse and Mental Health Services Administration (SAMHSA). (2011). *Center for Behavioral Health Statistics and Quality (November 22) Emergency department visits involving energy drinks. The Dawn Report*. Available at http://www.samhsa.gov/data/sites/default/files/DAWN126/DAWN126/sr126-energy-drinks-use.pdf. Accessed June, 9, 2016.

Trapp, G. S. A., Allen, K. L., O'Sullivan, T., Robinson, M., Jacoby, P., & Oddy, W. H. (2014). Energy drink consumption among young Australian adults: Associations with alcohol and illicit drug use. *Drug and Alcohol Dependence, 134,* 30–37. http://dx.doi.org/10.1016/j.drugalcdep.2013.09.006

Varvil-Weld, L., Marzell, M., Turrisi, R., Mallett, K. A., & Cleveland, M. J. (2013). Examining the relationship between alcohol-energy drink risk profiles and high-risk drinking behaviors. *Alcoholism: Clinical and Experimental Research, 37,* 1410–1416. http://dx.doi.org/10.1111/acer.12102

Verster, J. C., Benson, S., & Scholey, A. (2014). Motives for mixing alcohol with energy drinks and other nonalcoholic beverages, and consequences for overall alcohol consumption. *International Journal of General Medicine, 7,* 285–293. http://dx.doi.org/10.2147/IJGM.S64096

Vida, K., & Rácz, J. (2015). Prevalence and consequences of the consumption of alcohol mixed with energy drinks: A literature review. *Journal of Caffeine Research, 5,* 11–30. http://dx.doi.org/10.1089/jcr.2014.0022

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