Summer 2016

Caffeinated Alcohol Use in a Daily Context

Ashley N. Carmichael
Old Dominion University

CAFFEINATED ALCOHOL USE IN A DAILY CONTEXT

by

Ashley N. Carmichael
B.S. May 2010, Central Michigan University
M.S. August 2012, Old Dominion University

A Dissertation Submitted to the Faculty of
Old Dominion University in Partial Fulfillment of the
Requirements for the Degree of

DOCTOR OF PHILOSPHY

PSYCHOLOGY

OLD DOMINION UNIVERSITY
August 2016

Approved by:

Cathy Lau-Barraco (Director)

J. Matt Henson (Member)

Michelle L. Kelley (Member)

Shana Pribesh (Member)

ABSTRACT

CAFFEINATED ALCOHOL USE IN A DAILY CONTEXT

Ashley N. Carmichael
Old Dominion University, 2016
Director: Dr. Cathy Lau-Barraco

Caffeinated alcoholic beverage (CAB) use is associated with a range of substance-related problems. Few have examined socio-environmental and cognitive factors that may relate to CAB use and influence associations between use and negative consequences. Moreover, much research on CABs has been based on cross-sectional and retrospective reports, which can be subject to recall biases. The current research aimed to address the gaps in our understanding of use patterns by conducting a daily diary study. Participants were 122 (73.8% women) heavy drinking, college student CAB users. Mean age was 20.39 (*SD* = 2.08) years. Students completed a baseline questionnaire and up to 14 consecutive, daily surveys about last night's drinking behavior. Multilevel modeling results indicated that CAB days were linked with greater odds of drinking at a bar/club, pre-gaming behavior, and drinking around others. CAB days were associated with greater likelihood of experiencing an alcohol-related harm, beyond the amount of alcohol consumed and trait impulsivity. This study was the first to examine CAB use patterns in a within-subjects, longitudinal daily diary design. CABs appear to be consumed socially and in potentially risky contexts. Importantly, use of CABs is related to greater odds of experiencing negative consequences. Future research investigating use patterns may benefit from more fine-grained approaches to develop efficacious prevention and intervention efforts geared toward reducing CAB-related risks.

This dissertation is dedicated to my husband, Brad Carmichael.

ACKNOWLEDGMENTS

I am incredibly fortunate to have had such a strong mentorship team and support system throughout my time at Old Dominion University. I want to thank my advisor, Dr. Cathy Lau-Barraco, for the many, many hours she has spent mentoring and training me to become a more independent alcohol researcher. I am immensely grateful for all of the opportunities she has given me and for constantly inspiring me to think more critically and deeply, despite my occasional resistance! I would not be where I am today without her. I also want to thank my other committee members: Dr. Michelle Kelley, particularly for her unwavering encouragement and thoughtful feedback; Dr. Matt Henson, for serving as my statistical guru while still challenging me to figure things out for myself; and for Dr. Shana Pribesh, for helping me think through some of these dissertation aims as a student in her Qualitative Methods course. Beyond my committee, I am very appreciative of the support my labmates have given me. In particular, I am so glad to have formed such a close bond with my labmate, Amy Stamates over the years. She is my sounding board and she fuels my excitement for research. I also want to thank Abby Braitman for being my quasi-consultant and close friend since the day I arrived. She has helped me from conducting my very first correlation in my first year to asking her detailed questions about Poisson distributions during my last. I am very lucky to have such terrific friends who also happen to be co-workers. I also want to thank my parents for always believing in me and giving me reality checks when things got tough. Lastly, but certainly not least, I want to thank my husband, Brad for his patience, love, and friendship (particularly his patience!). His support and encouragement is what got me through graduate school and I am so excited to start the next chapter of our lives together.

TABLE OF CONTENTS

Page

LIST OF TABLES

Page

Table

CHAPTER I

INTRODUCTION

A growing trend among college student drinkers is the use of caffeinated alcoholic beverages (CABs; e.g., Red Bull and vodka; see Linden & Lau-Barraco, 2014 for a review). Research consistently has shown that CAB use can put a young adult at even greater risk for experiencing negative outcomes such as heavy episodic drinking, risk behaviors (O'Brien, McCoy, Rhodes, Wagoner, & Wolfson, 2008), and drug use (Brache & Stockwell, 2011; Snipes & Bentosch, 2013). There is still much information about CAB consumption that remains unknown, such as the context in which CABs are consumed and the cognitive factors that may predict, influence, or partially explain CABs' association with negative consequences. Given its popularity and associated harms, additional research is needed to better understand CAB drinking patterns. Toward this end, the current research sought to identify the antecedents and outcomes related to CAB consumption through the use of a daily diary design.

Background on CAB Use

Prevalence. CABs are commonly consumed on college campuses. Specifically, 75% of college students report lifetime use (Berger, Fendrich, & Fuhrmann, 2013), 24% report using in the past month (O'Brien et al., 2008), and 9% report consuming CABs in the past two weeks (Marczinski, 2011). CABs are particularly prevalent among younger adults, Caucasians (Berger, Fendrich, Chen, Arria, & Cisler, 2011), males (Miller, 2008), athletes, on-campus residents (Brache & Stockwell, 2011), and fraternity or sorority members (O'Brien et al., 2008).

CAB use and outcomes. CAB consumption has been associated consistently with negative consequences above and beyond a drinker's typical alcohol use. Research has shown that users tend to be more frequent heavy episodic drinkers, even after controlling for non-caffeinated alcohol consumption and risk-taking propensity (Brache & Stockwell, 2011). One study found that users had twice as many heavy drinking days and episodes of drunkenness as compared to non-users (O'Brien et al., 2008). A second study found that users reported consuming twice as much during their heaviest drinking occasion as compared to non-users (i.e., 18 versus 9 drinks; Woolsey, Waigandt, & Beck, 2010).

In addition to heavy alcohol consumption, CAB use is related to engaging in various risk behaviors. Several studies have indicated that CAB users were at greater odds of exhibiting risky driving behaviors. This includes driving home after drinking (Brache & Stockwell, 2011) and being a passenger in a car with an intoxicated driver (Brache & Stockwell, 2011; O'Brien et al., 2008). One field study of exiting patrons at a bar found that individuals who had consumed CABs were not only more likely to have a higher blood alcohol concentration (BACs) but also were four times more likely to drive home (Thombs et al., 2010). Furthermore, in a study investigating participants' perceptions of their own behaviors when consuming caffeinated and non-caffeinated alcohol, participants predicted that they would be more likely to drive after consuming CABs as opposed to alcohol (Woolsey et al., 2010). It is important to note that use was associated with risky driving behaviors even after controlling for typical risk-taking propensity and heavy episodic drinking behavior (Brache & Stockwell, 2011). Therefore, these findings suggest that drinking CABs may place a drinker at greater odds for

engaging in risk behaviors beyond their usual risk-taking and non-caffeinated alcohol use.

CAB use also is associated with exhibiting risky sexual behaviors. CAB consumption is related to greater odds of engaging in casual sex, having sex while intoxicated (Miller, 2012), and having unprotected sexual encounters (Snipes & Benotsch, 2013). In a study examining the association between use and various risky behaviors, researchers found that among users, 63.3% had sexual intercourse without a condom, 57.7% had sex after drinking too much, 28.4% had multiple sex partners, and 25.7% engaged in sexual behaviors while under the influence of drugs (Snipes & Bentosch, 2013). Another study examining the relationship between CABs and risky sexual behaviors found that hazardous drinkers who consumed CABs were twice as likely to engage in unprotected sex as compared to hazardous drinkers who did not consume CABs (Berger et al., 2013). Even more serious, users were at greater odds of having taken or been taken advantage of sexually than non-users (O'Brien et al., 2008). Together, these results suggest that using CABs appears to be uniquely associated with engagement in a variety of sexual risk behaviors beyond typical alcohol consumption.

Increased drug use is another risk behavior associated with CAB consumption. In a study of Canadian college students, Brache and Stockwell (2011) found that users were more likely to use substances with stimulant properties such as cocaine, crack-cocaine, amphetamines (e.g., diet pills, speed), and crystal meth. Other studies have found relationships between CAB use and cigarettes (Linden, 2012), marijuana, and ecstasy (Snipes & Bentosch, 2013). More specifically, nearly twice as many users as compared to non-users reported using marijuana (54.2% versus 32.2%), ecstasy (12.5% versus

6.8%), and cocaine (11.7% versus 5.4%; Snipes & Bentosch, 2013). Researchers suggested that CAB use may be associated with stimulant drugs in particular because stimulant users have a preference for stimulating substances in general and may be drawn toward the energizing effects of CABs (Brache & Stockwell, 2011; Snipes & Bentosch, 2013).

Aside from negative alcohol outcomes, CAB users are at additional risk for experiencing caffeine-related harms. In a study investigating classes of CAB users, researchers found that heavier users experience greater caffeine use severity than non-heavy CAB users (Lau-Barraco, Milletich, & Linden, 2014). Particularly, heavier users reported more caffeine dependence symptoms such as failed attempts to cut down or quit caffeine use, drinking caffeine despite experiencing negative outcomes, and consuming caffeine to avoid withdrawal symptoms. Other studies examined more specific physiological symptoms and found that on drinking occasions where individuals consume CABs as compared to non-caffeinated alcohol, users reported more caffeine use severity. Specifically, in a study by Peacock, Bruno, and Martin (2012a), Australian adults completed questionnaires about their general physiological, psychological, and behavioral outcomes after consuming CABs or non-caffeinated alcoholic beverages. Results indicated that participants experienced greater odds of heart palpitations, tremors, jolts and crashes, agitation and an inability to sleep on occasions where participants consumed CABs as compared to alcohol only. Qualitative interviews of Australian young adults similarly reported that on days where they consumed CABs, they experienced greater sleep difficulties, an increased heart rate (Pennay & Lubman, 2012) and heart palpitations (Jones, Barrie, & Berry, 2012). In concert with findings on

alcohol-related problems, it appears that CAB use is strongly associated with experiencing a wide range of unfavorable outcomes beyond non-caffeinated alcohol consumption.

Experimental evidence. Results from experimental studies investigating CABs suggest that one reason for the link between use and negative consequences may be that consuming CABs can reduce an individual's *feelings* of intoxication without actually reducing their level of drunkenness. Specifically, as a preliminary examination, Marczinski and Fillmore (2006) tested an individual's cognitive performance after administering alcohol, caffeine, or a mixture of the two substances. Consuming the CAB subjectively reduced the participants' feeling of intoxication, but did not reduce any physical alcohol-related impairment. That is, those who consumed CABs as opposed to regular alcohol felt less intoxicated than those who consumed only alcohol, but both groups still made errors on cognitive tasks. Another experimental study found that after consuming a CAB, participants reported feeling fewer alcohol-related physiological symptoms such as headache, dry mouth, and motor coordination failures as compared to those who only consumed alcohol (Ferreira, de Mello, Pompéia, & de Souza-Formigoni, 2006). Again, although these participants perceived that the CAB produced faster reaction times and less affected motor coordination than alcohol alone, these attributes were not observed in behavioral performance. Several studies demonstrated similar findings, such that after consuming a CAB, individuals had poorer cognitive functioning as measured by language performance and other visual-spatial tasks (Curry & Stasio, 2009) but breath alcohol concentration (BrAC) did not differ based on consuming non-caffeinated or caffeinated alcohol (Alford, Hamilton-Morris, & Verster, 2012). Further,

the consumption of CABs did not appear to enhance a user's driving, attention or reaction time as compared to non-caffeinated alcoholic beverages (Howland, Rohsenow, Vehige Calise, MacKillop, & Metrik, 2011).

In addition to CAB consumption reducing one's feelings of intoxication rather than actual intoxication, experimental evidence also provides an explanation for why use is associated with heavier alcohol consumption in general. Specifically, after drinking CABs, one experimental study found that participants exhibited less behavioral or impulse control than those who consumed only alcohol (Marczinski, Fillmore, Bardgett, & Howard, 2011). Another study found that those who were administered a CAB reported being more likely to desire additional alcohol than those who were provided with regular alcohol (Marczinski, Fillmore, Henges, Ramsey, & Young, 2013). These findings may indicate that CABs can increase one's motivation to drink as compared to drinking alcohol alone. Moreover, CABs may enable individuals to drink for longer because it increases more arousal than non-CABs (Attwood, Rogers, Ataya, Adams, & Munafo, 2012). Together, these experimental studies suggest that because one's level of impairment does not appear to differ based on the type of alcohol consumed (Marczinski, Fillmore, Henges, Ramsey, & Young, 2012), it may be that the only differences between non-caffeinated and caffeinated alcohol is a result of the subjective changes in the drinker (i.e., increased feelings of stimulation and decreased feelings of mental fatigue). Together, these results could indicate that after consuming CABs, one may be more likely to judge themselves as being less impaired and, for instance, more able to drive than someone who feels the sedative effects of alcohol. Thus, one explanation for the

strong link between CAB use and both heavy alcohol use and negative outcomes may be based on the physiological and subjective effects of the substance.

Conclusions. It is clear that CAB use is associated with a host of negative outcomes, such as heavy alcohol consumption, engagement in risky driving and sexual behaviors, drug use, and experience of caffeine-related harms. Because individuals are continuing to consume these beverages despite experiencing negative alcohol- and caffeine-related consequences, additional research is needed to identify specific factors that predict CAB use and maintain CAB drinking patterns.

Theoretical Foundation

Social learning theory (SLT; Bandura, 1969, 1977; Maisto, Carey, & Bradizza, 1999) has been offered as one empirically supported theoretical foundation for identifying underlying and influential factors related to alcohol use outcomes. Thus, it may provide a backdrop for determining constructs that relate to CAB use outcomes. Broadly, SLT suggests that learning is acquired through direct and indirect reinforcement. SLT posits that both cognitive and socio-environmental factors are crucial determinants of one's behavior, such that alcohol consumption may be reinforced by one's experiences with drinking. One aspect of SLT is the principle of reciprocal determinism, or the way in which one variable (i.e., one's behavior) can be influenced by another variable (i.e., one's cognitions) through a learning process. As it applies to alcohol use behavior, cognitions regarding the expected behavioral effects of the substance or a person's internal motivations for drinking may be reciprocally associated with consumption because they are shaped by drinking behavior over time. For example, having positive alcohol expectancies, or positive beliefs about the behavioral effects of

alcohol, may increase one's alcohol use, which could, in turn, further reinforce these beliefs. Research supports that such a reciprocal effect between alcohol cognitions and alcohol use exists (e.g., Sher, Wood, Wood, & Raskin, 1996). In addition to cognitions, SLT posits that socio-environmental factors can impact one's drinking behavior as well (Maisto et al., 1999). Specifically, SLT suggests one's immediate environment or contextual variables (e.g., physical setting, companions) can influence one's drinking behavior. That is, individuals may drink differently depending upon their location or with whom they are drinking. Overall, SLT supports both cognitive and socio-environmental factors as influential determinants of drinking behavior.

Given the utility of SLT in the broader alcohol literature (e.g., Maisto et al., 1999), it may be useful to apply this theoretical framework in understanding CAB use. To date, only one study has examined the context in which CABs are used (Peacock, Bruno, & Martin, 2012b) and only a few studies have identified certain motives and beliefs one holds regarding CABs (e.g., Lau-Barraco et al., 2014; Marczinski, 2011). However, it remains unclear how these cognitions may directly predict or influence use outcomes. Knowledge of the socio-environmental and cognitive factors associated with use patterns would provide a better understanding of CAB drinking patterns, such as identifying populations to target for intervention work and determining the types of factors that influence the association between CAB use and negative outcomes. Furthermore, such investigations also would allow for a more theoretical understanding of factors related to use. Consequently, in line with SLT, the present study sought to understand *how* college students are consuming CABs (i.e., CAB drinking context) as well as factors that drive the use of CABs (i.e., drinking cognitions).

Context of CAB Use

As mentioned, SLT suggests that socio-environmental variables may influence an individual's drinking behavior (Bandura, 1969, 1977; Maisto et al., 1999). Such contextual factors include the location, the attributes of the setting, one's social environment, and the interaction of these factors. For instance, drinking in environments such as bars and nightclubs is associated with particularly heavy alcohol consumption (e.g., Rossow, 1996; Single & Wortley, 1993). Regarding the social environment, people tend to drink heavier in large groups as compared to when drinking alone or with one other person (see McCarty, 1985). In relation to CAB use specifically, our knowledge of the context in which they are consumed is lacking. Identifying the characteristics of use (e.g., location) may illustrate whether CABs are used in a setting that increases the likelihood of engaging in risky behaviors. Further, the way in which individuals consume CABs (e.g., when pre-gaming, socially) may reflect their motivations for consuming it or their beliefs about its effects. Ultimately, this information would aid in more efficacious prevention policies and the development of strategies to prevent problematic CAB use.

Location of CAB use. Only a few cross-sectional studies and qualitative studies have examined the context of CAB use, such as the typical location of consumption, when it is used, with whom individuals drink, and how it is consumed. The limited research available suggested that CABs are usually consumed at bars and nightclubs (Jones et al., 2012; Peacock et al., 2012b; Pennay & Lubman, 2012). For example, in a study of Australian adults, Peacock and colleagues found that 42% of their sample reported typically consuming CABs in nightclubs and 30% in bars and pubs.

Approximately 25% reported consuming it in private residences such as a private party and a consumer's home. It should be noted that drinking at clubs and bars is associated with increases in alcohol use and aggression (e.g., Rossow, 1996; Single & Wortley, 1993). Therefore, the location in which CABs are usually consumed may represent a high-risk drinking situation.

When CABs are used. Regarding when CABs are consumed, Peacock and colleagues (2012b) found that over 75% of their sample reported consuming it in the evening. Specifically, the majority of consumption occurred in the late evening (27% consuming between 6:01 and 9:00 p.m., 52% consuming between 9:01 p.m. and 12:00 a.m.) while a small percentage (15%) reportedly started using CABs after midnight. These results may be partially explained by most reporting that they consumed CABs in nightclubs and bars (Peacock et al., 2012b). In addition to the time CABs are consumed, a few studies have supported that the beverage is often consumed while pre-gaming, or drinking prior to the main drinking event (Jones et al., 2012; Pennay & Lubman, 2012). In a qualitative study of Australian young adults, participants stated that they often drink CABs before going out to continue drinking (Jones et al., 2012). Further, they noted that the main attraction to CABs was that they perceived the drink to provide them with energy to start the evening and continue partying. Thus, some may be using CABs while pre-gaming in order to stay awake and keep drinking. Importantly, engaging in risky drinking activities such as pre-gaming or drinking games is predictive of heavy alcohol consumption and negative consequences (e.g., LaBrie, Hummer, Kenney, Lac, & Pedersen, 2011). Consequently, it may be worthwhile to examine CABs in the context of pre-gaming, as these may be situations that promote heavy drinking.

With whom CABs are used. CABs are viewed as beverages that are consumed in a social context. Qualitatively, participants have indicated that CABs are a social bonding activity, with friends consuming the shot (e.g., a Jager Bomb) at the same time (Jones et al., 2012). This sample indicated also that, by drinking CABs, they felt that they appear to be popular to others. Additionally, research investigating perceived norms (i.e., one's perceptions of how much their friends drink and approve of drinking) suggests that perceptions of close friends' CAB drinking are a salient indicator of the participants' own drinking (Varvil-Weld, Marzell, Turrisi, & Cleveland, 2013). That is, individuals who perceive their friends to consume more CABs also drink more CABs themselves. These limited findings suggest that the social aspect of consuming CABs could be a key determinant of consumption.

How CABs are used. CABs have been sold as both pre-mixed and self-mixed beverages. Although pre-mixed beverages, such as P.I.N.K., Four Loko, Sparks, and Joose were very popular among young adults, they were ultimately banned in the United States after several serious reports of young adults being hospitalized or dying as a potential consequence of overdosing on these beverages ("Update regarding our reformulated product," 2010). Despite the ban on pre-mixed caffeine and alcohol beverages, users are still able to consume self-mixed CABs, or drinks that an individual can either mix themselves or order at public establishments (e.g., bars, restaurants). Common self-mixed CABs include Red Bull and vodka, Jagerbombs (i.e., Jagermeister mixed with Red Bull), as well as rum and soda. Importantly, although self-mixed beverages are deemed legal, they are associated with serious and similar health risks (e.g., Thombs, Rossheim, Barnett, Weiler, Moorhouse, & Coleman, 2011) as pre-mixed

CABs. Some researchers have compared various types of self-mixed beverages in predicting negative outcomes. Initially, in a field study of patrons who were leaving a bar, Thombs and colleagues (2011) found that cola-caffeinated mixers (e.g., soda mixed with rum) appeared to produce similar negative outcomes (e.g., driving while intoxicated) as compared to energy drink mixers (e.g., Red Bull and vodka). A second field study conducted in a bar found that artificially sweetened cola-caffeinated mixer drinks produced more pronounced effects on intoxication (i.e., a higher breath alcohol concentration [BrAC]) than those who consumed other types of alcoholic beverages (Rossheim & Thombs, 2011). Other alcoholic beverages included alcohol-only drinks, alcohol mixed energy drinks, regular cola-caffeinated drinks, and diet cola-caffeinated drinks. Even more recently, experimental evidence suggests that the type of soft drink mixer may have differential effects on intoxication (Marczinski & Stamates, 2013). Specifically, because drinks that include sucrose slow the rate of the gastric emptying of alcohol, those who mix artificially sweetened (i.e., diet) drinks with alcohol can become more intoxicated and produce higher BrACs than those who mix regular soda with alcohol.

CAB users also may be co-administering CABs with other types of stimulant-enhancing drugs, such as caffeine pills. Users may be mixing their already caffeinated beverage with stimulants in order to get even more energy before going out to drink. To date, research has not investigated this potential relationship. However, given the link between use and stimulant drugs such as cocaine and amphetamines (Brache & Stockwell, 2011), further investigations of the co-use of CABs and stimulant drugs is warranted.

Cognitive Factors and CAB Use

In addition to contextual factors reviewed above, SLT also posits that cognitive factors are important determinants of one's drinking behavior. SLT indicates that two of the most influential cognitive factors include substance expectancies and one's motivations for drinking. Given the relevance of these psychosocial risk factors in predicting general alcohol use, it also may be useful to determine their associations with CAB consumption in order to better understand CAB use patterns.

Substance expectancies. Substance expectancies are one's beliefs about the effects of substance use, such as alcohol (Brown, Goldman, & Christiansen, 1985; Goldman, Brown, Christiansen, & Smith, 1991; Maisto et al., 1999) or caffeine (Heinz, Kassel, & Smith, 2009; Huntley & Juliano, 2012). In accordance with one aspect of SLT (Maisto et al., 1999), expectancies can be learned directly or indirectly through one's experience with a substance (see Jones, Corbin, & Fromme, 2001 for a review). Expectancies develop early in life before drinking initiation (Zucker, Kincaid, Fitzgerald, & Bingham, 1995). They have been found to be strong predictors of substance use outcomes, such as alcohol use and alcohol-related problems (Jones et al., 2001). The more an individual perceives alcohol to have positive influences, the more likely they are to drink and drink heavily. With regard to CAB use, because these beverages contain both caffeine and alcohol, research has examined a user's caffeine, alcohol, and CAB-specific expectancies in understanding consumption.

Caffeine expectancies. Research supports that stronger beliefs about the positive effects of caffeine are predictive of greater frequency and quantity of caffeine consumption (Heinz et al., 2009; Huntley & Juliano, 2012). Having expectations of

caffeine producing effects such as enhanced energy and work performance, appetite suppression, and social or mood effects positively predict caffeine use (Huntley & Juliano, 2012). Additionally, lower expectations of negative caffeine use outcomes (e.g., sleep disturbance, anxiety/negative physical effects) are predictive of greater caffeine use. Beyond caffeine consumption, stronger caffeine expectancies also are related to greater caffeine use severity. That is, having stronger positive (i.e., general positive effects, mood effects) and negative (i.e., withdrawal symptoms, general acute negative effects) reinforcement caffeine expectancies are associated with greater symptoms of caffeine dependence, difficulty stopping caffeine consumption, and level of caffeine addiction (Heinz et al., 2009).

Only a handful of studies have examined how one's beliefs about the effects of caffeine relate to CAB use specifically. Some studies suggest that having stronger withdrawal symptoms caffeine expectancies is associated with use outcomes (Heinz et al., 2009; Lau-Barraco et al., 2014; Linden, D'Lima, & Lau-Barraco, 2012). That is, higher rates of CAB use are negatively reinforced by perceptions that caffeine produces effects such as getting headaches and having trouble focusing if not consumed regularly. For instance, one study found that individuals who were grouped by their high CAB use endorsed stronger withdrawal symptoms caffeine expectancies than classes that consumed fewer CABs. The findings that withdrawal symptom expectancies are tied to consumption are particularly important given that withdrawal symptoms expectancies are associated with symptoms of caffeine dependence (Heinz et al., 2009). In fact, as compared to all other caffeine expectancies measured (i.e., general positive effects, acute

negative effects, and mood effects), withdrawal symptoms expectancies were the most strongly related to perceived dependence.

Other researchers have found that social and mood enhancement expectancies are tied to CAB consumption (Huntley & Juliano, 2012; Lau-Barraco et al., 2014), such as perceptions that caffeine will enhance sociability, improve mood, and increase confidence. One study found that social/mood enhancement expectancies were the only type of expectancy related to CAB user status (Huntley & Juliano, 2012). That is, CAB users had stronger social/mood enhancement expectancies than non-users, but groups did not differ on expectancies such as withdrawal/dependence, energy/work enhancement, appetite suppression, or sleep disturbance. Another study found that those who consumed more CABs had greater endorsement of mood caffeine expectancies (Lau-Barraco et al., 2014). Similar to withdrawal symptoms expectancies, social/mood expectancies also were positively associated with symptoms of caffeine dependence (Heinz et al., 2009; Huntley & Juliano, 2012). Overall, these studies examining use and caffeine expectancies suggested that CAB users had a wide range of beliefs about the effects of caffeine, which, in turn, predicted consumption.

Alcohol expectancies. A sizeable body of research indicates that one's beliefs about the effects of alcohol are strongly associated with alcohol consumption and negative alcohol-related consequences (e.g., Goldman, Darkes, & Del Boca, 1999). The perceived effects of alcohol may be positive (e.g., improved sexuality, social facilitation, greater courage) or negative (e.g., increased aggression, cognitive or behavioral impairment; Fromme, Stroot, & Kaplan, 1993). Furthermore, some positive expectancies have been shown to be modifiable in college student drinkers (Lau-Barraco & Dunn,

2008). Findings from these studies clearly support alcohol expectancies as a critical determinant of alcohol use outcomes.

To date, only two studies have examined alcohol expectancies in relation to CAB consumption (Lau-Barraco & Linden, 2014; Lau-Barraco et al., 2014). In the same study examining caffeine expectancies and CAB use classes, Lau-Barraco and colleagues also examined how CAB user classes differ based on positive alcohol expectancies. It was found that heavier users have more positive beliefs about the effects of alcohol than less heavy users. Another study investigated the unique and combined contributions of both caffeine and alcohol expectancies on use (Lau-Barraco & Linden, 2014). Results showed that although both sets of expectancies accounted for significant variance in CAB use and negative consequences, alcohol expectancies explained more of the variance in CAB use quantity, frequency, and alcohol-related problems than caffeine expectancies. Across studies, findings suggest that users have a wide range of beliefs about the effects of drinking CABs.

CAB-specific expectancies. Recently, several studies examined CAB-specific expectancies. One study developed a measure assessing various beliefs one holds for the effects of CAB use (MacKillop et al., 2012). The researchers identified two primary CAB expectancies: "intoxication enhancement" and "avoid negative consequences." Perceptions of intoxication enhancement included staying alert for longer, having more energy to party, and getting buzzed more quickly. Avoidance of negative consequences, on the other hand, included perceiving that CABs will allow one to drink more without feeling intoxicated, remain in control, and drive more safely. Intoxication enhancement expectancies were found to positively associate with frequency of CAB consumption, but

avoidance of negative consequences was unrelated to all CAB use outcomes. Results from this preliminary work suggest that CAB use is driven more by the expectation that drinking CABs will enhance one's level of intoxication than assist in avoiding negative consequences.

Two studies have examined CAB-specific expectancies as they relate to different classes of CAB users (Mallett, Marzell, Scaglione, Hultgren, & Turrisi, 2014; Varvil-Weld et al., 2013). Mallett and colleagues sampled college student CAB users and asked them about three different types of CAB expectancies, similar to MacKillop and colleagues' (2012) intoxication enhancement subscale. These items included: "I can consume more alcohol when I choose to combine alcohol and energy drinks", "I can party longer when I choose to combine alcohol and energy drinks", and "I expect to feel an enhanced 'buzz' (energized and less drowsiness) when I consume alcohol and energy drinks." Classes reporting heavier CAB use were found to more strongly perceive these effects from drinking CABs. A second study of freshmen college students was designed to ask participants about their use, CAB-specific expectancies, and alcohol-related problems during their spring semester of their freshman year (Time 1) and the fall semester of their sophomore year (Time 2). Researchers found that those who were categorized in part by their strong CAB-specific expectancies at Time 1 reported the heaviest CAB use and highest number of alcohol-related problems at Time 2. These findings suggest that CAB-specific expectancies predict use outcomes concurrently and prospectively.

Drinking motives. Drinking motives can be defined as one's motivations for using alcohol (Cooper, 1994). The motivational model of alcohol use (Cooper, 1994;

Cox & Klinger, 1988) proposes four primary motivations for drinking: social motives (i.e., drinking to be sociable), enhancement motives (i.e., drinking to increase positive affect), coping motives (i.e., drinking to reduce negative affect), and conformity motives (i.e., drinking to reduce fears of negative evaluation). Research has suggested that while social, enhancement, and conformity motives are associated with alcohol consumption, stronger coping motives are a risk factor of alcohol-related problems (Cooper, 1994; Martens, Rocha, Martin, & Serrao, 2008). Most young adults report that their primary reasons for drinking include social (LaBrie, Hummer, & Pedersen, 2007) and enhancement motives (Kairouz, Gliksman, Demers, & Adlaf, 2002). Although the motivational model is often used to understand the link between drinking motives and alcohol use in the general alcohol literature, research has not yet applied the motivational model to CAB consumption in specific. Given that drinking motives are strong determinants of alcohol use outcomes and that they are shown to be underlying or influential factors (Kuntsche, Knibbe, Gmel, & Engels, 2005), research investigating associations between drinking motives and particularly high-risk beverages, such as CABs, is warranted. Furthermore, understanding why young adults drink CABs may provide important information that can be targeted in intervention work.

A few studies have examined explicit reasons for drinking CABs beyond the realm of the motivational model of alcohol use. A large-scale preliminary study found that the majority of their sample reported using CABs to hide the flavor of alcohol (O'Brien et al., 2008). Several other quantitative studies found that college students reported using CABs to be able to drink more, feel less tired while drinking, to get intoxicated faster (Marczinski, 2011), and feel more energetic (Peacock et al., 2012b). A

qualitative study with a sample of Australian college students found these participants reported drinking for similar reasons as the quantitative studies (Jones et al., 2012). However, they found also that young adults consumed CABs as a means of pre-gaming (i.e., drinking prior to the main drinking event). Specifically, they noted using CABs in particular while pre-gaming because they wanted to get more energy while partying to stay awake and continue to drink. These quantitative and qualitative findings suggest that young adults are using CABs to experience the stimulant effects of caffeine but not the sedative effects of alcohol. Consequently, they perceive that by consuming CABs they are able to stay awake, drink more, and party longer.

The reports that young adults are motivated to use CABs to increase their energy and continue drinking is interesting in light of laboratory evidence that suggests the effects of CABs are mostly a result of the subjective changes in the drinker. As mentioned, CABs can reduce an individual's feelings of intoxication without actually reducing their level of impairment (e.g., Marczinski & Fillmore, 2006). That is, drinkers feel less intoxicated while consuming a CAB as opposed to a non-caffeinated alcoholic beverage, but one's actual level of impairment does not differ based on the type of alcohol consumed (Alford et al., 2012; Marczinski et al., 2012). These experimental studies *could* indicate that users are unaware that CABs can produce lower subjective feelings of intoxication. However, given reports of young adults' motivations for drinking CABs (e.g., Marczinski, 2011), it appears that individuals are intentionally using CABs to decrease a sedative effect. In addition, it is interesting to note that although users are reporting that they use CABs to enable them to keep drinking without feeling sedative effects from alcohol, they also report experiencing negative effects such as

blacking out and consuming more alcohol than planned because they do not feel intoxicated (Jones et al., 2012). Also, by experiencing fewer feelings of drunkenness, some individuals may be at greater odds of engaging in risky behaviors, such as driving home after drinking (e.g., Brache & Stockwell, 2011). Together, these findings could indicate that one's motivations for consuming CABs are contributing to one's hazardous drinking outcomes.

Although preliminary evidence suggests that young adults are consuming CABs in order to feel less intoxicated (Marczinski, 2011), it is still unknown how these motivations relate to CAB use outcomes. Specifically, it is unclear if, for instance, having stronger motivations to consume CABs in order to feel more energetic is related to the amount of CABs consumed. Determining which CAB-specific motives are most salient in predicting CAB use could indicate relevance for including a component about CAB-specific motives in existing alcohol interventions. Further, it is possible that certain use motives are influential mechanisms in the association between use and outcomes. That is, higher use coupled with stronger drinking motives to stay awake and continue partying may produce poorer outcomes.

In addition to CAB-specific motives, scant attention has been given to understanding how the more traditional motives for drinking (as reflected in the motivational model of alcohol use) may account for some use outcomes. A broader understanding of why young adults may drink CABs may indicate which motives are relevant to incorporate in alcohol interventions that target use. Given the predictive utility of drinking motives in understanding alcohol use in general (e.g., Cooper, 1994), it may be beneficial to determine how social, enhancement, coping, and conformity motives

may relate to CAB use as well. For example, conformity drinking motives may be predictive of use given that drinking norms are a salient factor predicting CAB consumption (e.g., Varvil-Weld et al., 2013). Further, social drinking motives may be relevant given the social milieu surrounding CAB use (e.g., Jones et al., 2012). Overall, the strong evidence derived from preliminary investigations signify the necessity of assessing one's motivations for drinking CABs in order to enhance our understanding of CAB use patterns.

Conclusions. Altogether, extant research on drinking motives and various substance expectancies (i.e., caffeine, alcohol, CAB-specific) suggests that these cognitions are salient constructs in understanding CAB consumption and negative outcomes. Although preliminary evidence of relationships between use and cognitions is established, several gaps remain in understanding CAB drinking patterns. First, the way in which an individual's cognitions can be directly associated with daily drinking has yet to be explored. For instance, it may be useful to determine how one's drinking motives prior to drinking predict subsequent use. Second, these factors have not been explored as a factor that may impact the association between use and negative consequences. As these cognitions are shown to be influential constructs in the link between alcohol use and alcohol-related problems, they also may be applicable to CAB use as well.

CAB Research Study Designs

Some extant CAB research is limited by various aspects of the study design. Specifically, the majority of our knowledge on CABs is based on between-subjects designs and retrospective cross-sectional data, both of which have serious limitations. A daily diary study that incorporates both a within-subjects and longitudinal design may aid

researchers in better understanding the influence of contextual and cognitive factors in predicting CAB use outcomes.

Within-subjects designs. As noted, most studies involving CABs have incorporated a between-subjects design in understanding differences in negative consequences. However, these designs do not take into account individual differences. Within-subjects designs, on the other hand, allow observations of individual variations, such as their experiences on days where they consumed CABs as opposed to days they consumed non-caffeinated alcohol. In fact, because of the limitations of between-subjects designs, such methodology has been called into question when studying the effects of CABs (de Haan, de Haan, der Palen, Olivier, & Verster, 2012).

One methodological concern regarding CAB use is whether CABs are associated with negative outcomes only because of the user's typical level of risk-taking behavior. That is, some researchers suggest that individuals may choose to drink CABs because they are drawn toward engaging in risky behaviors in general. CAB users may, in turn, experience more negative outcomes than non-users because of this difference in risk-taking propensity or one's level of impulsivity. One way to determine if CABs alone increase one's likelihood of engaging in negative outcomes is to conduct a within-subjects design to compare days where a participant consumed CABs as opposed to days they consumed alcohol. However, most studies on CAB use utilize between-subjects designs that do not take individual differences into account. The few within-subjects studies that exist have produced mixed findings. Specifically, some suggest that drinkers consume fewer alcoholic beverages on days where they consumed CABs as opposed to days where they consumed alcohol (de Haan et al., 2012; Woolsey et al., 2010). Other

studies have found that participants reported consuming more alcohol (Price, Hilchey, Darredeau, Fulton, & Barrett, 2010) and experiencing more problems (Woolsey et al., 2010) on occasions where they consumed CABs than days where they consumed only alcohol. Given the limited research utilizing within-subjects designs as well as the mixed findings that CABs pose a risk beyond that of alcohol, more in-depth within-subjects methodologies are warranted.

Retrospective cross-sectional designs. Although a handful of researchers employed within-subjects designs in studying CAB use, most findings are based on cross-sectional reports in which participants are asked to report on their CAB versus alcohol use outcomes *in general* or in the past month(s). Retrospective methods of collecting data can have serious limitations, such as inaccurate or biased reports. That is, participants may experience a recall bias when attempting to remember how many drinks they consumed over the past month(s) (Gmel & Daeppen, 2007). As a consequence to these risks, retrospective methodologies have been called into question (Ekholm, 2004).

Daily diary designs. One alternative to gathering data without the risks of retrospective reports is to conduct a daily diary study. Here, participants would report on their behaviors close to the time they occur, reducing potential recall biases. Consequently, reports of variables such as cognitive factors and CAB use close to the time they occur could provide a more accurate representation of the way in which these factors relate. Daily diary studies also are advantageous in that they allow for examinations of individual differences longitudinally. In terms of CAB use, participants could, for example, indicate their motivations for drinking prior to drinking as well as their use outcomes after drinking. Researchers could assess how one's motivations for

drinking prior to drinking actually affected the number of CABs the individual consumed that evening. Additionally, daily diary studies would allow participants to report on the context in which they consume CABs. Participants could report daily on where, when, with whom, and how they consumed CABs. Together, all of this information would provide researchers with a more comprehensive understanding of CAB use drinking patterns.

To date, only one study has examined alcohol and caffeine consumption using daily diary methodology (Patrick & Maggs, 2014). Researchers compared drinking days where individuals did versus did not consume energy drinks. Findings indicated that on drinking days where participants consumed energy drinks versus drinking days where participants did not consume energy drinks, they consumed more alcoholic beverages, reached a higher BAC, and experienced more negative consequences (e.g., experienced a hangover). This study design did not, however, inquire about the context of use, the cognitions associated with use, or a detailed assessment of the types of problems experienced. In addition, this study did not directly assess the simultaneous consumption of alcohol and energy drinks/caffeine but rather the extent to which drinking an energy drink at one point during a drinking day increases the odds of experiencing certain alcohol-related outcomes.

Study Purpose

The purpose present research was to identify the contextual and cognitive factors surrounding CAB use and negative consequences through the use of daily assessments over two weeks. Specifically, participants reported on their alcohol and CAB use behaviors over 14 consecutive days. This research offers a more in-depth understanding

of the antecedents and outcomes associated with CAB consumption patterns. Determining the specific factors related to this unique and potentially harmful substance could facilitate the advancement of alcohol prevention and intervention programming as well as specific interventions tailored for CAB users.

Aim 1. To examine the context in which college students consume CABs. Specifically, the context of use was compared on drinking days in which participants consumed CABs ("CAB days") and drinking days in which other types of alcohol were consumed ("non-CAB days"). Currently, only a handful of retrospective (e.g., Miller, Quigley, Eliseo-Arras, & Ball, 2016; Peacock et al., 2012b) and qualitative studies (Jones et al., 2012; Pennay & Lubman, 2012) have examined the environment that may promote CAB use.

Aim 1a. To investigate *where* college students usually drink CABs (e.g., at a bar, at house parties) in comparison to non-CAB days as well as the number of CABs consumed in each context. It was hypothesized that drinking at a bar/club would be more common on CAB days as compared to non-CAB days, and that more CABs would be consumed within this context as compared to other locations, based on prior research (e.g., Jones et al., 2012; Peacock et al., 2012b; Pennay & Lubman, 2012).

Aim 1b. To examine *when* CABs are typically used (e.g., while pre-gaming or playing drinking games) in comparison to non-CAB days. Based on qualitative findings, it was predicted that pre-gaming would be more likely to occur on CAB days as compared to non-CAB days (Jones et al., 2012; Pennay & Lubman, 2012).

Aim 1c. To investigate *with whom* CABs are usually consumed (e.g., alone, with friends) relative to non-CAB days. Building from prior qualitative research (Jones et al.,

2012; Pennay & Lubman, 2012), it was hypothesized that drinking with others (rather than alone) would be more likely to occur on CAB days than non-CAB days.

Aim 1d. To determine *how* CABs are typically consumed, such as the type of caffeine drinkers typically mix with their alcohol (i.e., regular soda mixer, diet mixer, and energy drink mixer) as well as whether drugs are used when drinking or prior to drinking (e.g., caffeine pills) on CAB days relative to non-CAB days. In terms of the mixer, based on past field research (Rossheim & Thombs, 2011), it was hypothesized that regular soda mixed with alcohol (e.g., rum and Coke) would be the most commonly reported type of CAB. Regarding drug use, based on cross-sectional linkages between CAB use and various substances (e.g., Brache & Stockwell, 2011), it was hypothesized that participants would be at greater odds of using other substances while drinking or prior to drinking on CAB days relative to non-CAB days.

Aim 2. To examine the prospective link between daily CAB use and daily negative consequences (i.e., alcohol-related problems, risky driving, risky sexual behavior). It should be noted that participants' typical impulsivity and alcohol consumption were added as covariates in all analyses to control for any individual differences in risk-taking (de Haan et al., 2012) and to ensure that any link between CAB use and negative consequences is not an artifact of the amount of alcohol consumed last night. It is hypothesized that, beyond one's trait level of impulsivity and the amount of alcohol consumed last night, participants would report greater odds of experiencing negative consequences on days where they consumed CABs as compared to days where they consumed other types of alcohol.

In addition, the link between baseline CAB consumption and baseline caffeine-related physiological symptoms was examined. It was hypothesized that heavier CAB use would be associated with greater caffeine-related physiological symptoms.

Aim 3. To examine cognitions associated with CAB consumption and/or negative outcomes. Based on SLT (Bandura, 1969, 1977; Maisto et al., 1999) and empirical evidence, substance expectancies as well as drinking motives were explored as moderators.

Aim 3a. To identify the association between motivations for drinking prior to consuming CABs. Previous research has not yet examined the association between drinking motives and CAB use, but based on the utility of studying other cognitions (i.e., expectancies) related to CAB use (Lau-Barraco & Linden, 2014; Lau-Barraco et al., 2014; MacKillop et al., 2012), it was hypothesized that stronger motivations to drink would be related to greater odds of it being a CAB day as compared to a non-CAB day, and that these motivations would moderate the association between daily CAB use and negative consequences. Regarding CAB-specific motives, it was hypothesized that stronger motives to drink would be associated with heavier CAB use.

Aim 3b. To assess positive and negative alcohol and caffeine expectancies in relation to CAB use. Also, to examine CAB-specific expectancies associated with use. Based on past research demonstrating that CAB use is predicted by caffeine, alcohol (Lau-Barraco & Linden, 2014) and CAB-specific expectancies (MacKillop et al., 2012), it was hypothesized that stronger expectancies would be associated with greater odds of it being a CAB day as compared to a non-CAB day, and that these expectancies would exacerbate the link between daily CAB use and negative outcomes.

CHAPTER II

METHOD

Participants and Procedure

Participants for the current study were college students from a public university. Participants were recruited through the psychology research pool (i.e., SONA systems). SONA advertisements indicated that this was a two-part study in which they must first complete a baseline survey and then complete follow-up surveys for two consecutive weeks. To be eligible, participants must have (1) been between the ages of 18 and 25 years old, (2) consumed CABs at least once in the past week, (3) been moderate to heavy drinkers (i.e., have engaged in heavy episodic drinking at least twice in the past month), and (4) reported daily access to the Internet for two weeks. Participants were compensated with research credit in their courses for their participation in the initial assessment, as assigned by the course instructor. For the daily portion, participants were provided with their choice of either additional research credit or $10 for participating in the entire daily diary portion of the study. Students who completed all daily assessments were entered into a raffle to win a $50 gift card. The current study was approved by the university's Institutional Review Board and all APA ethical guidelines were followed (APA, 2010).

Participants completed an online assessment remotely in order for the researcher to determine if they were eligible to participate in the daily diary portion and to provide baseline information about their drinking and other study variables (see measures below). The baseline assessment took approximately 30-45 minutes to complete. Prior to completing the survey, participants were provided with informed consent indicating the

involvement of their participation in both the initial and follow-up assessments. Participants were informed that the purpose of the study was to gain a better understanding of college student alcohol use and related behaviors. Additionally, participants were asked to provide their email address and phone number so that reminders could be sent for the daily survey portion of the study if they were deemed eligible. After completing the initial assessment, the researcher determined their eligibility. If eligible, they were provided with instructions for how to complete the daily online surveys thereafter.

Follow-up assessments for the daily diary portion of the study were collected online. Participants were informed that they could complete the follow-up survey through their cell phone or computer. Daily surveys were collected for 14 days (i.e., two weeks). All follow-up assessments were scheduled to start on a Tuesday and end on a Monday in order to ensure that data were collected across two weekends for all participants. Each morning, participants were sent an email reminder along with the survey link. While participants were instructed to complete the survey each day between 2:30 and 7 pm, all completed responses were considered for analysis. The consistent daily timeframe was set to control for any potential time of day effects. Participants who provided a cell phone number received a text message reminder at 2:30 pm to complete the survey.

Six hundred participants were screened for inclusion in the current study. Of those screened, 363 did not meet study inclusion criteria and were therefore not provided with follow-up assessments. Two hundred thirty-seven students were eligible to participate in the follow-up assessments. Based on suggestions provided by Black, Harel,

and Matthews (2011) and the nature of the research questions, only participants who provided at least two daily surveys and at least one drinking day were included. Among the 237 who met inclusion criteria, 115 were excluded from the study (85 did not complete any follow-up surveys, 11 completed only one follow-up survey, 19 did not report drinking during the two-week period). Eligible but excluded participants were more likely to be younger (M = 19.75 years; SD = 1.69) than those included (M = 20.32 years; SD = 2.04), $t(226.10) = -2.34$, $p = .020$. Excluded participants also consumed more alcohol during a typical week (M = 18.55 drinks; SD = 10.35) than those included (M = 14.46 drinks; SD = 9.49). Participants did not differ based on gender, ethnicity, or typical CAB use.

The final sample for analysis consisted of 122 (90 women) participants. The mean age was 20.39 (SD = 2.08) years with 52.5% under the age of 21. Class standing was 27.9% freshman, 23.8% sophomore, 13.9% junior, 32.8% senior, and 1.6% did not respond. Ethnicity was 54.9% Caucasian/White, 27.9% African American/Black, 6.6% self-reported "other" or biracial, 5.7% Hispanic, 3.3% Asian, and 1.6% Native American. The majority of participants lived off-campus (63.1%) and were not a member of a fraternity or sorority (81.1%). The majority were employed part-time (43.4%); others were not employed (38.5%), employed full-time (10.7%), employed full- and part-time (6.6%) and one participant did not respond (0.8%). Most participants reported a yearly individual income of less than $10,000 (69.7%) followed by $10,000 to $20,000 per year (17.2%), $20,001 to $40,000 per year (6.6%), $40,001 to $60,000 per year (4.9%) and more than $100,000 per year (1.6%). The majority of participants were single or never

married (82.8%); others were living with a partner (11.5%) or married (5.7%). Average GPA was 3.06 (*SD* = 0.60).

The sample for analysis provided a total of 1,652 out of a possible 1,708 surveys indicating a compliance rate of 96.7%. On average, participants completed 12.56 (*SD* = 2.15) daily reports out of 14. In line with study aims, only drinking days were included in subsequent analyses. Participants provided a total of 389 (23.5% of all days collected) daily diaries in which they consumed any type of alcohol. Of drinking days, 101 (26%) involved any CAB use. Most participants did not drink CABs across all drinking days assessed (*n* = 58; 47.5%), followed by 1 day of CAB use (*n* = 41; 33.6%), 2 days (*n* = 13; 10.7%), 3 days (*n* = 7; 5.7%), 4 days (*n* = 2, 1.6%), and 5 days (*n* = 1; 0.8%).

Measures

Initial assessment.

Alcohol expectancies. The Comprehensive Effects of Alcohol (CEOA; Fromme et al., 1993; Appendix A) was used to measure one's perceptions of the positive and negative effects of alcohol consumption. The 38-item scale measures the degree to which the participant believes that alcohol will affect them when under the influence of alcohol, ranging from 1 (*disagree*) to 4 (*agree*). The CEOA consists of seven subscales. Positive expectancies include: sociability (e.g., "I would be talkative"; α = .79), tension reduction (e.g., "My body would feel relaxed"; α = .79), liquid courage (e.g., "I would feel brave and daring"; α = .85), and sexuality (e.g., "I would be a better lover"; α = .77). Negative expectancies include: cognitive and behavioral impairment (e.g., "I would feel dizzy"; α = .82), risk and aggression (e.g., "I would be loud, boisterous, or noisy"; α = .69), and self-perception (e.g., "I would feel self-critical"; α = .76). Subscales were scored by

summing individual responses corresponding to each subscale. Higher scores represent stronger endorsement of the particular expectancy. This is a commonly used scale among college students and has demonstrated adequate levels of internal consistency, construct validity, and criterion validity (e.g., Dimeff, Baer, Kivlahan, & Marlatt, 1999; Fromme et al., 1993; Ham, Stewart, Norton, & Hope, 2005).

Caffeine expectancies. The Caffeine Expectancy Questionnaire (CEQ; Heinz et al., 2009; Appendix B) is a 37-item measure assessing beliefs about consuming caffeine, ranging from 1 (*strongly disagree*) to 4 (*strongly agree*). The CEQ consists of four subscales of different expectancies: withdrawal symptoms (e.g., "I get headaches if I don't drink regularly"; $\alpha = .95$), positive effects (e.g., "I pay attention more efficiently"; $\alpha = .92$), acute negative effects (e.g., "Caffeine makes my heart race"; $\alpha = .89$), and mood effects (e.g., "Drinking caffeine improves my mood"; $\alpha = .85$). Subscales were scored by summing endorsements on individual subscales with higher scores representing stronger beliefs for the particular expectancy. The CEQ has demonstrated adequate levels of content validity, substantive validity, and external validity. Further, recent research indicated that the CEQ demonstrated good to excellent levels of internal reliability (alphas ranged from .84 to .91; Lau-Barraco et al., 2014).

CAB-specific expectancies. The Caffeine + Alcohol Combined Effects Questionnaire (CACEQ; MacKillop et al., 2012; Appendix C) is a 9-item instrument that measures one's beliefs about the effects of CAB use. Response options range from 1 (*strongly disagree*) to 5 (*strongly agree*). There are two subscales: intoxication enhancement (e.g., being able to stay up and party for longer; $\alpha = .69$) and avoidance of negative consequences (e.g., being able to drive home after drinking; $\alpha = .80$). Both

subscales were scored by summing item responses for each scale; higher scores indicate greater endorsement of the subscale. Previous research has found both subscales to demonstrate good levels of internal reliability (Linden-Carmichael, Lau-Barraco, & Stamates, 2015). Further, as the intoxication enhancement subscale of the CACEQ was associated with CAB use frequency after controlling for typical alcohol consumption (MacKillop et al., 2012), this supports convergent validity for the CACEQ.

Alcohol, caffeine, and CAB use. The Daily Drinking Questionnaire (DDQ; Collins, Parks, & Marlatt, 1985; Appendices D - F) was used to assess typical consumption of alcohol for each day of the week in the past three months. The DDQ format was adapted to assess caffeine and CAB use. Participants were provided with information defining a standard alcoholic drink and examples of CABs. The DDQ is widely used to assess alcohol consumption (e.g., Geisner, Larimer, & Neighbors, 2004; Mallett, Bachrach, & Turrisi, 2008; Morean & Corbin, 2008). The DDQ has demonstrated adequate convergent validity with self-reported measures of negative alcohol-related consequences (e.g., Collins, Bradizza, & Vincent, 2007; Collins, Koutsky, & Izzo, 2000; Collins, & Lapp, 1992). Recent research used a modified version of the DDQ specifically to measure CAB use (Lau-Barraco et al., 2014) finding associations with alcohol and caffeine expectancies as well as alcohol-related problems. In addition, screening questions were included inquiring about the numbers heavy episodic drinking occasions in the past month and the number of CABs consumed in the past week.

Caffeine-related physiological symptoms. Participants were asked to indicate if they have ever experienced certain symptoms after consuming CABs (e.g., flushed face, nervousness/anxiety, heart palpitations; see Appendix G). Response options consist of

"yes" and "no". These questions were derived from a scale compiled by Hull, Dillon, O'Connell, Chitnavis, and Svikis (2011) evaluating effects of caffeine and CABs. The scale is scored by summing the number of positive endorsements with higher scores representing greater likelihood of experiencing caffeine-related physiological symptoms from drinking CABs. This scale was shown to correlate with CAB use quantity as well as caffeine expectancies (Linden et al., 2012). In the present study, $\alpha = .76$.

Impulsivity. The Barratt Impulsiveness Scale (BIS-11; Patton, Stanford, & Barratt, 1995; Appendix H) measured the personality trait of impulsiveness. The scale consists of 30 items in which participants indicate the degree to which they typically exhibit impulsive behavior (e.g., "I say things without thinking", "I get easily bored when solving thought problems", "I act on the spur of the moment"). Responses range from 1 (*rarely/never*) to 4 (*almost always/always*). After reverse-scoring certain items, higher scores on the BIS-11 indicate greater levels of typical impulsivity. The BIS has been shown to predict alcohol use and alcohol use severity (Fernie, Cole, Goudie, & Field, 2010) and has been used as a measure of impulsivity in a study examining college students and CABs (Marczinski et al., 2013). Additionally, a recent review of the BIS indicated that the BIS is not only commonly used but also demonstrates adequate levels of psychometric properties (Stanford, Mathias, Dougherty, Lake, Anderson, & Patton, 2009). In the current study, $\alpha = .85$.

Demographic information. A general background questionnaire was administered to assess demographic information such as age, class standing, gender, race, ethnicity, and daily Internet usage. See Appendix I.

Follow-up assessments. The daily assessment consisted of reporting on the

previous night's drinking (see Appendix J).

Drinking context. Participants were asked about the context of their drinking last night. First, they were provided with a 1-item questionnaire about their location for drinking last night (i.e., home, work, friend's house, restaurant, bar, "other"). They could select multiple locations. Responses on each drinking day were coded as either 1 (*consumed alcohol in this location*) or 0 (*did not consume alcohol in this location*) for each location. Participants also reported the number and type of alcoholic beverages consumed within each location.

Additionally, participants were asked if they engaged in pre-gaming or drinking game behaviors the night prior. Responses were coded as yes (1) or no (0) separately for pre-gaming and drinking games.

Participants also were provided with a 1-item measure of their social context with response options of 1 (*I drank alone*), 2 (*I drank with others but was not interacting with them and others were not drinking*), 3 (*I drank with others but was not interacting with them and others were drinking*), and 4 (*I drank with others and was interacting with others who were drinking also*). Response options 2 and 3 were rarely recorded (2.3% and 2.6% of days, respectively). Thus, only options 1 and 4 were examined and were subsequently recoded as 0 (*I drank alone*) and 1 (*I drank with others with whom I was interacting*).

Substance use. To measure alcohol consumption last night, participants were asked to report the number of alcoholic drinks they consumed for each beverage. That is, they were asked the number of beers, glasses of wine, shots, mixed drinks, and CABs they consumed the night before. Total number of drinks consumed last night was

calculated by summing the number of drinks consumed for each beverage. CAB use last night was determined based on whether they reported consuming alcohol mixed with regular soda, diet soda, or an energy drink last night. Responses were coded as either 0 (*did not drink CABs last night*) or 1 (*consumed at least one CAB last night*). Regarding other substance use, participants were asked if they used any other drugs (including other forms of caffeine) prior to or while drinking (e.g., caffeine pills, stimulant drugs) with yes (1) or no (0) response options.

Motivations for drinking. The Drinking Motives Questionnaire (DMQ-R; Cooper, 1994) was used to measure one's motivations for drinking. The DMQ-R was adapted to ask about last night's motivations for drinking in general. The scale consists of four subscales: coping (e.g., "To forget your worries"), conformity (e.g., "To fit in with a group you like"), social (e.g., "To be sociable"), and enhancement (e.g., "Because it helps you to enjoy a party"). Responses range from 1 (*almost never/never*) to 5 (*all of the time*). Subscales were scored by summing the responses that corresponded to each individual subscale. Higher scores on a subscale indicate greater endorsement of that particular drinking motive. This scale is widely used and has demonstrated adequate internal validity among college students. For instance, Lewis and colleagues (2008) found that Cronbach alphas for individual subscales ranged from .79 to .89. In the current study, internal validity for DMQ-R daily subscales ranged from .86 to .94.

Additionally, participants completed questions about their specific motivations for drinking CABs. Based on the most commonly reported reasons for drinking CABs from the literature (Marczinski, 2011; O'Brien et al., 2008), items consisted of (1) to hide the flavor of alcohol, (2) to feel less tired while drinking, (3) to get intoxicated faster, and (4)

to feel more energetic (Peacock et al., 2012b). Participants were asked to report the degree to which they consumed alcohol last night for these reasons with response options ranging from 1 (*almost never/never*) to 5 (*almost always/always*). Higher scores indicated greater motivations for using CABs for each specific reason. Because CAB-specific motives inquired about their use of CABs last night specifically, subsequent analyses involving CAB motives were restricted to only CAB days.

Drinking consequences. Participants were provided with several questions regarding drinking-related consequences that occurred the previous night.

First, participants were asked if they drove after drinking last night with yes (1) or no (0) response options.

Second, they were asked if they engaged in sexual intercourse after drinking last night with yes (1) or no (0) response options. If participants indicated that "yes" to this item, they were provided with two follow-up questions. These questions included: (1) "Please describe this partner" with response options of "this is a new sexual partner", "this is an occasional sexual partner", "this is a regular sexual partner", and "this is my main sexual partner" and (2) "Did you use protection or contraception?" with response options of "no, we did not", "yes, we used a condom", "yes, we used birth control", and "yes, we used both a condom and birth control." Given the lack of variability in contraception and type of partner across days, questions regarding the type of sexual partner and the use of contraception were excluded from analyses.

Third, participants were provided with the Brief Young Adult Alcohol Consequences Questionnaire (BYAACQ; Kahler, Strong & Read, 2005) asking about alcohol-related problems that occurred during the previous night. The BYAACQ is a 24-

item checklist with response options of yes (1) and no (0) for each item. In the present study, $\alpha = .90$. Given that participants did not experience a problem on approximately 50% of drinking days assessed and was thus positively skewed, this scale was scored dichotomously as 0 (*did not experience a problem on this day*) or 1 (*experienced at least one problem on this day*).

CHAPTER III

RESULTS

Power Analysis

Based on pilot data outcomes, the link between CAB use and negative consequences was anticipated to be a small- to medium-sized effect. Additionally, based on pilot data, it appeared that CAB users at the present university typically consume CABs three days per week. Thus, it was anticipated that over the course of two weeks, participants would, on average, report six CAB days. Using this information, the following formula was used to calculate power (West, Ryu, Kwok, & Cham, 2011):

$$N_{\text{effective}} = \frac{n_{L1} n_{L2}}{(1 + (n_{L1} - 1)ICC}$$

This equation accounts for both level-1 (n_{L1}) and level-2 (n_{L2}) sample sizes. Assuming a small effect and six days of CAB use, it was estimated that I would need approximately 200 participants (i.e., level 2 units). Assuming a medium effect it was assumed that I would need approximately 50 participants. Taking the average of the small and medium effects and assuming an interclass correlation (ICC) of approximately .3 (the apparent average of prior daily diary studies investigating alcohol use; Armeli, Todd, Conner, & Tennen, 2008; Maggs, Williams, & Lee, 2011), it was estimated that I would need approximately 100 to 125 participants with approximately six days of CAB use each to obtain adequate power to conduct study analyses. Data were collected from the planned number of level-2 units (N = 122), but fewer than the planned number of level-1 units (4.76 drinking days per person; 25.96% of these days were CAB days). To maximize power with the level 1 units collected, subsequent analyses were modified to

compare days where participants consumed at least one CAB ("CAB days") versus days where they consumed other types of alcohol ("non-CAB days") rather than comparing number of CABs continuously on CAB days.

Data Cleaning

Prior to conducting analyses, data were cleaned. First, duplicate, incomplete daily responses were deleted and only eligible participants who completed at least two daily surveys and consumed alcohol on at least one occasion were included in subsequent analyses (as described above). Second, missing data were addressed. Minimal data were missing (ranging from 0 to 3% across baseline measures and 0 to 5% on daily measures). Based on the procedural recommendations provided by Black and colleagues (2011), differences on key study variables (e.g., alcohol use last night, CAB use) did not differ based on whether each variable was missing, thus indicating that study variable outcomes were independent of the missingness mechanism. Consequently, missing data for continuous data were imputed using expectation maximization in SPSS. For categorical or dichotomous variables, missing datapoints were omitted using listwise deletion when conducting analyses in HLM software. Third, similar to procedures outlined by Armeli et al., 2008, participants were asked to complete daily surveys between the hours of 2:30 and 7 pm to control for time of day effects. Despite additional text message reminders sent at 2:30, the majority (68.8%) of participant reports were completed outside of the 2:30 to 7 pm range. Given that recall bias was limited (i.e., all reports inquiring about last night's drinking were completed within 24 hours) and that participants were provided with the date in question at the start of the survey, all daily reports were included in analyses in order to preserve sample size.

Statistical assumptions also were addressed prior to conducting analyses. First, normality was assessed using histograms. All continuous scales were normality distributed with the exception of the CEQ withdrawal subscale and the DMQ-R conformity subscale. These subscales were skewed and were normalized via a square root transformation. Square root transformed predictors yielded similar outcomes as the non-transformed predictors, thus the non-transformed predictors are presented here to enhance interpretability. Second, outliers were examined using boxplots. Extreme outliers outside of the 3 *SD* range were winsorized (Barnet & Lewis, 1994) to match the next highest value. Third, to reduce the potential effects of multicollinearity, all main effects and interaction terms were centered. Given the nature of the nested data, level-1 predictors were group-mean centered and level-2 predictors were grand-mean centered. Fourth, a Bernoulli distribution was specified for all dichotomous outcomes (e.g., whether someone experienced a problem after drinking last night) and a Poisson distribution was specified for continuous outcomes (i.e., number of drinks consumed). Fifth, the variance components were examined to determine whether they should be treated as "free" or "fixed" effects. Key study variables (e.g., CAB use, number of drinks last night, drinking motives) did not vary significantly between-person. Thus, variance components were fixed to zero in subsequent analyses.

It should be noted that the outcomes assessed were originally intended to be level-2 outcomes. These outcomes included alcohol-related problems, risky driving, risky sexual behavior, and general caffeine-related physiological problems. By examining an outcome at level 2, the research question is modified to ask about last night's drinking predicting *general* behavior (e.g., general alcohol-related problems experienced in the

last year) rather than *last night's* behavior. To gain a more enhanced view of how last night's drinking was related to last night's behavior, additional data that happened to be collected regarding outcomes that occurred last night were used in subsequent analyses. As noted above, this includes daily alcohol-related problems (i.e., whether an individual experienced a problem last night), daily driving behavior (i.e., whether an individual reported driving after drinking last night), and daily sexual behavior (i.e., whether an individual reported engaging in sexual intercourse after drinking last night). Last night's caffeine-related physiological symptoms did not happen to be collected along with this other data; thus, this outcome is not included in multilevel analyses. An examination of the link between baseline CAB use and baseline caffeine-related physiological symptoms is presented below.

As noted above, eligible participants who were included versus excluded in the current study differed with regard to age and typical alcohol consumption. Age was unrelated key study variables including CAB use and alcohol-related problems and was thus not included as a control variable in order to be parsimonious. Aggregate alcohol use was included as a control variable in Aims 2 and 3.

All multilevel modeling analyses were conducted using HLM 7.01 software (Raudenbush, Bryk, & Congdon, 2013). Results from unit-specific models with robust standard errors are reported. Issues specific to individual aims are discussed in turn below.

Aim 1

The first aim of the current study was to determine the context in which CABs are consumed (i.e., where, when, with whom, and how). This aim was examined in two

ways. First, proportions were calculated to determine how often these behaviors occurred on CAB days and how often these behaviors occurred on non-CAB days. Proportions were calculated by summing the number of times an individual engaged in a particular behavior across all drinking days divided by the number of days they provided drinking data. Proportions were calculated separately for CAB days and non-CAB days. Second, given the multilevel structure of the data and the unbalanced nature of the predictor variables (i.e., each individual has a different number of daily observations), the likelihood of drinking a CAB within each context was examined using multilevel modeling. For example, if the relationship between pre-gaming and CAB use were to be examined, the predictor (e.g., whether someone pre-gamed) would be scored as 0 (*did not engage in this behavior on this day*) or 1 (*engaged in this behavior on this day*) and the CAB use outcome would be scored as 0 (*a non-CAB day*) or 1 (*a CAB day*).

An example equation involving whether an individual consumed CABs (0 = non-CAB day, 1 = CAB day) on a particular drinking day predicting whether an individual pre-gamed (0 = did not pregame, 1 = did pregame) is provided in which drinking days (t) were nested within people (i):

$$\log (\pi/1-\pi) = \pi_{00} + \pi_{10}(\text{CABuse}_{ti}) + e_{ti}$$

Location[1]. Drinking locations included home, work, friend's house, restaurant, bar/club, or "other". For locations only, participants also indicated the number of CABs consumed within each location on CAB days. Multilevel modeling was used to examine the number of CABs consumed in each context on CAB days. An example equation involving whether an individual drank at home (0 = did not drink at home last night, 1 =

[1] Regarding location specifically, because participants were able to select multiple locations, the percentages add up to more than 100%.

drank at home last night) predicting the number of CABs consumed (measured continuously) is provided:

$$NumCABdrinks_{ti} = \pi_{00} + \pi_{10}(Home_{ti}) + e_{ti}$$

Regarding drinking at home, 50.16% of non-CAB days and 42% of CAB days involved drinking at home. CAB use was unrelated to the likelihood of drinking at home last night, Odds Ratio (OR) = 0.67, $p = .169$. Drinking at home was significantly and positively associated with the number of CABs consumed, Event Rate Ratio (ERR) = 1.42, $p = .004$. This indicates that CAB use was heavier when drinking at home as compared to other locations.

For work, 1.71% of non-CAB days and 1.6% of CAB days involved drinking at work. Drinking at work was unrelated to the number of CABs consumed, ERR = 2.22, $p = .192$.[2]

Regarding a friend's house, 40.93% of non-CAB days and 33.2% of CAB days involved drinking at a friend's house. CAB use was unrelated to the likelihood of drinking at a friend's house last night, OR = 1.24, $p = .395$. Drinking at a friend's house was unassociated with number of CABs consumed, ERR = 0.91, $p = .495$.

For restaurant, 13.50% of non-CAB days and 16.3% of CAB days involved drinking at a restaurant. CAB use was not associated with odds of drinking at a restaurant last night, OR = 1.57, $p = .217$. Drinking at a restaurant was significantly negatively related to the number of CABs consumed, ERR = 0.68, $p = .008$.

For bar/club, 9.61% of non-CAB days and 14.7% of CAB days involved drinking at a bar/club. Odds of drinking at a bar were higher on CAB days as compared to non-

[2] HLM software was unable to compute the link between CAB use and drinking at work because of the limited number of days in which participants reported drinking at work.

CAB days, OR = 2.41, p = .016. Drinking at a bar or club was unassociated with the number of CABs consumed, ERR = 1.24, p = .227.

Regarding "other", 7.96% of non-CAB days and 4.7% of CAB days involved drinking at a location not listed. "Other" locations included drinking in their car, a hotel, tailgating, outdoors, or a wedding. Drinking CABs last night was unassociated with the likelihood of drinking at an "other" location last night, OR = 0.39, p = .079. Drinking at an "other" location was unrelated to the number of CABs consumed, ERR = 0.43, p = .183.

Pre-gaming and drinking game behavior. Pre-gaming occurred on 9.32% of non-CAB days as compared to 22.7% of CAB days. Odds of engagement in pre-gaming last night were higher on CAB days as compared to non-CAB days, OR = 3.13, $p < .001$. Conversely, drinking games occurred on 13% of non-CAB days and 5% of CAB days. Engagement in drinking games last night was unrelated to odds of using a CAB last night, OR = 0.44, p = .057.

Social context. Drinking with other individuals with whom the participant was interacting occurred on 76.38% of non-CAB days and 81.3% of CAB days. Odds of drinking with others was higher on CAB days as compared to non-CAB days, OR = 1.87, p = .045.

Use of other substances. Participants reported using other substances prior to or while drinking on 6.7% of non-CAB days and 3.9% of CAB days. CAB use last night was unrelated to use of substances last night, OR = 0.41, p = .165. The most common substances used included marijuana (14 days), Adderall (three days), and caffeine (e.g., 5-hour energy; three days).

Type of caffeine mixer. On CAB days, 63.5% of the CABs consumed included a regular soda mixer, 12.8% included a diet soda mixer, and 34% included an energy drink mixer.

Aim 2

The second aim of the present study was to examine the association between daily CAB use (i.e., 0 = drinking day in which CABs were not consumed, 1 = drinking day where at least one CAB was consumed) and alcohol outcomes. Drinking-related outcomes were the amount of alcohol consumed and alcohol-related outcomes including: alcohol-related consequences as measured by the BYAACQ (0 = did not experience an alcohol problem last night, 1 = experienced at least one alcohol problem last night), driving after drinking last night (0 = did not drive after drinking, 1 = drove after drinking), and engagement in sexual activity last night (i.e., whether the participant engaged in sex after drinking [0 = did not have sex, 1 = had sex], use of contraceptives [0 = did not use any contraceptives, 1 = used contraceptives], and type of partner [0 = new/occasional partner, 1 = main/regular partner]).

Descriptively, on non-CAB days, participants consumed an average of 4.07 drinks compared to 5.64 drinks on CAB days. Regarding alcohol-related problems, 49.3% of non-CAB days involved experiencing at least one alcohol-related problem as compared to 63.98% of CAB days. Regarding driving behavior, 8.6% of non-CAB days involved driving after drinking as compared to 9% of CAB days. In terms of sexual behavior, 12.1% of non-CAB days involved engaging in sex after drinking compared to 12.2% of CAB days. On days where participants engaged in sex, 75% of non-CAB days involved using some form of protection as compared to 95% of CAB days. Additionally, on days

where participants reported having sex, 83% of non-CAB days involved having sex with their main or regular partner as compared to 85% of CAB days.

Similar to the first aim, multilevel modeling was used given the unbalanced and nested nature of the predictor variables. Using separate equations, each outcome was regressed on daily CAB use. These associations also were tested after controlling for several factors that could confound the relationship between CAB use and outcomes. Control variables included the number of drinks consumed last night (level 1), typical impulsivity (level 2), and typical alcohol use (i.e., aggregate alcohol use over the two-week period). To determine the incremental influence of each control variable, separate models were tested including (1) no covariates, (2) the inclusion of the number of drinks last night as a covariate, (3) the inclusion of number of drinks last night and impulsivity as covariates, and (4) the inclusion of number of drinks last night, impulsivity, and typical alcohol use as covariates.

An example of each of the four equations is provided below. Here, the likelihood of experiencing an alcohol-related problem (0 = did not experience a problem last night, 1 = experienced a problem last night) predicted by whether they consumed CABs (CABuse), which time (t) is nested within individuals (i).

(1) $\log (\pi/1-\pi) = \pi_{00} + \pi_{10}(\text{CABuse}_{ti}) + e_{ti}$

(2) $\log (\pi/1-\pi) = \pi_{00} + \pi_{10}(\text{CABuse}_{ti}) + \pi_{20}(\text{NumDrinks}_{ti} - \overline{\text{NumDrinks.}}_{i}) + e_{ti}$

(3) $\log (\pi/1-\pi) = \pi_{00} + \pi_{10}(\text{CABuse}_{ti}) + \pi_{20}(\text{NumDrinks}_{ti} - \overline{\text{NumDrinks.}}_{i}) +$

$\pi_{01}(\text{Impulsivity}_{i} - \overline{\text{Impulsivity.}}) + e_{ti}$

(4) $\log (\pi/1-\pi) = \pi_{00} + \pi_{10}(\text{CABuse}_{ti}) + \pi_{20}(\text{NumDrinks}_{ti} - \overline{\text{NumDrinks.}}_{i}) +$

$\pi_{01}(\text{Impulsivity}_{i} - \overline{\text{Impulsivity.}}) + \pi_{02}(\text{NumDrinks}_{i} - \overline{\text{NumDrinks.}}) + e_{ti}$

In the first equation, no covariates are included. In the second equation, the number of drinks (NumDrinks) consumed last night is added as a group-mean centered covariate. In the third equation, trait impulsivity (Impulsivity) is added as a grand-mean centered covariate. In the fourth equation, aggregated number of drinks over all of the individual's drinking days assessed is added as a grand-mean centered covariate.

Multilevel results are presented in Tables 1 – 3 regarding alcohol-related problems, driving after drinking, and engagement in sex after drinking. Given that engagement in sex was somewhat rare (occurred on 52 out of 389 days), follow-up analyses were underpowered to examine contraceptive use and partner type on days where participants reported having sex. Overall, CAB use last night was associated with a greater likelihood of experiencing an alcohol-related problem last night, even after controlling for the number of drinks consumed last night and trait impulsivity. The link between CAB use and alcohol-related problems was no longer significant after including aggregate alcohol use as an additional covariate. CAB use last night was unassociated with odds of driving after drinking last night or engaging in sex last night, regardless of the addition of covariates.

CAB use last night also was associated with heavier drinks consumed last night, even after controlling for impulsivity and aggregate alcohol use, ERR = 1.34, $p < .001$.

Baseline CAB use and baseline caffeine-related physiological symptoms also were examined using linear regression. For only this analysis, baseline data from all individuals who were eligible was used, regardless of their follow-up completion. This sample was chosen because it was larger ($N = 237$) than the final sample used in the multilevel analyses ($N = 122$) and thus had sufficient power to analyze a linear

regression. Additionally, those who completed the follow-up reports did not differ from those who did not complete follow-up reports in terms of their typical caffeine use, $t(231) = 0.38$, $p = .707$, CAB use, $t(230) = 0.87$, $p = .387$, or caffeine-related physiological symptoms, $t(235) = 0.08$, $p = .935$. Results indicated that after controlling for amount of caffeine consumed during a typical week, heavier CAB use was associated with more caffeine-related physiological symptoms reported, $B = 0.05$, $SE = 0.02$, $p = .035$.

Table 1

Multilevel Models Predicting Daily Alcohol-related Problems

	Model 1 OR (CI)	Model 2 OR (CI)	Model 3 OR (CI)	Model 4 OR (CI)
Intercept	0.90 (0.64-1.28)	0.96 (0.67-1.39)	0.97 (0.67-1.41)	0.99 (0.69-1.43)
Level 1: Daily level				
CAB use last night	2.20 (1.33-3.61)**	1.80 (1.09-2.99)*	1.83 (1.11-3.03)*	1.61 (0.96-2.72)
Number of drinks last night	--	1.27 (1.14-1.41)***	1.27 (1.14-1.41)***	1.28 (1.15-1.44)***
Level 2: Person level				
Impulsivity	--	--	1.02 (0.99-1.05)	1.01 (0.98-1.04)
Aggregate drinks	--	--	--	1.27 (1.11-1.44)***

Note. Separate models were conducted adjusting for: Model 1: no covariates; Model 2: the number of drinks consumed last night; Model 3: the number of drinks consumed last night and impulsivity; Model 4: the number of drinks consumed last night, impulsivity, and aggregate alcohol use over the two-week period. CAB = caffeinated alcoholic beverage as measured by 0 = did not use CABs during last night's drinking episode and 1 = used at least one CAB last night. OR = odds ratio from Bernoulli multilevel modeling distribution. CI = confidence interval. *$p < .05$. **$p < .01$. ***$p < .001$.

Table 2

Multilevel Models Predicting Daily Driving after Drinking

	Model 1 OR (CI)	Model 2 OR (CI)	Model 3 OR (CI)	Model 4 OR (CI)
Intercept	0.04 (0.02-0.07)*	0.09 (0.05-0.15)*	0.09 (0.06-0.14)*	0.09 (0.05-0.14)*
Level 1: Daily level				
CAB use last night	1.26 (0.46-3.45)	0.97 (0.46-2.06)	0.99 (0.47-2.07)	1.05 (0.49-2.24)
Number of drinks last night	--	1.05 (0.92-1.20)	1.05 (0.92-1.20)	0.92 (0.81-1.05)
Level 2: Person level				
Impulsivity	--	--	1.02 (0.97-1.06)	1.02 (0.97-1.06)
Aggregate drinks	--	--	--	0.92 (0.81-1.05)

Note. Separate models were conducted adjusting for: Model 1: no covariates; Model 2: the number of drinks consumed last night; Model 3: the number of drinks consumed last night and impulsivity; Model 4: the number of drinks consumed last night, impulsivity, and aggregate alcohol use over the two-week period. CAB = caffeinated alcoholic beverage as measured by 0 = did not use CABs during last night's drinking episode and 1 = used at least one CAB last night. OR = odds ratio from Bernoulli multilevel modeling distribution. CI = confidence interval. *$p < .001$.

Table 3

Multilevel Models Predicting Sex after Drinking Last Night

	Model 1 OR (CI)	Model 2 OR (CI)	Model 3 OR (CI)	Model 4 OR (CI)
Intercept	0.09 (0.06-0.15)**	0.13 (0.08-0.20)**	0.08 (0.05-0.14)**	0.13 (0.08-0.20)**
Level 1: Daily level				
CAB use last night	0.65 (0.26-1.62)	0.79 (0.35-1.77)	0.37 (0.13-1.10)	0.73 (0.33-1.62)
Number of drinks last night	--	1.22 (1.07-1.40)*	1.33 (1.12-1.58)*	1.08 (0.95-1.23)
Level 2: Person level				
Impulsivity	--	--	1.01 (0.97-1.05)	1.00 (0.97-1.04)
Aggregate drinks	--	--	--	1.22 (1.07-1.39)*

Note. Separate models were conducted adjusting for: Model 1: no covariates; Model 2: the number of drinks consumed last night; Model 3: the number of drinks consumed last night and impulsivity; Model 4: the number of drinks consumed last night, impulsivity, and aggregate alcohol use over the two-week period. CAB = caffeinated alcoholic beverage as measured by 0 = did not use CABs during last night's drinking episode and 1 = used at least one CAB last night. OR = odds ratio from Bernoulli multilevel modeling distribution. CI = confidence interval. *$p < .01$. **$p < .001$.

Aim 3

Cognitions and CAB use. The third aim of the study was to examine the cognitions (i.e., drinking motives, expectancies) associated with CAB use last night. Consistent with Aim 2, multilevel modeling was used to test the influence of level 1 and level 2 variables on CAB use. Level 1 cognitions included motivations for drinking last night (i.e., general drinking motives, CAB-specific motives); these variables were group-mean centered. The respective, aggregated motive for drinking last night over all drinking days assessed (level 2), impulsivity (level 2), the amount of alcohol consumed last night (level 1), and the aggregated amount of alcohol consumed over all drinking days assessed (level 2) were included as covariates in analyses.[3] Because CAB use is a dichotomous outcome (i.e., 0 = did not use CABs last night, 1 = used at least one CAB last night), a Bernoulli distribution was used.[4]

An example of last night's social drinking motives (SocialMotives) predicting the likelihood of drinking CABs last night is provided below:

$$\log(\pi/1-\pi) = \pi_{00} + \pi_{10}(\text{SocialMotives}_{ti} - \overline{\text{SocialMotives}}_{.i}) + \pi_{20}(\text{NumDrinks}_{ti} - \overline{\text{NumDrinks}}_{.i}) + \pi_{01}(\text{Social Motives}_{i} - \overline{\text{SocialMotives}}_{.}) + \pi_{02}(\text{NumDrinks}_{i} - \overline{\text{NumDrinks}}_{.}) + \pi_{03}(\text{Impulsivity}_{i} - \overline{\text{Impulsivity}}_{.}) + e_{ti}$$

Regarding general motivations for drinking last night, while controlling for covariates, social motives (OR = 1.02, CI = 0.97-1.08), enhancement motives (OR =

[3] Results for level 1 and level 2 predictors generally remained consistent when including or excluding the covariates listed.

[4] The only exception was for analyses involving CAB-specific motives. Because the CAB motive questionnaire referred specifically to CAB use, analyses were restricted to CAB days and thus CAB days could not be compared with non-CAB days on CAB-specific motives. Instead, a Poisson distribution was used to assess the relationship between CAB motives and the number of CABs consumed. All covariates remained the same with the exception that the aggregate number of CABs consumed was also included as a level 2 covariate.

1.00, CI = 0.92-1.08), conformity motives (OR = 1.05, CI = 0.96-1.16), and coping motives (OR = 0.99, CI = 0.91-1.07) were unrelated to CAB use last night. Regarding CAB-specific drinking motives, on CAB days, drinking to feel less tired (ERR = 0.81, p = .021) or to feel more energetic (ERR = 0.73, p = .005) was related to fewer CABs consumed last night. Drinking to hide the flavor of alcohol (ERR = 0.94, p = .447) or to become intoxicated faster (ERR = 1.01, p = .927) were unassociated with number of CABs consumed.

Level 2 cognitions included expectancies (i.e., alcohol expectancies, caffeine expectancies, CAB-specific expectancies); these variables were grand-mean centered. Trait impulsivity (level 2), amount of alcohol consumed last night (level 1), and aggregated amount of alcohol consumed over all drinking days (level 2) were included as covariates in analyses.

An example with sociability expectancies (SocialExpect) predicting the odds of drinking CABs last night is provided below:

$$\log(\pi/1-\pi) = \pi_{00} + \pi_{10}(\text{NumDrinks}_{ti} - \overline{\text{NumDrinks}}_{.i}) + \pi_{01}(\text{SocialExpect}_{i} - \overline{\text{SocialExpect}}_{.}) + \pi_{02}(\text{NumDrinks}_{i} - \overline{\text{NumDrinks}}_{.}) + \pi_{03}(\text{Impulsivity}_{i} - \overline{\text{Impulsivity}}_{.}) + e_{ti}$$

After controlling for covariates, all positive and negative alcohol expectancies were unassociated with odds of using CABs last night. This included expectancies of sociability (OR = 0.97, CI = 0.89-1.05), tension reduction (OR = 0.99, CI = 0.86-1.14), liquid courage (OR = 1.00, CI = 0.92-1.09), sexuality (OR = 1.05, CI = 0.94-1.17), cognitive-behavioral impairment (OR = 1.04, CI = 0.99-1.10), risk and aggression (OR = 1.02, CI = 0.92-1.15), and self-perception (OR = 1.09, CI = 0.96-1.23).

All caffeine expectancies were unrelated to odds of using CABs last night after controlling for covariates. This included withdrawal symptom (OR = 1.02, CI = 0.99-1.06), acute negative effects (OR = 1.02, CI = 0.97-1.08), positive effects (OR = 1.02, CI = 0.99-1.06), and mood expectancies (OR = 1.02, CI = 0.96, 1.08).

Regarding CAB-specific expectancies, intoxication enhancement expectancies were found to positively associate with odds of using CABs last night (OR = 1.17, CI = 1.04-1.32). Avoidance of negative consequences expectancies were unassociated with CAB use (OR = 1.04, CI = 0.98-1.10).

Cognitions as a moderator. The cognitions mentioned above also were examined as moderators of the relationship between whether CABs were consumed last night and negative consequences. Consistent with Aim 2 outcomes, negative consequences included whether the participant reported (a) experiencing an alcohol-related problem last night, (b) driving after drinking last night, and (c) engaging in sexual intercourse last night. Bernoulli distributions were used for these dichotomous outcomes. Separate moderation analyses were conducted for each cognition and each negative outcome. When examining motivations for drinking (i.e., general drinking motives last night, CAB-specific motives last night) as moderators of the association between CAB use and negative consequences, level 1 predictors included the respective drinking motive last night (e.g., social drinking motives last night), CAB use last night, and the level-1 interaction between the drinking motive and CAB use (e.g., social drinking motives X CAB use). Covariates included amount of alcohol consumed last night (level 1), aggregate alcohol use over all drinking days assessed (level 2), the respective drinking

motive aggregated over drinking days assessed (level 2; e.g., aggregate social motives), and impulsivity (level 2).[5]

An example of a social drinking motives (SocialMotives) as a level-1 moderator of the relationship between CAB use and odds of experiencing an alcohol problem last night is provided below:

$$\log(\pi/1-\pi) = \pi_{00} + \pi_{10}(CABuse_{ti}) + \pi_{20}(SocialMotives_{ti} - \overline{SocialMotives}_{.i}) + \pi_{30}(NumDrinks_{ti} - \overline{NumDrinks}_{.i}) + \pi_{40}(SocialMotives_{ti} - \overline{SocialMotives}_{.i} \text{ X } CABuse_{ti}) + \pi_{01}(\text{Social Motives}_{i} - \overline{SocialMotives}_{.}) + \pi_{02}(NumDrinks_{i} - \overline{NumDrinks}_{.}) + \pi_{03}(Impulsivity_{i} - \overline{Impulsivity}_{.}) + e_{ti}$$

Daily-level drinking motives (i.e., general drinking motives, CAB-specific motives) as a moderator between CAB use last night and negative consequences can be seen in Tables 4 thru 11. Regarding traditional drinking motives (i.e., social, enhancement, conformity, coping motives), social and enhancement motives moderated the relationship between CAB use and alcohol-related problems experienced last night after including covariates. In other words, on CAB days, individuals were more likely to experience an alcohol-related problem, especially if they endorsed higher social or enhancement drinking motives than usual. Additionally, social motives moderated the link between CAB use and odds of driving after drinking last night. None of the traditional motives moderated the relationship between CAB use and odds of engaging in sex after drinking last night.

[5] Consistent with the bivariate associations between CAB use and CAB-specific motives, these motives were restricted to examining only CAB days, given the nature of the questionnaire. Additionally, CAB use in these analyses was defined as the number of CABs consumed, rather than whether CABs were consumed. Aggregate CAB use was included as a level 2 covariate when examining these motives as well.

In terms of CAB-specific motivations, drinking to hide the flavor of alcohol, to feel intoxicated faster, or to feel more energetic did not moderate the link between CAB use and any of the negative consequences. Drinking to feel less tired moderated the association between CAB use and odds of driving after drinking as well as engaging in sex after drinking.

When examining expectancies (i.e., alcohol expectancies, caffeine expectancies, CAB-specific expectancies) as moderators of the association between CAB use and each negative consequence. Predictors included the respective expectancy (level 2; e.g., sociability expectancies), CAB use last night (level 1), and a cross-level interaction between the respective expectancy and CAB use last night (level 2 x level 1 interaction; e.g., sociability expectancies X CAB use). Covariates included amount of alcohol consumed last night (level 1), aggregate alcohol use (level 2), and impulsivity (level 2).

An example of sociability expectancies (SocialExpect) as a level 2 moderator of the relationship between CAB use and odds of experiencing an alcohol problem last night is provided below:

$$\log(\pi/1-\pi) = \pi_{00} + \pi_{10}(CABuse_{ti}) + \pi_{20}(NumDrinks_{ti} - \overline{NumDrinks_{.i}}) + \pi_{01}(SocialExpect_{i} - \overline{SocialExpect_{.}}) + \pi_{02}(NumDrinks_{i} - \overline{NumDrinks_{.}}) + \pi_{03}(Impulsivity_{i} - \overline{Impulsivity_{.}}) + \pi_{11}(CABuse_{ti} \text{ X } SocialExpect_{i} - \overline{SocialExpect_{.}}) + e_{ti}$$

Alcohol, caffeine, and CAB-specific expectancies were individually tested as moderators of the link between CAB use and negative consequences. Results are displayed in Tables 12 to 24. Among alcohol expectancies, only liquid courage and risk/aggression moderated the relationship between CAB use and the likelihood of engaging in sex last night after drinking. In terms of caffeine expectancies, only acute

negative expectancies moderated the relationship between CAB use and the odds of experiencing an alcohol-related problem last night. Mood effects moderated the link between CAB use and the likelihood of driving after drinking. In terms of CAB-specific expectancies, avoidance of negative consequence expectancies moderated the link between CAB use and alcohol-related problems. All other interactions were non-significant.

Table 4

Multilevel Models of the Interaction between Daily-level Social Motives and CAB Use Predicting Negative Consequences

	Alcohol-related problems OR (CI)	Driving after Drinking OR (CI)	Sex after Drinking OR (CI)
Intercept	1.20 (0.85-1.69)	0.08 (0.05-0.13)***	0.11 (0.08-0.17)***
Level 1: Daily-level			
Social drinking motives	1.08 (0.99-1.18)	1.13 (1.00-1.29)	0.97 (0.97-1.02)
CAB use last night	1.68 (0.87-3.22)	0.86 (0.42-1.75)	0.31 (0.12-0.80)*
Social motives x CAB use	1.37 (1.03-1.81)*	1.32 (1.06-1.65)*	0.96 (0.76-1.21)
Number of drinks last night	1.26 (1.12-1.42)***	1.00 (0.85-1.17)	1.28 (1.12-1.46)***
Level 2: Person-level			
Impulsivity	1.01 (0.98-1.04)	1.02 (0.98-1.07)	1.01 (0.97-1.04)
Aggregate drinks	1.12 (0.99-1.28)	0.90 (0.76-1.06)	0.98 (0.86-1.12)
Aggregate social motive	1.17 (1.08-1.27)	1.01 (0.91-1.13)	1.11 (1.03-1.19)**

Note. CAB = caffeinated alcoholic beverage as measured by 0 = did not use CABs during last night's drinking episode and 1 = used at least one CAB last night. OR = odds ratio from Bernoulli multilevel modeling distribution. CI = confidence interval. *$p < .05$. **$p < .01$. ***$p < .001$.

Table 5

Multilevel Models of the Interaction between Daily-level Enhancement Motives and CAB Use Predicting Negative Consequences

	Alcohol-related problems OR (CI)	Driving after Drinking OR (CI)	Sex after Drinking OR (CI)
Intercept	1.20 (0.84-1.71)	0.08 (0.05-0.14)***	0.11 (0.07-0.16)***
Level 1: Daily-level			
Enhancement drinking motives	1.13 (1.01-1.26)*	1.02 (0.91-1.15)	1.05 (0.95-1.15)
CAB use last night	1.93 (1.02-3.66)*	1.30 (0.56-1.15)	0.28 (0.11-0.72)**
Enhancement motives x CAB use	1.65 (1.10-2.47)*	1.13 (0.57-2.24)	1.27 (0.82-1.96)
Number of drinks last night	1.26 (1.12-1.42)***	1.04 (0.91-1.20)	1.27 (1.11-1.45)***
Level 2: Person-level			
Impulsivity	1.01 (0.99-1.04)	1.02 (0.97-1.07)	1.01 (0.98-1.04)
Aggregate drinks	1.17 (1.03-1.33)*	0.94 (0.81-1.10)	1.01 (0.89-1.14)
Aggregate enhancement motive	1.17 (1.07-1.28)*	0.96 (0.85-1.08)	1.11 (1.02-1.20)*

Note. CAB = caffeinated alcoholic beverage as measured by 0 = did not use CABs during last night's drinking episode and 1 = used at least one CAB last night. OR = odds ratio from Bernoulli multilevel modeling distribution. CI = confidence interval. *$p < .05$. **$p < .01$. ***$p < .001$.

Table 6

Multilevel Models of the Interaction between Daily-level Conformity Motives and CAB Use Predicting Negative Consequences

	Alcohol-related problems OR (CI)	Driving after Drinking OR (CI)	Sex after Drinking OR (CI)
Intercept	1.23 (0.87-1.73)	0.08 (0.05-0.13)***	0.11 (0.07-0.17)***
Level 1: Daily-level			
Conformity drinking motives	1.16 (0.91-1.48)	1.28 (1.07-1.53)**	0.99 (0.89-1.11)
CAB use last night	1.65 (0.93-2.93)	0.99 (0.44-2.25)	0.28 (0.11-0.73)**
Conformity motives x CAB use	1.34 (0.76-2.38)	1.27 (0.91-1.78)	1.18 (0.81-1.71)
Number of drinks last night	1.28 (1.14-1.43)***	1.03 (0.89-1.18)	1.27 (1.11-1.45)***
Level 2: Person-level			
Impulsivity	1.00 (0.97-1.03)	1.02 (0.97-1.07)	1.00 (0.96-1.04)
Aggregate drinks	1.27 (1.11-1.44)***	0.91 (0.80-1.04)	1.07 (0.94-1.21)
Aggregate conformity motive	1.26 (1.13-1.40)***	1.06 (0.92-1.21)	1.12 (1.00-1.25)*

Note. CAB = caffeinated alcoholic beverage as measured by 0 = did not use CABs during last night's drinking episode and 1 = used at least one CAB last night. OR = odds ratio from Bernoulli multilevel modeling distribution. CI = confidence interval. *$p < .05$. **$p < .01$. ***$p < .001$.

Table 7

Multilevel Models of the Interaction between Daily-level Coping Motives and CAB Use Predicting Negative Consequences

	Alcohol-related problems OR (CI)	Driving after Drinking OR (CI)	Sex after Drinking OR (CI)
Intercept	1.16 (0.82-1.65)	0.09 (0.06-0.14)***	0.11 (0.07-0.17)***
Level 1: Daily-level			
Coping drinking motives	1.06 (0.90-1.24)	0.98 (0.81-1.18)	1.02 (0.89-1.17)
CAB use last night	1.71 (0.97-3.04)	1.24 (0.51-3.02)	0.31 (0.12-0.81)*
Coping motives x CAB use	1.21 (0.82-1.78)	0.93 (0.64-1.35)	1.23 (0.75-2.01)
Number of drinks last night	1.27 (1.14-1.42)***	1.06 (0.92-1.21)	1.26 (1.11-1.43)***
Level 2: Person-level			
Impulsivity	0.99 (0.97-1.03)	1.01 (0.97-1.06)	1.00 (0.97-1.04)
Aggregate drinks	1.25 (1.10-1.42)***	0.91 (0.80, 1.04)	1.06 (0.94-1.21)
Aggregate coping motive	1.19 (1.06-1.34)**	1.03 (0.89-1.19)	1.04 (0.94-1.17)

Note. CAB = caffeinated alcoholic beverage as measured by 0 = did not use CABs during last night's drinking episode and 1 = used at least one CAB last night. OR = odds ratio from Bernoulli multilevel modeling distribution. CI = confidence interval. *$p < .05$. **$p < .01$. ***$p < .001$.

Table 8

Multilevel Models of the Interaction between Daily-level Alcohol Flavor Motives and CAB Use Predicting Negative Consequences

	Alcohol-related problems OR (CI)	Driving after Drinking OR (CI)	Sex after Drinking OR (CI)
Intercept	2.11 (1.18-3.76)*	0.04 (0.02-0.10)***	0.08 (0.03-0.18)***
Level 1: Daily-level			
Alcohol flavor motives	0.32 (0.09-1.13)	0.22 (0.09-0.54)**	2.50 (0.84-7.50)
CAB use last night	1.02 (0.45-2.29)	0.26 (0.10-0.70)**	1.70 (0.96-3.02)
Alcohol flavor x CAB use	0.41 (0.07-2.55)	0.75 (0.18-3.14)	0.77 (0.14-4.27)
Number of drinks last night	1.09 (0.70-1.69)	1.11 (0.76-1.63)	0.97 (0.60-1.59)
Level 2: Person-level			
Impulsivity	1.01 (0.96-1.06)	0.96 (0.90-1.02)	0.94 (0.88-1.01)
Aggregate drinks	1.35 (1.09-1.67)**	1.02 (0.86-1.21)	1.21 (0.98-1.51)
Aggregate CAB use	0.77 (0.48-1.22)	0.55 (0.21-1.41)	1.34 (0.82-2.19)
Aggregate alcohol flavor motives	1.07 (0.69-1.67)	0.40 (0.20-0.79)**	0.80 (0.47-1.35)

Note. Alcohol flavor = motivations to hide the flavor of alcohol. CAB = number of caffeinated alcoholic beverages consumed last night. OR = odds ratio from Bernoulli multilevel modeling distribution. CI = confidence interval. *$p < .05$. **$p < .01$. ***$p < .001$.

Table 9

Multilevel Models of the Interaction between Daily-level Less Tired Motives and CAB Use Predicting Negative Consequences

	Alcohol-related problems OR (CI)	Driving after Drinking OR (CI)	Sex after Drinking OR (CI)
Intercept	2.35 (1.20-4.60)*	0.01 (0.00-0.09)***	0.08 (0.03-0.21)***
Level 1: Daily-level			
Less tired drinking motives	1.62 (0.38-6.94)	0.05 (0.00-0.51)*	0.54 (0.20-1.48)
CAB use last night	1.41 (0.67-3.00)	0.08 (0.02-0.41)**	2.15 (0.90-5.12)
Less tired motives x CAB use	3.95 (0.93-16.68)	0.01 (0.00-0.19)**	6.73 (1.05-42.99)*
Number of drinks last night	1.02 (0.60-1.75)	0.96 (0.62-1.47)	1.02 (0.66-1.59)
Level 2: Person-level			
Impulsivity	1.01 (0.96-1.06)	1.02 (0.96-1.08)	0.95 (0.89-1.02)
Aggregate drinks	1.39 (1.08-1.80)*	1.03 (0.88-1.21)	1.23 (1.00-1.51)
Aggregate CAB use	0.81 (0.51-1.26)	0.41 (0.13-1.32)	1.44 (0.89-2.35)
Aggregate less tired motive	1.40 (0.76-2.58)	0.07 (0.00-1.34)	0.94 (0.47-1.86)

Note. CAB = number of caffeinated alcoholic beverages consumed last night. Less tired = motivations to drink to feel less tired. OR = odds ratio from Bernoulli multilevel modeling distribution. CI = confidence interval. *$p < .05$. **$p < .01$. ***$p < .001$.

Table 10

Multilevel Models of the Interaction between Daily-level Intoxication Motives and CAB Use Predicting Negative Consequences

	Alcohol-related problems OR (CI)	Driving after Drinking OR (CI)	Sex after Drinking OR (CI)
Intercept	2.02 (1.11-3.70)*	0.04 (0.01-0.18)***	0.07 (0.03-0.20)***
Level 1: Daily-level			
Intoxication drinking motives	0.84 (0.36-1.96)	0.19 (0.01-4.67)	0.88 (0.25-3.07)
CAB use last night	1.10 (0.51-2.36)	0.11 (0.02-0.59)*	1.64 (0.85-3.18)
Intoxication motives x CAB use	0.98 (0.06-16.06)	0.00 (0.00-4.68)	1.89 (0.10-36.13)
Number of drinks last night	1.05 (0.62-1.77)	1.21 (0.85-1.74)	1.07 (0.70-1.64)
Level 2: Person-level			
Impulsivity	1.01 (0.96-1.06)	1.00 (0.95-1.05)	0.95 (0.88-1.03)
Aggregate drinks	1.30 (1.07-1.59)*	0.99 (0.87-1.13)	1.21 (0.97-1.51)
Aggregate CAB use	0.75 (0.48-1.17)	0.51 (0.25-1.03)	1.14 (0.64-2.06)
Aggregate intoxication motive	1.86 (0.94-3.68)	0.31 (0.09-1.02)	1.72 (1.03-2.89)*

Note. CAB = number of caffeinated alcoholic beverages consumed last night. Intoxication = drinking to feel intoxicated faster. OR = odds ratio from Bernoulli multilevel modeling distribution. CI = confidence interval. *$p < .05$. **$p < .01$. ***$p < .001$.

Table 11

Multilevel Models of the Interaction between Daily-level Energetic Motives and CAB Use Predicting Negative Consequences

	Alcohol-related problems OR (CI)	Driving after Drinking OR (CI)	Sex after Drinking OR (CI)
Intercept	2.57 (1.30-5.06)**	0.06 (0.02-0.16)***	0.09 (0.04-0.21)***
Level 1: Daily-level			
Energetic drinking motives	2.68 (0.51-14.06)	0.57 (0.14-2.31)	2.28 (0.73-7.12)
CAB use last night	1.53 (0.75-3.16)	0.32 (0.09-1.11)	1.77 (0.87-3.58)
Energetic motives x CAB use	7.29 (0.60-88.82)	0.22 (0.03-1.55)	0.73 (0.09-5.62)
Number of drinks last night	1.02 (0.59-1.74)	1.13 (0.72-1.79)	1.05 (0.68-1.63)
Level 2: Person-level			
Impulsivity	1.00 (0.95-1.05)	1.00 (0.95-1.05)	0.96 (0.90-1.02)
Aggregate drinks	1.42 (0.10-1.83)**	0.97 (0.85-1.12)	1.19 (0.98-1.46)
Aggregate CAB use	0.71 (0.44-1.14)	0.48 (0.20-1.16)	1.27 (0.78-2.04)
Aggregate energetic motive	1.87 (1.02-3.42)*	0.93 (0.36-2.38)	0.86 (0.47-1.59)

Note. CAB = number of caffeinated alcoholic beverages consumed last night. Energetic = drinking to feel more energetic. OR = odds ratio from Bernoulli multilevel modeling distribution. CI = confidence interval. *$p < .05$. **$p < .01$. ***$p < .001$.

Table 12

Multilevel Models of the Interaction between Sociability Expectancies and Daily-level CAB Use Predicting Negative Consequences

	Alcohol-related problems OR (CI)	Driving after Drinking OR (CI)	Sex after Drinking OR (CI)
Intercept	1.12 (0.79-1.60)	0.08 (0.05-0.13)***	0.11 (0.07-0.17)***
Level 1: Daily-level			
CAB use last night	1.67 (0.96-2.93)	1.35 (0.59-3.11)	0.28 (0.11-0.75)*
Number of drinks last night	1.28 (1.14-1.44)***	1.05 (0.91-1.21)	1.26 (1.11-1.45)***
Level 2: Person-level			
Impulsivity	1.01 (0.98-1.04)	1.02 (0.97-1.07)	1.00 (0.97-1.04)
Aggregate drinks	1.26 (1.11-1.43)***	0.89 (0.78-1.03)	1.09 (0.96-1.23)
Sociability expectancies	1.07 (0.95-1.20)	1.10 (0.95-1.28)	0.96 (0.86-1.08)
Level 1 x Level 2			
CAB use x Sociability expectancies	0.96 (0.82-1.13)	0.89 (0.74-1.07)	1.10 (0.84-1.45)

Note. CAB = caffeinated alcoholic beverage as measured by 0 = did not use CABs during last night's drinking episode and 1 = used at least one CAB last night. OR = odds ratio from Bernoulli multilevel modeling distribution. CI = confidence interval. *$p < .05$. **$p < .01$. ***$p < .001$.

Table 13

Multilevel Models of the Interaction between Tension Reduction Expectancies and Daily-level CAB Use Predicting Negative Consequences

	Alcohol-related problems OR (CI)	Driving after Drinking OR (CI)	Sex after Drinking OR (CI)
Intercept	1.13 (0.79-1.60)	0.09 (0.06-0.14)***	0.11 (0.07-0.16)***
Level 1: Daily-level			
CAB use last night	1.66 (0.96-2.87)	1.23 (0.52-2.93)	0.29 (0.11-0.74)*
Number of drinks last night	1.28 (1.15-1.44)***	1.05 (0.91-1.21)	1.25 (1.10-1.43)***
Level 2: Person-level			
Impulsivity	1.01 (0.98-1.04)	1.01 (0.97-1.06)	1.01 (0.98-1.04)
Aggregate drinks	1.28 (1.12-1.46)***	0.92 (0.81-1.04)	1.08 (0.95-1.22)
TR expectancies	0.93 (0.78-1.11)	0.92 (0.73-1.18)	1.08 (0.88-1.31)
Level 1 x Level 2			
CAB use x TR expectancies	1.00 (0.73-1.37)	0.85 (0.61-1.18)	0.74 (0.39-1.42)

Note. CAB = caffeinated alcoholic beverage as measured by 0 = did not use CABs during last night's drinking episode and 1 = used at least one CAB last night. TR = tension reduction expectancies. OR = odds ratio from Bernoulli multilevel modeling distribution. CI = confidence interval. *$p < .05$. **$p < .01$. ***$p < .001$.

Table 14

Multilevel Models of the Interaction between Liquid Courage Expectancies and Daily-level CAB Use Predicting Negative Consequences

	Alcohol-related problems OR (CI)	Driving after Drinking OR (CI)	Sex after Drinking OR (CI)
Intercept	1.13 (0.79-1.60)	0.09 (0.06-0.14)***	0.10 (0.06-0.15)***
Level 1: Daily-level			
CAB use last night	1.68 (0.97-2.93)	1.31 (0.60-2.85)	0.18 (0.08-0.42)***
Number of drinks last night	1.28 (1.15-1.44)***	1.05 (0.91-1.21)	1.29 (1.13-1.47)***
Level 2: Person-level			
Impulsivity	1.01 (0.98-1.04)	1.02 (0.97-1.07)	1.01 (0.97-1.04)
Aggregate drinks	1.28 (1.13-1.46)***	0.92 (0.81-1.04)	1.08 (0.95-1.23)
Liquid courage expectancies	1.02 (0.91-1.13)	1.04 (0.88-1.22)	1.06 (0.95-1.19)
Level 1 x Level 2			
CAB use x liquid courage expectancies	0.97 (0.83-1.14)	0.99 (0.83-1.18)	1.48 (1.14-1.90)**

Note. CAB = caffeinated alcoholic beverage as measured by 0 = did not use CABs during last night's drinking episode and 1 = used at least one CAB last night. OR = odds ratio from Bernoulli multilevel modeling distribution. CI = confidence interval. *$p < .05$. **$p < .01$. ***$p < .001$.

Table 15

Multilevel Models of the Interaction between Sexuality Expectancies and Daily-level CAB Use Predicting Negative Consequences

	Alcohol-related problems OR (CI)	Driving after Drinking OR (CI)	Sex after Drinking OR (CI)
Intercept	1.16 (0.82-1.64)	0.09 (0.06-0.14)***	0.10 (0.07-0.16)***
Level 1: Daily-level			
CAB use last night	1.89 (1.04-3.45)*	1.28 (0.57-2.90)	0.37 (0.12-1.09)
Number of drinks last night	1.28 (1.14-1.43)***	1.05 (0.91-1.21)	1.25 (1.09-1.43)**
Level 2: Person-level			
Impulsivity	1.02 (0.99-1.05)	1.02 (0.97-1.07)	1.00 (0.96-1.04)
Aggregate drinks	1.28 (1.12-1.46)***	0.92 (0.81-1.04)	1.08 (0.95-1.23)
Sexuality expectancies	0.92 (0.81-1.03)	1.00 (0.83-1.22)	1.12 (0.98-1.29)
Level 1 x Level 2			
CAB use x Sexuality expectancies	0.85 (0.70-1.03)	1.01 (0.82-1.23)	0.85 (0.57-1.27)

Note. CAB = caffeinated alcoholic beverage as measured by 0 = did not use CABs during last night's drinking episode and 1 = used at least one CAB last night. OR = odds ratio from Bernoulli multilevel modeling distribution. CI = confidence interval. *$p < .05$. **$p < .01$. ***$p < .001$.

Table 16

Multilevel Models of the Interaction between Impairment Expectancies and Daily-level CAB Use Predicting Negative Consequences

	Alcohol-related problems OR (CI)	Driving after Drinking OR (CI)	Sex after Drinking OR (CI)
Intercept	1.13 (0.80-1.61)	0.09 (0.06-0.14)***	0.11 (0.07-0.17)***
Level 1: Daily-level			
CAB use last night	1.66 (0.96-2.89)	1.29 (0.55-3.00)	0.30 (0.12-0.78)*
Number of drinks last night	1.28 (1.15-1.44)***	1.05 (0.92-1.21)	1.26 (1.11-1.43)***
Level 2: Person-level			
Impulsivity	1.01 (0.98-1.05)	1.02 (0.97-1.06)	1.00 (0.97-1.04)
Aggregate drinks	1.28 (1.13-1.46)***	0.92 (0.81-1.04)	1.07 (0.95-1.22)
Impairment expectancies	1.00 (0.92-1.07)	1.01 (0.90-1.12)	1.02 (0.94-1.10)
Level 1 x Level 2			
CAB use x Impairment expectancies	0.94 (0.85-1.03)	1.00 (0.91-1.10)	1.03 (0.91-1.18)

Note. CAB = caffeinated alcoholic beverage as measured by 0 = did not use CABs during last night's drinking episode and 1 = used at least one CAB last night. Impairment = cognitive-behavioral impairment expectancies. OR = odds ratio from Bernoulli multilevel modeling distribution. CI = confidence interval. *$p < .05$. **$p < .01$. ***$p < .001$.

Table 17

Multilevel Models of the Interaction between Risk/Aggression Expectancies and Daily-level CAB Use Predicting Negative Consequences

	Alcohol-related problems OR (CI)	Driving after Drinking OR (CI)	Sex after Drinking OR (CI)
Intercept	1.13 (0.80-1.60)	0.08 (0.05-0.13)***	0.10 (0.06-0.15)***
Level 1: Daily-level			
CAB use last night	1.66 (0.96-2.87)	1.40 (0.62-3.17)	0.15 (0.05-0.40)***
Number of drinks last night	1.28 (1.15-1.44)***	1.05 (0.92-1.19)	1.28 (1.12-1.47)***
Level 2: Person-level			
Impulsivity	1.01 (0.98-1.04)	1.02 (0.97-1.07)	1.01 (0.98-1.05)
Aggregate drinks	1.28 (1.12-1.46)***	0.91 (0.80-1.03)	1.09 (0.95-1.25)
R/A expectancies	1.02 (0.90-1.15)	1.05 (0.88-1.26)	1.01 (0.86-1.19)
Level 1 x Level 2			
CAB use x R/A expectancies	1.00 (0.81-1.25)	0.82 (0.66-1.03)	1.76 (1.22-2.52)**

Note. CAB = caffeinated alcoholic beverage as measured by 0 = did not use CABs during last night's drinking episode and 1 = used at least one CAB last night. R/A = risk and aggression expectancies. OR = odds ratio from Bernoulli multilevel modeling distribution. CI = confidence interval. *$p < .05$. **$p < .01$. ***$p < .001$.

Table 18

Multilevel Models of the Interaction between Self-perception and Daily-level CAB Use Predicting Negative Consequences

	Alcohol-related problems OR (CI)	Driving after Drinking OR (CI)	Sex after Drinking OR (CI)
Intercept	1.13 (0.78-1.61)	0.09 (0.06-0.14)***	0.11 (0.07-0.17)***
Level 1: Daily-level			
CAB use last night	1.67 (0.96-2.92)	1.29 (0.53-3.12)	0.30 (0.12-0.76)*
Number of drinks last night	1.28 (1.15-1.44)***	1.05 (0.92-1.21)	1.25 (1.11-1.42)***
Level 2: Person-level			
Impulsivity	1.01 (0.98-1.04)	1.01 (0.96-1.07)	1.00 (0.97-1.04)
Aggregate drinks	1.28 (1.13-1.46)***	0.92 (0.81-1.04)	1.07 (0.95-1.21)
Self-perception expectancies	1.04 (0.88-1.22)	1.03 (0.82-1.30)	1.05 (0.89-1.23)
Level 1 x Level 2			
CAB use x Self-perception expectancies	1.03 (0.85-1.25)	1.13 (0.81-1.57)	0.90 (0.65-1.27)

Note. CAB = caffeinated alcoholic beverage as measured by 0 = did not use CABs during last night's drinking episode and 1 = used at least one CAB last night. OR = odds ratio from Bernoulli multilevel modeling distribution. CI = confidence interval. *$p < .05$. **$p < .01$. ***$p < .001$.

Table 19

Multilevel Models of the Interaction between Withdrawal Expectancies and Daily-level CAB Use Predicting Negative Consequences

	Alcohol-related problems OR (CI)	Driving after Drinking OR (CI)	Sex after Drinking OR (CI)
Intercept	1.13 (0.80-1.59)	0.08 (0.05-0.13)***	0.11 (0.07-0.17)***
Level 1: Daily-level			
CAB use last night	1.66 (0.95-2.91)	1.29 (0.56-2.99)	0.29 (0.11-0.77)*
Number of drinks last night	1.28 (1.15-1.44)***	1.05 (0.92-1.20)	1.26 (1.11-1.44)***
Level 2: Person-level			
Impulsivity	1.00 (0.97-1.04)	1.02 (0.98-1.07)	1.01 (0.97-1.05)
Aggregate drinks	1.32 (1.15-1.51)***	0.91 (0.79-1.05)	1.06 (0.94-1.21)
Withdrawal expectancies	1.04 (1.00-1.09)	0.98 (0.92-1.04)	0.99 (0.94-1.03)
Level 1 x Level 2			
CAB use x Withdrawal expectancies	1.07 (1.00-1.14)	1.07 (0.98-1.16)	1.05 (0.94-1.18)

Note. CAB = caffeinated alcoholic beverage as measured by 0 = did not use CABs during last night's drinking episode and 1 = used at least one CAB last night. OR = odds ratio from Bernoulli multilevel modeling distribution. CI = confidence interval. *$p < .05$. **$p < .01$. ***$p < .001$.

Table 20

Multilevel Models of the Interaction between Acute Negative Expectancies and Daily-level CAB Use Predicting Negative Consequences

	Alcohol-related problems OR (CI)	Driving after Drinking OR (CI)	Sex after Drinking OR (CI)
Intercept	1.13 (0.80-1.62)	0.08 (0.05-0.13)***	0.11 (0.07-0.16)***
Level 1: Daily-level			
CAB use last night	1.55 (0.91-2.66)	1.13 (0.48-2.68)	0.27 (0.09-0.81)*
Number of drinks last night	1.30 (1.16-1.46)***	1.06 (0.92-1.22)	1.26 (1.11-1.45)***
Level 2: Person-level			
Impulsivity	1.01 (0.98-1.04)	1.01 (0.96-1.06)	1.01 (0.98-1.05)
Aggregate drinks	1.28 (1.13-1.46)***	0.92 (0.81-1.05)	1.05 (0.93-1.18)
Acute negative expectancies	0.99 (0.93-1.06)	1.05 (0.97-1.15)	0.93 (0.87-1.00)
Level 1 x Level 2			
CAB use x Acute negative expectancies	1.11 (1.02-1.22)*	1.07 (0.94-1.21)	0.98 (0.83-1.17)

Note. CAB = caffeinated alcoholic beverage as measured by 0 = did not use CABs during last night's drinking episode and 1 = used at least one CAB last night. OR = odds ratio from Bernoulli multilevel modeling distribution. CI = confidence interval. *$p < .05$. **$p < .01$. ***$p < .001$.

Table 21

Multilevel Models of the Interaction between Positive Caffeine Expectancies and Daily-level CAB Use Predicting Negative Consequences

	Alcohol-related problems OR (CI)	Driving after Drinking OR (CI)	Sex after Drinking OR (CI)
Intercept	1.12 (0.79-1.59)	0.08 (0.05-0.13)***	0.11 (0.07-0.17)***
Level 1: Daily-level			
CAB use last night	1.43 (0.73-2.81)	1.01 (0.49-2.07)	0.31 (0.12-0.79)*
Number of drinks last night	1.29 (1.15-1.45)***	1.06 (0.92-1.22)	1.25 (1.10-1.42)***
Level 2: Person-level			
Impulsivity	1.01 (0.98-1.04)	1.02 (0.97-1.07)	1.01 (0.97-1.04)
Aggregate drinks	1.29 (1.13-1.47)***	0.92 (0.81-1.05)	1.06 (0.93-1.20)
Positive expectancies	1.02 (0.98-1.06)	1.02 (0.97-1.07)	0.98 (0.93-1.03)
Level 1 x Level 2			
CAB use x Positive expectancies	1.06 (0.97-1.17)	1.08 (1.00-1.17)	0.95 (0.88-1.04)

Note. CAB = caffeinated alcoholic beverage as measured by 0 = did not use CABs during last night's drinking episode and 1 = used at least one CAB last night. OR = odds ratio from Bernoulli multilevel modeling distribution. CI = confidence interval. *$p < .05$. **$p < .01$. ***$p < .001$.

Table 22

Multilevel Models of the Interaction between Mood Expectancies and Daily-level CAB Use Predicting Negative Consequences

	Alcohol-related problems OR (CI)	Driving after Drinking OR (CI)	Sex after Drinking OR (CI)
Intercept	1.13 (0.80-1.60)	0.08 (0.05-0.13)***	0.11 (0.07-0.16)***
Level 1: Daily-level			
CAB use last night	1.65 (0.94-2.91)	1.12 (0.37-3.37)	0.28 (0.10-0.78)*
Number of drinks last night	1.32 (1.16-1.52)***	1.05 (0.91-1.22)	1.25 (1.10-1.42)***
Level 2: Person-level			
Impulsivity	1.00 (0.98-1.03)	1.01 (0.97-1.06)	1.01 (0.93-1.20)
Aggregate drinks	1.30 (1.16-1.45)***	0.93 (0.78-1.11)	1.06 (0.93-1.20)
Mood expectancies	1.09 (1.01-1.17)*	1.04 (0.94-1.15)	0.96 (0.88-1.06)
Level 1 x Level 2			
CAB use x Mood expectancies	1.11 (0.97-1.27)	1.15 (0.93-1.42)	0.91 (0.75-1.11)

Note. CAB = caffeinated alcoholic beverage as measured by 0 = did not use CABs during last night's drinking episode and 1 = used at least one CAB last night. OR = odds ratio from Bernoulli multilevel modeling distribution. CI = confidence interval. *$p < .05$. **$p < .01$. ***$p < .001$.

Table 23

Multilevel Models of the Interaction between CAB-specific Intoxication Enhancement Expectancies and Daily-level CAB Use Predicting Negative Consequences

	Alcohol-related problems OR (CI)	Driving after Drinking OR (CI)	Sex after Drinking OR (CI)
Intercept	1.12 (0.79-1.59)	0.08 (0.06-0.13)***	0.11 (0.07-0.17)***
Level 1: Daily-level			
CAB use last night	1.65 (0.88-3.12)	1.15 (0.51-2.60)	0.31 (0.11-0.88)*
Number of drinks last night	1.28 (1.15-1.44)***	1.05 (0.92-1.21)	1.26 (1.10-1.43)***
Level 2: Person-level			
Impulsivity	1.01 (0.98-1.04)	1.02 (0.97-1.07)	1.01 (0.97-1.04)
Aggregate drinks	1.28 (1.12-1.46)***	0.92 (0.80-1.04)	1.07 (0.94-1.22)
IE expectancies	1.11 (0.97-1.28)	1.09 (0.92-1.30)	1.01 (0.86-1.19)
Level 1 x Level 2			
CAB use x IE expectancies	1.01 (0.73-1.39)	1.17 (0.83-1.66)	0.94 (0.63-1.42)

Note. CAB = caffeinated alcoholic beverage as measured by 0 = did not use CABs during last night's drinking episode and 1 = used at least one CAB last night. IE = intoxication enhancement. OR = odds ratio from Bernoulli multilevel modeling distribution. CI = confidence interval. *$p < .05$. **$p < .01$. ***$p < .001$.

Table 24

Multilevel Models of the Interaction between CAB-specific Avoidance of Negative Consequences Expectancies and Daily-level CAB Use Predicting Negative Consequences

	Alcohol-related problems OR (CI)	Driving after Drinking OR (CI)	Sex after Drinking OR (CI)
Intercept	1.13 (0.80-1.61)	0.08 (0.05-0.13)***	0.11 (0.07-0.17)***
Level 1: Daily-level			
CAB use last night	1.49 (0.87-2.54)	1.17 (0.56-2.45)	0.31 (0.12-0.80)*
Number of drinks last night	1.29 (1.15-1.44)***	1.05 (0.92-1.21)	1.26 (1.10-1.43)***
Level 2: Person-level			
Impulsivity	1.01 (0.98-1.04)	1.02 (0.97-1.07)	1.00 (0.97-1.04)
Aggregate drinks	1.28 (1.13-1.46)***	0.92 (0.81-1.05)	1.07 (0.94-1.22)
ANC expectancies	1.03 (0.96-1.10)	0.97 (0.87-1.08)	1.02 (0.95-1.11)
Level 1 x Level 2			
CAB use x ANC expectancies	1.15 (1.03-1.29)*	1.13 (0.94-1.36)	0.98 (0.84-1.15)

Note. CAB = caffeinated alcoholic beverage as measured by 0 = did not use CABs during last night's drinking episode and 1 = used at least one CAB last night. ANC = avoidance of negative consequences. OR = odds ratio from Bernoulli multilevel modeling distribution. CI = confidence interval. *$p < .05$. **$p < .01$. ***$p < .001$.

CHAPTER IV

DISCUSSION

Caffeinated alcoholic beverages (CABs) are associated with a host of negative consequences (see Linden & Lau-Barraco, 2014 for a review). To date, the extent of our knowledge on CABs has been based primarily on between-subject and aggregate reports, which can limit information on intraindividual CAB drinking patterns and may be subject to recall bias. In addition, scant research has examined predictors of CAB consumption, such as the socio-environmental context and cognitions associated with use. The current study sought to address the gaps in our knowledge by examining individual differences in CAB consumption using daily diary methodology. Specifically, the current study aimed to examine (1) the context in which college students consume CABs (i.e., where, when, with whom, how), (2) the link between daily CAB use and negative consequences, and (3) the cognitions (i.e., motives, expectancies) associated with CAB use and outcomes.

CAB Use Context

Social learning theory (SLT; Bandura, 1969, 1977; Maisto et al., 1999) posits that socio-environmental factors can greatly influence one's drinking behavior. For example, drinking in particular environments and drinking around a particular group of people can influence one's own drinking, such as how much they drink, the outcomes they experience, and, perhaps, what type of beverage they choose. Given the lack of knowledge on the influence of context in relation to CAB use behavior, the first aim of the current study was to compare days in which CABs were used and drinking days in which CABs were not used with regard to the physical setting (i.e., location), pre-gaming and drinking game behavior, social context, and other substance use. In addition, to gain

better insight as to the type of CABs that are most often consumed, the frequency of using various types of CABs (i.e., soda mixer, diet soda mixer, energy drink mixer) also was investigated.

Location. One aspect of the first aim was to determine if there were differences in *where* CABs versus other types of alcohol were consumed. Specifically, the drinking location on days where CABs were consumed ("CAB days") were compared to days in which other types of alcohol were consumed ("non-CAB days"). Findings suggested that odds of drinking at all locations were similar on both types of days except for drinking at a bar/club. In particular, the odds of drinking at a bar/club as opposed to other locations (i.e., home, work, friend's house, restaurant) were higher on CAB days versus non-CAB days. When comparing the number of CABs consumed on CAB days, drinking at home as compared to other locations was positively associated with the number of drinks consumed and drinking at a restaurant was negatively associated with number of drinks consumed. Thus, on CAB days, more CABs are consumed when drinking at home as compared to other locations, but fewer CABs are consumed in restaurants than other locations. Together, these results suggest that CAB days are more likely to involve drinking at a bar or club than a non-CAB day, but that heavier use occurs at home. Given that heavier use occurred at home, it may be worthwhile to explore the implications of this finding in future research. In particular, given the link between CAB use and aggression (e.g., Jones et al., 2012; Woolsey et al., 2010), heavier alcohol use at home could suggest that aggression, and intimate partner violence in particular may occur more frequently on CAB days than non-CAB days.

The link between CAB use and bars or clubs is consistent with prior cross-sectional work conducted in Australia indicating that CABs are most often consumed at nightclubs and bars as compared to other locations (Peacock et al., 2012b). These findings are important given that these environments are known to be associated with increased risk for harm, such as alcohol-related aggression (e.g., Rossow, 1996; Single & Wortley, 1993). Specific to CAB use, recent research found that within bar environments, heavier CAB use was linked with higher levels of physical and verbal aggressive behavior after controlling for the amount of alcohol consumed and individual differences (Miller et al., 2016). Thus, although heavier use appeared to occur at home, drinking at a bar or club may have unique risks when consuming CABs.

Pre-gaming and drinking game behavior. In addition to determining where CABs are consumed, another sub-aim was to examine *when* CABs are used, particularly in pre-gaming and drinking game contexts. Findings indicated that pre-gaming was more likely on CAB days as compared to non-CAB days. The link between pre-gaming and CAB behavior is in line with prior qualitative studies suggesting that CABs are often consumed prior to the main drinking event in order to stay energized and party for longer without getting tired (Jones et al., 2012; Pennay & Lubman, 2012). Prior research supports that pre-gaming in itself can be a risky drinking activity that is related to drinking heavily and experiencing negative alcohol-related outcomes such as blacking out (LaBrie et al., 2011; Pedersen & LaBrie, 2007). Pre-gaming with CABs may be a particularly risky situation, given that CABs can reduce the feeling of sedative effects or feelings of intoxication without reducing actual intoxication (Marczinski & Fillmore, 2006). That is, if individuals are consuming CABs while pre-gaming, they may be even

more likely to drink heavily throughout the rest of the night because they may not feel the sedative effects of alcohol, which could have caused a person to cease drinking.

Interestingly, although pre-gaming was more likely to occur on CAB days as compared to non-CAB days, drinking games were just as likely to occur on CAB days as they were on non-CAB days. These conflicting findings may be explained by the distinction between pre-gaming and drinking games. Prior work has found that although these risky drinking activities may be inherently related, they tend not to occur at the same time and pre-gaming appears to be more strongly associated with level of intoxication (Borsari, Boyle, Hustad, Barnett, O'Leary Tevyaw, & Kahler, 2007). This apparent discrepancy in risk may be attributed to one's drinking intentions for pre-gaming versus drinking games. As posited by Kenney, Hummer, and LaBrie (2010), individuals may have different motivations or drinking intentions when engaging in each activity. That is, because the premise of pre-gaming is for individuals to drink in preparation to continue drinking elsewhere, they may be more driven to become intoxicated than if playing drinking games with friends. Similarly, on days where individuals drink CABs, their drinking intentions may be more in line what pre-gaming can offer (i.e., getting intoxicated or buzzed; Marczinski, 2011) as opposed to drinking games.

It is interesting to note that the relationships between CAB use and pre-gaming as well as CAB use and location may be intertwined. Prior research suggests that pre-gaming tends to occur most often in homes as opposed to other locations and nights where individuals pre-gamed and continued to drink elsewhere was a heavier drinking occasion than occasions in which individuals stayed in one location (Labhart, Graham,

Wells, & Kuntsche, 2013). It could be that the reason why CAB use is heavier at home as compared to other locations is because home is the location in which they are pre-gaming. That is, perhaps participants are reporting heavier CAB use at home in particular because they are pre-gaming at home. A post-hoc analysis using multilevel modeling supports this supposition, such that CABs were more likely to be consumed at home on pre-gaming days as compared to other locations, OR = 3.45, p = .047. These preliminary findings and the unique risks associated with CAB use and with pre-gaming warrant additional research using a more in-depth examination of pre-gaming behavior on CAB days, as discussed later in the Future Directions section.

Social context. Regarding *with whom* CABs were consumed, it was found that CAB days were linked with greater odds of drinking with others as opposed to drinking alone. Coupled with the knowledge that drinking in public venues (i.e., bars or clubs) and pre-gaming is more likely to occur on CAB days as opposed to non-CAB days, CABs appear to be a beverage that is consumed socially. Prior work has found that perceptions of others' CAB use is a predictor of one's own CAB use (Varvil-Weld et al., 2013) and that drinking certain types of CABs can be a social bonding activity (Jones et al., 2012). Given the potential influence that others' use may have on one's own drinking behavior, it may be beneficial for future research to expand upon the preliminary findings that CABs are consumed socially, and to additionally investigate friends' use (e.g., amount and type of alcohol consumed) while participants are using CABs. This work may elucidate the extent to which one's social network impacts CAB use day to day.

Other substance use. *How* CABs are consumed, or the use of other substances while drinking or prior to drinking, did not differ between CAB days and non-CAB days.

The discrepancy between the current study findings and those of prior work (e.g., Brache & Stockwell, 2011) could be attributed to the type of design used. That is, although prior between-subject research indicated that CAB users are more likely to use stimulant drugs than non-CAB users (Brache & Stockwell, 2011), it may be that the use of CABs on a particular day is not indicative of one's likelihood of using substances (i.e., within-subject). An alternative explanation could be related to the finding that use of other substances was generally uncommon across all days. Perhaps because substance use, particularly drugs related to CAB use such as cocaine and amphetamine (Brache & Stockwell, 2011), is fairly uncommon or infrequently used among college students (Johnston, O'Malley, Bachman, Schulenberg, & Miech, 2015), more people would need to be studied across more days in order to fully examine this link. Current study findings do suggest that a small sub-group of individuals did report a range of stimulant drugs on CAB days including Adderall and 5-hour energy drinks that may be used to feel even more energized prior to or while drinking CABs. Thus, it may be fortuitous for future research to examine these potential links in a more wide-scale investigation.

Type of caffeine mixer. The type of caffeine mixer used on CAB days was assessed as another index of *how* CABs are consumed. It was found that the most common caffeinated mixer was soda mixed with alcohol (e.g., rum and Coke), followed by energy drinks mixed with alcohol (e.g., Red Bull and vodka), followed by diet soda mixed with alcohol (e.g., rum and diet Coke). The majority of prior work examining caffeinated alcohol has examined alcohol mixed with energy drinks rather than other types of caffeine mixed with alcohol. The popularity of soda mixers relative to energy drink mixers as well as prior field work suggesting these mixers are equally associated

with alcohol outcomes (Thombs et al., 2011) warrants future work examining daily differences in CAB days where soda was mixed with alcohol as compared to days in which energy drinks were mixed with alcohol.

Negative Consequences

The second aim of the current study was to examine the association between CAB use and negative consequences. Specifically, CAB days were compared with non-CAB drinking days in terms of odds of experiencing an alcohol-related problems in general, likelihood of driving after drinking, and likelihood of engaging in sexual behavior after drinking.

Alcohol-related problems. In terms of alcohol-related problems, findings indicated that experiencing at least one alcohol-related problem was more likely to occur on days in which participants reported drinking CABs as opposed to days where participants consumed other types of alcohol. Examples of problems include social-interpersonal problems, physiological concerns (e.g., hangover), academic/occupational issues, and blacking out from drinking. Moreover, this association remained significant after controlling for the amount of alcohol consumed last night and one's trait impulsivity. In other words, regardless of the total number of drinks consumed last night and one's typical level of impulsivity, drinking a CAB last night was linked with greater odds of experiencing an alcohol-related problem than drinking other types of alcohol. These findings indicate that CAB use may pose a unique risk for experiencing various negative consequences from drinking.

This study represents the first to compare CAB days and non-CAB days using a within-subjects, daily diary design. The finding that CABs are linked with negative

consequences is in line with past between-subjects, cross-sectional research (e.g., Brache & Stockwell, 2011; Snipes & Bentosch, 2013; Thombs et al., 2010), but supplements these findings by demonstrating that problems do not necessarily differ solely between CAB users and non-users but rather between days that these same individuals report drinking CABs versus other types of alcohol. These findings may be due in part to the subjective feelings of intoxication between the two types of beverages. Marczinski and Fillmore (2006) found that feelings of subjective intoxication (e.g., headache, motor coordination) were lower after drinking CABs as compared to drinking regular alcohol. Thus, the caffeine content of the drink may counteract some of the sedative effects of alcohol thus providing consumers with feelings that they can continue partying and drinking. Without feeling the sedative effects of alcohol, users may engage in behaviors that they normally would not if highly intoxicated, hence experiencing more alcohol-related problems. An alternative explanation for the link between CAB use and negative consequences could be that CAB nights inherently involve other activities that may compound the influence of CABs on negative consequences. For example, as pre-gaming and drinking at bars/clubs are more likely on CAB nights than non-CAB nights and these contexts are uniquely linked with negative outcomes (e.g., Barnett, Orchowski, Read, & Kahler, 2013; Graham, Bernards, Osgood, & Wells, 2006), it may be that the environment or context in which CABs are consumed increases the likelihood of experiencing problems rather than the chemical properties of the beverage itself.

Prior research has often speculated that heavy drinking and impulsivity may account for the relationship between CAB use and negative consequences (e.g., Verster, Aufricht, & Alford, 2012). Users do tend to drink more (O'Brien et al., 2008) and be

more prone to engaging in risky behaviors (Brache & Stockwell, 2011). In addition, participants retrospectively reported drinking more on occasions where they drank CABs as opposed to other drinking occasions (Price et al., 2010). Indeed, in the current study, participants reported heavier alcohol use on days where CABs were consumed as compared to other drinking days. Trait impulsivity did not influence the likelihood of drinking CABs. Importantly, because of the nature of the study design, we were able to determine that the likelihood of experiencing negative consequences on CAB days as compared to non-CAB days occurred above the influence of these potential confounds. It is, however, important to note that when including person-level covariates of amount of alcohol consumed over all drinking days assessed, the relationship between CAB use and negative consequences was no longer significant. Perhaps because heavy drinking in general is already linked with negative consequences (see White & Hingson, 2013 for a review), it does not necessarily matter what type of beverage that someone consumes on a particular day. Thus, one's typical proneness to experiencing alcohol-related harms in general may supersede the uniqueness that CAB use may have on the likelihood of these consequences.

The current study findings regarding CAB use and general alcohol outcomes are generally consistent with one prior daily diary examination that compared drinking days where participants consumed an energy drink that day as compared to days where they did not consume energy drinks (Patrick & Maggs, 2014). Although it was unknown whether alcohol and energy drink consumption occurred simultaneously, researchers found that the addition of energy drinks on a particular drinking day was related to outcomes including heavier alcohol use, higher estimated BACs, and more negative

consequences (e.g., hangover, getting into trouble) experienced that day. In combination with the current study findings, it appears that simultaneously mixing caffeine with alcohol and using energy drinks at some point during a drinking day is linked with several negative alcohol outcomes.

Driving after drinking. CAB days and non-CAB drinking days also were compared in the likelihood of driving after drinking. No differences were found between drinking days. Past research comparing CAB users and non-users found that users were more likely to drive home after drinking and be a passenger in a car with an intoxicated driver (Brache & Stockwell, 2011; Woolsey, Williams, Housman, Barry, Jacobson, & Evans, 2015). Moreover, Thombs and colleagues' (2011) field study revealed that individuals who consumed CABs at a bar were four times more likely to drive home after drinking, despite achieving higher BACs than individuals who consumed other types of alcohol. One explanation for the discrepancy in prior and current study findings may be that the link between CAB use and driving after drinking is a between-subject effect, rather than a within-subject effect. That is, perhaps individuals who select CABs are also more likely to drive home after drinking. Prior work has demonstrated that this between-subjects association exists above one's heavy episodic drinking behavior and trait risk-taking tendency, but there may be other variables that underlie this relationship, such as perceived risk or beliefs about the effects of CABs.

An alternative explanation for the study findings is that the current study was statistically lacking power to examine this relationship or to examine it in more depth. That is, driving after drinking was a rare occurrence across non-CAB days and CAB days overall and thus occasions were too limited to be able to fully examine differences.

Relatedly, because there were so few of occasions in which individuals reported driving after drinking, the current study was limited in its ability to parse this relationship further and examine the intoxication level of the driver. In other words, the extent of measuring driving behavior was solely based on whether the individual drove after drinking, rather than whether the driver was above the legal limit of driving. It could be that on CAB days, one does indeed feel less intoxicated than days where they drank CABs and are less likely to drive home, but perhaps this is contingent on the driver's level of intoxication or their perception of intoxication relative to actual intoxication. A larger study involving more participants and more days of reporting driving could help elucidate this relationship.

Sex after drinking. CAB days and non-CAB days also did not differ in terms of engagement in sexual behavior after drinking. Similar to driving behavior, engagement in sex after drinking also did not occur often. More uncommon were sexual-risk behaviors, such as engagement in casual sex and unprotected sex. That is, on drinking days where participants reported engaging in sex, the vast majority of these days involved use of protection and sex with one's main sexual partner, regardless of the type of alcohol consumed. These within-subject findings are inconsistent with between-subjects research demonstrating that users were more likely to engage in sexual risk-taking behaviors than non-users (Berger et al., 2013; O'Brien et al., 2008). Consistent with the lack of differences in daily driving after drinking behavior, it may be that these more specific risky behaviors only exist at the between-subjects level and/or require more observations across participants and days to fully study these associations.

Cognitive Factors

The final aim of the present study was to examine cognitive factors associated with one's likelihood of using CABs. As guided by social learning theory (SLT; Bandura, 1969, 1977; Maisto et al., 1999), two of the cognitions that are most impactful in predicting substance use include one's reasons for drinking (i.e., drinking motives) and beliefs about the effects of a substance (i.e., expectancies). Based on the idea of reciprocal determinism under this theory, drinking motives and expectancies increase one's odds of drinking and, in turn, reinforce these cognitions. Each cognition was examined as a predictor of likelihood of CAB use as well as a moderator in the relationship between CAB use last night and the experience of alcohol-related outcomes last night (i.e., alcohol-related problems, driving after drinking, sex after drinking).

Motives and CAB use. Traditional drinking motives from the motivational model of alcohol use (Cooper, 1994; Cox & Klinger, 1988) in addition to specific motives for drinking CABs identified by prior research (Marczinski, 2011) were examined in relation to one's use of CABs last night. Traditional drinking motives include drinking to be social ("social motives"), drinking to enhance positive affect ("enhancement motives"), drinking to conform to one's peers or to "fit in" ("conformity motives") and drinking to alleviate negative affect ("coping motives"). Overall, none of the traditional drinking motives were found to differ based on type of alcohol consumed. That is, participants' motivations to drink did not impact their decision to drink CABs or to drink other types of alcohol. Given that CABs days are more likely to involve drinking around others and drinking in social contexts (e.g., clubs, pre-gaming), it is surprising that social motives were not higher on CAB days than non-CAB days. It is

possible that these motives are not necessarily predictive of the *type* of alcohol consumed, but rather the *amount* of alcohol consumed. Perhaps similar to non-caffeinated alcohol use (see Kuntsche et al., 2005 for a review), motives are differentially related to the number of CABs consumed. Future research using a larger sample with more data on CAB days with more variability in CAB use by day may be able to test this possibility.

CAB-specific motives also were tested in relation to the CAB use last night on CAB days. Specifically, reasons that past participants have reported for using CABs were examined in association with the number of CABs consumed. The majority of CAB-specific motives found in past research are associated with the lack of a sedative effect that one may experience when drinking CABs (Marczinski & Fillmore, 2006). These include to hide the flavor of alcohol (O'Brien et al., 2008), to feel less tired while drinking, to get intoxicated faster (Marczinski, 2011), and to feel more energetic (Peacock et al., 2012b). Findings indicated that participants reported *fewer* CABs consumed when motivations to drink to feel less tired and to feel more energetic were higher. Prior work has suggested that staying awake and needing more energy were among the most common reasons for drinking CABs among users (Bonar, Cunningham, Polshkova, Chermack, Blow, & Walton, 2015). Although this may suggest that participants would consume *more* CABs when these motivations are higher, these results could have occurred for two reasons. First, despite the perception that CABs have a relatively lower sedative effect than other types of alcohol, it may be that regardless of the type of alcohol, drinking *more* alcohol will eventually produce sedative effects. Thus, participants who are trying to feel fewer sedative effects may drink fewer drinks (including CABs) throughout the night to avoid these effects. An alternative explanation

may be due to the assessment type. That is, because the questionnaire inquired about one's motivations for using CABs specifically last night, comparisons between CAB days and non-CAB days could not be made. It may be that other types of motives such as feeling less tired or more energetic as well as drinking to hide the flavor of alcohol may be higher on CAB days than non-CAB days, given that these are commonly reported reasons for drinking CABs (Bonar et al., 2015; Cobb, Nasim, Jentik, & Blank, 2015; Droste, Tonner, Zinkiewicz, Pennay, & Miller, 2014). That is, it may be that stronger motives are not necessarily related to the amount of CABs consumed but may instead influence one's decision to drink CABs on a particular day. To test these possible associations, additional research would benefit from comparing CAB-specific motives on days where individuals reported using CABs as opposed to days in which they consumed other types of alcohol.

Future research may benefit from building upon the motives assessed in this study in light of the recent identification of other types of motives relevant to CAB use. In particular, Droste and colleagues (2014) found that hedonistic motives, or drinking CABs to fulfill the needs of sensation-seeking or pleasure-seeking, were associated with CAB use and various harms. These harms included symptoms of alcohol dependence, experience of injury, and experience of aggressive behavior. Given the emergence of hedonistic motives in the CAB literature and its association with use and negative consequences, it may be advantageous for future work to investigate daily-level hedonistic motives and its association with likelihood of using CABs, number of CABs used, and alcohol-related harms experienced.

Expectancies and CAB use. In addition to the link between drinking motives and CAB use, typical expectancies also were examined as a predictor of whether CABs were consumed last night. Because CABs include multiple psychoactive substances (i.e., caffeine, alcohol), several different types of expectancies were examined in relation to CAB use. This included beliefs about the effects of alcohol, caffeine, and CABs specifically.

Similar to examining drinking motives that were not specific to CABs, general alcohol expectancies (regardless of whether positive or negative) and general caffeine expectancies were unrelated to the odds of using CABs last night. The lack of association is surprising, given past cross-sectional research indicating that these expectancies are predictive of CAB user status and/or amount of CABs used (Heinz et al., 2009; Huntley & Juliano, 2012; Lau-Barraco & Linden, 2014; Lau-Barraco et al., 2014). For example, Lau-Barraco and colleagues found that both caffeine and alcohol expectancies differentially predicted CAB user profiles. The contrast between past research and the current study findings may be due to the study design. Past research has only examined alcohol and caffeine expectancies cross-sectionally and in a between-subjects design. In the current study, alcohol and caffeine expectancies were modeled to predict daily decisions about CAB use. Thus, it may be that these expectancies are salient in predicting general, aggregate CAB use but are not as salient in predicting daily use. These findings suggest that although expectancies may be indicative of whether someone is a CAB user, they are not impactful on what a CAB user drinks on a particular drinking occasion.

In contrast with alcohol and caffeine expectancies, some CAB-specific expectancies were related to odds of using CABs last night. In particular, stronger intoxication enhancement CAB-specific expectancies (e.g., expectations that CABs can increase energy to party, getting buzzed more quickly, staying alert for longer) were found to associate with one's likelihood of using CABs. That is, stronger expectations that CABs can provide energy and enhance intoxication are associated with greater odds of using CABs last night as compared to other types of alcohol. On the other hand, avoidance of negative consequences expectancies, such as perceiving that CABs can allow someone to drink more without feeling drunk and to drive more safely, were unassociated with likelihood of using CABs last night. This pattern of results is consistent with prior research demonstrating that intoxication enhancement expectancies were associated with frequency of CAB use but that avoidance of negative consequences expectancies were unrelated (MacKillop et al., 2012).

Taken together with results from drinking motives, CAB-specific expectancies and motives are most relevant to drinking CABs, and drinking CABs in order to increase energy is a salient factor in determining the type of alcohol one will consume on a given night. Consistent with the motivational model posited by Cooper, Frone, Russell, and Mudar (1995), expectations are theorized to serve as a more distal antecedent to drinking motives, which in turn predict substance use. As applied to CAB use, it may be that one's expectations that drinking CABs will increase energy influence one's motivations for drinking CABs for that reason on a given night, which in turn increase one's odds of using CABs on a given night. Additional research with a larger sample may allow for

advanced multilevel model testing of these associations between expectancies, drinking motives, and CAB use.

Motives and expectancies as moderators. In addition to examining the relationship between cognitions (i.e., motives, expectancies) and odds of CAB use, cognitions also were examined as moderators of the association between CAB use and alcohol-related outcomes (i.e., alcohol-related problems last night, driving after drinking last night, sex after drinking last night). Regarding drinking motives, social and enhancement drinking motives served as the only cognitions to influence the association between CAB use and alcohol-related outcomes. For example, on CAB days, higher levels of social motives that day increased the odds of experiencing an alcohol-related problem last night. Enhancement motives also impacted the association between CAB use and alcohol-related problems last night. In other words, on CAB days, individuals were more likely to experience an alcohol-related problem, especially when they reported stronger social or enhancement motivations than usual. It is interesting to note that while these cognitions were unassociated with odds of drinking CABs last night, these cognitions can generally impact the alcohol-related harms one experiences as related to their CAB use. In other words, although drinking for positive reinforcement-related reasons may not contribute to one's decision to drink CABs, they appear to increase the likelihood of experiencing negative consequences.

Regarding CAB-specific motives as moderators, consistent with bivariate associations between motivations to drink to feel less tired and fewer CABs consumed, findings revealed that this motivation was also impactful of one's likelihood of engaging in risky behaviors. That is, stronger motivations to drink to feel less tired were related to

lower odds of driving after drinking and engaging in sex after drinking on CAB days. It is possible that because stronger motivations were related to drinking fewer CABs, individuals were less likely to engage in behaviors that are typically found to associate with heavier CAB use (e.g., Brache & Stockwell, 2011; O'Brien et al., 2008). Thus, across all findings regarding CAB-specific motives, it appears that drinking to feel less tired may serve as a protective factor against heavier use and certain alcohol outcomes.

Expectancies were generally non-influential factors in the relationship between CAB use and alcohol-related outcomes. For alcohol expectancies, beliefs that alcohol can make one feel powerful, courageous, and brave ("liquid courage") as well as engaging in loud, dominant behaviors ("risk and aggression") moderated the link between CAB use and likelihood of engaging in sex last night. The general overlap between these subscales could suggest that greater feelings of engaging in power (whether it be within themselves or in relation to others) increase the odds of engaging in sexual behavior. Given the link between CAB use and sexual risk (e.g., Miller, 2012; Snipes & Benotsch, 2013), it could be that stronger perceptions that drinking can help increase feelings of courage may amplify the effect that CABs already have on reducing inhibitions. Interestingly, however, when examining the main effects, the association between CAB use last night and engagement in sexual behavior was negative, yet the interaction term was positive. This may indicate a buffering effect, such that the effect of CAB use on sexual behavior was buffered or lessened by one's expectancies of liquid courage or risk/aggression.

Beliefs about caffeine generally did not impact the association between CAB use and negative consequences. It was, however, found that acute negative expectancies, or

beliefs that caffeine would cause negative consequences such as shakiness, a racing heart, or anxiety, moderated CAB use and alcohol-related problems. In other words, on CAB nights, individuals were more likely to experience an alcohol-related problem, especially among those who held stronger acute negative caffeine expectancies. These expectations may exacerbate the effect of CAB use on alcohol-related problems because caffeine- and alcohol-related harms may be co-occurring side effects of CAB use (Peacock et al., 2012a). *Expectations* of the negative side effects of caffeine are related to *actual* negative caffeine consequences (e.g., symptoms of dependence, level of addiction; Heinz et al., 2009) and thus, individuals with stronger expectations may be experiencing more substance-related harms in general on CAB days. Aside from acute negative expectancies, caffeine-related mood expectancies also moderated the association between CAB use and likelihood of driving after drinking. Mood expectancies include feelings of being carefree and calm. Individuals have reported being more willing to drive after drinking CABs as compared other types of alcohol (Thombs et al., 2010), potentially due to the counterbalancing effects of caffeine (e.g., Peacock et al., 2012a); therefore, if one also has expectations that drinking beverages containing caffeine makes them feel carefree, they may be even more inclined to drive home after drinking without worrying about potential consequences.

In terms of CAB-specific expectancies, avoidance of negative consequences expectancies were found to influence the relationship between CAB use and alcohol-related problems. That is, individuals were more likely to report experiencing alcohol-related problems on CAB days, especially if they perceived that drinking CABs would help them avoid experiencing negative consequences from drinking. These beliefs

included feeling better in the morning, avoiding unintended sex, feeling more in control, and driving more safely. Thus, drinkers were actually *more* likely to experience harm on CAB days if they thought that CABs would cause *less* harm. It may be that if individuals perceived that CABs helped them drive more safely, they may not need to protect themselves from harm as they would when drinking other types of alcohol. This faulty logic is in line with cross-sectional findings that CAB use was indirectly linked with alcohol-related harms through avoidance of negative consequences expectancies (Linden-Carmichael et al., 2015). That is, heavier CAB use was associated with stronger beliefs that drinking CABs can help deter them from experiencing consequences, which in turn, is associated with less frequent use of strategies that can protect one from harm and more alcohol-related problems.

Overall, across findings from motives and expectancies, it appears that these cognitions are loosely related to CAB use and generally do not impact the link between CAB use and negative consequences. There may be several explanations for these findings. One explanation may be related to measurement. That is, with regard to traditional motives and expectancies, these cognitions could be more strongly associated with the *amount* of CABs consumed rather than whether CABs are consumed on a particular drinking day. Because all of the participants are CAB users, their cognitions may not change much based on *what* they are drinking but rather *how much* they are drinking. Conversely, certain CAB motives may be related to whether they opt to drink CABs on a particular day rather than the amount. Additional data collected from more individuals across more CAB days could help clarify these research questions. A second explanation could be that because of the within-subject nature of this design, participants

generally have stable cognitions that do not vary or impact one's consequences based on the type of drink they consumed. That is, although some specific attributes about CABs predict consumption, they may generally drink for the same reasons on all days but that on some days they happen to drink CABs. Perhaps a stronger emphasis in future research needs to be placed on more fine-grained consequences that come from drinking CABs rather than the cognitions that precede it.

Future Directions

The current study offered a preliminary overview of a CAB night as compared to other drinking occasions. In general, it appears that drinking in social environments, drinking at a bar or club, and pre-gaming tends to occur more often on CAB days than non-CAB days. In addition, individuals tend to report heavier alcohol use and greater odds of experiencing an alcohol-related problem on CAB days than non-CAB days. Moreover, although generally uninfluential, positive reinforcement drinking motives and various types of substance expectancies can impact the association between CAB use and the odds of experiencing certain alcohol-related outcomes. Based on these initial findings, several future directions are suggested requiring the use of a larger sample across more days in order to examine several CAB drinking patterns more in-depth.

One area that deserves additional research is teasing apart the relationship between CABs and problems based on the caffeine mixer type. The current study defined CABs as any type of caffeine mixed with alcohol, which could include regular soda, diet soda, or an energy drink. Although results indicated that the CAB use overall last night was associated with odds of experiencing alcohol-related problems last night, it may be that certain mixers account for more variance within this association. The CAB

literature has generally focused on energy drinks mixed with alcohol. Given the level of caffeine content relative to soda (80 mg of caffeine in Red Bull relative to 34.5 mg of caffeine in Coca-Cola; Reissig, Strain, & Griffiths, 2009), energy drink mixers may offset the sedative effects of alcohol more so than soda mixers; thus, energy drink mixers may be a stronger predictor or the sole predictor of alcohol-related harms. Alternatively, because CABs as a whole were associated with alcohol-related harms and cola-caffeinated beverages were the most commonly used mixer, this may suggest that soda mixers may pose similar risks as energy drink mixers. These findings are in line with prior field research indicating that cola-caffeinated mixers are linked with comparable negative outcomes, such as driving while intoxicated as compared to energy drink mixers (Thombs et al., 2011). Moreover, given research suggesting potential risks of mixing alcohol with a diet beverage (Marczinski & Stamates, 2013; Rossheim & Thombs, 2011), experimental and daily diary research is needed to tease apart the relative harms of each type of caffeine mixer.

Another avenue investigating CAB use patterns pertains to the influence of impulsivity. In the current study, it was found that impulsivity was unassociated with one's likelihood of drinking CABs and that the association between CAB use and alcohol-related harms existed after controlling for impulsivity. Some researchers contend that CAB use itself may not be the true culprit of experiencing negative consequences from drinking, but rather that individual-level differences in impulsivity or risk-taking propensity better explain this association (Verster et al., 2012). That is, it may be that individuals who are more impulsive are more likely to select CABs, and one's impulsive, risky actions are the cause of the heavy drinking and harms that can occur. Past research

investigating the role of risk-taking or impulsive behavior is mixed, with some suggesting that CABs are linked with alcohol-related outcomes even after controlling for these characteristics (Brache & Stockwell, 2011) while others suggest that these traits fully account for this relationship (de Haan et al., 2012). The current study did not find support for individual-level differences predicting the decision to drink CABs, suggesting that more impulsive individuals were at similar odds of choosing to drink a CAB or a non-CAB on a given drinking occasion. It could, however, be worthwhile to examine one's *daily* level of impulsivity as a predictor of CAB use. That is, perhaps one's level of impulsivity fluctuates day to day and covaries with one's decision to drink CABs on a daily basis. Only recently have researchers begun to examine impulsivity as a state-level construct using daily diary methodology (Tomko et al., 2014), but preliminary evidence suggests that impulsivity does tend to fluctuate day to day and covaries with substance use, such as marijuana (Ansell, Laws, Roche, & Sinha, 2015). It is possible that daily levels of impulsivity play a role in one's selection of beverage type, as well. Future research may wish to incorporate measures of state-level impulsivity in examining CAB use patterns to determine the extent to which this characteristic predicts CAB use or potentially amplifies the association between CAB use and alcohol-related harms.

Although the current study offers a preliminary snapshot of CAB drinking days as compared to non-CAB drinking days, a more fine-grained daily assessment method is needed to better examine CAB use over the course of the evening. Ecological momentary assessment (EMA) designs permit the collection of real-time data (e.g., smartphone data collection) that could allow for a more detailed picture of CAB consumption. EMA designs could better examine CAB use patterns, including

antecedents and consequences of CAB use. For example, the current study found that pre-gaming was more likely to occur on CAB days as compared to non-CAB days. It is unknown, however, the point at which CAB use occurred in relation to pre-gaming. It is possible that, as suggested by prior qualitative work (e.g., Jones et al., 2012), individuals used CABs while pre-gaming in order to try to stay awake and continue drinking at the next location. Given that individuals report feeling less intoxicated while drinking CABs, individuals who consume CABs while pre-gaming may drink *even more* during the rest of the evening as compared to pre-gaming occasions where they consumed other types of alcohol. Relatedly, research investigating CAB use more in-depth is needed to elucidate the relationship between CAB use and heavy drinking. While some experimental research suggests that drinking CABs may predict heavy drinking, possibly related to the relative lack of sedative effects (e.g., Marczinski & Fillmore, 2006) and increased desire to drink (Marczinski et al., 2013) resulting from CAB use, recent field research suggests that drinking CABs could be the result of heavy drinking (Rossheim et al., 2016). Specifically, Rossheim and colleagues found that although heavy drinking on a given night was associated with greater odds of drinking CABs, this link also existed with other types of alcoholic beverages such as beer, wine, and liquor. In other words, it may be that when individuals are drinking more heavily, they simply have more chances for one of those beverages to be a CAB. An EMA design could tease apart the directionality of heavy drinking and CAB consumption by tracking CAB use over the course of an evening. Finally, an EMA design could provide an enhanced view of the way in which CAB use associates with alcohol-related problems. The current study indicates that on CAB days, individuals are more likely to experience alcohol-related harms. Although

this link is theoretically sound, it is uncertain as to exactly *why* this relationship occurs. More specifically, it is possible that because individuals appear to select CABs for particular reasons and choose to drink CABs in specific locations, drinkers may plan for CAB nights to be riskier occasions. That is, one's drinking intentions may differ based on the type of drink that they have, and this may be why they experience more alcohol-related harms. An alternative explanation is that individuals may experience harms from drinking CABs because of their level of subjective intoxication (e.g., Marczinski & Fillmore, 2006). That is, because they do not feel intoxicated, they may engage in behaviors (e.g., risky sex, driving home after drinking) that they normally would not because they judge themselves to be sober. EMA could test these direct or indirect associations by tracking participants' subjective intoxication throughout the night as well as inquiring about their intentions for drinking and comparing this to occasions where they consumed CABs and occasions where they did not consume CABs. Overall, the current study provided evidence that CAB days are linked with heavier drinking and increased odds in experiencing alcohol-related harms, but research is needed to study the temporal pattern of these relationships.

Lastly, future research using a larger sample across more days would benefit from partitioning out the influence of certain risky situations to determine the unique influence of CABs on alcohol-related harms. The present research identified several variables that were associated with one's odds of consuming CABs, including social influences, contexts (e.g., pre-gaming, drinking at a bar/club), and cognitions. These socio-environmental factors alone have been shown to associate with alcohol use outcomes; thus, it remains unclear whether (a) these factors are the ultimate driving force behind the

CAB-negative consequences relationship, (b) whether CAB use is associated regardless of these factors (e.g., the context in which it is consumed), or (c) whether these factors exacerbate this link. A more large-scale study comparing variations in CAB days could provide further insight into this association.

Practical Implications

The findings from the current study provide some suggestions for intervention and prevention efforts for CAB users. First, the information gathered on the socio-environmental context of CAB use may be useful knowledge when working with college student drinkers. For example, information about CABs could be incorporated into existing alcohol interventions such as brief motivational interventions (BMIs), such as the Brief Alcohol Screening and Intervention for College Students (BASICS; Dimeff et al., 1999). These types of interventions often include personalized feedback on the students' drinking habits, sometimes including information about social and other risk factors. It may be useful for interventionists to know more information about the context in which CABs are consumed when working with students who are frequent CAB users. Additionally, information about the potential risks associated with CAB use found in this study and others could be included in existing alcohol educational resources, such as Alcohol 101 Plus (Century Council, 2003). Moreover, given that some students falsely perceive that CABs can help them avoid harms (e.g., they can drive more safely, be more in control) relative to other types of alcohol (MacKillop et al., 2012) and that these beliefs influence the association between CAB use and alcohol-related problems, it may be useful to incorporate factual knowledge on CABs in these existing interventions to help correct these misperceptions.

Limitations

There are several limitations that should be noted. First, although the current study found several links comparing CAB days and non-CAB days, the nature of the design precludes any causal inferences between CAB use and negative consequences. Second, caffeine-related physiological symptoms were not included as a level-1 outcome and thus the daily association between CAB use and caffeine consequences could not be assessed. Given the preliminary cross-sectional links between these two variables as demonstrated in the current study, future research may benefit from examining this as a daily construct. Third, the current study was limited in its ability to examine several consequences more in-depth given the rarity of certain events and limited number of CAB days. For example, the rarity of driving after drinking and engagement in potentially risky sex behaviors prohibited comparisons of these behaviors on CAB days versus non-CAB days. Finally, the current study was a preliminary examination of CAB use over a two-week period. Some relationships may have been non-significant due to the lack of CAB days assessed. A larger sample with a longer assessment window (e.g., 30 days) could provide an enhanced view of study findings, particularly by examining CAB use continuously (i.e., the number of CABs consumed) rather than dichotomously (i.e., whether CABs were consumed).

CHAPTER V

CONCLUSIONS

This study was the first to examine CAB use drinking patterns in a longitudinal, daily-diary design. Specifically, this study examined the socio-environmental context associated with CAB use, the relationship between CAB use and alcohol-related outcomes, as well as the prediction and influence of various cognitions and CAB consumption. It was found that when comparing CAB days and non-CAB drinking days, CAB days were more likely to be at a bar/club, to involve pre-gaming and to be consumed socially than non-CAB drinking days. CAB days also were linked with heavier drinking and greater odds of experiencing an alcohol-related problem, even after controlling for last night's drinking and trait impulsivity. In addition, positive reinforcement motives and various expectancies predicted the odds of experiencing some alcohol-related outcomes. Overall, these findings demonstrate the uniqueness of CAB use as compared to use of other types of alcoholic beverages in terms of the factors that may predict or maintain drinking patterns as well as the potential for increased harms. Future research is needed to examine CAB drinking patterns using more fine-grained approaches to better inform prevention and intervention efforts.

REFERENCES

Alford, C., Hamilton-Morris, J., & Verster J. C. (2012). The effects of energy drink in combination with alcohol on performance and subjective awareness. *Psychopharmacology, 222*, 519–532. doi:10.1007/s00213-012-26771

American Psychological Association. (2010). Ethical principles of psychologists and code of conduct. Retrieved from http://www.apa.org/ethics/code/principles.pdf.

Ansell, E. B., Laws, H. B., Roche, M. J., & Sinha, R. (2015). Effects of marijuana use on impulsivity and hostility in daily life. *Drug and Alcohol Dependence*, *148*, 136-142. doi: 10.1016/j.drugalcdep.2014.12.029

Armeli, S., Todd, M., Conner, T. S., & Tennen, H. (2008). Drinking to cope with negative moods and the immediacy of drinking within the weekly cycle among college students. *Journal of Studies on Alcohol and Drugs, 69*, 313-322. doi: 10.15288/jsad.2008.69.313

Attwood, A. S., Rogers, P. J., Ataya, A. E., Adams, S., & Munafo, M. R. (2012). Effects of caffeine on alcohol-related changes in behavioral control and perceived intoxication in light caffeine consumers. *Psychopharmacology, 221*, 551-560. doi: 10.1007/s00213-011-2601-0

Bandura, A. (1969). *Principles of behavior modification*. New York: Holt, Rinchart & Winston.

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

Barnet, V. & Lewis, T. (1994). Outliers in statistical data. New York: Wiley

Barnett, N. P., Orchowski, L. M., Read, J. P., & Kahler, C. W. (2013). Predictors and consequences of pregaming using day- and week-level measurements. *Psychology of Addictive Behaviors, 27,* 921-933. doi: 10.1037/a0031402

Berger, L. K., Fendrich, M., Chen, H. -Y., Arria, A. M., & Cisler, R. A. (2011). Sociodemographic correlates of energy drink consumption with and without alcohol: Results of a community survey. *Addictive Behaviors, 36,* 516-519. doi:10.1016/j.addbeh.2010.12.027

Berger, L., Fendrich, M., & Fuhrmann, D. (2013). Alcohol mixed energy drinks: Are there associated negative consequences beyond hazardous drinking in college students? *Addictive Behaviors, 38,* 2428-2432. doi: 10.1016/j.addbeh.2013.04.003

Black, A.C., Harel, O., & Matthews, G. (2011). Techniques for analyzing intensive longitudinal data with missing values. In M. R. Mehl, & T. A. Conner (Eds.), *Handbook of research methods for studying daily life* (pp. 339–356). New York, NY: Guilford Press

Bonar, E. E., Cunningham, R. M., Polshkova, S., Chermack, S. T., Blow, F. C., & Walton, M. A. (2015). Alcohol and energy drink use among adolescents seeking emergency department care. *Addictive Behaviors, 43,* 11-17. doi: 10.1016/j.addbeh.2014.11.023

Borsari, B., Boyle, K. E., Hustad, J. T. P., Barnett, N. P., O'Leary Tevyaw, T., & Kahler, C. W. (2007). Drinking before drinking: Pregaming and drinking games in mandated students. *Addictive Behaviors, 32,* 2694-2705. doi: 10.1016/j.addbeh.2007.05.003

Brache, K., & Stockwell, T. (2011). Drinking patterns and risk behaviors associated with combined alcohol and energy drink consumption in college drinkers. *Addictive Behaviors, 36,* 1133-1140. doi:10.1016/j.addbeh.2011.07.003

Brown, S. A., Goldman, M. S., & Christiansen, B. A. (1985). Do alcohol expectancies mediate drinking patterns of adults? *Journal of Consulting and Clinical Psychology, 53,* 512-519. doi: 10.1037/0022-006X.53.4.512

Century Council. (2003). Alcohol 101 Plus [Computer software]. Retrieved from http://www.alcohol101plus.org/home.html

Cobb, C. O., Nasim, A., Jentink, K., & Blank, M. D. (2015). The role of caffeine in the alcohol consumption behaviors of college students. *Substance Abuse, 36,* 90-98. doi: 10.1080/08897077.2013.835763

Collins, R.L., Bradizza, C.M., & Vincent, P.C. (2007). Young-adult malt liquor drinkers: Prediction of alcohol problems and marijuana use. *Psychology of Addictive Behaviors, 21,* 138-146. doi: 10.1037/0893-164X.21.2.138

Collins, R.L., Koutsky, J.R., & Izzo, C.V. (2000). Temptation, restriction, and the regulation of alcohol intake: Validity and utility of the Temptation and Restraint Inventory. *Journal of Studies on Alcohol, 61,* 766-773. doi: 10.15288/jsa.2000.61.766

Collins, R.L., & Lapp, W.M. (1992). The Temptation and Restraint Inventory for measuring drinking restraint. *British Journal of Addiction, 87,* 625-633. doi: 10.1111/j.1360-0443.1992.tb01964.x

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. doi: 10.1037/0022-006X.53.2.189

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

Cooper, M. L., Frone, M. R., Russell, M., & Mudar, P. (1995). Drinking to regulate positive and negative emotions: A motivational model of alcohol use. *Journal of Personality and Social Psychology*, *69*, 990-1005. doi: 10.1037/0022-3514.69.5.990

Cox, W. M., & Klinger, E. (1988). A motivational model of alcohol use. *Journal of Abnormal Psychology*, *97*, 168–180. doi: 10.1037/0021-843X.97.2.168

Curry, K., & Stasio, M. J. (2009). The effects of energy drinks alone and with alcohol on neuropsychological functioning. *Human Psychopharmacology: Clinical and Experimental*, *24*, 473-481. doi: 10.1002/hup.1045

de Haan, L., de Haan, H. A., van der Palen, H. A., Olivier, B., & Verster, J. C. (2012). Effects of consuming alcohol mixed with energy drinks versus consuming alcohol only on overall alcohol consumption and negative alcohol-related consequences. *International Journal of General Medicine, 5*, 953-960. doi: 10.2147/IJGM.S38020

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.

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. doi: 10.1111/acer.12438

Ekholm, O. (2004). Influence of the recall period on self-reported alcohol intake. *European Journal of Clinical Nutrition, 58,* 60-63.

Fernie, G., Cole, J. C., Goudie, A. J., & Field, M. (2010). Risk-taking but not response inhibition or delay discounting predict alcohol consumption in social drinkers. *Drug and Alcohol Dependence, 112,* 54-61. doi: 10.1016/j.drugalcdep.2010.05.011

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

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. doi: 10.1037/1040-3590.5.1.19

Geisner, I.M., Larimer, M., & Neighbors, C. (2004). The relationship among alcohol use, related problems, and symptoms of psychological distress: Gender as a moderator in college sample. *Addictive Behaviors, 29,* 843-848. doi: 10.1016/j.addbeh.2004.02.024

Gmel, G., & Daeppen, J. B. (2007). Recall bias for seven-day recall measurement of alcohol consumption among emergency department patients: Implications for

case-crossover designs. *Journal of Studies on Alcohol and Drugs, 68,* 303–310. doi: 10.15288/jsad.2007.68.303

Goldman, M. S., Brown, S. A., Christiansen, B. A., & Smith, G. T. (1991). Alcoholism and memory: Broadening the scope of alcohol expectancy research. *Psychological Bulletin, 110,* 137-146. doi: 10.1037/0033-2909.110.1.137

Goldman, M. S., Darkes, J., & Del Boca, F. K. (1999). Expectancy mediation of biopsychosocial risk for alcohol use and alcoholism. In I. Kirsch (Ed.), *How expectancies shape experience* (pp. 233-262). Washington, DC: American Psychological Association. doi: 10.1037/10332-010

Graham, K., Bernards, S., Osgood, D. W., & Wells, S. (2006). Bad nights or bad bars? Multi-level analysis of environmental predictors of aggression in late-night large-capacity bars and clubs. *Addiction, 101*, 1569-1580. doi: 10.1111/j.1360-0443.2006.01608.x

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. doi: 10.1007/s10862-005-0631-9

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. doi: 10.1037/a0016654

Howland, J., Rohsenow, D. J., Vehige Calise, T., MacKillop, J., & Metrik, J. (2011). Caffeinated alcoholic beverages: An emerging public health problem. *American Journal of Preventive Medicine, 40,* 268-271. doi: 10.1016/j.amepre.2010.10.026

Hull, L.C., Dillon, P.M., O'Connell, M.M., Chitnavis, P., & Svikis, D.S. (2011). Caffeinated energy drinks in college students linked to higher levels of alcohol, marijuana and tobacco use. Poster presented at the Institute for Drug and Alcohol Studies.

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. doi: 10.1037/a0026417

Johnston, L. D., O'Malley, P. M., Miech, R. A., Bachman, J. G., & Schulenberg, J. E. (2015). *Monitoring the Future national survey results on drug use: 1975-2014: Overview, key findings on adolescent drug use*. Ann Arbor: Institute for Social Research, The University of Michigan.

Jones, S. D., Barrie, L., & Berry, N. (2012). Why (not) alcohol energy drinks? A qualitative study with Australian university students. *Drug and Alcohol Review, 31*, 281-287. doi:10.1111/j.1465-3362.2011.00319.x

Jones, B. T., Corbin, W., & Fromme, K. (2001). A review of expectancy theory and alcohol consumption. *Addiction, 96,* 57-72.

Kahler, C. W., Strong, D. R., & Read, J. P. (2005). Toward efficient and comprehensive measurement of the alcohol problems continuum in college students: The Brief Young Adult Alcohol Consequences Questionnaire. *Alcoholism: Clinical and Experimental Research, 29,* 1180-1189. doi: 10.1097/01.ALC.0000171940.95813.A5

Kairouz, S., Gliksman, L., Demers, A., & Adlaf, E. M. (2002). For all these reasons, I do…drink: A multilevel analysis of contextual reasons for drinking among Canadian undergraduates. *Journal of Studies on Alcohol and Drugs, 63,* 600-608. doi: 10.15288/jsa.2002.63.600

Kenney, S. R., Hummer, J. F., & LaBrie, J. W. (2010). An examination of prepartying and drinking game playing during high school and their impact on alcohol-related risk upon entrance into college. *Journal of Youth and Adolescence, 39,* 999-1011. doi: 10.1007/s10964-009-9473-1

Kuntsche, E., Knibbe, R., Gmel, G., & Engels, R. (2005). Why do young people drink? A review of drinking motives. *Clinical Psychology Review, 25,* 841-861. doi: 10.1016/j.cpr.2005.06.002

Labhart, F., Graham, K., Wells, S., & Kuntsche, E. (2013). Drinking before going to licensed premises: An event-level analysis of predrinking, alcohol consumption, and adverse outcomes. *Alcoholism: Clinical and Experimental Research, 37,* 284-291. doi: 10.1111/j.1530-0277.2012.01872.x

LaBrie, J. W., Hummer, J., Kenney, S., Lac, A., & Pedersen, E. (2011). Identifying factors that increase the likelihood for alcohol-induced blackouts in the prepartying context. *Substance Use & Misuse, 46,* 992- 1002. doi: 10.3109/10826084.2010.542229

LaBrie, J. W., Hummer, J. F., & Pedersen, E. R. (2007). Reasons for drinking in the college student context: The differential role and risk of the social motivator. *Journal of Studies on Alcohol and Drugs, 68,* 393-398.

Lau-Barraco, C., & Dunn, M. E. (2008). Evaluation of a single-session expectancy challenge intervention to reduce alcohol use among college students. *Psychology of Addictive Behaviors, 22,* 168-175.doi: 10.1037/0893-164X.22.2.168

Lau-Barraco, C., & Linden, A. N. (2014). Caffeinated alcohol users' expectancies for caffeine versus alcohol. *Substance Use & Misuse, 49,* 1241-1249. doi: 10.3109/10826084.2014.891619.

Lau-Barraco, C., Milletich, R. J., & Linden, A. N. (2014). Caffeinated alcohol consumption profiles and associations with use severity and outcome expectancies. *Addictive Behaviors, 39,* 308-315. doi: 10.1016/j.addbeh.2013.10.017

Lewis, M. A., Hove, M. C., Whiteside, U., Lee, C. M., Kirkeby, B. S., Oster-Aaland, L., … Larimer, M. E. (2008). Fitting in and feeling fine: Conformity and coping motives as mediators of the relationship between social anxiety and problematic drinking. *Psychology of Addictive Behaviors, 22,* 58-67. doi: 10.1037/0893-164X.22.1.58

Linden, A. N. (2012). *Caffeinated alcohol use among college students with anxiety.* Unpublished master's thesis, Old Dominion University, Norfolk, VA.

Linden, A. N., D'Lima, G., & Lau-Barraco, C. (2012, November). Caffeinated alcohol and negative consequences: Are caffeine expectancies a mediator? Poster presented at the annual meeting of the Association for Behavioral and Cognitive Therapies, National Harbor, MD.

Linden, A. N., & Lau-Barraco, C. (2014). A qualitative review of psychosocial risk factors associated with caffeinated alcohol use. *Experimental and Clinical Psychopharmacology*, *22*, 144-153. doi: 10.1037/a0036334

Linden-Carmichael, A. N., Lau-Barraco, C., & Stamates, A. L. (2015). Testing a model of caffeinated alcohol-specific expectancies. *Addictive Behaviors, 47,* 38-41. doi: 10.1016/j.addbeh.2015.03.015

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 Questionnaire (CACEQ). *Experimental and Clinical Psychopharmacology, 20,* 466-472. doi:10.1037/a0030539

Maggs, J. L., Williams, L. R., & Lee, C. M. (2011). Ups and downs of alcohol use among first-year college students: Number of drinks, heavy drinking, and stumble and pass out drinking days. *Addictive Behaviors, 36,* 197-202. doi: 10.1016/j.addbeh.2010.10.005

Maisto, S. A., Carey, K. B., & Bradizza, C. M. (1999). Social learning theory. In H. T. Blane & K. E. Leonard (Eds.), *Psychological theories of drinking and alcoholism* (pp. 106-163). New York: Guilford Press.

Mallett, K.A., Bachrach, R.L., & Turrisi, R. (2008). Are all negative consequences truly negative? Assessing variations among college students' perceptions of alcohol related consequences. *Addictive Behaviors, 33,* 1375-1381. doi: 10.1016/j.addbeh.2008.06.014

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. doi: 10.1037/a0032203

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. doi:10.3390/ijerph8083232

Marczinski, C. A., & Fillmore, M. T. (2006). Clubgoers and their trendy cocktails: Implications of mixing caffeine into alcohol on information processing and subjective reports of intoxication. *Experimental and Clinical Psychopharmacology, 14*, 450-458. doi:10.1037/1064-1297.14.4.450

Marczinski, C. A., Fillmore, M. T., Bardgett, M. E., & Howard, M. A. (2011). Effects of energy drinks mixed with alcohol on behavioral control: Risks for college students consuming trendy cocktails. *Alcoholism: Clinical and Experimental Research, 35*, 1282-1292. doi:10.1111/j.1530-0277.2011.01464.x

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 Child Psychopharmacology, 20*, 129-138. doi:10.1037/a0026136

Marczinski, C. A., Fillmore, M. T., Henges, A. L., Ramsey, M. A., & Young, C. R. (2013). Mixing an energy drink with an alcoholic beverage increases motivation

for more alcohol in college students. *Alcoholism: Clinical and Experimental Research, 37,* 276-283. doi:10.1111/j.1530-0277.2012.01868.x

Marczinski, C. A., & Stamates, A. L. (2013). Artificial sweeteners versus regular mixers increase breath alcohol concentrations in male and female social drinkers. *Alcoholism: Clinical and Experimental Research, 37,* 696-702. doi: 10.1111/acer.12039

Martens, M. P., Rocha, T. L., Martin, J. L., & Serrao, H. F. (2008). Drinking motives and college students: Further examination of a four-factor model. *Journal of Counseling Psychology, 55,* 289-295. doi: 10.1037/0022-0167.55.2.289

McCarty, D. (1985). Environmental factors in substance abuse: The microsetting. In M. Galizio & S. A. Maisto (Eds.), *Determinants of substance abuse* (pp. 247-282). New York: Guilford Press.

Miller, K. E. (2008). Energy drinks, race, and problem behaviors among college students. *Journal of Adolescent Health, 43,* 490-497. doi:10.1016/j.jadohealth.2008.03.0003

Miller, K. E. (2012). Alcohol mixed with energy drink use and sexual risk-taking: Casual, intoxicated, and unprotected sex. *Journal of Caffeine Research, 2,* 62-69. doi:10.1089/caf.2012.0015

Miller, K. E., Quigley, B. M., Eliseo-Arras, R. K., & Ball-N. J. (2016). Alcohol mixed with energy drink use as an event-level predictor of physical and verbal aggression in bar conflicts. *Alcoholism: Clinical and Experimental Research, 40,* 161-169. doi: 10.1111/acer.12921

Morean, M. E. & Corbin, W.R. (2008). Subjective alcohol effects and drinking behavior: The relative influence of early response and acquired tolerance. *Addictive Behaviors, 33* 1306-1313. doi: 10.1016/j.addbeh.2008.06.007

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. doi:10.1111/j.1553-2712.2008.00085.x

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. doi: 10.1016/j.jadohealth.2013.09.013

Patton, J. H., Stanford, M. S., & Barratt, E. S. (1995). Factor structure of the Barratt Impulsiveness Scale. *Journal of Clinical Psychology, 51*, 768-774.

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

Peacock, A., Bruno, R., & Martin, F. H. (2012b). Patterns of use and motivations for consuming alcohol mixed with energy drinks. *Psychology of Addictive Behaviors, 27*, 202-206. doi:10.1037/a0029985

Pedersen, E. R., & LaBrie, J. (2007). Partying before the party: Examining prepartying behavior among college students. *Journal of American College Health, 56*, 237-245. doi: 10.3200/JACH.56.3.237-246

Pennay, A., & Lubman, D. I. (2012). Alcohol and energy drinks: A pilot study exploring patterns of consumption, social contexts, benefits and harms. *BMC Research Notes, 5*, 1-10. doi:10.1186/1756-0500-5-369

Price, S. R., Hilchey, C. A., Darredeau, C., Fulton, H. G., & Barrett, S. P. (2010). Energy drink co-administration is associated with increased reported alcohol ingestion. *Drug and Alcohol Review, 29*, 331-333. doi:10.1111/j.1465-3362.2009.00163.x

Raudenbush, S. W., Bryk, A. S., & Congdon, R. (2013). *HLM 7 for Windows* [Computer software]. Skokie, IL: Scientific Software International

Reissig, C. J., Strain, E. C., & Griffiths, R. R. (2009). Caffeinated energy drinks – A growing problem. *Drug and Alcohol Dependence, 99*, 1-10. doi: 10.1016/j.drugalcdep.2008.08.001

Rossheim, M. E., & Thombs, D. L. (2011). Artificial sweeteners, caffeine, and alcohol intoxication in bar patrons. *Alcoholism: Clinical and Experimental Research, 35*, 1891-1896. doi:10.1111/j.1530-0277.2011.01534.x

Rossheim, M. E., Thombs, D. L., Weiler, R. M., Barry, A. E., Suzuki, S., Walters, S. T., … Cannell, B. (2016). Alcohol mixed with energy drink: Use may be a consequence of heavy drinking. *Addictive Behaviors, 57*, 55-61. doi: 10.1016/j.addbeh.2016.02.013

Rossow, I. (1996). Alcohol-related violence: The impact of drinking pattern and drinking context. *Addiction, 91*, 1651-1661.

Sher, K. J., Wood, M. D., Wood, P. K., & Raskin, G. (1996). Alcohol outcome expectancies and alcohol use: A latent variable cross-lagged panel study. *Journal of Abnormal Psychology, 105*, 561-574. doi: 10.1037/0021-843X.105.4.561

Single, E., & Wortley, S. (1993). Drinking in various settings as it relates to demographic variables and level of consumption: Findings from a national survey in Canada. *Journal of Studies on Alcohol, 54,* 590-599. doi: 10.15288/jsa.1993.54.590

Snipes, D. J., & Benotsch, E. G. (2013). High-risk cocktails and high-risk sex: Examining the relation between alcohol mixed with energy drink consumption, sexual behavior, and drug use in college students. *Addictive Behaviors, 38,* 1418-1423. doi:10.1016/j.addbeh.2012.07.011

Stanford, M. S., Mathias, C. W., Dougherty, D. M., Lake, S. L., Anderson, N. E., & Patton, J. H. (2009). Fifty years of the Barratt Impulsiveness Scale: An update and review. *Personality and Individual Differences, 47,* 385-395. doi: 10.1016/j.paid.2009.04.008

Thombs, D. L., O'Mara, R. J., Tsukamoto, M., Rossheim, M. E., Weiler, R. M., Merves, M. L., & Goldberger, B. A. (2010). Event-level analyses of energy drink consumption and alcohol intoxication in bar patrons. *Addictive Behaviors, 35,* 325-330. doi: 10.1016/j.addbeh.2009.11.004

Thombs, D., Rossheim, M., Barnett, T. E., Weiler, R. M., Moorhouse, M. D., & Coleman, B. N. (2011). Is there a misplaced focus on AmED? Associations between caffeine mixers and bar patron intoxication. *Drug and Alcohol Dependence, 116,* 31-36. doi:10.1016/j.drugalcdep.2010.11.014

Tomko, R. L., Solhan, M. B., Carpenter, R. W., Brown, W. C., Jahng, S., Wood, P. K., & Trull, T. J. (2014). Measuring impulsivity in daily life: The Momentary Impulsivity Scale. *Psychological Assessment, 26,* 339-349. doi: 10.1037/a0035083

Update regarding our reformulated product. (2010, December). Phusion Projects. Retrieved from http://www.phusionprojects.com/media_reformulationupdate.html

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. doi: 10.1111/acer.12102

Verster, J. C., Aufricht, C., & Alford, C. (2012). Energy drinks mixed with alcohol: Misconceptions, myths, and facts. *International Journal of General Medicine*, *5*, 187-198. doi: 10.2147/IJGM.529313

West, S. G., Ryu, E., Kwok, O-M., Cham, H. (2011). Multilevel modeling: Current and future applications in personality research. *Journal of Personality, 79*, 1-49. doi: 10.1111/j.1467-6494.2010.00681.x

White, A., & Hingson, R. (2013). The burden of alcohol use: Excessive alcohol consumption and related consequences among college students. *Alcohol Research: Current Reviews, 35*, 201-218.

Woolsey, C., Waigandt, A., & Beck, N. C. (2010). Athletes and energy drinks: Reported risk-taking and consequences from the combined use of alcohol and energy drinks. *Journal of Applied Sport Psychology, 22*, 65-71. doi:10.1080/10413200903403224

Woolsey, C. L., Williams, R. D., Housman, J. M., Barry, A. E., Jacobson, B. H., & Evans, M. W. (2015). Combined use of alcohol and energy drink increases participation in high-risk drinking and driving behaviors among college students.

Journal of Studies on Alcohol and Drugs, *76*, 615-619. doi: 10.15288/jsad.2015.76.615

Zucker, R. A., Kincaid, S. B., Fitzgerald, H. E., & Bingham, C. R. (1995). Alcohol schema acquisition in preschoolers: Differences between children of alcoholics and children of nonalcoholics. *Alcoholism: Clinical and Experimental Research, 19*, 1011-1017. doi: 10.1111/j.1530-0277.1995.tb00982.x

Appendix A
CEOA

The following section assesses what you would expect to happen if you were under the influence of alcohol.

Check from disagree to agree – depending on whether you expect the effect to happen to you if you were under the influence of alcohol. These effects will vary, depending upon the amount of alcohol you typically consume.
This is not a personality assessment. We want to know what you expect to happen if you were to drink alcohol, not how you are when you are sober. Example: If you are always emotional, you would not check agree as your answer unless you expected to become MORE EMOTIONAL if you drank.

If I were under the influence from alcohol:

	Disagree	Slightly disagree	Slightly agree	Agree
1. I would be outgoing	1	2	3	4
2. My senses would be dulled	1	2	3	4
3. I would be humorous	1	2	3	4
4. My problems would seem worse	1	2	3	4
5. It would be easier to express my feelings	1	2	3	4
6. My writing would be impaired	1	2	3	4
7. I would feel sexy	1	2	3	4
8. I would have difficulty thinking	1	2	3	4
9. I would neglect my obligations	1	2	3	4
10. I would be dominant	1	2	3	4
11. My head would feel fuzzy	1	2	3	4
12. I would enjoy sex more	1	2	3	4
13. I would feel dizzy	1	2	3	4
14. I would be friendly	1	2	3	4

15. I would feel clumsy	1	2	3	4
16. It would be easier to act out my fantasies	1	2	3	4
17. I would be loud, boisterous, or noisy	1	2	3	4
18. I would feel peaceful	1	2	3	4
19. I would be brave and daring	1	2	3	4
20. I would feel unafraid	1	2	3	4
21. I would feel creative	1	2	3	4
22. I would be courageous	1	2	3	4
23. I would feel shaky or jittery the next day	1	2	3	4
24. I would feel energetic	1	2	3	4
25. I would act aggressively	1	2	3	4
26. My responses would be slow	1	2	3	4
27. My body would be relaxed	1	2	3	4
28. I would feel guilty	1	2	3	4
29. I would feel calm	1	2	3	4
30. I would feel moody	1	2	3	4
31. It would be easier to talk to people	1	2	3	4
32. I would be a better lover	1	2	3	4
33. I would feel self-critical	1	2	3	4
34. I would be talkative	1	2	3	4
35. I would act tough	1	2	3	4
36. I would take risks	1	2	3	4
37. I would feel powerful	1	2	3	4

38. I would act sociable	1	2	3	4

Appendix B
CEQ

Please use the rating scale below to indicate how much you agree with the following statements**.**

	Strongly disagree	**Somewhat disagree**	**Somewhat agree**	**Strongly agree**
1. Caffeinated beverages help sharpen my memory.	1	2	3	4
2. I have trouble concentrating when I drink caffeinated beverages.	1	2	3	4
3. My thoughts race when I drink caffeinated beverages.	1	2	3	4
4. Drinking a caffeinated beverage helps me think more clearly.	1	2	3	4
5. Caffeinated beverages help me pay attention more efficiently.	1	2	3	4
6. I am more alert when I drink caffeinated beverages.	1	2	3	4
7. I get more talkative or chatty when I consume caffeinated beverages.	1	2	3	4
8. I enjoy drinking caffeinated beverages in social settings.	1	2	3	4
9. Drinking caffeinated beverages makes me more outgoing.	1	2	3	4
10. I drink caffeinated beverages to help me relax.	1	2	3	4
11. Caffeinated beverages make me tense.	1	2	3	4
12. When I’m upset, drinking a caffeinated beverage will help calm me down.	1	2	3	4

13. Caffeinated beverages make me feel restless.	1	2	3	4
14. Drinking caffeinated beverages helps improve my mood.	1	2	3	4
15. Drinking caffeinated beverages make me anxious.	1	2	3	4
16. I feel more carefree when I drink caffeinated beverages.	1	2	3	4
17. I get irritable if I don't drink caffeinated beverages regularly.	1	2	3	4
18. I feel more energized when I drink caffeinated beverages.	1	2	3	4
19. Drinking caffeinated beverages causes me to tremble and/or gives me the jitters.	1	2	3	4
20. Caffeinated beverages make my heart race.	1	2	3	4
21. I feel flushed when I drink caffeinated beverages.	1	2	3	4
22. Caffeinated beverages make me feel hyper or jacked.	1	2	3	4
23. I am less sleepy when I drink caffeinated beverages.	1	2	3	4
24. The more caffeine I drink, the more addicted I get.	1	2	3	4
25. I get headaches if I don't drink caffeinated beverages regularly.	1	2	3	4
26. The longer I drink caffeinated beverages, the harder it will be to cut down or quit.	1	2	3	4
27. I feel nauseous if I don't drink caffeinated beverages regularly.	1	2	3	4

28. I get drowsy if I don't drink caffeinated beverages regularly.	1	2	3	4
29. If feel fatigued if I don't drink caffeinated beverages regularly.	1	2	3	4
30. Drinking caffeinated beverages is good for dealing with boredom.	1	2	3	4
31. Caffeinated beverages help to center me.	1	2	3	4
32. I feel more excited when I drink caffeinated beverages.	1	2	3	4
33. I have trouble focusing if I don't drink caffeine regularly.	1	2	3	4
34. I have less motivation to get work done if I don't drink caffeine regularly.	1	2	3	4
35. I get muscle pain or stiffness when I don't drink caffeine regularly.	1	2	3	4
36. I feel more content when I drink caffeinated beverages.	1	2	3	4
37. Drinking a caffeinated beverage is satisfying.	1	2	3	4

Appendix C
CACEQ

Instructions: Compared to equal amounts of nonenergy alcoholic beverages, please mark the extent to which you agree that alcoholic beverages mixed with energy drinks allow one to:

	Strongly Disagree	**Disagree**	**Neutral**	**Agree**	**Strongly Agree**
1. Stay alert longer	1	2	3	4	5
2. Have more energy to party	1	2	3	4	5
3. Get high or “buzzed” quicker	1	2	3	4	5
4. Drink more without feeling drunk	1	2	3	4	5
5. Feel better in the morning	1	2	3	4	5
6. Avoid unintended sexual encounters	1	2	3	4	5
7. Spend less money	1	2	3	4	5
8. Be in control	1	2	3	4	5
9. Drive safer	1	2	3	4	5

Appendix D
DDQ - Alcohol

IMPORTANT: The follow set of questions asks about your consumption of alcohol. This DOES NOT include your use of caffeinated alcohol (such as Red Bull and vodka or rum and Coke).

In the past month, how many times have you consumed more than 4 drinks (for women) or 5 drinks (for men) in a single sitting?

_____

Please think about your typical drinking over the **PAST 3 MONTHS NOT INCLUDING CAFFEINATED ALCOHOL (e.g., Red Bull and vodka)**. On a typical day, how many drinks would you have, and over how many hours would you have them? That is, how many drinks would you typically have on each day in the past three months? How long (in hours) would a typical drinking occasion last on that day?

Over the PAST 3 MONTHS, on a….

	TYPICAL MONDAY	TYPICAL TUESDAY	TYPICAL WED-NESDAY	TYPICAL THURSDAY	TYPICAL FRIDAY	TYPICAL SATURDAY	TYPICAL SUNDAY
NUMBER OF DRINKS							
NUMBER OF HOURS							

Appendix E
DDQ - CAFFEINE

The following questions have to do with caffeine (non-alcoholic) use. For these questions, please choose the answer that best describes your drinking in the **past 3 months**.

Note: Caffeine can include: Tea (hot or cold), coffee, soda, energy drinks
1 Beverage = 12 oz.
12 oz = Starbucks "tall" coffee or can of soda
16 oz = Starbucks "grande"
20 oz. = Starbucks "vente" or plastic bottle of soda

Please think about your typical caffeine consumption over the **PAST 3 MONTHS**. On a typical day, how many caffeinated beverages would you have, and over how many hours would you have them? That is, how many beverages would you typically have on each day in the past three months? How long (in hours) would a typical occasion last on that day?

Over the PAST 3 MONTHS, on a….

	TYPICAL MONDAY	TYPICAL TUESDAY	TYPICAL WED-NESDAY	TYPICAL THURSDAY	TYPICAL FRIDAY	TYPICAL SATURDAY	TYPICAL SUNDAY
NUMBER OF DRINKS							
NUMBER OF HOURS							

Appendix F
DDQ - CAFFEINATED ALCOHOL

1. How many **caffeinated alcoholic beverages** (e.g., Red Bull and vodka; rum and Coke) have you consumed in the past **WEEK?** _____

The following questions have to do with caffeinated alcohol use. For these questions, please choose the answer that best describes your drinking in the **past 3 months**.

> Note: 1 Drink = 1 energy drink with alcohol (e.g., Red Bull and vodka; Jager Bomb)
> = 1 soda (e.g., Coke) mixed with alcohol (e.g., rum)

Please think about your typical drinking of caffeinated alcohol over the **PAST 3 MONTHS**. On a typical day, how many drinks would you have, and over how many hours would you have them? That is, how many drinks would you typically have on each day in the past three months? How long (in hours) would a typical drinking occasion last on that day? Lastly, what type of caffeine (e.g., regular soda, diet soda, energy drink) do you usually use to mix with alcohol?

2. Over the PAST 3 MONTHS, on a….

	TYPICAL MONDAY	TYPICAL TUESDAY	TYPICAL WED-NESDAY	TYPICAL THURSDAY	TYPICAL FRIDAY	TYPICAL SATURDAY	TYPICAL SUNDAY
NUMBER OF DRINKS							
NUMBER OF HOURS							
TYPE OF CAFFEINE MIXER	[Drop down menu: regular soda, diet soda, energy drink]	[Drop down menu: regular soda, diet soda, energy drink]	[Drop down menu: regular soda, diet soda, energy drink]	[Drop down menu: regular soda, diet soda, energy drink]	[Drop down menu: regular soda, diet soda, energy drink]	[Drop down menu: regular soda, diet soda, energy drink]	[Drop down menu: regular soda, diet soda, energy drink]

Appendix G
Caffeine-related Physiological Symptoms

Please indicate whether or not you have experienced the following symptoms after consuming caffeinated alcohol (e.g., rum and Coke; Red Bull and vodka)?

	NO	YES
1. Headache	**1**	**2**
2. Restlessness	**1**	**2**
3. Nervousness/anxiety	**1**	**2**
4. Trouble falling/staying asleep	**1**	**2**
5. Flushed face	**1**	**2**
6. Increased urination	**1**	**2**
7. Nausea/vomiting	**1**	**2**
8. Tremors	**1**	**2**
9. Rambling flow of thought and speech	**1**	**2**
10. Palpitations/racing heart rate	**1**	**2**
11. Other (please specify): _____	**1**	**2**

Appendix H
BIS-11

DIRECTIONS: People differ in the ways they act and think in different situations. This is a test to measure some of the ways in which you act and think. Read each statement and put an X on the appropriate circle on the right side of this page. Do not spend too much time on any statement. Answer quickly and honestly.

	Rarely/ Never	**Occasionally**	**Often**	**Almost Always/ Always**
1. I plan tasks carefully.	1	2	3	4
2. I do things without thinking.	1	2	3	4
3. I make-up my mind quickly.	1	2	3	4
4. I am happy-go-lucky.	1	2	3	4
5. I don't "pay attention."	1	2	3	4
6. I have "racing" thoughts.	1	2	3	4
7. I plan trips well ahead of time.	1	2	3	4
8. I am self controlled.	1	2	3	4
9. I concentrate easily.	1	2	3	4
10. I save regularly.	1	2	3	4
11. I "squirm" at plays or lectures.	1	2	3	4
12. I am a careful thinker.	1	2	3	4
13. I plan for job security.	1	2	3	4
14. I say things without thinking.	1	2	3	4
15. I like to think about complex problems.	1	2	3	4
16. I change jobs.	1	2	3	4

17. I act “on impulse.”	1	2	3	4
18. I get easily bored when solving thought problems.	1	2	3	4
19. I act on the spur of the moment.	1	2	3	4
20. I am a steady thinker.	1	2	3	4
21. I change residences.	1	2	3	4
22. I buy things on impulse.	1	2	3	4
23. I can only think about one thing at a time.	1	2	3	4
24. I change hobbies.	1	2	3	4
25. I spend or charge more than I earn.	1	2	3	4
26. I often have extraneous thoughts when thinking.	1	2	3	4
27. I am more interested in the present than the future.	1	2	3	4
28. I am restless at the theater or lectures.	1	2	3	4
29. I like puzzles.	1	2	3	4
30. I am future oriented.	1	2	3	4

Appendix I
Demographic Questionnaire

1) How old are you?

_____

2) What is your student class?

a. Freshman
b. Sophomore
c. Junior
d. Senior
e. Graduate student
f. Other (please specify): _____

3) What is your gender?

a. Female
b. Male

4) What is your living situation?

a. On-campus
b. Off-campus

5) What is your race?

a. African American/Black
b. Caucasian/White
c. Asian
d. Hispanic
e. Native Hawaiian or Other Pacific Islander
f. Native American or Alaskan Native
g. Other (please specify): _____

6) Are you currently a member of a fraternity or sorority on campus?

a. Yes
b. No

7) What is your height?

_____ feet, _____ inches

8) What is your weight?

_____ pounds

9) Yearly Individual Income:
a. Under $10,000
b. $10,000 - $20,000
c. $20,001 - $40,000
d. $40,001 - $60,000
e. $60,001 - $80,000
f. $80,000 - $100,000
g. $100,000 or more

10) What is your relationship status?
a. Single/never married
b. Living with partner
c. Married
d. Separated/Divorced
e. Widowed

11) Are you employed now?
a. Yes, part-time only
b. Yes, full and part-time
c. Yes, full time only
d. No

12) What is your current overall GPA?
_____

13) Do you have regular access to the Internet (either via phone, computer, etc.)?
a. Yes
b. No

Appendix J
Follow-up Assessments

1. Did you drink last night?
a. Yes
b. No [*if no, skip to DMQ*]

2. When you were drinking last night, where did you drink? Check all that apply.
a. Home
b. Work
c. Friend's house
d. Restaurant
e. Bar
f. Other (please specify): _____
[*For each location participants reported consuming alcohol, they will be directed to answer the following question. The word "<<location>>" would be computer generated to state the location (e.g., home)*]

3. When you drank at <<location>>, how many drinks did you consume of each type?
a. Beer: _____
b. Wine: _____
c. Liquor: _____
d. Mixed drink (non-caffeinated): _____
e. Mixed drink (caffeinated regular soda mixed with alcohol): _____
f. Mixed drink (caffeinated diet soda mixed with alcohol): _____
g. Mixed drink (caffeinated energy drink mixed with alcohol): _____

4. Did you pre-game last night (i.e., drink prior to the main drinking event)?
a. Yes
b. No

5. Please indicate the number of drinks you consumed TOTAL last night for each beverage:
a. Beer: _____
b. Wine: _____
c. Liquor: _____
d. Mixed drink (non-caffeinated): _____
e. Mixed drink (caffeinated regular soda mixed with alcohol): _____
f. Mixed drink (caffeinated diet soda mixed with alcohol): _____
g. Mixed drink (caffeinated energy drink mixed with alcohol): _____

6. Did you play drinking games last night?
a. Yes
b. No

7. Please describe the social context in which you drank last night (check all that apply):
☐I drank alone
☐I drank with others but was not interacting with them and others were not drinking
☐I drank with others but was not interacting with them and others were drinking
☐I drank with others and was interacting with others who were drinking also

8. Did you use any substances prior to drinking or while drinking last night? Examples might include, but aren't limited to: stimulant drugs, caffeine tablets/pills, 5-hour energy drinks, or Adderall.

a. Yes
b. No

If yes, what type of drug? _____

9. Did you drive after drinking last night?

a. Yes
b. No

10. Did you have sexual intercourse after drinking last night?

a. Yes
b. No [*if no, skip to BYAACQ*]

11. If yes, please describe this partner:

a. This is a new sexual partner
b. This is an occasional sexual partner
c. This is a regular sexual partner
d. This is my main sexual partner

12. Did you use protection or contraception?

a. No, we did not
b. Yes, we used a condom
c. Yes, we used birth control
d. Yes, we used both a condom and birth control

B-YAACQ

Below is a list of things that sometimes happen to people either during, or after they have been drinking alcohol. Next to each item below, please mark an "X" in either the YES or NO column to indicate whether that item describes something that has happened to you **AFTER DRINKING LAST NIGHT.**

Last night**...**

		No	Yes
1	While drinking, I have said or done embarrassing things.		
2	I have had a hangover (headache, sick stomach) the morning after I had been drinking.		
3	I have felt very sick to my stomach or thrown up after drinking.		
4	I often have ended up drinking on nights when I had planned not to drink.		
5	I have taken foolish risks when I have been drinking.		
6	I have passed out from drinking.		
7	I have found that I needed larger amounts of alcohol to feel any effect, or that I could no longer get high or drunk on the amount that used to get me high or drunk.		
8	When drinking, I have done impulsive things that I regretted later.		
9	I've not been able to remember large stretches of time while drinking heavily.		
10	I have driven a car when I knew I had too much to drink to drive safely.		
11	I have not gone to work or missed classes at school because of drinking, a hangover, or illness caused by drinking.		
12	My drinking has gotten me into sexual situations I later regretted.		
13	I have often found it difficult to limit how much I drink.		
14	I have become very rude, obnoxious or insulting after drinking.		
15	I have woken up in an unexpected place after heavy drinking.		
16	I have felt badly about myself because of my drinking.		
17	I have had less energy or felt tired because of my drinking.		
18	The quality of my work or schoolwork has suffered because of my drinking.		
19	I have spent too much time drinking.		
20	I have neglected my obligations to family, work, or school because of drinking.		
21	My drinking has created problems between myself and my boyfriend/girlfriend/spouse, parents, or other near relatives.		
22	I have been overweight because of drinking.		

23	My physical appearance has been harmed by my drinking.		
24	I have felt like I needed a drink after I'd gotten up (that is, before breakfast).		

DMQ

Instructions: The following is a list of reasons that some people give for drinking alcohol. Thinking about your drinking last night, how much would you say that you planned to drink for each of the following reasons?

	Almost never/ never	Some of the time	Half of the time	Most of the time	All of the time
1. To forget your worries.	1	2	3	4	5
2. Because your friends pressure you to drink.	1	2	3	4	5
3. Because it helps you to enjoy a party.	1	2	3	4	5
4. Because it helps you when you feel depressed or nervous.	1	2	3	4	5
5. To be sociable.	1	2	3	4	5
6. To cheer up when you are in a bad mood.	1	2	3	4	5
7. Because you like the feeling.	1	2	3	4	5
8. So that others won't kid you about not drinking.	1	2	3	4	5
9. Because it's exciting.	1	2	3	4	5
10. To get high.	1	2	3	4	5
11. Because it makes social gatherings more fun.	1	2	3	4	5
12. To fit in with a group you like.	1	2	3	4	5
13. Because it gives you a pleasant feeling.	1	2	3	4	5
14. Because it improves parties and celebrations.	1	2	3	4	5
15. Because you feel more self-confident and sure of yourself.	1	2	3	4	5
16. To celebrate special occasions with friends.	1	2	3	4	5

17. To forget about your problems.	1	2	3	4	5
18. Because it's fun.	1	2	3	4	5
19. To be liked.	1	2	3	4	5
20. So you won't feel left out.	1	2	3	4	5

DMQ – Caffeinated Alcohol

Instructions: The following is a list of reasons that some people give for drinking **caffeinated alcohol** (e.g., Red Bull and vodka or Jagerbombs). Thinking about your drinking **caffeinated alcohol** last night, how much would you say that you planned to drink for each of the following reasons?

	Almost never/ never	**Some of the time**	**Half of the time**	**Most of the time**	**All of the time**
1. To hide the flavor of alcohol	1	2	3	4	5
2. To feel less tired while drinking	1	2	3	4	5
3. To get intoxicated faster	1	2	3	4	5
4. To feel more energetic	1	2	3	4	5
5. Other (please specify): _____ _	1	2	3	4	5

VITA

Ashley N. Carmichael

Old Dominion University
Department of Psychology
Norfolk, VA 23529

Education and Training

Ph.D. **Old Dominion University,** *Norfolk, VA*
Applied Experimental Psychology, 2016
Advisor: Cathy Lau-Barraco, Ph.D.

M.S. **Old Dominion University,** *Norfolk, VA*
Experimental Psychology, 2012
Advisor: Cathy Lau-Barraco, Ph.D.

B.S. **Central Michigan University,** *Mt. Pleasant, MI*
Psychology and Sociology, 2010
Advisor: Stuart W. Quirk, Ph.D.

Background

Ashley N. Carmichael is a sixth year doctoral candidate in the Applied Experimental Psychology doctoral program at Old Dominion University. Her dissertation research and doctoral training is supported by the Ruth L. Kirschstein National Research Service Award from the National Institutes of Health (#F31 AA023118). Ashley's research interests are primarily in using advanced methodological and statistical techniques to study young adult substance use patterns, primarily Red Bull and vodka use.

Selected Publications

Linden-Carmichael, A. N., Lau-Barraco, C., & Stamates, A. L. (2015). Testing a model of caffeinated alcohol-specific expectancies. *Addictive Behaviors, 47*, 38-41. doi: 10.1016/j.addbeh.2015.03.015

Linden-Carmichael, A. N., Braitman, A. L., & Henson, J. M. (2015). Protective behavioral strategies as a mediator between depressive symptoms fluctuations and alcohol consumption: A longitudinal examination among college students. *Journal of Studies on Alcohol and Drugs*, *76*, 80-88.

Linden, A. N., & Lau-Barraco, C. (2014). A qualitative review of psychosocial risk factors associated with caffeinated alcohol use. *Experimental and Clinical Psychopharmacology*, *22*, 144-153. doi: 10.1037/a0036334

Linden, A. N., Lau-Barraco, C., & Milletich, R. J. (2014). Protective behavioral strategies, alcohol expectancies, and drinking motives in a model of college student drinking. *Psychology of Addictive Behaviors, 28*, 952-959. doi: 10.1037/a0037041