

THE EXAMINATION OF MIXING ALCOHOL AND ENERGY DRINKS AMONG
COLLEGE UNDERGRADUATES USING THE THEORY OF PLANNED BEHAVIOR

by

SUPRIYA GILLELLA REDDY

STUART L. USDAN, COMMITTEE CHAIR
JEN NICKELSON, COMMITTEE CHAIR

DAVID A. BIRCH

JAMES D. LEEPER

JOSEPH E. SCHUMACHER

A DISSERTATION

Submitted in partial fulfillment of the requirements
for the degree of Doctor of Philosophy
in the Department of Health Science
in the Graduate School of
The University of Alabama

TUSCALOOSA, ALABAMA

2013

Copyright Supriya Gillella Reddy 2013
ALL RIGHTS RESERVED

ABSTRACT

The purpose of this study was two fold. First, the study examined whether constructs from the Theory of Planned Behavior (TPB: Ajzen, 1985, 1991) play a role in predicting consumption of alcohol mixed with energy drinks (AmED) among college undergraduates. Second, the study also estimated the prevalence of AmED consumption and provided a better understanding of the theoretical and demographic variables associated with AmED consumption among a large sample of college undergraduates located at a public university in the Southeastern United States.

The study used a cross-sectional study design (n=676) to administer a 39-item survey assessing alcohol use, energy drink (ED) use, and the consumption of mixing alcohol with energy drinks (AmED). As part of this assessment, students responded to theoretical questions about AmED consumption in the last 30 days.

Analyses exploring the univariate significance of theoretical and demographic predictors revealed that all of the TPB constructs were significant univariately. Additionally, the demographic predictors of class year and Panhellenic affiliation were also univariately significant ($p < .05$).

However, when incorporated into a logistic regression model, the TPB constructs of behavioral intention and attitude were the only significant predictors ($p < .05$) of AmED consumption among undergraduate college students. Subjective norms and perceived behavioral control were no longer significant. Furthermore, logistic regression analyses also showed that the demographic variables of age, sex, place of residence, and Panhellenic affiliation also did not predict AmED consumption, while class year remained a significant predictor ($p < .05$) of AmED consumption.

Lastly, a mediation analyses was conducted using logistic regression techniques. Results showed that behavioral intention is a complete mediator for the effect of subjective norms on AmED consumption and is also a partial mediator for the effect of attitudes on AmED consumption in the last 30 days.

Despite the cross-sectional nature of this study, its primary strength was its application of theory to better understand AmED use among college undergraduates. Findings from this study have implications for future intervention development aimed at targeting preventive efforts among college populations.

DEDICATION

This dissertation is dedicated to all of my family and friends who never failed to guide me through this process. To my family, without your love and unending support the completion of this manuscript would not have been possible. To my dear friends, your constant encouragement, prayers, and willingness to listen will never be forgotten. A heartfelt thank you goes out to all of you for both praying and genuinely believing in me.

LIST OF ABBREVIATIONS AND SYMBOLS

AmED	Alcohol mixed with energy drinks
AOR	Adjusted Odds Ratio
BAC	Blood Alcohol Content
BrAC	Breath Alcohol Concentration
CAS	College Alcohol Survey
CHES	College of Human Environmental Sciences
α	Alpha
χ^2	Chi-Square Value
ED or EDs	energy drink or energy drinks
=	Equal to
FED	Functional energy drink
GPA	Grade point average
GRE	Graduate Record Examination
IRB	Institutional Review Board
μ	Mean of the population
MEP	Motor-evoked potentials
NIAAA	National Institute on Alcohol Abuse and Alcoholism
ρ	Probability associated with the occurrence under the null hypothesis of a value equally or more extreme than the observed value.

LIST OF ABBREVIATIONS AND SYMBOLS

SD	Standard deviation, which is a measure of dispersion related to the data that has been collected
TPB	Theory of Planned Behavior

ACKNOWLEDGMENTS

It would have been impossible for me to complete this research endeavor without those who have provided me with guidance and support throughout this process. There are numerous individuals who have invested so much time and effort into helping me and I feel that it is only appropriate to thank them. Dr. Usdan, our road together has certainly been a long one. You have spent the better part of 8 years helping me get through one hurdle after the next. Even in times of your own difficulty, you never hesitated to be there for me and consistently provide me with needed words of affirmation. Thank you for always believing in me, especially during the countless instances when I doubted myself. I am truly honored to be mentored by you and look forward to working with you in the future. Dr. Schumacher, thank you for just taking a chance on me. The opportunity to work with you during my master's degree program paved the way for the rest of my academic pursuits. I would not have met Dr. Usdan if it were not for you, nor would I have had the desire to pursue a career in academia. Thank you for constantly listening, encouraging, making me laugh, and never failing to push me to my full potential. I am so grateful for both your friendship and mentorship all these years. I would not be where I am today if it were not for you. Dr. Nickelson, your willingness to be attentive to my needs never ceases to amaze me. Regardless of how busy you were during the day, you never hesitated to make time for me. Thank you for not only guiding me through the dissertation process, but also for allowing me to consistently pop into your office just to talk. During times of anxiety and self-doubt, you were always there to let me know that finishing was achievable.

Dr. Birch, working with you was such a joy. Thank you for showing a genuine interest in this project. Despite the constant demands of your schedule, you always seemed to find time for

me. Dr. Leeper, your readiness and willingness to help me with my statistical methods was such a blessing. I am so thankful for your expertise and will definitely miss your unique sense of humor. I have, undoubtedly, gained a strong grasp of statistics because of your ability to teach it so well.

I also would also like to thank my friends and family for their never-failing love and support. To my Mom and Dad, you have always been there to support me in my academic pursuits regardless of how long it took. You both have endlessly sacrificed your wants in order to provide for me. I know you both probably wondered sometimes if I would ever get finished. Thank you for loving me and never losing faith in me. I love you both dearly. To my sister, your constant drive and desire to succeed in everything you do has been so motivating during this endeavor. It is hard to believe that we have both earned the title of doctor now. I love you and am so proud of all that you have become. Martha and Ty, words cannot adequately express just how grateful I am for your friendship. Thank you for always listening and just letting me cry in order to "let it all out" when I most needed it. Your advice, love, support, and prayers have been invaluable during this journey. Ava and Xander, thank you for always bringing endless joy and love into my life. I love you both. Michelle, thank you for your willingness to be there every step of the way. There are so few who understand the challenges associated with pursuing a doctorate. Our late night conversations were always welcomed after a long day of writing and editing. Sae, thank you so much for trusting me to help further your own academic pursuits, you have graciously provided me with the reassurance that I truly might be equipped for what the future holds. Finally, thank you to all of my precious friends who consistently prayed and told me "to just keep moving along" I have finally reached my goal.

CONTENTS

ABSTRACT	ii
DEDICATION	iv
LIST OF ABBREVIATIONS AND SYMBOLS	v
ACKNOWLEDGMENTS	vii
LIST OF TABLES	xiv
LIST OF FIGURES	xv
I. INTRODUCTION	1
Alcohol Use and Misuse among College Undergraduates	2
Energy Drink Use among College Undergraduates	3
Mixing of Alcohol and Energy Drinks among College Undergraduates.....	4
Mixing of Alcohol and Energy Drinks as a Public Health Concern.....	5
Application of the Theory of Planned Behavior	6
Statement of the Problem.....	6
Statement of Purpose	8
Significance	8
Research Questions.....	10
Research Hypotheses	10
Limitations	11
Delimitations.....	12
Terminology.....	13

II. LITERATURE REVIEW.....	15
Alcohol Use and Misuse among College Students.....	16
Negative Consequences of Alcohol Use among College Students.....	17
Personal Injury.....	17
Academic Impairment	17
Physical Illness.....	19
Sexual Consequences.....	21
Impaired Driving.....	21
Energy Drink Use and Misuse among College Students.....	22
Prevalence of Energy Drink Use.....	23
Factors Associated with Energy Drink Use and Misuse among College Undergraduates	24
Motivations for energy drink use and misuse among college undergraduates... ..	24
Associations with alcohol consumption and drug use.....	24
Race.....	28
Sport-related identity.	29
Physiological Effects of Caffeine in Energy Drinks.....	30
Psychological and cognitive factors.....	31
Physical performance.....	36
Fatigue.....	38
Adverse health effects.....	40

Mixing of Alcohol and Energy Drinks among College Students	42
Prevalence of Alcohol Mixed with Energy Drinks.....	42
Factors Associated with AmED Use Among College Students	43
Demographic factors associated with AmED use.....	43
Motivations for AmED use among college students	44
Physiological Effects of Alcohol Mixed with Energy Drinks	45
Negative consequences of mixing alcohol and energy drinks	45
Effects of AmED use on behavioral control.....	47
Effects of AmED on subjective intoxication	48
Theoretical Foundation: The Theory of Planned Behavior	48
Studies Using the Theory of Planned Behavior.....	50
III. METHODOLOGY	53
Statement of Purpose.....	53
Research Questions.....	54
Pilot Study.....	54
Study Procedures for Pilot Testing Methods	54
Results from Pilot Study.....	57
Approval from the Institutional Review Board	58
Sampling	59
Instrument	59

Demographics	59
Alcohol Use and Misuse.....	60
ED Use	60
Alcohol Mixed with Energy Drinks.....	61
Theoretical Questions	61
Data Collection Procedures.....	62
Data Entry and Management	63
Statistical Analyses	64
Research Question #1	64
Research Question #2	64
Research Question #3	66
Research Question #4	67
Research Question #5	68
IV. RESULTS.....	70
Sample Demographics	71
Research Questions.....	73
Research Question #1	73
Research Question #2	74
Univariate analyses	76
Multivariate analyses	77
Research Question #3	79

Bivariate analyses	79
Multivariate analyses	81
Research Question #4	84
Research Question #5	86
Summary	89
V. DISCUSSION	91
Research Questions	92
Research Question #1	92
AmED Use among College Undergraduates	92
Research Question #2	94
Research Question #3	97
Research Question #4	98
Research Question #5	99
Limitations	101
Study Implications	103
Future Research	104
Conclusions	106
VI. REFERENCES	107
APPENDICES	
APPENDIX A: Final Version of Survey	114
APPENDIX B: IRB Approval	125

LIST OF TABLES

Table 4.1	Demographic Information of Participants	72
Table 4.2	Descriptive Statistics of Scores for TPB Constructs.....	73
Table 4.3	Profile of Alcohol Use Only, ED Consumption, and AmED Consumption in the Last 30 Days.....	74
Table 4.4	Correlation Matrix of TPB Constructs.....	76
Table 4.5	Results from Four Regression Models Exploring the Univariate Significance of Each Theoretical Construct.....	77
Table 4.6	All-Inclusive Logistic Regression for Association Between TPB Constructs and AmED Consumption in the Last 30 Days.....	78
Table 4.7	Stepwise Logistic Regression for Association Between TPB Constructs and AmED Consumption in the Last 30 Days.....	79
Table 4.8	Bivariate Associations for AmED Consumption in the Last 30 Days.....	80
Table 4.9	All- Inclusive Logistic Regression of Demographic Variables and Association of AmED Consumption in the Last 30 Days.....	82
Table 4.10	Step Two of Logistic Regression of Demographic Variables and Association of AmED Consumption in the Last 30 Days.....	84
Table 4.11	Logistic Regression of Previously Determined Significant Demographic and Theoretical Predictors and Association with AmED Consumption in the Last 30 Days.....	86
Table 4.12	Logistic Regression Establishing Significance between TPB Constructs and AmED Consumption in the Last 30 Days.....	88
Table 4.13	Correlation Matrix of Significant TPB Constructs and Behavioral Intention.....	88
Table 4.14	Final Logistic Regression Establishing Significance between TPB Constructs, Including Behavioral Intention and AmED Consumption in the Last 30 Days of	86

LIST OF FIGURES

Figure 2.1 *Figure of The Theory of Planned Behavior*..... 50

CHAPTER I

INTRODUCTION

Alcohol abuse and misuse among college students continues to be problematic despite numerous efforts to combat excessive drinking and associated negative health outcomes (NIAAA, 2007; Wechsler & Nelson, 2008). Findings from a self-report questionnaire focused on the drinking habits of college students indicate that 31% of college students met the diagnostic criteria for alcohol abuse and 6% for a diagnosis of dependence in the last 12 months (Knight, Wechsler, Kuo, Sebring, Weitzman, & Schuckit, 2002). Furthermore, an estimated 599,000 college students between the ages of 18 and 24 are unintentionally injured each year under the influence of alcohol (Hingson, Zha, & Weitzman, 2009). The National Highway Traffic and Safety Administration (NHTSA) also reports that in 2009 alone, there were 10,389 fatalities in crashes involving a driver with a BAC of .08 or higher, which resulted in 32% of total traffic fatalities for the year (NHTSA, 2009). The greatest proportion of alcohol-related traffic fatalities (34%) was among the 21-24 year old age group (NHTSA, 2009).

The alcoholic drink preferences of college students have shifted in the last decade, with caffeinated alcoholic beverages becoming extremely popular among college students (Marczinski & Fillmore, 2006). Since the introduction of energy drinks (ED) such as Red Bull and Monster to the United States in 2001, college students commonly use them as mixers for their alcoholic drinks (Marczinski & Fillmore, 2006). Consumption of alcohol mixed with ED (AmED) is associated with heavy episodic drinking and episodes of weekly drunkenness (O'Brien, McCoy, Rhodes, Wagoner & Wolfson, 2008). The combined use of alcohol and ED is an issue of concern because of its potential negative consequences (O'Brien et al, 2008.). Due to

reduced subjective intoxication in spite of alcohol-induced impairment, mixing may lead college students to engage in potentially harmful risk-taking behaviors such as drinking and driving (Ferreira, Tulio de Mello, Pompeia, & de Souza Formigoni, 2006). Furthermore, studies show that college students engaging in AmED consumption were also more susceptible to being taken advantage of sexually, riding with an intoxicated driver and being physically hurt or injured (O'Brien et al, 2008).

Alcohol Use and Misuse Among College Undergraduates

The pervasiveness of heavy alcohol consumption across U.S. college campuses is recognized as an important health problem for college students (Wechsler et al., 1998; Wechsler & Kuo, 2000; Wechsler & Nelson, 2008). According to the 2008 CORE Institute Report, alcohol is still the preferred drug of choice among U.S. college students, with 81.7% of college students reporting engaging in alcohol use in the last 30 days prior to survey administration (Presley et al., 2009). The same 2008 report indicated that 43.1% of students had engaged in binge drinking in the past two weeks (Presley et al, 2009). The National Institute for Alcohol and Alcohol Abuse (2004) defines binge drinking as consumption of 5 or more drinks within a 2-hour time frame for males and 4 or more drinks for females. In addition, results from the Harvard College Alcohol Study (CAS) indicate that 44.9% of all students surveyed were classified as binge drinkers (Wechsler & Nelson, 2008). Research also has revealed that from 1993 to 2001 there was a 52% increase in binge drinking rates among U.S. college students (Wechsler & Nelson, 2008).

Numerous prevention strategies and interventions have been created to tackle the college-drinking problem, but findings suggest that college drinking has actually worsened in recent years (NIAAA, 2007). Results from a recent study examining binge drinking trends from 1979-2006, indicated that little improvement has occurred in binge drinking rates for college students.

Additionally, those individuals that were 21-23 years of age continue to have the highest rates of binge drinking when compared to age groups that are both younger and older (Grucza, Norberg, & Bierut, 2009).

Energy Drink Use among College Undergraduates

ED consumption in the United States has grown in popularity with the 2001 introduction of Red Bull, the current leader in the ED market (Boyle & Castillo, 2006). More than 500 new EDs were launched globally in 2007 and the ED market now constitutes a \$5.7 billion beverage industry (Boyle & Castillo, 2006). EDs including Red Bull, Amp, Monster, Rock Star, Rip It, Cocaine, and Full Throttle are designed to give the consumer a boost of energy or stimulate the central nervous system. This boost of energy is typically provided by a combination of stimulants and other energy inducing compounds such as caffeine and taurine. EDs typically contain 80 to 141 mg of caffeine per 8 ounces, which is the equivalent of 5 ounces of coffee or 2 12-ounce cans of a caffeinated soft drink such as Mountain Dew. Some brands of EDs contain even caffeine than this (The Marin Institute, 2007).

Although the research in this area is limited, study findings suggest that factors associated with college students who reported using EDs consumed them to stay awake, feel a lack of energy, and also drink with alcohol while partying (Malinauskas, Aeby, Overton, Carpenter-Aeby, and Barber-Heidal, 2007). One study found that frequency of ED consumption among college students was associated with marijuana use, engaging in risky sexual behaviors, seatbelt omission, and taking risks on a dare. In the same sample, smoking, drinking, and illicit prescription drug use were associated with frequency of ED consumption for White students, but not for African American students (Miller, 2008).

Mixing of Alcohol and Energy Drinks among College Undergraduates

Despite booming sales in the United States and worldwide, very little research has been conducted to examine the recent phenomenon of ED consumption or the consumption of AmED among college students. However, findings in this area do reveal that the consumption of EDs alone and with alcohol is common among college students. One study found that those college students who are ED users also consumed three or more energy drinks at a time when combining them with alcohol while partying (Malinauskas et al., 2007). In addition, more than half of the college students surveyed reported using EDs in the last month (Malinauskas et al., 2007).

Another study of college students reported that 24% of past 30-day alcohol drinkers also consumed AmED in the past 30 days (O'Brien, et al., 2008). Similarly, a recent study found that 23% of 465 college students surveyed in Western Canada reported consuming AmED in the past last 30 days. Furthermore, more frequent AmED users also had twice the odds of experiencing one or more related negative consequences, such as drinking and driving or being hurt or injured when compared to less frequent AmED users after controlling for risk-taking propensity (Brache & Stockwell, 2011). Overall, limited research in this area suggests that about 20% of college students who indicate using alcohol in the past 30 days also report AmED consumption in the last 30 days (O'Brien et al., 2008).

Race, sex, and Greek affiliation also appear to play an integral role in AmED consumption among college students. For example, the existing literature indicates that male gender participation in intramural athletics, and fraternity or sorority membership are all associated with consumption of AmED (O'Brien, et al. 2008).

Mixing of Alcohol and Energy Drinks as a Public Health Concern

The combined use of alcohol and energy drinks is an issue of concern for many reasons. AmED consumption is worrisome because of the potential for alcohol-related negative consequences. Due to reduced subjective intoxication (i.e., not feeling intoxicated) in spite of alcohol-induced impairment, mixing may lead students to engage in potentially harmful risk-taking behaviors, such as drinking and driving (Ferreira, Hartmann-Quadros, Trindale, Takahashi, Koyama & Fromigoni, 2004). As noted previously, students engaging in AmED consumption are more likely than those consuming alcohol only to be taken advantage of sexually, ride with an intoxicated driver, or suffer physical harm (O'Brien et al., 2008). In an event-level analyses of bar patrons, those who had consumed AmED were at a three-fold increased risk of leaving the bar with a BAC \geq .08, as well as a four-fold risk of driving upon leaving the bar district when compared to those who either consumed alcohol only or consumed alcohol and EDs as separate beverages, without mixing them together (Thombs, O'Mara, Tsukamoto, Rossheim, Weiler, Merves & Goldberger, 2010). Furthermore, as is the case with other stimulants, the mixing of alcohol with EDs is associated with increased alcohol intake during drinking sessions (Barrett, Darredeau, & Pihl, 2006). Evidence also suggests that ED consumption may serve as a gateway drug for other forms of drug dependence (Reissig, Strain, and Griffiths, 2009). A theoretical framework has not yet been applied to the study of AmED among college students. Thus, in order to contribute to the small body of current literature, this investigation utilized the Theory of Planned Behavior (TPB; Azjen 1985, 1991) to develop an instrument to explore AmED consumption among college undergraduates. This survey was designed to identify prevalence and correlates of AmED consumption and to determine the

degree to which attitudes, subjective norms, behavioral intentions, and perceived behavioral control explain AmED consumption (Ajzen 1985, 1991).

Application of the Theory of Planned Behavior

The TPB explores relationships among attitudes, subjective norms, perceived behavioral control, behavioral intentions, and behavior. The TPB assumes that behavioral intention is the most important determinant of behavior. According to this model, behavioral intention is influenced by a person's attitude toward performing a given behavior, and also by subjective norms about whether individuals who are important to a person either approve or disapprove of the behavior; and perceived behavioral control, the beliefs regarding whether or not one is able to control a particular behavior (Ajzen & Driver, 1991). The existing literature does not include any research using the TPB to explain AmED consumption, but the TPB has been used to examine both alcohol consumption and binge drinking among undergraduate students (Collins & Carey, 2007; Hutching et al., 2008; Norman et al., 2007). In addition, several studies do show that binge drinking, alcohol consumption, and ED consumption are correlated behaviors (Arria et al., 2011; Brache et al., 2011; Miller, 2008; O'Brien et al., 2008; Thombs et al., 2009). Using the TPB to explain AmED consumption is a logical extension of its application to the alcohol literature.

Statement of the Problem

Since the introduction of products such as Red Bull and Monster to the United States in 2001, EDs have become increasingly popular and are used among college students as a mixer for their alcoholic beverages (Marczinski & Fillmore, 2006). The marketing of these energy drinks differs across countries, with some of the most lax regulatory requirements existing in the United States (Reissig, Strain, & Griffiths, 2009).

The Food and Drug Administration banned pre-mixed caffeinated alcoholic beverages, such as Four Loko, from the U.S. market in 2010; however, the mixing of alcohol and EDs among college students continues to be a growing problem.

College students who consume AmED experience dramatically higher rates of serious alcohol-related consequences than those who do not mix alcohol with energy drinks, independent of the quantity of alcohol consumed (O'Brien et al., 2008). This association is thought to be a result of changes in the drinker's perception of intoxication (Ferreira et al., 2006). Evidence does suggest that the usual signs of subjective intoxication, such as dizziness, fatigue, headache, and trouble walking, were ameliorated when an ED was consumed along with the alcohol (O'Brien et al., 2008). That is, the subjective symptoms of drunkenness seem to be reduced, even though the person is intoxicated by objective measurement. This phenomenon has serious implications because college students also have reported mixing EDs with alcohol in order to engage in partying for longer periods of time (Malinauskas et al., 2007). It is thought that consuming AmED may not only impair a college student's ability to assess their own level of intoxication, but also their ability to judge intoxication in someone else, which can result in riding with an intoxicated driver (O'Brien et al., 2008). Two studies found that, in addition to experiencing greater negative consequences and alcohol-related harms, college students who engage in weekly or daily ED consumption also are at greater risk for alcohol dependence when compared to those who do not consume EDs at all and those who only consume EDs only on occasion, which is defined as 1 to 11 times in the past 12 months (Arria et al., 2011; Reissig et al., 2009).

Overall, the consumption of AmED is oftentimes trivialized by college students due to the lack of understanding about the dangers and consequences associated with this behavior. Students enjoy the feeling of a "wide awake drunk" (Atilla & Cakir, 2011) and are unaware that

this behavior has the potential to lead to greater health problems such as drug and alcohol dependence.

Studies that examine AmED consumption among college students are relatively new with the literature dating back less than 10 years. Reported prevalence has varied from 24% to 48.4% (Atilla & Cakir, 2011; O'Brien et al., 2008; Oteri, Salvo, Patrizio Caputi, & Calapai, 2007; Price et al., 2010). Based on this large variance in prevalence findings, lack of a theory-based examination of this behavior, and the novelty of this research agenda, a further inspection of AmED behaviors was warranted.

Statement of Purpose

The purpose of this study was two fold. First, the study examined which TPB constructs (TPB: Ajzen, 1985, 1991), predict AmED consumption among college undergraduates. Second, the study also estimated the prevalence of AmED consumption and provided a better understanding of the theoretical and demographic variables associated with AmED consumption among a large sample of college undergraduates located at The University of Alabama, a large public university in the Southeastern United States.

Significance

Current research into AmED is entirely atheoretical with no published literature that employs health behavior theory as a framework. This study utilized methodological approaches that incorporated health behavior theory in order to identify correlates of AmED and to provide a foundation for future intervention development.

This study incorporated TPB to examine correlates of AmED consumption among college undergraduates because of the theory's ability to predict future behavior through assessing attitudes, subjective norms, behavioral intentions, and perceived behavioral control (Ajzen 1985, 1991). Furthermore, the TPB has been used to examine behaviors such as alcohol consumption and binge drinking among undergraduate students (Collins & Carey, 2007; Hutching et al., 2008; Norman et al., 2007). As a result, previous research provided an ideal springboard for examining the role of the TPB in also explaining AmED consumption among college populations.

To examine these behaviors through application of the TPB, this study replicated parts of two different surveys developed by Brache and Stockwell (2011) and Collins, Witkiewitz, and Larimer (2011). Brache and Stockwell's survey was designed to examine prevalence, motivations, and correlates of AmED consumption. The survey developed by Collins and colleagues utilized the TPB to examine heavy episodic drinking. Because there is no existing research that employs the TPB as a framework for explaining AmED consumption, questions were modified to develop an instrument that examined AmED using the same TPB constructs applied to heavy episodic drinking in the original survey. The resulting questions within the survey can be recognized as the first theory-based scale that was designed to examine AmED consumption among college undergraduates. The results and conclusions of this study can aid in the development of future interventions targeting college populations that are especially susceptible to engaging in this risky behavior.

Research Questions

The study examined five research questions related to AmED consumption among college undergraduate students using the TPB:

1. What are the prevalence rates, in the last 30 days, for AmED use, ED use only, and alcohol use only among undergraduate students aged 18-24?
2. Are the theoretical variables of attitudes, subjective norms, behavioral intentions, and perceived behavioral control associated with AmED consumption?
3. Are the demographic variables of age, sex, race, class year, place of residence, and fraternity or sorority membership associated with AmED consumption?
4. How are the combinations of TPB constructs and demographic variables predictive of AmEd consumption among undergraduate college students?
5. Does behavioral intention mediate the effect of attitudes, subjective norms, and perceived behavioral control on AmED consumption in the last 30 days?

Research Hypotheses

The following research hypotheses were generated for the research questions that were addressed by this study:

1. The prevalence of AmED consumption, ED use only, and alcohol use only, among undergraduate students aged 18-24 during the last 30 days will be consistent with findings in the published literature.
2. Attitudes, subjective norms, behavioral intentions, and perceived behavioral control will be positively associated with AmED.

3. The demographic variables of age, sex, race, class year, place of residence, and fraternity or sorority membership will be associated with AmED consumption.
4. A combination of TPB constructs and demographic variables will predict AmED consumption.
5. The TPB construct of behavioral intention will mediate the effect of attitudes, subjective norms, and perceived behavioral control on AmED consumption in the last 30 days.

Limitations

This study had several limitations. First, analyses relied solely on self-report data related to the consumption of AmED among college undergraduates. It is possible that respondents under-reported activities they believed would be considered socially undesirable or stigmatized (O'Brien et al., 2008). Thus, college students engaging in AmED consumption may have been less likely to complete the survey instrument. To reduce response bias, participants were told that their truthful participation in the study was important for researchers to understand this phenomenon. The second limitation of this study is that the data provided only a cross-sectional assessment of behaviors relating to AmED. Therefore, analyses examining potential causal relationships were not possible. Additionally, data from this survey cannot examine trends, changes in behavior pertaining to AmED during the duration of a semester or academic year or the theory's proposition that intention predicts future behavior. Although a cross-sectional survey is not the ideal mechanism to examine AmED, existing studies of ED and AmED have utilized cross-sectional data and a strong observational foundation is necessary to justify more costly and time-consuming longitudinal research (Malinauskas et al., 2007; Miller, 2008; O'Brien et al., 2007).

Lastly, data were collected from a convenience sample of college undergraduates. Although college students were the population of interest, data gathered from a convenience sample of only one institution precluded generalizability to the entire population of undergraduate students in the United States. Although not ideal, other preliminary studies in the area of AmED (Arria et al., 2010; Arria et al., 2011; Atilla & Cakir, 2011; Miller, 2008) were also based on comparable data.

Delimitations

Participants in this study comprised undergraduate students enrolled at The University of Alabama, a large, public university in the Southeastern United States during the 2012 spring semester. Students who were present on the day the survey was administered were asked to complete the questionnaire. The University of Alabama Institutional Review Board approved the study. Willingness to complete the survey represented a students' consent to participate and the need to provide written informed consent was waived. Only undergraduates that were 18-24 years of age were included in statistical analyses.

Although the legal drinking age in the U.S. is 21, studies of a variety of negative health behaviors such as college alcohol use, tobacco use, suicide among college students, and college drinking and driving consider the age range of 18-24 years to be representative of the traditional college student (Hingson, Heeren, Zackocs, Kopstein, & Wechsler, 2001; Hingson, Heeren, Zackocs, Winter & Wechsler, 2003; Rigotti, Eun Lee, & Wechsler, 2000; Westerfield, McConnell, Jenkins, & Marshall, 2001). Therefore, respondents who identified themselves as being outside of the age 18-24 parameters were excluded during the data analysis process for the present study.

Terminology

AmED Users: Those individuals who mix alcohol with energy drinks

Attitude: an individual's positive or negative evaluation of performing a behavior (Ajzen, 1991).

Alcohol Use: Typically refers to any alcohol consumption in the past 30 days (Presley et al., 1996; Wechsler, Lee, Kuo et al., 2002).

Behavioral Intention: an indication of an individual's readiness to perform a given behavior. (Ajzen, 1991).

Binge Drinking: A pattern of drinking that brings blood alcohol concentration (BAC) to .08 or above. This pattern corresponds to five or more drinks for a male and four or more drinks for a female in about a two-hour period (NIAAA, 2004). This behavior is sometimes referred to as heavy episodic drinking. (Wechsler & Nelson, 2001).

Cocaine: Most commonly known as an illicit drug, but also the brand name of an energy drink that is highly marketed in the Los Angeles area. It is also available as a two-ounce shot that contains 280 mg of caffeine.

Drink Mixer: The non-alcoholic ingredient in a mixed alcoholic beverage (Marczinski & Fillmore, 2006).

Energy Drink (ED): A beverage that derives its energy-boosting properties chiefly from sugar and caffeine, but may contain other substances such as taurine that may have synergistic pharmacological effects beyond those of caffeine alone (Miller, 2008).

Energy Drink (ED) User: A person who has reported consuming more than one energy drink each month in an average month for the current semester (Malinauskas et al., 2007).

High Frequency Energy Drink (ED) User: An individual who has reported using energy drinks for 52 days or more in the past year (Arria, Caldeira, Kasperski, Vincent, Griffiths, & O'Grady, 2011).

Low Frequency Energy Drink (ED) User: An individual who has reported using energy drinks for 1 to 51 days in the past year (Arria et al., 2011).

Motivation to Comply: inner or social stimulus influencing a person's choice to enact a specific behavior (Ajzen, 1991).

Perceived Behavioral Control: an individual's self-assessed difficulty in performing a specific behavior (Ajzen, 1991).

Subjective Intoxication: An individual's perception of his or her own level of drunkenness (O'Brien et al., 2008).

Substance Abuse: A pattern of maladaptive substance use that is associated with recurrent and significant adverse consequences (American Psychological Association, 2000).

Substance Dependence: A compulsive pattern of maladaptive substance use that is characterized by a loss of control over substance use and continued use despite the presence of substance-related problems (APA, 2000).

Subjective Norm: An individual's perception of social pressures or the beliefs of others in making a decision as to whether the individual should perform a given behavior (Ajzen, 1991).

Theory of Planned Behavior (TPB): A health behavior model that proposes that attitudes, subjective norms, and perceived behavioral control predict an individual's intention to perform a specific behavior (Ajzen, 1991).

CHAPTER II

LITERATURE REVIEW

In spite of increased prevention efforts, problem drinking continues to be a major public health concern with many negative consequences. Well-documented research has indicated that college students are particularly at risk for alcohol misuse and abuse. According to a self-report survey examining the drinking habits of college students, 31% of the college students surveyed met the diagnostic criteria for alcohol abuse and 6% for a diagnosis of dependence in the last 12 months (Knight, Wechsler, Kuo, Sebring, Weitzman & Shuckit, 2002). Additionally, The National Highway Traffic Safety Administration (NHTSA) reports that in 2009 alone, there were 10,389 fatalities in crashes involving a driver with a BAC of .08 or higher, which resulted in 32% of total fatalities for the year. (NHTSA, 2009). Additionally, the 21-24 year old age group had the highest percentage of drivers in fatal crashes with a BAC of .08 or higher (NHTSA, 2009).

Current research also shows that the alcoholic drink preferences of college students have shifted in the last 10 years, with caffeinated alcoholic beverages becoming more popular among college students (Marczinski & Fillmore, 2006). Since the introduction of energy drinks such as Red Bull and Monster to the United States in 2001, college students have increasingly used them as a mixer for their alcoholic drinks (Marczinski & Fillmore, 2006). The combined use of alcohol and EDs is an issue of concern because of its potential negative consequences. Due to reduced subjective intoxication in spite of objective alcohol-induced impairment, mixing may lead college students to engage in potentially harmful risk-taking behaviors, such as drinking and driving (Ferreira et al, 2006).

Negative outcomes associated with this recent phenomenon have garnered extensive attention in media, and major policy changes, such as the removal of pre-mixed energy drinks from the U.S. market in 2010, have been implemented (U.S. Food and Drug Administration, 2010). Causal factors associated with the mixing of alcohol with EDs remains unknown and further examination of this risky behavior is warranted.

Alcohol Use and Misuse Among College Students

The pervasiveness of heavy alcohol consumption across U.S. college campuses is recognized as an important health problem for college students (Wechsler et al., 1998; Wechsler & Kuo, 2000; Wechsler & Nelson, 2008). According to the 2008 CORE Institute Report, alcohol is still the preferred drug of choice among U.S. college students, with 81.7% of college students engaging in alcohol use in the last 30 days prior to survey administration (Presley et al., 2009). The same report indicated that 43.1% of students admit to engaging in binge drinking in the past two weeks (Presley et al, 2009). The National Institute for Alcohol and Alcohol Abuse (2004) defines binge drinking as consumption of 5 or more drinks within a 2-hour time frame for males and 4 or more drinks for females. In addition, results from the Harvard College Alcohol Study (CAS) indicated that 44.9% of all students surveyed were classified as binge drinkers (Wechsler & Nelson, 2008). Research also has revealed that from 1993 to 2001, there was a 52% increase in binge drinking rates among U.S. college students (Wechsler & Nelson, 2008).

Numerous prevention strategies and interventions have been created to tackle the college-drinking problem, but findings suggest that college drinking has actually worsened in recent years (NIAAA, 2007). Results from the Harvard CAS found that the proportion of college students who were classified as frequent binge drinkers increased from 19.7% in 1993 to 22.8% in 2001 (Wechsler & Nelson, 2008; NIAAA, 2007).

Negative Consequences of Alcohol Use among College Students

When examining the literature related to alcohol use and misuse among college undergraduate students, it is useful to categorize the broad range of associated negative consequences by the object and nature of the consequences themselves. For instance, in the associated college health and alcohol literature, alcohol related consequences are categorized as those that cause personal injury, academic impairment, physical illness, sexual consequences, and problems related to impaired driving.

Personal injury. Injury and other alcohol-related harms to oneself are not uncommon among alcohol consumers. These injuries include falls, drowning, burns, firearms injuries, sexual assault, and those related to domestic violence. The Harvard CAS found that 12.8% of all students surveyed had experienced some form of personal injury as a consequence of their drinking (Wechsler et al., 2002). Additionally, the most recent CORE survey indicated that 14.3% of students have experienced personal injury as a result of drinking or drug use (Presley, 2009).

Academic impairment. A substantial amount of empirical evidence has established a relationship between college drinking and impaired academic performance. According to the most recent CORE Institute Report, 20.2% of respondents indicated that they had performed poorly on a test or a project and 26.4% of these students reported having missed a class due to their alcohol or drug use (Presley, 2009). The most recent Harvard CAS study indicated that 29.5% of respondents reported missing a class during the academic year as a result of their drinking (Wechsler et al., 2002). Moreover, the survey illustrated both males and females who engaged in binge drinking at least once or twice in a 2-week period were found to be more than 3 times as likely to fall behind in their schoolwork during the academic year when compared to

more moderate drinkers. Wechsler's seminal study (1998) also demonstrated that students who engaged in binge drinking at least 3 times over a 2-week period were more than 8 times more likely to report falling behind in their schoolwork as a negative consequence of their drinking behavior as compared to those who did not engage in binge drinking. The Student Alcohol Questionnaire, which was administered to a sample of 12,081 college students across 168 4-year colleges or universities in the United States (Eng, Diebold, & Hanson, 1996), found that students who reported higher levels of alcohol consumption also experienced notably higher rates of academic related consequences than students reporting lower levels of alcohol consumption. Of students categorized as "high risk" drinkers (defined as 22 drinks per week for a male and 15 drinks per week for a female), more than half reported to having missed a class due to a hangover. In addition, 15% of these students reported receiving lower grades due to their risky drinking behavior.

Furthermore, studies also have revealed a relationship between student's self-reported grade point average and alcohol consumption. One national study found a consistent inverse relationship between alcohol consumption and grade point average (GPA; Eng, Diebold, & Hanson, 1996), i.e., alcohol consumption increased as grade point average decreased. Results from the CORE survey showed that 67.1% of students who consumed alcohol in the 30 days prior to survey administration reported receiving overall average grades of a C, D, or an F in their classes (Presley, 2009). However, correlation does not prove causation. Although a causal relationship between problem drinking and lower GPA is conceivable, cross-sectional data alone are insufficient to draw definite conclusions that heavy alcohol consumption was exclusively responsible for the lowered GPAs. Lastly, the most recent National College Health Assessment

(NCHA) data found that 5.1% of all undergraduate students surveyed experienced some form of academic impairment as a result of their alcohol use (NCHA, 2012).

A study comprising personal interviews with 754 college students over a period of 4 semesters did find that the amount of alcohol consumed correlated significantly with GPA (Singleton, 2007). This result is consistent with other findings in the literature that state that a range of alcohol related problems correlate with the volume of alcohol consumed (Presley, 2009; Wechsler et al., 1998). Furthermore, an experiment conducted by Howland and colleagues (2010) assessed the effects of binge drinking on the next day test taking performance of college students. The study employed a placebo-controlled crossover design with a randomly assigned order of conditions. Participants were randomized to either alcoholic beverage [mean = 0.12 g% breath alcohol concentration (BrAC)] or placebo on the first night and then received the other beverage a week later. The next day, participants were assessed on test taking, neurocognitive performance and mood state. Results indicated that test-taking performance was not affected on the morning after alcohol administration, but mood state and attention/reaction-time were affected. However, a 6-year longitudinal study of 444 undergraduates at a large Midwestern university found that a significant bivariate association between greater alcohol use and decreased academic performance was substantially reduced when controlling for family background and preexisting academic characteristics of the student (Wood, Sher, Erickson, & DeBord, 1997).

Physical illness. Negative health-related consequences due to heavy alcohol consumption are experienced by a vast majority of college drinkers. The most recent CORE survey data showed that 59.6% of respondents had experienced a hangover as a direct result of their drinking

or drug use. In addition, 50.8% of these college students have reported experiencing nausea or vomiting from alcohol use during the year prior to survey administration (Presley, 2009).

Other serious health-related consequences, of heavy alcohol consumption and misuse, include alcohol poisoning and even the occasional alcohol-related death. Fatalities occur as a result of elevated BAC levels and are commonly seen on university campuses, at university health centers, and in hospital emergency rooms. Unfortunately, prevalence is not well documented in the research literature. Reports are currently found only in mass media and other anecdotal sources. However, research exploring data from large nationally recognized U.S. data sets indicates that alcohol-related unintentional injury deaths among college students ages 18-24 have increased from 1,440 in 1998 to 1,825 in 2005 (Hingson, Zha, & Weitzman, 2009).

Assessed data sets included the NHTSA Fatality Analysis Reporting System, Centers for Disease Control and Prevention Injury Mortality Data, National Coroner Studies, U.S. Census, the National Household Survey on Drug Use and Health, and the CAS surveys.

Long-term health-related consequences due to heavy alcohol consumption can sometimes also include a decreased resistance to illness. For instance, research showed that that self-reported illnesses among college undergraduates at a Midwestern university was correlated with the number of drinks consumed per week. However, light to moderate drinking was not correlated with illness (Engs & Aldo-Benson, 1995). Additionally, consuming 22 drinks or more per week was associated with an increased number of respiratory infections (Engs & Aldo-Benson).

Furthermore, recent studies have also explored alcohol-related illness and utilization of ambulance calls. Retrospective data collected at a Midwestern university over a four-year period

found that alcohol consumption was a co-morbid factor in illness and injury that necessitated pre-hospital emergency care (McLaughlin, 2010).

Sexual consequences. Previous studies also have focused on unintended and unprotected sexual activity as a consequence of risky drinking behavior among college undergraduates. Various instruments have been developed in order to assess sexual behaviors in relation to college drinking. One study using a convenience sample of 210 students at a large Southeastern university found that one-third of the study respondents indicated had engaged in drinking in order to enhance sexual experiences and two-thirds of students reported to experiencing some type of sexually related negative consequence, such as engaging in unplanned sexual activity or being the victim of sexual assault, as a result of their drinking behavior (Poulson, 1998). In addition, results from the Harvard CAS showed that 21.3% of the study sample had engaged in unintended sexual activity, and 10.4% of these students reported not using condoms as a result of their drinking (Wechsler, 2002). Lastly, the most recent CORE data indicated that 8.5% of college drinkers had also been taken advantage sexually (Presley, 2009).

Impaired driving. Impaired driving is another negative consequence of college drinking that is well documented in the literature. The most recent CORE Institute Report found that 24.1% of college students surveyed reported driving under the influence in the past year (Presley, 2009) and 29% of respondents endorsed having driven after drinking (Wechsler et al., 2001). Furthermore, NHTSA (2009) reports that in 2009 alone, there were 10,389 fatalities in crashes involving a driver with a BAC of .08 or higher, which resulted in 32% of total traffic fatalities for the year. (NHTSA, 2009). The 21-24 year old age group had the highest percentage of drivers in fatal crashes, which was 34%, with a BAC of .08 or higher (NHTSA, 2009).

Among a survey of 1,253 first-year college students entering college for the first time at a large mid-Atlantic university over a 4-year period, results found 17% of 19 year- olds reported they had driven while intoxicated (Beck, Kasperski, Caldeira, Vincent, O'Grady, & Arria, 2010). Furthermore, 42% drove after drinking any alcohol, and 38% rode with an intoxicated driver. For all 3 behaviors, prevalence and frequency increased at 21 years of age. Males were more likely than females to engage in these behaviors (Beck et al., 2010).

Lastly, a recent literature review found that, among college students aged 18-24 years, the proportions of students who drove under the influence in the past year increased from 26.5% to 28.9% during the time period of 1998 to 2005 (Hingson, Zha, & Weitzman, 2009).

Energy Drink Use and Misuse Among College Students

ED consumption in the United States has grown in popularity with the 2001 introduction of Red Bull, the current leader in the energy drink market (Boyle & Castillo, 2006). More than 500 new EDs were launched globally in 2007, and the ED market now constitutes a \$5.7 billion industry (Boyle & Castillo, 2006). EDs including Red Bull, Amp, Monster, Rock Star, Rip It, Cocaine, and Full Throttle are designed to give the consumer a boost of energy or stimulate the central nervous system. This boost of energy is typically provided by a combination of stimulants and other energy inducing compounds such as caffeine and taurine. EDs typically contain 80 to 141 mg of caffeine per 8 ounces, which is the equivalent of 5 ounces of coffee or two 12-ounce cans of a caffeinated soft drink such as Mountain Dew, but some brands of EDs contain even more caffeine (The Marin Institute, 2007).

The small body of literature in this area suggests that college students who reported using EDs consume them to stay awake, feel a lack of energy, and also drink EDs with alcohol while partying (Malinauskas, Aeby, Overton, Carpenter-Aeby, and Barber-Heidal, 2007). One study

found that frequency of ED consumption among college students is associated with marijuana use, engaging in risky sexual behaviors, seatbelt omission, and taking risks on a dare. Furthermore, smoking, drinking, and illicit prescription drug use are associated with frequency of ED consumption for White students only. This relationship is not found among African American students (Miller, 2008). The surge of ED sales in recent years (Heckman, Sherry & Gonzalez de Mejia, 2010) has raised concern for public health professionals (O'Brien et al., 2008) due to the possibility of adverse effects from caffeine intoxication and potential deleterious health outcomes resulting from the high sugar content in the majority of these beverages.

Prevalence of Energy Drink Use

Although the research in this area is limited, evidence highlights that college students represent the principal target population for energy drink marketing (Heckman, Sherry, & Gonzalez de Mejia, 2010). Although national studies do not currently investigate the prevalence of ED use among college students, regional efforts have documented that the past-month prevalence of ED consumption among college students ranges from 39% to 57% (Malinauskas et al., 2007; Miller, 2008b; Oteri et al., 2007). These studies suggest that discrepancies in prevalence are largely attributable to school location as well as the demographics of the college or university (Malinauskas et al., 2007; Miller, 2008b; Oteri et al., 2007). The highest prevalence of ED consumption was found in Italy (Ferreira et al., 2006). The highest prevalence of ED consumption within the U.S. occurs in the Southeastern region among White males. Further examination of this behavior is needed to provide a more accurate assessment of the current prevalence of ED consumption among college undergraduates

Factors Associated with Energy Drink Use and Misuse among College Undergraduates

Motivations for energy drink use and misuse among college undergraduates.

Motivations for undergraduate students to engage in ED consumption are numerous. However, they typically fall into social and/or academic categories (Malinauskas et al., 2007; Atilla & Cakir, 2011). Commonly endorsed reasons for ED consumption include lack of sleep, needing energy (in general), driving a car for an extended period of time, mixing with alcohol while partying, treating a hangover, and boosting performance in sports (Malinauskas et al., 2007; Atilla & Cakir, 2011). The primary academic reason for ED use is staying awake for longer while studying (Malinauskas et al.). Social reasons are the most common impetus for students to misuse EDs, particularly when related to alcohol consumption (Malinauskas et al., ;Atilla & Cakir, 2011; Velasquez, Poulos, Latimer, & Pasch, 2011).

Associations with alcohol consumption and drug use. Evidence suggests that ED consumption is associated with an escalation of alcohol-related problems in young adults, especially, college students. Existing data indicate that college populations who consume EDs have high rates of alcohol-related problems (Caldeira et al., 2009; Knight et al., 2002; Wu et al., 2007). For instance, a study of 496 randomly surveyed college students attending a state university in the Central Atlantic region of the United States revealed that 51% of respondents reported consuming more than one ED per month in an average month for the current semester (Malinauskas et al., 2007). More than half of these ED users (54%) consumed energy drinks to facilitate drinking more alcohol while partying. The majority of ED users consumed one energy drink in most alcohol drinking situations, although consuming three or more EDs was a common phenomenon in order to drink more alcohol while partying (49%) (Malinauskas et al., 2007). In

addition, 29% of college students experienced weekly jolt and crash episodes, (high energy followed by extreme tiredness), 22% reported having headaches, and 19% felt heart palpitations.

Cross-sectional data, or data that was collected at one point in time, were collected from 602 undergraduate students in western New York in the spring 2006 semester to examine the relationship between ED consumption and associated problem behaviors (Miller, 2008a).

Differences in problem behaviors by frequency of ED consumption were assessed by multivariable linear regression and logistic regression models, controlling for gender, race, age, parental education, and college GPA. Overall, frequency of ED consumption was positively associated with marijuana use, sexual risk taking, fighting, seatbelt omission, and taking risks on a dare (Miller, 2008a).

Oteri and colleagues examined a sample of 500 college students from the University of Messina School of Medicine in Italy. Respondents answered questions regarding consumption of ED alone and in combination with alcoholic beverages. Although the exposure to various brands of EDs may differ in Italy when compared to the U.S. market, data did indicate that a total of 59.6% of these students endorsed using EDs (Oteri et al., 2007). In addition, 48.4% of ED users associated energy drinks with alcohol. These results are consistent with other reports in the area and indicate not only that the combination of EDs with alcohol is popular among college students, but also that college students associate EDs with alcohol.

Arria and colleagues (2010) conducted a longitudinal study to examine the prevalence and correlates of energy drink consumption among college students. An examination of possible predictive associations between subsequent drug use was also conducted. Participants consisted of 1,060 undergraduate college students from a large public university. Students completed 3 annual interviews, beginning in their first year of college. Use of EDs, other caffeinated

products, tobacco, and alcohol, and misuse of prescription drugs were assessed, as well as demographic and personality characteristics. Results showed that the annual prevalence of ED use was 22.6% in the first year of college and 36.5% in the second and third year of college. ED users had heavier alcohol consumption patterns and were more likely to use other drugs than non-ED users. Regression analyses revealed that second-year ED use was significantly associated with third year nonmedical use of prescription stimulants and analgesics, but not with any other type of substance use in the third year with holding demographics and prior drug use constant (Arria et al, 2010.).

Subsequently, Arria and colleagues (2011) collected data via personal interviews from 1,097 fourth-year college students. Respondents were sampled from a large public university as part of an ongoing longitudinal study, and alcohol dependence was assessed and defined according to DSM-IV criteria (American Psychological Association, 2000). After adjustment for sampling design, 51.3% of students were classified as "low-frequency ED users" (consuming energy drinks for 1 to 51 days in the past year), and 10.1% of students were classified as "high-frequency ED users" (consuming energy drinks for ≥ 52 days in the past year). Results indicated that, when compared to the low frequency group, high-frequency users drank alcohol more frequently (141.6 days vs. 103.1 days). The high-frequency group also drank alcohol in larger quantities than the low-frequency group (6.15 vs. 4.64 drinks in a typical drinking day). Logistic regression analyses revealed that high-frequency users were significantly more likely to meet criteria for alcohol dependence when compared to both non-users (AOR= 2.40, 95% CI= 1.27 to 4.56, $p = .007$) and low frequency users (AOR= 1.86, 95%, CI= 1.10 to 3.14, $p = .020$). Furthermore, high frequency users demonstrated greater likelihood of alcohol dependence as compared to non-users and low-frequency users even after controlling for factors such as

demographics, typical alcohol consumption, involvement in a fraternity or sorority, depressive symptoms, parental history of alcohol or drug related problems, and problems related to childhood conduct. Low-frequency users did not differ from non-users in their risk for alcohol dependence (Arria et al., 2011).

In addition, a study conducted at Hacettepe University in Ankara, Turkey, investigated the frequency of ED consumption and associated factors in a group of college students (Atilla & Cakir, 2011). The study enrolled 439 fourth-year college students pursuing careers in medicine, sports, or the arts. Data were collected via self-administered questionnaire. Bivariate analyses revealed that the frequency of ED consumption was higher in students who drank alcoholic beverages. Regular users of EDs reported that they consumed EDs to stay awake, obtain more energy, and boost performance while engaging in sports, which is consistent with other reports in the literature. Furthermore, 40% of these regular ED consumers reported using EDs as a mixer for their alcoholic beverages. Multivariate analyses demonstrated that use of alcohol was a significant predictor for ED consumption (Atilla & Cakir).

Finally, another recent study (Velazquez et al., 2011) of 585 college students measured ED consumption in the past month and the past week. Linear and logistic regression analyses were performed controlling for gender, age, and race and/or ethnicity. Results indicated that for each one unit increase of ED consumption (an additional day of energy drink use), the likelihood of past month alcohol use increased by 80%, heavy drinking (either 4 or 5 drinks in one sitting) increased by 80%, and consumption of AmED in the past month increased by 90%. Similar results were found for ED use in the past week. As expected, a positive relationship between ED consumption and alcohol was found ($p < .001$).

Overall, EDs are readily available to students and are growing in popularity. Students who report greater ED consumption also consume more alcohol, are more likely to mix EDs and alcohol, and experience more episodes of heavy drinking (Atilla & Cakir, 2011; Malinauskas et al., 2007; Arria et al., 2011; Velasquez et al., 2011). Engaging in the risky behaviors mentioned above is problematic due to the potential negative consequences.

Race. Published findings conflict as to whether race is a correlate of ED use and misuse among college students. Miller (2008a) examined the relationship between ED consumption and problem behaviors among adolescents as well as those approaching adulthood. Results of this cross-sectional study, utilizing a sample of undergraduate students, revealed that frequency of ED consumption was positively associated with smoking, drinking, alcohol problems, and illicit prescription drug use for White students only (Miller, 2008a).

Another study conducted by Berger and colleagues (2011) examined the sociodemographic correlates of ED use and the differences between those who use EDs with and without alcohol in a representative community. Researchers used a random digit dial landline telephone survey of adults in the Milwaukee, Wisconsin area. Respondents were asked to answer to questions about use of ED use and AmED. Almost one-third of respondents reported they had consumed at least one ED in their lifetime while a little more than 25% reported drinking AmED in their lifetime. In addition, 6% reported consuming AmED consumption in the past year. Some significant racial and ethnic differences in consumption patterns were identified. For instance, when compared to non-users of EDs, past-year ED users were more likely to be non-African American minorities. Furthermore, when compared to ED users only, those who engaged in AmED consumption in the past-year were more likely to be White and 18-29 years of age.

An examination conducted by Velazquez and colleagues (2011) also explored the relationship between ED consumption and alcohol use among 585 college students. ED consumption was measured for the past month and the past week. Linear and logistic regression analyses controlled for gender, age, and race and/or ethnicity. Results indicated that there was no significant interaction between ED consumption and race (Velazquez et al., 2011).

Thus, a consensus as to whether race is a risk factor for ED consumption does not exist. Several studies indicated that White and non-African American participants were more likely to consume EDs when compared to African Americans (Miller, 2008a; Berger et al., 2011).

However, another published study suggests that race is not a significant risk factor for ED consumption (Velasquez et al., 2011). To determine if race is in fact a risk factor for undergraduate students' ED consumption, further examination is warranted.

Sport-related identity. One study has examined whether the consumption of Red Bull and comparable stimulant beverages is also associated with behaviors and attitudes that are collectively termed "toxic jock identity." Toxic jock identity is defined as a sport-related identity predicated on risk taking and hyper masculinity (Miller, 2008b). ED advertising consistently emphasizes a physically active lifestyle featuring a range of extreme sports and placing male athletes as one of the prime targets of this product (Kapner, 2004).

Miller (2008b) conducted a study to examine a possible link between sport-related identity, adherence to conventional norms for masculine behavior, risk taking, and ED consumption. Particular attention was placed on the relationship between jock identity, or identifying oneself as an athlete, and ED use (Miller, 2008b). The author surveyed 795 undergraduate students enrolled in introductory level courses at a public university. Analyses of ED consumption regressed on frequencies on sociodemographic characteristics, jock identity,

masculine norms, and risk taking behavior were conducted (Miller, 2008b). Findings indicated that 39% of the study population engaged in ED consumption in the past month, with more frequent use by men (2.49 days/month) than women (1.22 days/month). Furthermore, jock identity was positively associated with frequency of energy drink consumption; this relationship was mediated by both masculine norms and risk taking behavior (Miller, 2008b).

In sum, sport-related identity, hyper-masculinity, and risk taking are all components of an emerging picture of "toxic jock identity." This combination of personality characteristics may signal an elevated risk of engaging in behaviors that are harmful to one's health (Miller et al., 2008b). A series of regression analyses revealed that the frequent consumption of EDs among college undergraduates should be recognized as a potential predictor of toxic jock identity. Further research on this topic is warranted in order to determine if the reverse is true. (Miller et al., 2008b).

Physiological Effects of Caffeine in Energy Drinks

EDs are defined as beverages that typically contain 80 to 141 mg of caffeine per 8 ounces, which is the equivalent of 5 ounces of coffee or two 12-ounce cans of a caffeinated soft drink such as Mountain Dew; but some brands of EDs contain higher amounts of caffeine (The Marin Institute, 2007). The high caffeine content of these beverages can account for both positive and negative health effects (Smit et al., 2004). Consumption of caffeine, the primary active ingredient in these beverages, is associated with improvement in psychological and cognitive factors such as mood (Alford, Cox, & Westcott., 2001; Smit & Rogers, 2002; Smit et al., 2004) and cognitive performance (Alford et al., 2001; Seidl, Peyrl, Nicham, & Hauser, 2000; Smit et al. 2004; Smit & Rogers, 2002). Caffeine and ED consumption have also been linked to improvement in physical performance (Alford et al., 2001; Forbes, Candow, Little, Magnus, &

Chilibeck, 2007) and fatigue (FDA, 2012; Reyner & Horne, 2002). However, caffeine use also is correlated with insomnia and poor sleep quality (Jay et al., 2006), and may cause adverse health effects such as seizures (Iyadurai & Chung, 2006) and decreased subjective intoxication (Marczinski and Fillmore, 2010).

Psychological and cognitive factors. An examination of EDs is warranted to explore the relationship between caffeine and cognitive performance. For instance, Warburton and colleagues (2001) conducted a randomized controlled trial of 49 participants in which participants were asked to abstain from caffeine prior to study activities. Individuals were randomly assigned to different groups in which they were given either 250 ml of an ED containing taurine and 80 mg of caffeine, 250 ml of a caffeine-free glucose placebo, or 250 ml of a caffeine-free, glucose-free placebo. The participants were then tested for cognitive skills such as attention, verbal reasoning, verbal memory, spatial memory, and mood. Results indicated that the caffeine-aurine drink was responsible for significantly improved attention, which was measured by rapid visual information processing (number of correct items detected as well as reaction time). Furthermore, reaction time for verbal reasoning was significantly quicker for those in the caffeine-aurine drink group as compared to those in the placebo groups. Additionally, there was a significant positive association between ED consumption and favorable changes in mood (Warburton et al., 2001). That is, participants who consumed the EDs reported changes in mood such as alertness, clear-headedness, and attentiveness. However, there were no significant differences among groups in verbal and spatial memory.

A series of three studies examined the effects on mood of the most popular ED on the market, Red Bull (Alford et al., 2001). Each of the three studies was conducted over a four-week period of time. The first study enrolled 10 participants and included a pre-post examination of

heart rate, blood pressure, subjective mood, and choice reaction time. The second study comprised 14 individuals and also employed a pre-post design, which evaluated heart rate, blood pressure, subjective alertness, and choice reaction time.

The third study used a pre-post design and examined performance on cognitive tasks in 12 individuals. Treatment groups also differed in all three studies. The first study examined the effects of carbonated mineral water against Red Bull. A control group of "no drink" was added to the second study, and a caffeine-free placebo ED was added for the third study. The caffeine-free placebo ED was the equivalent to a Red Bull without caffeine. Participants were asked to refrain from caffeine consumption on study participation days in the second and third study, but not in the first. Members of each treatment group were given either 250 ml of their respective beverage or a Red Bull containing 80 mg of caffeine. Participants were tested before treatment and again 30 minutes following treatment to allow for absorption of the beverage (Alford et al., 2001).

Findings from the first test revealed that reaction time was greatly improved in the treatment group, i.e., those who consumed Red Bull. The second study indicated that both choice reaction time and subjective alertness showed a significant increase in the Red Bull condition. Blood pressure remained relatively stable in all conditions, but heart rate was significantly higher for the participants who consumed Red Bull (Alford et al., 2001).

The third test showed that memory performance, as assessed through immediate recall, showed a significant increase in the treatment (Red Bull) condition (Alford et al., 2001). However, improvements in these human performance and mood tasks cannot be attributed solely to caffeine, but may be a result of the combination of the different ingredients that are present in Red Bull. This particular ED contains taurine and glucuronolactone in addition to caffeine. Furthermore, concentration showed only marginal improvement in the treatment condition.

There were no significant differences in blood pressure across groups (Alford et al., 2001).

In another series of three different examinations, Smit and colleagues (2004) examined the effects of carbonation, sugar, and caffeine in EDs on 271 adult participants. The first study contained 28 participants and was a double-blind study that investigated the active components in EDs. EDs were tested against a placebo that was absent of both caffeine and carbonation in order to test the hypothesis that EDs improve both mood and cognitive function. The second study included 146 participants and expanded on the results of the initial investigation examining the roles of caffeine and carbonation separately, as well as their interaction. In addition, the effect of carbonation was examined by testing EDs under all relevant conditions. The second study examined a full ED against the following: an ED without any carbohydrates, ED without carbonation, ED without caffeine, and a placebo. The third enrolled 108 individuals and investigated the glucose-related effects of energy drinks by testing an ED against a sensory matched placebo that did not contain any carbohydrates. In addition, the effects of carbonation were tested by comparing the full ED with the non-carbonated version. In each study, beverages were administered to the study participants, and then they were asked to perform a sequence of tasks in order to measure simple reaction time, rapid visual information processing, immediate and delayed word recall tasks, and a letter search task (Smit et al.).

Results of the first study revealed that EDs had a statistically significant stimulating effect when compared to the placebo beverages (Smit et al., 2004). Specifically, there was a significant increase in reaction time and information processing for those individuals who consumed EDs (Smit et al.). The second study showed that EDs were consistently the largest contributor to increased reaction time when compared to the various placebo beverages (Smit et al., 2004).

The third study showed no significant differences between treatment groups (Smit et al.,

2004) In another randomized control trial conducted by Smit and Rogers (2002), an examination on the effects of EDs on both performance and mood was conducted. The study comprised 23 individuals who were asked to abstain from caffeine usage one night before participating in the study. Different treatment groups received 150 ml of energy drink A, 150 ml of water, 250 ml of energy drink B, 250 ml of water, or brief break. Both energy drink groups contained ED's with 75 mg of caffeine. Prior to assignment of treatment groups, because caffeine is intended to reduce feelings of tiredness, study participants endured a rigorous mental task that was intended to induce a mild state of fatigue. Soon after consuming a study beverage, individuals performed tasks involving simple reaction time, rapid visual information processing, memory tasks, and mood assessment (Smit & Rogers, 2002). Researchers also found that there was a significant effect on rapid visual information processing. In other words, groups that were asked to consume an energy drink performed better on tasks involving rapid visual information processing and simple reaction time. Overall, the findings indicated that the caffeine was a significant component in regards to simple reaction time (Smit & Rogers, 2002).

Another study conducted by Kennedy and Scholey (2004) investigated the effects of EDs on performance by specifically examining the effects of caffeine and glucose. Effects of a combination of caffeine and glucose were assessed in two double blind, placebo-controlled, crossover studies during extended performance of cognitively demanding tasks. In the first study, 30 participants received two drinks containing both carbohydrates and caffeine, (68 g/38 mg or 68 g/46 mg, respectively) and a placebo, in counter-balanced order, on separate days. In the second study, 26 participants received a drink containing a combination of 60 g of carbohydrate and 33 mg of caffeine and a placebo drink. In both studies, participants completed a 10-min battery of Rapid Visual Information Processing tasks. When compared to the placebo group, all

three active drinks improved the accuracy of rapid visual information processing. Additionally, both the drink with the higher level of caffeine in first study and the active drink in the second study resulted in lower ratings of mental fatigue. These results indicate that a combination of caffeine and glucose can ameliorate deficits in cognitive performance during extended periods of cognitive demand. (Kennedy & Scholey, 2004).

Finally, Marczinski and Fillmore (2010) conducted a study examining the objective and subjective effects of EDs. The purpose was to investigate the acute effects of a glucose energy drink (Red Bull) on cognitive functioning. Eighty study participants were randomly assigned to one of five conditions: 1.8 ml alcohol/kg ED, 3.6 ml alcohol/kg ED, 5.4 ml alcohol/kg ED, placebo beverage, or no drink. Participants completed a cued go/no-go task (a well-validated behavioral control task) as well as subjective measures of stimulation, sedation, and mental fatigue was assessed before and 30 minutes after beverage administration.

Comparable to other findings in the literature, results indicated that when compared with the placebo and no-drink conditions, the ED did decrease reaction times on the behavioral control task, increased subjective ratings of stimulation, and decreased ratings of mental fatigue (Marczinski & Fillmore, 2010). The greatest improvements in reaction times and subjective measures were observed with the lowest dose, and the amount of decrease in improvement diminished as the dose increased. That is, improvements continued as dosage levels increased, but these improvements were not as substantial.

Overall, study findings suggest that ED consumption can improve cognitive performance on a behavioral control task. The role of EDs in enhancement of cognitive performance may explain the dramatic rise in popularity of these beverages (Marczinski & Fillmore, 2010).

Physical performance. Manufacturers also claim improved physical performance in marketing EDs (Forbes et al., 2007). As a result, several studies have focused on investigating the effects of ED consumption on physical performance.

Forbes and colleagues (2007) enrolled 16 participants in a study to examine the effects of Red Bull versus a placebo. The treatment group received a beverage containing 2.0 mg of caffeine per kg of body weight. The placebo resembled the beverage in the treatment group but did not contain any caffeine. Participants were tested before and after consuming their assigned study beverage and were required to abstain from caffeine for 48 hours prior to onset of the study sessions. Sixty minutes after ingestion of either the treatment beverage or placebo beverage, the participants were tested for muscle endurance by performing a physical task consisting of 3 bench press repetitions at an intensity of 70% of the baseline maximum. Cycle performance was also measured. Results showed that Red Bull significantly increased bench press repetitions when compared to the placebo group. However, Red Bull did not have an effect on the cycle performance tests (Forbes et al., 2007).

Another study conducted by Specterman and colleagues (2005) investigated the role of caffeine and glucose on corticospinal excitability. Corticospinal excitability was measured by motor-evoked potentials (MEPs). MEPs in muscles typically become engaged during voluntary tasks; however other factors including consuming carbonated water alone or consuming carbonated water with caffeine and glucose have been linked to rises in MEPs. EDs such as Lucozade are marketed specifically to improve brain function and athletic performance. The study sample consisted of 10 individuals who were asked to refrain from caffeine consumption the night prior to the study. Four of the participants were in the control group, and the other six participants were exposed to four different conditions with one-week intervals between each

condition.

The first condition consisted of consuming 380 ml of carbonated water containing 68 g of glucose; the second condition included 380 ml of carbonated water containing 46 mg of caffeine; the third condition entailed consuming 380 ml of Lucozade, which contained 68 g of glucose and 46 mg of caffeine; and the beverage for the fourth condition was 380 ml of carbonated water alone. Blood glucose levels were recorded 30 minutes before ingestion and every 30 minutes for up to two hours after ingestion. Additionally, individual MEPs were tested via thenar muscles of the right hand, ulnar nerve at the wrists, and transcranial magnetic stimulation (Specterman et al., 2005).

Results demonstrated that the MEPs of all participants were consistently stimulated in the thenar muscles at the intensity of 1.1 in all of the experimental conditions. However, the MEPs became significantly larger in the participants who consumed Lucozade at both 30 and 60 minutes after ingestion. Furthermore, MEPs were greatly elevated 30, 60, and 90 minutes after ingestion of Lucozade. Additionally, when plotted against normal blood glucose concentrations, portraying a dose response relationship, the MEPs rose significantly when blood glucose concentrations were higher, up to 120 minutes after ingestion of the glucose drink and/or Lucozade. There was no change in MEPs after ingesting carbonated water alone (Specterman et al., 2005).

In conclusion, the MEPs rose significantly with ingestion of Lucozade, the glucose-only drink, and the caffeine-only drink. The effects of caffeine and glucose were much greater when the two were combined in the Lucozade drink (Specterman et al., 2005). Although Lucozade does contain lower doses of caffeine as compared to other EDs on the market, this research highlighted the effects of the combination of caffeine and glucose (Specterman et al., 2005).

Overall, energy drinks do have a positive effect on physical performance (Forbes et al., 2007; Specterman et al., 2005). In addition, Specterman and colleagues discovered that the combination of caffeine and sugar has effects on muscle reaction (Specterman et al., 2005).

Fatigue. Similar to other beverages that contain caffeine as their active ingredient, EDs are often utilized to diminish feelings of tiredness, especially when high levels of attentiveness and optimal performance are necessary. The use of EDs to reduce driver fatigue may be especially valuable because falling asleep while driving is a significant cause of motor vehicle accidents (Reyner & Horne, 2002).

In a double-blind study investigating the efficacy of ED in offsetting fatigue in drivers who were sleepy, Reyner and Horne (2002) enrolled 12 participants who were assigned to treatment or placebo. The treatment group consumed a 250 ml can of Red Bull, which contained 80 mg of caffeine. The placebo was a 250 ml can of a beverage with a similar taste to Red Bull, but did not contain any caffeine. Participants engaged in a 2-hour practice drive in a driving simulator. After 1 week, study participants returned to the laboratory. Prior to returning, study participants restricted their sleep for five hours the night before testing took place. Restriction of sleep was monitored by a wrist actimeter in order to ensure compliance with the study design.

The study sequence began with a 30-minute driving simulation followed by a 30-minute break, at which time, the treatment or control beverage was administered. The participants were then required to drive for 2 hours post-treatment. The driving simulator detected driver sleepiness by lane drifting. Additionally, a hidden camera filmed participants as they underwent tests with the driving simulator. Video was then reviewed to determine whether lane drifting was due to either inattention or sleepiness.

The participants also answered the Karolinska Sleepiness Scale every 200 seconds with responses ranging from “extremely alert” to “very sleepy” and “great effort to stay awake.” The last assessment included electroencephalogram (EEG) measurements of eye movements and muscle artifact. An increased EEG response also indicated increased sleepiness (Reyner & Horne, 2002).

Results revealed that, during the pre-treatment period, the rate of lane drifting was similar between groups. However, post-treatment, the treatment group showed significantly less lane drifting when compared to the control group. Subjective sleepiness was also reported 30 minutes before ingestion and every 30 minutes for up to 2 hours after ingestion. Reports of sleepiness were significantly lower in the treatment group; those who consumed an ED reported a lesser feeling of fatigue up to 90 minutes after treatment (Reyner & Horne, 2002). These findings indicated that EDs do have an effect in reducing fatigue and also have the ability to increase alertness while driving (Reyner & Horne, 2002).

Jay and colleagues (2006) conducted a study examining the relationship between EDs and fatigue. The study targeted an EDs ability to reduce fatigue in night-shift workers because they are often sleep deprived. Additionally, caffeine could further disrupt the sleep cycle, contributing to the lack of sleep of shift workers. In a simulated night shift work setting, at two different time periods, 15 participants were given either a 250 ml placebo drink or a 250 ml functional energy drink (FED) containing 1000 mg taurine, 600 mg glucuronolactone, and 80 mg caffeine. Electrodes were connected to the jaw of study participants to examine the first night-shift protocol, which was followed by 24 hours of being awake and an 8-hour sleep period for recovery. The electrodes provided data on the sleep patterns of these individuals. Sleepiness was assessed by an objective psychomotor vigilance task that tested reaction time. Results indicated

that those individuals who consumed an ED also slept for a lesser amount of time. Furthermore, those in the placebo group were shown to engage in more restful sleep. In addition, sleep architecture, which is expressed as total sleep time in each stage of sleep, was significantly greater in the placebo group. (Jay et al., 2006).

Thus, there is conflicting evidence in regards to the physiological effects of ED's. While the majority of evidence indicates that EDs can be beneficial in increasing alertness, cognitive performance, and reaction times, research also shows that EDs can have harmful effects such as sleep deprivation.

Adverse health effects. Although much of the evidence that is available on EDs portrays the positive effects of these beverages, a few existing case report studies have indicated that the consumption of EDs can result in serious negative health outcomes. For example, Iyadurai and Chung (2006) linked the consumption of energy drinks to seizures in 4 patients with no prior history of any type of neurological disorder.

The four case studies included 3 men ages 25, 19 and 26 years, and 1 woman, age 28. These individuals had no previous history of seizures. Upon drinking two 24-ounce cans of an ED in one sitting, each of the patients had experienced tonic-clonic seizures followed by a feeling of confusion. Additionally, 3 out of the 4 patients also experienced high blood pressure and high heart rate after consuming two 24-ounce cans of an ED. After receiving immediate treatment for their seizures, the patients were asked to refrain from any ED consumption. At both 2- and 6-month follow-up periods, study participants denied experiencing any additional seizures (Iyaduri & Chung, 2006).

The case report records indicated that all four patients could have been diagnosed with idiopathic epilepsy. However, when the individuals consumed small amounts of ED there was no

indication of any seizure activity. Seizures were induced, in a short period of time, only when consuming larger amounts of ED. These findings may suggest a dose- dependent effect of the caffeine stimulant in energy drinks (Iyaduri & Chung, 2006). That is, greater consumption of EDs may result in a higher likelihood of experiencing adverse health effects related to ED consumption.

Another case study, reported by Machado-Vieira et al. (2001) involved a 36-year-old male with a diagnosis of bipolar I disorder. The patient was admitted to the hospital when he suffered a second manic episode after not experiencing any form of mania for 5 years. A week prior to hospitalization, the patient had consumed a total of 6 cans of Red Bull. After a period of 4 days, the patient reported feelings of hyperactivity, increased libido, and irritability. Seven days following hospital admission, consuming only his typical lithium dosage for treatment of bipolar disorder and abstaining from EDs, the patient's manic episode subsided. As evidenced in the literature, this case study indicates that the active ingredients in EDs affect human mood. In this particular situation, caffeine may have exacerbated manic symptoms (Machado-Vieira, 2001).

The Food and Drug Administration (FDA) is continuing to investigate reports of illness, injury or death of individuals who consumed products marketed as EDs or "energy shots" The FDA has cautioned consumers that products marketed as "energy shots" or EDs are not alternatives to rest or sleep. It is important for consumers to realize that stimulants such as caffeine may make one feel awake, but judgment and reaction time can still be impaired from a lack of sleep (FDA, 2012).

Mixing of Alcohol and Energy Drinks among College Students

Despite booming sales in the United States and worldwide, very little research has been conducted to examine the recent phenomenon of ED consumption or the consumption of AmED among college students. However, findings in this area do reveal that the consumption of EDs alone and with alcohol is common among college students.

Prevalence of Alcohol Mixed with Energy Drinks

AmED consumption among college students is a relatively new phenomenon and literature examining its use dates back less than 10 years. Prevalence of AmED consumption in these studies varies from 24% to 48.4% (Atilla & Cakir, 2011; Caputi & Calapai, 2007; O'Brien et al., 2008; Oteri, Salvo, Patrizio Caputi & Calapai, 2007; Price et al., 2010; Marczynski, 2011).

Price et al. (2010) conducted a study in order to further examine the co-administration patterns of alcohol and energy drinks. Study participants were 72 ED users in the Halifax, Nova Scotia, university community in Eastern Canada (Price et al, 2010). They provided information about lifetime ED use and other forms of substance use; detailed data on ED and alcohol use in the week prior to survey administration were collected using timeline follow-back methodology.

Timeline follow back is a calendar-based drinking assessment method that obtains estimates of daily drinking and has been evaluated with clinical and nonclinical populations (Sobell, 2001). Using a calendar, people provide retrospective estimates of their daily drinking over a specified time period up to 12 months prior to the interview date. Several memory aids can be used to enhance recall (e.g., key dates such as holidays serve as anchors). Standard drink conversion to g/mL ethanol is employed (Sobell, 2001).

Findings indicated that 76% of participants reported ever deliberately mixing alcohol

with EDs, and 19% reported consumption of AmED in the week prior to survey administration (Price et al., 2010). Participants reported drinking significantly more alcohol when they consumed EDs as compared to drinking sessions when they used alcohol alone. As evidenced by other literature in the area (O'Brien et al., 2008), AmED consumption is a popular behavior and is associated with increased alcohol consumption.

In a study of 706 college undergraduate students at Northern Kentucky University, 44% reported trying AmED at least once, and 9% reported engaging in AmED consumption at least once in the two weeks prior to survey administration (Marczinski, 2011). Furthermore in a study conducted with a sample of 465 college students in Western Canada, 105 respondents (25%) reported consuming AmED in the 30 days prior to survey administration (Brache & Stockwell, 2011). These students engaging in AmED consumption were also more likely to be heavier drinkers when compared to non-AmED users after controlling for risk-taking propensity (Brache & Stockwell, 2011). Similarly, O'Brien et al., (2008) found AmED prevalence of 24% among participants who endorsed heavy drinking.

Factors Associated with AmED Use Among College Students

The small body of literature focused on AmED consumption among undergraduates addresses various risk factors for consuming AmED, but no study has utilized a theoretical framework to examine these risk factors. The research to date has focused on demographic risk factors and motivations for AmED use.

Demographic factors associated with AmED use. In the fall 2006 semester, a computer-based survey was conducted in a stratified random sample of 4,271 college students from 10 universities in North Carolina (O'Brien et al, 2008). Findings revealed that 697 students (24% of past 30-day drinkers) reported consuming AmED in the 30 days prior to survey

administration. Results indicated that students who were male, White, intramural athletes, fraternity or sorority members or pledges, and younger in age were significantly more likely to consume AmED when compared to non-AmED users.

Motivations for AmED use among college students. Binge drinking among college students is widespread, and much evidence suggests that this behavior leads to significant harms and health hazards for the drinker. One factor that may contribute to this hazardous drinking behavior among college students is growing popularity of consuming AmED (Marczinski, 2011). However, the motivations associated with AmED use are not yet well established due to the small body of literature in this area. In fact, to date, there is currently only one study in the existing literature whose primary purpose was to assess motivations for AmED use among college students (Marczinski, 2011).

Marczinski's study (2011) was conducted among 706 college undergraduate students (354 males and 352 females) at Northern Kentucky University. Northern Kentucky University is a traditional 4-year undergraduate institution with an enrollment of approximately 12,000 students. More than 1,200 students from the psychology department were eligible to participate in this study; 706 individuals were recruited, resulting in a response rate of 58% (Marczinski, 2011).

A computer-based survey was utilized to ensure complete anonymity of responses. The questions on the assessment queried demographic information, ED, alcohol, and AmED consumption patterns. The demographic and alcohol use questions in this assessment were similar to those used in the Harvard CAS (Marczinski, 2011; Wechsler et al., 2008).

The primary objectives of this study were to report prevalence estimates for ED and AmED consumption and to examine motivations for using AmEDs among those who reported

regular consumption of these beverages. When asked about motivations, students indicated that they engaged in AmED consumption to get drunk and to reduce sedation compared to alcohol alone. Overall, motivations for AmED consumption among college students emphasized reduction of the sedative effects of alcohol (Marczinski, 2011). Further investigations of motivations for AmED consumption among college undergraduates are warranted to determine if the results of this single study, conducted at only one site, can be replicated.

Physiological Effects of Alcohol Mixed with Energy Drinks

Negative consequences of mixing alcohol and energy drinks. AmED is a major risk factor for injury. O'Brien and colleagues (2008) conducted the seminal study in this area, which was the first to examine relationships among ED use, high-risk drinking behavior, and alcohol related consequences in a sample of undergraduate college students. In multivariable analyses, consumption of AmED was associated with heavy episodic drinking (6.4 days/week vs. 3.4 days on average; $p < .001$) and twice as many episodes of weekly drunkenness (1.4 days/week vs. 0.73 days/week; $p < .001$) In general, students who reported consuming AmED had a significantly higher prevalence of alcohol-related consequences, including being taken advantage of sexually, taking advantage of another person sexually, riding with an intoxicated driver, being physically hurt or injured, and requiring medical treatment ($p < .005$). Finally, there was a significant interaction between consuming AmED and driving while intoxicated ($p=.027$)

Another study examined the drinking patterns and risk behaviors associated with AmED use among college undergraduates (Brache & Stockwell, 2011). The primary objective was to expand upon previous research by investigating behaviors associated with AmED while controlling for risk-taking propensity, examining a range of outcomes, and replicating findings from a Canadian sample.

In the winter of 2009-2010 a computer-based survey was completed by 465 students attending a university in Western Canada (Brache & Stockwell, 2011). Regression analyses were used to examine whether AmED consumption was associated with heavy drinking, stimulant drug use, and alcohol-related consequences. Results demonstrated that participants who engaged in AmED consumption more frequently were two times more likely to experience alcohol-related negative consequences, such as drinking or driving or being hurt or injured, when compared to those who reported less frequent consumption of AmED (Brache & Stockwell, 2011). Thus, students who consumed AmED were at risk for experiencing alcohol-induced harms. These findings indicate that AmED consumption should be considered a risky drinking behavior, and preventive efforts to discourage this behavior among college students are needed.

Another study investigated event-level associations among ED consumption, alcohol intoxication, and intention to drive a motor vehicle in patrons exiting bars at night (Thombs et al., 2010). This was the first alcohol-related field study intended to examine behaviors associated with ED consumption. Data were collected in a United States college bar district from 82 randomly selected and self-selected patrons. Anonymous interview and survey data were obtained, as well as BAC readings.

Logistic regression models revealed that patrons who had consumed AmED were three times more likely than those who had not consumed AmED to leave a bar highly intoxicated ($\text{BrAC} \geq .08\text{g}/210\text{L}$) when compared to those that did not consume AmED. Furthermore, they were four times more likely to have intentions to drive upon leaving the bar district when compared to other bar patrons who did not engage in AmED consumption (Thombs et al., 2010).

These event-level analyses support the claim that AmED consumption at bars is a marker for elevated young adult involvement in nighttime risk taking behavior, which ultimately may

lead to alcohol-related negative consequences. Further field research in this area is warranted to possibly develop sound regulatory policies related to the sales of alcohol and EDs in bars (Thombs et al., 2010).

Effects of AmED use on behavioral control. Marczinski and colleagues (2011b) examined how the effects of AmED differ from the effects of alcohol alone. The primary purpose was to investigate if the addition of an ED is responsible for altering neurocognitive and subjective measures of intoxication induced by alcohol alone (Marczinski et al., 2011a).

A total of 56 study participants attended one session in which they were randomly assigned to receive 1 of 4 treatments: .65g/kg alcohol, 3.57ml/kg energy drink, .65g/kg alcohol plus 3.57 ml/kg energy drink, or a placebo beverage. Performance on a cued go/no go task was used to measure the mechanisms of behavioral control following the administration of various doses. Subjective ratings of stimulation, sedation, impairment, and level of intoxication were recorded (Marczinski et al., 2011b).

Alcohol alone impaired mechanisms of behavioral control, as evidenced by increased inhibitory failures and increased response times compared to baseline performance. Co-administration of the energy drink with alcohol counteracted some of the alcohol-induced impairment. Alcohol increased subjective ratings of stimulation, liking the drink, impairment, and level of intoxication but decreased ratings of ability to drive.

Co-administration of the energy drink with alcohol increased self-reported stimulation but did not significantly alter ratings of other subjective effects. Overall, an ED appears to alter some of the objective and subjective impairing effects of alcohol but not others. Thus, AmED may contribute to a high-risk scenario for the drinker (Marczinski et al., 2011b).

Effects of AmED on subjective intoxication. A second study from Marcizinski's group investigated relationships among AmED, cognitive processing, and subjective measures of intoxication (Marczinski et al., 2012). The study enrolled 18 participants who attended 4 test sessions where they received 1 of 4 doses in random order: 0.65g/kg alcohol; 3.57 ml/kg Red Bull (ED); 0.65g/kg of 40% alcohol/volume Smirnoff Red Label vodka with 3.57ml/kg of Red Bull (AmED); and 3.57ml/kg of a carbonated beverage marketed as Squirt.

Performance on a psychological refractory period task was used to measure dual-task information processing, and performance on the Purdue pegboard task was used to measure simple and complex motor coordination following dose administration. In addition, various subjective measures of stimulation, sedation, impairment, and level of intoxication were also recorded (Marczinski, et al., 2012).

Results indicated that alcohol slowed dual-task information processing and impaired simple and complex motor coordination. AmED did not alter the alcohol-induced impairment on these objective measures. Alcohol increased various subjective ratings indicative of feelings of intoxication. AmED reduced perceptions of mental fatigue and enhanced feelings of stimulation compared to alcohol alone. In conclusion, AmED may contribute to a high-risk scenario for a drinker. The mix of behavioral impairment with reduced fatigue and enhanced stimulation may lead AmED consumers to perceive that they are better able to function than is actually the case (Marczinski et al., 2012).

Theoretical Foundation: The Theory of Planned Behavior

As portrayed in Figure 1, the Theory of Planned Behavior (TPB) is an adaptation of the formulation of the Theory of Reasoned Action (TRA), which was originally developed by Ajzen and Fishbein in 1967 (Montano & Kaspysk, 2008). The TRA explores relationships among

behavior, beliefs, attitudes, and intentions (Ajzen, 1991). Both the TRA and the TPB assume that behavioral intention is the most important determinant of a given health behavior (Ajzen, 1991). However, Ajzen posited a construct of perceived behavioral control in 1980 that differentiates the TPB from the TRA (Ajzen 1985, 1991).

Behavioral intention is influenced by three independent constructs: attitude, subjective norms, and perceived behavioral control. The first determinant of behavioral intention is a person's attitude towards the behavior. Attitude is a personal evaluation of the behavior and references the degree to which an individual has a favorable or unfavorable response to the behavior of interest (Ajzen, 1985, 1991).

The second determinant of behavioral intention is subjective norms, which are beliefs concerning whether key persons in an individual's life approve or disapprove of a behavior. The TPB proposes that individuals are more likely to behave in a way that gains the approval of these key persons (Ajzen, 1985, 1991).

The third and final determinant of behavioral intention is perceived behavioral control. The construct was added to the model by Ajzen (1991) as an extension of the concept of self-efficacy to account for factors that are outside of one's control. Ajzen and Driver hypothesized that people may try harder to perform a behavior if they feel they have a high degree of control over the behavior (Ajzen 1985, 1991). Furthermore, the amount of perceived behavioral control an individual has is dependent upon the individual alone and is specific to the action or health behavior that is being studied (Ajzen, 1985, 1991). The TPB and TRA alike assume that all other external factors, such as culture and environment, function through the constructs of the model. They do not independently explain whether an individual will behave in a certain way.

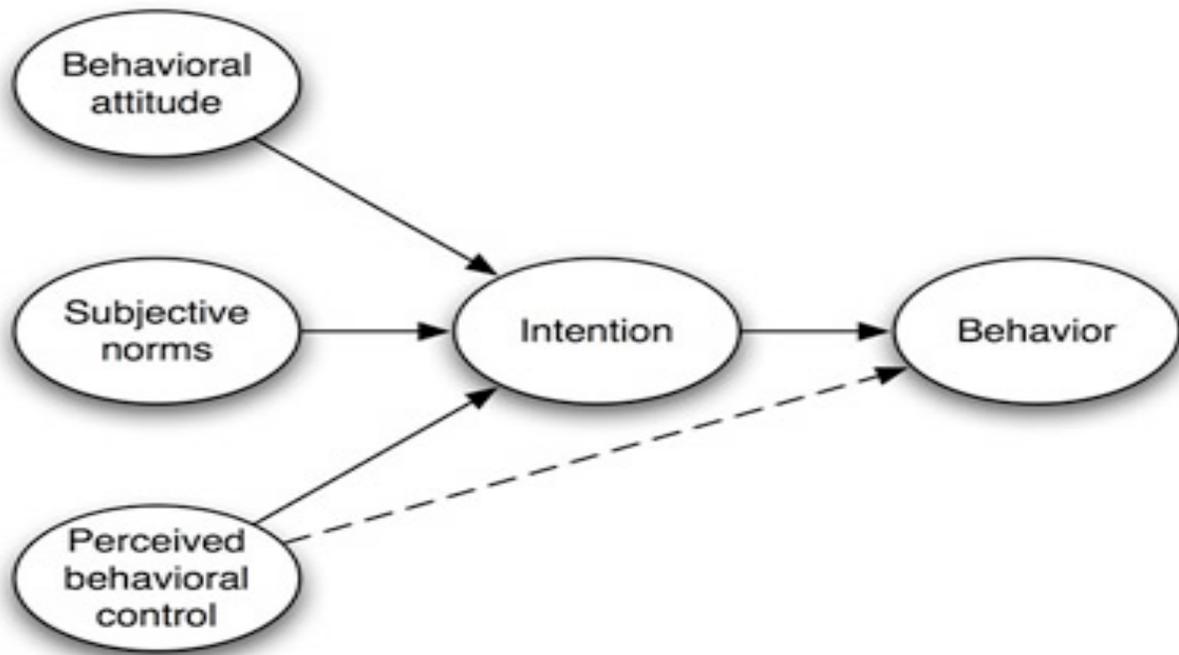


Figure 2.1: Bennett, K., Kinney, J., & Ullrich, S. The Public Health Models: The Theory of Planned Behavior, Operationalized (n.d.). Retrieved April 8, 2012, from <http://publichealthnerds.blogspot.com/2011/06/theory-of-planned-behavior.html>

Studies Using the Theory of Planned Behavior

Binge Drinking

Because there is currently a lack of literature that utilizes health behavior theory as a framework for explaining AmED consumption, studies examining behaviors that are related to AmED consumption were reviewed to assess the utility of this model. Because the TPB has been utilized to investigate alcohol consumption and binge drinking behaviors among undergraduate college students (Collins & Carey, 2007; Hutching et al., 2008) the TPB provides a gateway to examine the potential effectiveness of the theory to study AmED consumption among college undergraduates.

Huchting et al., (2008) recruited a sample of 247 college undergraduates who were also members of a sorority. Study participants attended a midsized, private university in the southern region of California. The primary objective the study was to examine the usefulness of the TPB in predicting college drinking behaviors. Results from a confirmatory factor analysis, for the cross-sectional data that was collected, indicated that all of the item loadings on TPB constructs were statistically significant and interrelated ($p < .01$) with the greatest correlation found between intentions and behaviors ($r = .83, p < .01$) (Huchting et al., 2008). However, results also showed that the weakest correlation that existed and was detected by confirmatory factor analysis of the TPB was between the constructs of behavioral control and intentions ($r = .33, p < .01$) (Huchting et al., 2008). Study findings suggest that all three predictor variables, which were attitudes toward drinking, subjective norms, and perceived behavioral control, were all significantly and positively correlated with one another. These inter-factor correlations suggest that as attitudes towards drinking become more positive, positive subjective norms regarding drinking, and perceived lack of perceived behavioral control over drinking related problems also increase. Furthermore, findings resulting from structural equation modeling revealed that attitudes and subjective norms were the two best predictors of drinking behavior among undergraduate college students (Huchting et al., 2008). In addition, a second structural equation model found that both intentions and perceived behavioral control were significant predictors of binge drinking behavior (Huchting et al., 2008).

Collins et al. (2010) tested the TPB's constructs as a predictor of growth in risky college drinking over a 3-month period. Per TPB assumptions, the investigators hypothesized that attitudes, subjective norms, and perceived behavioral control would predict intention to engage in risky drinking behaviors, which would then predict growth in future risky drinking behaviors

(Collins et al., 2010). Study participants consisted of 837 college drinkers who were randomly selected from 2 West coast U.S. universities. Individuals were selected to participate in a larger study focusing on college drinking norms. The study utilized latent growth curve modeling to test the ability of the TPB to predict baseline levels of as well as linear and quadratic growth of risky college drinking. Chi-square tests and goodness of fit indices indicated a close fit for the resulting structural model. That is, perceived behavioral control, attitudes, and subjective norms were significant predictors of baseline intention. Furthermore, mediation analyses revealed that intention to engaged in risky drinking mediated the effects of self-efficacy and attitudes on increased in risky drinking. Although further research in this area is warranted, findings did support the TPB in predicting risky college drinking (Collins et al., 2010). In sum, a review of the abovementioned literature on the TPB and college drinking behaviors indicated that the TPB has application in the study of AmED consumption among college undergraduates.

CHAPTER III

METHODOLOGY

This cross-sectional study added to existing research on AmED by examining behaviors among a large sample of college undergraduates aged 18-24 years, enrolled at The University of Alabama, a public university in the Southeastern United States. Data for this study was collected through a paper-based survey. This survey was designed to obtain data from a convenience sample of students in a classroom setting. The questions included in this instrument assessed the prevalence associated with AmED consumption. This assessment also incorporated questions designed to examine the relationship between AmED and TPB constructs. Previous research does include atheoretical examinations on the consumption of AmED (Arria et al., 2011; Brache & Stockwell, 2011; O' Brien et al., 2008; Thombs et al., 2010). However, no existing studies apply constructs of TPB or other well-known health behavior theories to the consumption of AmED among college students. Due to this absence of theory-based research, an examination of the relationship between AmED behaviors and TPB constructs is warranted.

Statement of Purpose

The purpose of this study was two fold. First, the study examined which TPB constructs (Ajzen, 1991) predict AmED consumption among college undergraduates. Second, this study estimated the prevalence of AmED consumption and was designed to elucidate correlates of AmED consumption among a large sample of college undergraduates at The University of Alabama, a large public university located in the Southeastern United States.

Research Questions

The study examined five research questions related to AmED consumption among college undergraduate students using the TPB:

1. What are the prevalence rates, in the last 30 days, for AmED, ED use only, and alcohol use only among undergraduate students aged 18-24?
2. Are the theoretical variables of attitudes, subjective norms, behavioral intentions, and perceived behavioral control associated with AmED consumption?
3. Are the demographic variables of age, sex, race, class year, place of residence, and fraternity or sorority membership associated with AmED consumption?
4. How are the combinations of TPB constructs and demographic variables predictive of AmED consumption among undergraduate college students?
5. Does behavioral intention mediate the effect attitudes, subjective norms, and perceived behavioral control on AmED consumption in the last 30 days?

Pilot Study

A pilot study was carried out prior to conducting the final study to examine AmED consumption among undergraduates. The purpose of this pilot study was to obtain a better definition and contextual understanding of AmED consumption among college students. Furthermore, the pilot study also determined if current survey items accurately capture the manner in which college students consume AmED.

Study Procedures for Pilot Testing Methods

The diagnostic tool known as cognitive interviewing was used for purposes of this pilot study. Cognitive interviewing is utilized for pre-testing existing survey instruments.

This process is focused primarily on the questionnaire itself, rather than the survey process, paying explicit attention to mental responses that respondents use to answer survey questions. This technique allows for problems with the survey instrument to be identified. Cognitive interviewing techniques are qualitative and are complementary to traditional field testing or piloting (Willis, 1999).

The two cognitive techniques that were used in this pilot study were the "think aloud" interview method and probing. These two methods involved an interviewer asking each participant about how he or she went about answering the survey question or completing a self-report questionnaire. The "think-aloud" method asked students to actually think aloud as he or she answered the question or completed the survey. The probing method entailed the investigator asking specific questions or probes that were designed to elicit how the study participant went about answering the question. These cognitive techniques were used concurrently. These techniques have been widely used in the design and evaluation of survey instruments (Willis, 1999). Cognitive interviewing provides a means of systematically developing survey questions through investigations that intensely probe the thought processes of the respondents who are presented with the survey instrument.

Thirty undergraduate students at The University of Alabama, enrolled in HHE 378 (Drug Awareness Education) were enrolled in the pilot study. All respondents were age 19 or older because enrollment in the course was restricted to juniors and seniors. To allow for ample time for students to think about their study participation, the instructor of the class briefly explained the nature of the study the day before the researcher visited the classroom in order to recruit study participants.

The pilot survey was estimated to take approximately 16 to 20 minutes to complete and the protocol was approved by the UA Institutional Review Board.

The investigator of this study scheduled a class time with the class instructor in order to administer the questionnaire during the Summer 2012 semester. The instructor of the class provided a brief explanation of the study at the beginning of the class period, and the investigator provided consent to all of the students. The consent form provided a more detailed explanation of the study and assured students that their responses would be kept anonymous and confidential.

Next, the study investigator distributed the survey to students. Before the survey was administered, participants were asked to refrain from providing information on their questionnaire that could potentially be used to identify them such as their name, address, or social security number.

During survey administration, participants underwent the "think aloud" method. As study participants filled out the survey they thought aloud according to cognitive interviewing procedures (Willis, 1999). The study investigator paid special attention to major themes that presented themselves during the think aloud exercise, taking notes as needed to potentially make necessary change to the survey instrument.

Once all students had finished taking the survey, the study investigator also probed students in addition to using the "think aloud" method. For instance, a Power Point presentation displayed individual survey items. Students were asked questions such as "How did you go about answering that question?", "I noticed you hesitated before answering a particular question": "What were you thinking about?"; "How easy or difficult did you find these questions to answer?"; "Why do you say that?"; What does the term alcohol mixed with energy drinks mean

to you?"; "Do you understand the term alcohol mixed with energy drinks?"; and "How did you feel about answering the following question?"

Results from Pilot Study

Findings from the pilot study resulted in changes that needed to be made to the survey instrument. Results also helped to develop an understanding of contextual factors associated with AmED consumption among college undergraduates. The researcher implemented a variety of recommended changes based on pilot survey and cognitive interviewing responses. First, the researcher clarified whether or not students could choose more than one option for the race question. Study participants indicated that it was important to account for those college undergraduates who identified with more than one racial or ethnic group.

Second, changes were made to behavioral intention measures (Q16-17), a subjective norms question (Q21), and the attitudes scale (Q18-25). Pilot participants mentioned that the behavioral intentions measures were confusing because they were previously on a 7-point Likert scale. The researcher therefore standardized behavioral intention measures on a 5-point Likert scale. Study participants also stated that they seem to associate a lower number with disagreement, so directionality of response options was also changed. Specifically, behavioral intention measures ranged from 1 (strongly disagree) to 5 (strongly agree) rather than the reverse.

For the subjective norms question (Q21) pilot participants again indicated that the response options and wording were confusing. As a result, the response options were standardized on a 5-point Likert scale with a range of 1 (low) to 5 (high). Furthermore, Q21 was re-worded to read: "How important is it that your **closest family member** approves of you drinking alcohol mixed with energy drinks at least once in the last 30 days?" The original

wording was, "How much would your **closest family member** approve of you drinking alcohol mixed with energy drinks at least once in the last 30 days?" Lastly, no changes were made to attitudes questions, but all of the questions corresponding to this section were also standardized on a 5-pt Likert scale.

Results from the pilot study allowed the researcher to gain a greater understanding of contextual factors associated with AmED consumption among college undergraduates. The most helpful result in this area was the finding that AmED consumption in the same glass was reported more frequently than AmED consumption in a separate glass. However, some college students did report to chasing alcohol with an ED. Therefore, this practice also needed to be covered in the survey instrument. In sum, this finding assisted in operationally defining AmED consumption in the survey instrument.

Overall, the "think aloud" method and the probing method were used concurrently to determine necessary modifications to an existing survey instrument. The entire pilot test was only conducted one time and took most of the class period, which was about an hour and a half. Results from this study were not published and students were thanked for their time and participation at the conclusion of this study. Results of this pilot study were utilized to develop the survey instrument that was employed in the final study.

Approval from the Institutional Review Board

The survey instruments and study procedures were approved by The University of Alabama IRB prior to conducting this study.

Sampling

All faculty in the College of Human Environmental Sciences (CHES) who were teaching classes at the university during October of the Fall 2012 term were solicited via email to request class time for data collection purposes. All classes of faculty members who granted permission were ultimately utilized for the study. Results from a power analysis indicated that at least 597 respondents were needed with 4 continuous predictors, an alpha level of .05, a statistical power of .80, and a small effect size of .02. Oversampling assured that the required sample size would be maintained after any necessary exclusions from analysis due to incomplete surveys or failure to meet inclusion criteria. A total of 676 students were recruited from 22 classes.

Instrument

The survey (see Appendix A) consisted of sets of questions intended to assess respondent demographics, alcohol use and misuse, energy drink use, AmED behavior, and TPB constructs. Further details follow:

Demographics

Six items were used to obtain demographic information: age (a continuous variable), sex (dichotomous, male/female), current year of study (categorized as 1st year undergraduate, 2nd year undergraduate, 3rd year undergraduate, 4th year undergraduate, 5th year or more undergraduate, and other), location of student residence (categorized as on campus, off campus, off campus with parents, and other), race (categorized as White, Black/African American, Native Hawaiian/Other Pacific Islander, American Indian/Alaska Native, and other), and fraternity or sorority membership (dichotomous, yes/no). For purposes of conducting chi-square analyses that require expected counts of at least five in each cell, categories for demographic variables were collapsed or recoded. For instance, race was recoded into White and non-White; class year was

recoded into 1st year undergraduate, 2nd year undergraduate, 3rd year undergraduate, 4th year undergraduate, and 5th year undergraduate or more; and place of residence was recoded into those that either lived on campus or lived off campus. Questions were derived from two separate surveys developed by Brache & Stockwell (2011) and the National College Health Association (2007). Modifications were made to develop a concise instrument that could be easily understood while including all variables necessary to answer previously defined research questions. Only one question from Brache & Stockwell's original survey was deleted and replaced with a question pertaining to Panhellenic affiliation (Q6). The item pertaining to Panhellenic affiliation was adopted from the National College Health Assessment (NCHA) (American College Health Association, 2007). In addition, Brache and Stockwell's question concerning current year of study (Q3 in modified survey) was re-worded for purposes of clarity.

Alcohol Use and Misuse

Questions in this section collected information on alcohol use and misuse among undergraduate college students. The alcohol use and misuse section contained 3 items that assessed 30-day prevalence of alcohol use and misuse. These questions were formatted into yes/no and fill in the blank response sets and consisted of both categorical and continuous variables. For this study, alcohol use was defined by a dichotomous item assessing whether or not the student had consumed alcohol in the past 30 days.

ED Use

Two items addressed prevalence of ED use and negative consequences associated with ED use among college students in the last 30 days. These questions were formatted into yes/no and fill in the blank response sets and included both categorical and continuous variables. For

this study, ED use was defined by a dichotomous item assessing whether or not the student had consumed EDs in the past 30 days.

Alcohol Mixed with Energy Drinks

Questions in this section addressed prevalence of AmED consumption in the 30 days prior to survey administration. The questions that were utilized to examine AmED consumption included (a) In the past 30 days, have you consumed alcohol mixed with energy drinks? (e.g. Red Bull and Vodka, Jagermeister and Red Bull) (b) In the past 30 days, have you consumed alcohol mixed with energy drinks in the same sitting, but in a separate cup/bottle? (c) How many days in the past 30 days have you consumed alcohol mixed with an energy drink? (d) How many days in the past 30 days have you consumed alcohol mixed with an energy drink in the same sitting, but in a separate cup/bottle? No response scale was actually provided for the question regarding number of days students had consumed AmED in the last 30 days prior to completing the survey. Instead, students were asked to write down the numerical value for the number of days they consumed AmED in the 30 days prior to completing the survey. If students did not engage in the behavior at all, then they entered in a 0. For this study, AmED use was defined by a dichotomous item assessing whether or not the student had consumed AmEDs in the past 30 days (item (a) above [Q12]).

Theoretical Questions

The instrument also incorporated theoretical questions that were modified from a survey that originally utilized TPB constructs to study heavy episodic drinking among college undergraduates (Collins, Witkiewitz, & Larimer, 2011). This section of the instrument included a total of 23 theory-based questions with Likert-type response options assessing a student's overall impressions of AmED.

Two items assessed behavioral intention, 8 concerned subjective norms, 7 queried attitudes about AmED, and 6 related to perceived behavioral control.

Data Collection Procedures

The investigator scheduled class time with the instructors to disseminate the questionnaire during a given time period during the fall 2012 semester. At the beginning of the scheduled class period, the investigator provided a brief explanation of the study and distributed information sheets to all of the students. The information sheet provided a more detailed explanation of the study and also informed students that their responses would be anonymous. The survey was estimated to take 16 to 20 minutes. This information also assured students that their participation in the study was completely voluntary, that refusal to participate did not result in any penalty or loss of benefits to which the student was otherwise entitled, and that the participant could withdraw from the study at any time without penalty or loss of benefit. To maintain the anonymity of students, participants were not required to sign this information sheet and were able to keep it for their personal records.

Before the surveys were distributed, potential study participants were instructed that filling out their survey also served as their consent to participate in this study. Students were therefore asked to refrain from providing any information on the survey form that could potentially be used to identify them such as their name, address, or social security number. They also were asked not to complete the survey if they had already participated in the study through another class. Those students who opted not to complete the survey, or did not complete the survey due to failure to meet inclusion criteria, were given permission to leave the classroom. The investigator then distributed the survey to the students.

Once the investigator had distributed all of the class surveys, the instructor was asked to step outside of the classroom while students were completing surveys. This request was intended to decrease possible identification or response biases in students' answers. After the instructor had left the classroom, students were given about 20 minutes to complete the survey. They were asked to place completed surveys in an envelope at the opposite end of the classroom from the investigator. This prevented the possibility of survey identification. When all surveys had been completed, the investigator transported them back to the study office and secured them in a locked filing cabinet to ensure that the students' information was protected.

Data Entry and Management

Before the start of any data entry, every survey was thoroughly examined for age and undergraduate classification. Completed surveys from students who were outside of the specified 18-24-age range were removed and stored separately from those surveys that met study criteria. Next, those surveys that identified students as graduate students or did not provide a class year for students were also removed and excluded from the study. These surveys were also stored separately with the other surveys that did not meet inclusion criteria. This examination of surveys resulted in the removal of 71 students from entry into the data set.

All of the survey data was quality checked for errors. Upon completion of the data cleaning process, survey data were entered by hand by using PASW Statistics version 18.0 (2010). The research investigator then selected 10% of the surveys and cross-referenced the original surveys with the responses that were labeled in the original data set. This process of cross-referencing distinguished the amount of error that was accumulated during the data entry process. This process determined an error rate of 7.4%. All data entry mistakes were corrected.

During the data entry process, answers pertaining to alcohol use and misuse, ED use, and consumption of AmED were inspected for inconsistencies. If students failed to comply with the appropriate skip patterns incorporated into the survey instrument, protocols were implemented to account for these discrepancies in survey responses. For example, if a student reported to never consuming alcohol at all and then answered, "yes" to mixing alcohol with EDs, this data was excluded from the analysis because it was nonsensical. However, if a student answered questions in a logical manner, and study responses did not contradict one another, the data was accepted.

Lastly, any unanswered theory-based questions were treated as missing data. Respondents who failed to answer at least 70% of the questions pertaining to a specific theoretical construct, also were excluded from the final analysis (DeCoster, 2006).

Statistical Analyses

Research Question #1

What are the prevalence rates, in the last 30 days, of AmED, ED use only, and alcohol use only among undergraduate students aged 18-24?

To estimate the proportion of students who endorsed engaging in AmED use, ED use only, and alcohol use only in the last 30 days, prior to survey administration, the number of users or those who answered yes to the items that queried the pertinent behavior was divided by the total number surveyed.

Research Question #2

Are the theoretical variables of attitudes, subjective norms, behavioral intentions, and perceived behavioral control associated with AmED consumption?

Two series of analyses were conducted to examine the relationship between the theoretical variables and AmED consumption. In the first set of analyses, four separate logistic

regression models were conducted in order to examine the univariate significance of each theoretical construct. AmED consumption in the last 30 days prior to survey administration was used as the outcome variable.

In the second set of analyses, an exploratory all-inclusive logistic regression model was completed with AmED consumption in the last 30 days prior to survey administration as the dependent variable. The continuous independent variables included in this model were behavioral intention, attitudes, subjective norms, and perceived behavioral control. Next, in the interest of non-collinearity and parsimony, variables that were not significant were removed from the model, and a second all-inclusive logistic regression analysis was conducted. Lastly, variables that were significant in this model were included in a stepwise logistic regression analysis. The forward, or all-inclusive, procedure terminates when, at some stage, a given predictor variable will not make a significant contribution to the prediction equation itself. As a result, the procedure terminates. It is important to note, that with this procedure, once a variable is incorporated into the logistic regression model, it stays. The stepwise procedure is a variation of the all-inclusive method. However, at each stage of the stepwise procedure, a test is made of the least useful predictor. The importance of each predictor is constantly reassessed with multiple iterations. As a result, a predictor variable that may have been the best candidate, for entry into the model, may now be superfluous (Stevens, 1992). Unlike bivariate analysis, this multivariate approach was able to identify the relative importance of each of the TPB constructs (DeCoster, 2006).

Research Question #3

Are the demographic variables of age, sex, race, class year, place of residence, and fraternity or sorority membership associated with AmED consumption?

Two series of analyses were conducted to examine the relationship between demographic variables and AmED consumption. In the first set of analyses, bivariate associations between demographic characteristics and AmED were tested using chi-square analyses for categorical outcomes. Bivariate analyses were conducted in order to explore the relationship between categorical predictors (i.e., demographics) (DeCoster, 2006).

In the second series of analyses, to determine if the demographic variables of age, sex, race, class year, place of residence, and fraternity/sorority membership were associated with AmED consumption, an all-inclusive regression model was conducted to determine the amount of variance that could be explained by the demographic predictors for AmED consumption in the 30 days prior to survey administration. Regression analyses determined which variables were associated with AmED consumption, while controlling for the effects of the other variables in the model.

The dependent variable in the logistic regression analysis was AmED consumption. The categorical predictor variables included in the model were sex, race, class year, and place of residence, and fraternity or sorority membership. The continuous predictor variable included in this analysis was age.

Subsequently, a stepwise logistic regression model was also conducted in order to assess the relationship between predictors as they were incorporated into a regression model one at a time, as opposed to all at once with the all-inclusive method. Similar to the process for the all-inclusive method, conducted above, AmED consumption in the last 30 days was used as the

dependent outcome variable and predictor variables were the demographic variables. As stated above, the forward, or all-inclusive, procedure terminates when, at some stage, a given predictor variable will not make a significant contribution to the prediction equation itself, As a result, the procedure terminates. It is important to note, that with this procedure, once a variable is incorporated into the logistic regression model, it stays. The stepwise procedure is a variation of the all-inclusive method. However, at each stage of the stepwise procedure, a test is made of the least useful predictor. The importance of each predictor is constantly reassessed with multiple iterations. As a result, a predictor variable that may have been the best candidate, for entry into the model, may now be superfluous (Stevens, 1992).

In addition to explained variances, 95% confidence intervals and odds ratios for each variable were examined for both the all-inclusive and stepwise logistic regression methods.

Research Question #4

How are the combinations of TPB constructs and demographic variables predictive of AmED consumption among undergraduate college students?

To determine which combination of TPB constructs and demographic variables was predictive of AmED consumption among college students, an all-inclusive bivariate logistic regression analysis was conducted. Predictors that were found to be significant in the analyses addressing research questions 2 and 3 were incorporated. In this analysis, the dependent variable was AmED consumption. The regression model explored the relationship between this dependent variable and the independent or predictor variables, which were a combination of continuous and categorical predictors. In addition to explained variances, 95% confidence intervals and odds ratios for each variable were examined.

Research Question #5

Does behavioral intention mediate the effect of attitudes, subjective norms, and perceived behavioral control on AmED consumption in the last 30 days?

In order to determine if behavioral intention was a mediator of the effects of attitudes, subjective norms, and perceived behavioral control on AmED consumption in the last 30 days a series of logistic regression analyses were conducted.

According to Barron & Kenny (1986), mediation is a hypothesized causal chain in which one variable affects a second variable that, in turn affects a third variable. The intervening variable, in this case was behavioral intention, and was termed the mediator. Per the TPB (Ajzen 1985, 1991) behavioral intention mediates the relationship between the predictor variables and the outcome. In this scenario, the predictor variables were attitudes, subjective norms, and perceived behavioral control, and the outcome variable was AmED consumption in the last 30 days prior to survey administration. The respective paths by which attitudes, subjective norms, and perceived behavioral control lead to the mediating variable of behavioral intention were designated direct effects. Similarly, the path by which behavioral intention leads to AmED consumption in the last 30 days was also classified as a direct effect.

The meditational effect was one in which attitude, subjective norms, and perceived behavioral control lead to AmED consumption in the last 30 days, through behavioral intention. This meditational effect was termed the indirect effect in these particular analyses.

The steps involving mediation analysis are all the same, regardless of which method is used to measure them (Barron & Kenny, 1986). First, one must show that the initial variable is correlated with the outcome. In this case, results of a logistic regression analysis may indicate that the TPB constructs of attitudes, subjective norms, and perceived behavioral control are

associated with AmED consumption. This step is conducted in order to establish that there is an effect to be mediated. Secondly, one must show that mediator, behavioral intention, is associated with the outcome variable. In other words, another logistic regression analysis of data from this study also must show that behavioral intention was associated with AmED consumption. It is not sufficient to only establish a relationship between the mediator and the outcome. One also must control for the effect of the initial variable in establishing the effect of the mediator on the outcome variable. Next, the theoretical predictors that were found to be significant in the first step, must be incorporated into a correlation analysis in order to determine if these theoretical predictors are significantly correlated with behavioral intention.

Finally, although complete mediation was not required, to determine whether or not mediation has occurred, the effect of the mediator variable (behavioral intention in this instance) on the TPB constructs should not be significant. If the significance values of these theoretical constructs decreases, then partial mediation has occurred. An all-inclusive bivariate logistic regression was conducted by utilizing AmED consumption in the last 30 days prior to survey administration as the outcome variable. The independent variables used in this model were the TPB constructs that were significant in the correlation analysis.

CHAPTER IV

RESULTS

The purpose of this study was two fold. First, the study sought to examine whether constructs from the Theory of Planned Behavior (TPB; Ajzen, 1985, 1991) play a role in predicting consumption of alcohol mixed with energy drinks (AmED) among college undergraduates. Second, the study estimated the prevalence of AmED consumption and provided a better understanding of the theoretical and demographic variables associated with AmED consumption among a large sample of college undergraduates located at a large public university in the southeastern United States.

Students were recruited from The University of Alabama's College of Human Environmental Sciences (CHES). Instructors who taught classes within this college in October of 2012 were contacted via e-mail about the possibility of providing class time for their students to complete the survey. Of the 44 instructors contacted, 19 agreed to volunteer class time to allow for data collection. A total of 676 surveys were collected from participating class sections. Twenty-one (3.1%) of the surveys were excluded because the responses were non-sensical. Additionally, 50 surveys (7.3%) surveys were excluded from the final analysis because the forms were incomplete. For example, some students that failed to answer at least 70% of the theoretical questions pertaining to each TPB construct. The exclusion of these participants resulted in a final sample of 605 usable surveys.

Sample Demographics

Table 4.1 shows the demographic profile of the sample. A total of 138 males (22.8%), 460 females (76%), and 7 (1.1%) individuals who did not report gender comprised this sample (n=605) of 18-24 year old (mean= 20.26, SD=1.51) undergraduate students. Respondents were 79.7% White, 16.5% Black or African American, 0.3% Native Hawaiian or Other Pacific Islander, .5% American Indian or Alaskan Native, and 3% Other. The sample included 19.7% 1st year undergraduates, 17.4% 2nd year students, 25.6% 3rd year students, 27.8% 4th year students, and 9.8% of those sampled were in their 5th of study or more. One student failed to report any information for class year. Finally, the sample used in this study contained 39.8% of participants who reported an affiliation with a Panhellenic organization (fraternity or sorority). In comparison, the most recent data, obtained from a contact at the Office of Student Affairs, The University of Alabama found that 23% of all undergraduate students were associated with a fraternity or sorority (Office of Student Affairs, personal correspondence, 2012). Table 4.2 is a depiction of the sample (n=605) in relation to TPB constructs. Descriptive statistics, which include mean scores, minimum and maximum values, and standard deviations are reported below for behavioral intention, subjective norms, attitudes, and perceived behavioral control. Mean scores for these TPB constructs, which were on a 5 pt Likert scale, ranged from 1.45-2.17. The higher the score, the greater the level of behavioral intention, subjective norms, attitudes, and perceived behavioral control. As one can see below, subjective norms actually had the highest mean score (Mean= 2.17, SD= .598). Minimum and maximum values for these TPB constructs ranged from 1 to 5, with the exception of subjective norms, which ranged from 1 to 4.67.

Table 4.1
Demographic Information of Participants

	<i>N</i> = 605	%
Gender		
Male	138	22.8
Female	460	76.0
Missing	7	1.2
Race		
White	482	79.7
Black or African American	100	16.5
Native Hawaiian or Other Pacific Islander	2	.3
American Indian, Alaskan Native	3	.5
Other	18	3.0
Class Year		
1st year undergraduate	119	19.7
2nd year undergraduate	105	17.4
3rd year undergraduate	155	25.6
4th year undergraduate	168	27.8
5th year undergraduate or more and Other	57	9.4
Missing	1	.2
Place of Residence		
On Campus	175	28.9
Off Campus	409	67.6
Off Campus with Parents	18	3.0
Other	3	.5
Panhellenic Affiliation		
Yes	241	39.8
No	363	60.0
Missing	1	.2

Table 4.2
Descriptive Statistics of Scores for TPB Constructs

<i>N</i> =605	Mean	<i>SD</i>	Minimum	Maximum
Behavioral Intention	1.45	.827	1	5
Attitude	2.10	.947	1	5
Subjective Norms	2.17	.598	1	4.67
Perceived Behavioral Control	1.19	.574	1	5

Research Questions

Research Question 1:

What are the prevalence rates, in the last 30 days, of AmED, ED use only, and alcohol use only among undergraduate students aged 18-24?

Prevalence rates are illustrated in Table 4.3. A total of 478 of students (79%) reported consuming alcohol alone, 191 students (31.6%) reported consuming ED alone, and 129 students (21.3%) indicated they had consumed AmED in the past 30 days.

Table 4.3
Profile of Alcohol Use Only, ED Consumption, and AmED Consumption in the Last 30 Days

		<i>N</i> = 605	%
Alcohol Use Only			
	Yes	478	79.0
	No	125	20.7
	Missing	2	.3
Energy Drink Use Only (ED)			
	Yes	191	31.6
	No	409	67.6
	Missing	5	.8
Alcohol Mixed with Energy Drink (AmED)			
	Yes	129	21.3
	No	476	78.7

Research Question #2

Are the theoretical variables of attitudes, subjective norms, behavioral intentions, and perceived behavioral control associated with AmED consumption?

Prior to conducting any statistical analyses, the researcher created scale variables for the theoretical constructs. Cronbach's alpha was calculated to test the internal consistency of each TPB construct scale (DeCoster, 2005). A subscale that displayed a coefficient between .70 and .90 was considered to have appropriate internal consistency (Morgan, Gliner, & Harmon, 2006). Cronbach's alpha for scales also was examined because it can sometimes determine how a theoretical variable is constructed. When constructing the subjective norms variable, Q21 was deleted prior to data analysis in order to obtain appropriate internal consistency. Scale (internal consistency) reliability was acceptable for all TPB variables: attitudes (Cronbach's $\alpha = .942$),

subjective norms (Cronbach's $\alpha = .733$ after the deletion of Q21 from analysis), behavioral intentions (Cronbach's $\alpha = .70$), and perceived behavioral control (Cronbach's $\alpha = .922$). These variables for TPB constructs were continuous, with an additive score created for each construct. Responses from behavioral intention questions were scored from 1 (Strongly Disagree) to 5 (Strongly Agree); questions pertaining to subjective norms were scored from 1 (Highly Disapprove or Highly Unimportant) to 5 (Highly Approve or Highly Important), with the exception of two questions that were scored from 1 (Completely False) to 5 (Completely True); questions concerning attitudes were scored from 1 (Unfavorable) to 5 (Favorable); and perceived behavioral control was scored from 1 (Strongly Disagree) to 5 (Strongly Agree). Respondent scores for all items within each theoretical construct were then averaged to create a mean response score for each of the groupings.

A correlation matrix showing how these TPB constructs are related to one another is depicted below in Table 4.4. All of the constructs are weakly to moderately correlated with one another. Behavioral intentions most positively correlated with attitudes ($r = .564$), social norms is most positively correlated with attitudes ($r = .535$), perceived behavioral control is most positively correlated with social norms ($r = .324$), and attitudes is most positively correlated with behavioral intention ($r = .564$). All of the correlations among these TPB constructs were positive. In addition, it is important to note that a correlation coefficient ranges from -1 to 1. A coefficient that is less than .50 indicates a weak, positive relationship, whereas a correlation that is greater than .80 indicates a strong positive relationship (Daniel, 2008).

Table 4.4
Correlation Matrix of TPB Constructs

		Correlations			
N=605		Behavioral Intention	Social Norms	Perceived Behavioral Control	Attitudes
Behavioral Intention	Pearson Correlation Sig. (2-tailed)	1	.415** .000	.194** .000	.564** .000
Social Norms	Pearson Correlation Sig. (2-tailed)	.415** .000	1	.324** .000	.535** .000
Perceived Behavioral Control	Pearson Correlation Sig. (2-tailed)	.194** .000	.324** .000	1	.172** .000
Attitudes	Pearson Correlation Sig. (2-tailed)	.564** .000	.535** .000	.172** .000	1

** . Correlation is significant at the 0.01 level (2-tailed).

Univariate analyses. Results from logistic regression analyses examining univariate significance of each theoretical construct are outlined in Table 4.5. Results indicated that all of the theoretical predictors of behavioral intention, attitudes, subjective norms, and perceived behavioral control were significant predictors of AmED consumption when incorporated into four separate bivariate logistic regression models ($p < .05$). Furthermore, results also indicate that, the odds of engaging in AmED consumption increased 4.871 times with each one-point increase in the behavioral intention scale OR=4.871, 95% CI= 3.645-6.510) Second, the odds of consuming AmED increased 5.077 (OR=5.077, 95% CI=3.708-6.951) times with each one-point increase in attitudes scale. Third, the odds of engaging in AmED consumption increased 4.571

(OR=4.571, 95% CI=3.131-6.673) times with each one-point increase in the subjective norms scale. Lastly, the odds of consuming AmED increased 1.589 times with each one-point increase in perceived behavioral control scores (OR=1.589, 95% CI=1.186-2.128).

Table 4.5
Results from Four Regression Models Exploring the Univariate Significance of Each Theoretical Construct

	β	SE	χ^2_{Wald}	df	p	OR	Odds 95% CI	
							LL	UL
Behavioral Intention	1.583	.148	114.501	1	.001*	4.871	3.645	6.510
Attitude	1.625	.160	102.761	1	.001*	5.077	3.708	6.951
Subjective Norms	1.520	.193	61.970	1	.001*	4.571	3.131	6.673
Perceived Behavioral Control	.463	.149	9.629	1	.002*	1.589	1.186	2.128

Note: * Indicates significance ($p < .05$). LL=Upper Limit, UL=Lower Limit

Multivariate analyses. The results of the first all-inclusive logistic regression model are presented in Table 4.6. The model ($n=605$) was significant ($p < .05$), with a Nagelkerke $R^2 = .462$, explaining 46.2% of the variance, and it correctly classified 85.3% of the participants. A Hosmer-Lemeshow test revealed a significance of .179 indicating that the model was a good fit. Subjective norms and perceived behavioral control were not significantly associated with AmED consumption after controlling for other TPB constructs in the logistic regression model below (Table 4.6). However, behavioral intention and attitudes were significant predictors of AmED consumption ($p < .05$). After controlling for all other variables in the model, the odds of engaging in AmED consumption increased by 2.821 times with each one-unit increase in attitude scores. (OR=2.821, 95% CI=1.961-4.058), which is consistent with what one would expect.

Additionally, after controlling for all other variables in the model, the odds of engaging in AmED consumption increased by 2.596 times with each one unit increase in behavioral intention scores (OR 2.596, 95% CI=1.919-3.510).

Table 4.6
All-Inclusive Logistic Regression for Association Between TPB Constructs and AmED Consumption in the Last 30 Days

	β	SE	χ^2_{Wald}	df	p	OR	Odds 95% CI	
							LL	UL
Behavioral Intention	.954	.154	38.373	1	.001*	2.596	1.919	3.510
Attitude	1.037	.186	31.240	1	.001*	2.821	1.961	4.058
Subjective Norms	.391	.259	2.287	1	.130	1.479	.891	2.457
Perceived Behavioral Control	-.039	.223	.030	1	.862	.962	.622	1.489
Constant	-6.241	.608	105.502	1	.001*	.002		

Note: * Indicates significance ($p < .05$). LL=Upper Limit, UL=Lower Limit
 Nagelkerke $R^2 = .462$
 Cox & Snell $R^2 = .298$

Lastly, a forward-stepwise logistic regression was also conducted using AmED use as the dependent variable and behavioral intention and attitude as the two independent variables. This stepwise method also revealed a significant model as well ($p < .05$) with a Nagelkerke $R^2 = .458$, also explaining 45.8% of the variance for the last step in the model, and it also correctly classified 78.7% of the participants. The Hosmer-Lemeshow test revealed a test statistic of .204, indicating that the model was a good fit. Results for this model are reported below in Table

Table 4.7

Stepwise Logistic Regression for Association Between TPB Constructs and AmED Consumption in the Last 30 Days

	β	SE	χ^2_{Wald}	df	p	OR	Odds 95% CI	
							LL	UL
Behavioral Intention	.985	.152	41.709	1	.001	2.677	1.986	3.610
Attitude	1.145	.175	43.017	1	.001	3.142	2.231	4.423
Constant	-5.701	.465	150.613	1	.001	.003		

Note: * Indicates significance ($p < .05$). LL=Upper Limit, UL=Lower Limit

Nagelkerke $R^2 = .458$

Cox & Snell $R^2 = .295$

Research Question #3

Are the demographic variables of age, sex, race, class year, place of residence, and fraternity or sorority membership associated with AmED consumption?

Bivariate analyses. Table 4.8 displays the bivariate analyses results by categories, including gender, race, class year, place of residence, and Panhellenic affiliation. The resulting data indicated that 21.3% of the 605 students had engaged in AmED consumption in the last 30 days prior to survey administration. Bivariate results did not identify a statistically significant difference in AmED consumption by gender (males 26.1% vs. females 20.0%), race (White 22.8% vs. 15.4% non-White %), or place of residence (on campus 17.1% vs. off campus 23.0%). However, these analyses did identify a statistically significant group differences in AmED consumption for class year (1st year undergraduate 13.4% vs. 2nd year undergraduate 11.4% vs. 3rd year undergraduate 23.9% vs. 4th year undergraduate 25.6% vs. 5th year undergraduate or more plus other 36.8%), ($p < .05$) and Panhellenic affiliation (Yes 25.7% vs. No 18.2%).

Table 4.8

Bivariate Associations for AmED Consumption in the Last 30 days

Independent Variables (IV)		Yes to AmED <i>n</i> (IV%)	No to AmED <i>n</i> (IV%)	χ^2	<i>p</i>
Race				3.1777	.075
	White	110 (22.8%)	372(77.2%)		
	Non-White	19 (15.4%)	104(84.6%)		
Gender				2.338	.126
	Male	36 (26.1%)	102(73.9%)		
	Female	92 (20.2%)	368(61.5%)		
Class Year				21.114	.001*
	1st year undergraduate	16 (13.4%)	103(86.6%)		
	2nd year undergraduate	12 (11.4%)	93(88.6%)		
	3rd year undergraduate	37 (23.9%)	118(76.1%)		
	4th year undergraduate	43 (25.6%)	125(74.4%)		
	5th year undergraduate and Other	21 (36.8%)	36(63.2%)		
Panhellenic Affiliation				4.936	.026*
	Yes	62 (25.7%)	179(74.3%)		
	No	66 (18.2%)	297(81.8%)		
Place of Residence				2.564	.109
	On Campus	30 (17.1%)	145(82.9%)		
	Off Campus	99(23%)	331(77%)		

Note: IV% represents percent of independent variable's group

* Indicates significance ($p < .05$).

Multivariate analyses. Additionally, to determine if the demographic variables of age, sex, race, class year, and Panhellenic affiliation were associated with AmED use while adjusting for all other variables in the model, all-inclusive logistic regression analyses as well as a stepwise logistic regression analyses were performed. The all-inclusive logistic regression analysis was performed using AmED use as the dependent variable, and the demographic variables as the predictor variables. This model (n=605) was found to be significant ($p < .05$), with a Nagelkerke $R^2 = .075$, explaining 7.5% of the variance, and correctly classified 78.6% of the study participants. The Hosmer-Lemeshow test displayed a test statistic of .064, indicating that this model was marginally a good fit. In other words, as the Hosmer-Lemeshow test statistic gets closer to 1, it indicates a better fit of the logistic regression model; .064 is not much greater than .05, indicating a marginally good fit. In this particular model, the demographic predictor of class year, was not significant ($p > .05$). Furthermore, Panhellenic affiliation was marginally significant ($p = .049$). Fraternity or sorority members were 1.551 times more likely to engage in AmED consumption in the last 30 days, compared to those that were not members of a fraternity or sorority (95% CI=1.002-2.401) The results of this analysis are displayed in Table 4.9, below.

Table. 4.9

All-Inclusive Logistic Regression of Demographic Variables and Association of AmED Consumption in the Last 30 Days

	β	SE	χ^2_{Wald}	df	p	OR	Odds 95% CI	
							LL	UL
Class Year	---	---	7.341	4	.119	---	---	---
1st year undergraduate	-1.219	.727	2.811	1	.094	.295	.071	1.229
2nd year undergraduate	-1.523	.590	6.661	1	.010*	.218	.069	.693
3rd year undergraduate	-.557	.424	1.728	1	.189	.573	.250	1.315
4th year undergraduate	-.450	.371	1.468	1	.226	.638	.308	1.320
5th year undergraduate and Other	---	---	---	1	---	---	---	---
Panhellenic Affiliation				1				
Yes	.439	.223	3.883	1	.049*	1.551	1.002	2.401
No	---	---	---	1	---	---	---	---
Place of Residence				1				
On Campus	-.033	.313	.011	1	.917	.968	.524	1.788
Off Campus	---	---	---	1	---	---	---	---
Age	-.001	.140	.000	1	.992	.999	.759	1.314
Gender								
Male	.392	.240	2.663	1	.103	1.481	.924	2.372
Female	---	---	---	1	---	---	---	---
Race								
White	.162	.299	.294	1	.588	1.176	.654	2.114
Non-White	---	---	---	1	---	---	---	---
Constant	-.982	3.155	.097	1	.756	.375	---	---

Note: * Indicates significance ($p < .05$). LL=Upper Limit, UL=Lower Limit

Nagelkerke $R^2 = .075$

Cox & Snell $R^2 = .049$

Subsequently, a stepwise logistic regression model was also conducted, with AmED use defined as the dependent outcome variable. This model (n=605) was found to be significant ($p < .05$), with a Nagelkerke $R^2 = .068$ for the second, and final step, in the model, explaining very little of the variance, (only 6.8%). The model correctly classified 78.6% of the study participants. The Hosmer-Lemeshow test displayed a test statistic of .433, for the last step in the model, indicating that this model was a good fit. In this model, class year and fraternity or sorority membership were the significant demographic predictors of AmED consumption in the

last 30 days prior to survey administration ($p < .05$). More specifically, being classified as a first or second year undergraduate was a significant predictor and was inversely related to AmED consumption in the last 30 days.

First year undergraduate students were .263 times as likely (less likely) to engage in AmED consumption (95% CI= .123-.562) in the last 30 days when compared to the referent category (those students that were classified as fifth year undergraduate students or greater). Additionally, those students that were classified as second year undergraduates were .200 times as likely to engage in AmED consumption in the last 30 days prior to survey administration when compared to the referent category (95% CI= .087-.458). In addition respondents classified as a third year undergraduate student were .515 times as likely (less likely) than students in other classifications to engage in AmED consumption in the last 30 days, when compared to those who were distinguished as being 1st year undergraduates. However, this finding relating to third year undergraduate students was just marginally significant ($p = .048$). Classifications for fourth year undergraduate students were not significant.

For Panhellenic affiliation, members of a fraternity or sorority were 1.569 times more likely to engage in AmED consumption compared to those that were not affiliated with a Greek organization ($p < .05$), (95% CI=1.047-2.350). Table 4.10 below, displays results from the stepwise logistic regression analyses.

Table. 4.10

Step Two of Stepwise Logistic Regression of Demographic Variables and Association of AmED Consumption in the Last 30 Days

	β	SE	χ^2_{Wald}	df	p	OR	Odds 95% CI	
							LL	UL
Class Year	---	---	20.347	4	.001*			
1st year undergraduate	-1.304	.387	11.921	1	.001*	.263	.123	.562
2nd year undergraduate	-1.610	.423	14.463	1	.001*	.200	.087	.458
3rd year undergraduate	-.664	.336	3.897	1	.048*	.515	.266	.995
4th year undergraduate	-.580	.330	3.088	1	.079	.560	.293	1.069
5th year undergraduate and Other	---	---	---	1	---	---	---	---
Panhellenic Affiliation				1				
Yes	.450	.206	4.765	1	.029*	1.569	1.047	2.350
No	---	---	---	1	---	---	---	---
Constant	-.695	.286	5.909	1	.015*	.499	---	---

Note: * Indicates significance ($p < .05$). LL=Upper Limit, UL=Lower Limit, 1st year undergraduate is the reference category

Nagelkerke $R^2 = .068$

Cox & Snell $R^2 = .044$

Research Question #4

How are the combinations of TPB constructs and demographic variables predictive of AmED consumption among undergraduate college students?

To determine how the combinations of both TPB constructs and demographic variables were predictive of AmED, an all-inclusive logistic regression model was created, with AmED use as the dependent variable. The independent variables were previously determined significant predictors, which consisted of class year, Panhellenic affiliation, attitudes, and behavioral intention. This model ($n=605$) was found to be significant ($p < .05$) with a Nagelkerke $R^2 = .504$ explaining 50.4% of the variance in the model. The model correctly classified 87.2% of the study participants. The Hosmer-Lemeshow test displayed a test statistic of .327, indicating that this model was a good fit. In this model, class year, attitudes, and behavioral intention were all

significant predictors of AmED consumption in the last 30 days prior to survey administration ($p < .05$), whereas Panhellenic affiliation was no longer significant. More specifically, being classified as a first year or second year undergraduate classification were significant predictors and were inversely related to AmED consumption in the last 30 days. Furthermore, the other classification of third year undergraduate was marginally significant. First year undergraduate students were .187 times as likely to engage in AmED consumption in the last 30 days when compared to those students when compared to the referent category (those students that were classified as fifth year undergraduate or more) (95% CI= .072-.490). Additionally, those students that were classified as second year undergraduates were .110 times as likely to (95% CI= .038-.315) to engage in AmED in the last 30 days when compared to the referent category. Third year undergraduates were .190 times as likely to engage in AmED consumption in the last 30 days when compared to the referent (95% CI=.190-.984).

In regards to theoretical predictors, both attitude and behavioral intention remained significantly associated with AmED consumption ($p < .05$). Furthermore, for each one-unit increase in attitudes, the odds of engaging in AmED increased by 3.351 times (95% CI=2.334-4.812). Also, with each one unit increase in behavioral intention scores, the odds of increasing in AmED consumption increased by 2.753 times (95% CI=2.018-3.757). These findings are depicted below, in Table 4.11.

Table 4.11

Logistic Regression of Previously Determined Significant Demographic and Theoretical Predictors and Association with AmED Consumption in the Last 30 Days.

	β	SE	χ^2_{wald}	df	p	OR	Odds 95% CI	
							LL	UL
Class Year	---	---	22.020	4	.001*	---	---	---
1st year undergraduate	-1.675	.491	11.6521	1	.001*	.187	.072	.490
2nd year undergraduate	-2.207	.537	16.885	1	.001*	.110	.038	.315
3rd year undergraduate	-.840	.420	3.998	1	.046*	.432	.190	.984
4th year undergraduate	-.709	.417	2.885	1	.089	.492	.217	1.115
5th year undergraduate and Other	---	---	---	1	---	---	---	---
Panhellenic Affiliation		.262	2.988		.083	1.575	.942	2.634
Yes	.454							
No								
Attitude	1.209	.185	42.948	1	.001*	3.351	2.334	4.812
Behavioral Intention	1.013	.159	40.800	1	.001*	2.753	2.018	3.757
Constant	-5.109		78.178		.001*	.006	---	---

Note: * Indicates significance ($p < .05$). LL=Upper Limit, UL=Lower Limit

Nagelkerke $R^2 = .500$

Cox & Snell $R^2 = .323$

Research Question #5

Does behavioral intention mediate the effect of attitudes, subjective norms, and perceived behavioral control on AmED consumption in the last 30 days?

According to Baron and Kenny (1986), as outlined above, the steps involving mediation are all the same, regardless of what statistical method was used. In this case, the researcher first demonstrated that attitudes and subjective norms, are associated with AmED consumption by conducting a logistic regression analysis (Table 4.12). Perceived behavioral control was not associated with AmED consumption when controlling for the effects of the other variables. This step established that there are effects that may be mediated for attitudes and subjective norms, but not perceived behavioral control. Second, the researcher showed that behavioral intention is

associated with the outcome variable, AmED consumption. This analysis was conducted in a logistic regression model shown above (refer to table 4.6). It is not enough to simply associate the mediator with the outcome, one must control for the effect of the initial variable in establishing the effect of the mediator and the outcome variable. Third, a correlation analysis was conducted in order to explore significance between the initial variables, attitudes and subjective norms and the mediator, which was behavioral intention (Table 4.13). Finally, those theoretical predictors that were significant in the correlation analysis were included in a final all-inclusive bivariate logistic regression model (Table 4.14). In this case, subjective norms, behavioral intention, and attitudes were included as predictor variables and AmED consumption in the last 30 days was the outcome variable. When making comparisons to the initial logistic regression model that was conducted, results do indicate that behavioral intention is a mediating variable for the effect of subjective norms on AmED consumption in the last 30 days due to the reduction in odds ratios and in change in p-value. Furthermore, results also show that behavioral intention is a partial mediator for the effect of attitudes on AmED consumption in the last thirty days. In this case, because both of the logistic regression models that were used for this analysis reflect a significance value of $p = .001$, odds ratios were used to assess mediation in regards to attitudes. Because the odds ratios were reduced, one can assume partial mediation for the effect of attitudes on AmED consumption in the last 30 days.

Table 4.12

Logistic Regression Establishing Significance between TPB Constructs and AmED Consumption in the Last 30 Days

	β	<i>SE</i>	χ^2_{Wald}	<i>df</i>	<i>p</i>	<i>OR</i>	<i>Odds 95% CI</i>	
							<i>LL</i>	<i>UL</i>
Subjective Norms	.593	.244	5.895	1	.015*	1.809	1.121	2.920
Attitudes	1.439	.172	70.292	1	.001*	4.218	3.013	5.905
Perceived Behavioral Control	.071	.198	.130	1	.719	1.074	.729	1.582
Constant	-6.275	.600	109.243	1	.001*	.002	---	---

Note: * Indicates significance ($p < .001$). *LL*=Upper Limit, *UL*=Lower Limit

Nagelkerke $R^2 = .385$

Cox & Snell $R^2 = .249$

Table 4.13

Correlation Matrix of Significant TPB Constructs and Behavioral Intention

Correlations

		Attitudes	Social Norms	Behavioral Intention
Attitudes	Pearson Correlation	1	.535**	.564**
	Sig. (2-tailed)		.000	.000
Social Norms	Pearson Correlation	.535**	1	.415**
	Sig. (2-tailed)	.000		.000
Behavioral Intention	Pearson Correlation	.564**	.415**	1
	Sig. (2-tailed)	.000	.000	

** . Correlation is significant at the 0.01 level (2-tailed).

Table 4.14

Final Logistic Regression Establishing Significance between TPB Constructs, Including Behavioral Intention, and AmED Consumption in the Last 30 Days

	β	<i>SE</i>	χ^2_{Wald}	<i>df</i>	<i>p</i>	<i>OR</i>	<i>Odds 95% CI</i>	
							<i>LL</i>	<i>UL</i>
Subjective Norms	.593	.243	2.389	1	.122	1.457	.904	2.348
Attitudes	1.439	.185	31.472	1	.001*	2.827	1.966	4.064
Behavioral Intention	.071	.154	38.427	1	.001*	2.590	1.917	3.500
Constant	-6.275	.601	108.173	1	.001*	.002	---	---

Summary

In conclusion, this study examined whether TPB constructs (Ajzen, 1991) predict AmED consumption among college undergraduates. The study also estimated the prevalence of AmED consumption and provided a better understanding of the theoretical and demographic variables associated with AmED consumption among a large sample of college undergraduates at a large public university in the Southeastern United States. More specifically, with constructs of the TPB as the basis for analysis, univariate analyses showed that the TPB constructs of attitudes, behavioral intention, subjective norms and perceived behavioral control were all significant predictors of AmED consumption in the last 30 days. However, multivariate analyses, conducted through a logistic regression model, showed that behavioral intention and attitudes predicted AmED consumption in the last 30 days prior to survey administration when controlling for all other variables in the model. In addition, bivariate associations found that class year and Panhellenic affiliation were significantly associated with the outcome. However, results of the final logistic regression model revealed that only the demographic variable of class year also played a significant role in predicting AmED behavior in the last 30 days. Lastly, results from

the mediation analyses revealed that behavioral intention is a mediator for the effect of subjective norms on AmED consumption in the last 30 days. Additionally, behavioral intention is also a partial mediator for the effect of attitudes on AmED consumption in the last 30 days.

CHAPTER V

DISCUSSION

The purpose of this study was two fold. First, this research estimated the prevalence of AmED consumption. Second, it was designed to elucidate correlates of AmED consumption among a large sample of college undergraduates located at the University of Alabama, a large public university in the southeastern U.S.

Until now, a theoretical framework had not been applied to the study of AmED consumption among college students. Thus, in order to contribute to the small body of current literature, this investigation utilized the TPB to develop an instrument that was intended to explore AmED consumption among college undergraduates. The survey was created via modification of an existing instrument. The resulting survey determined the degree to which attitudes, subjective norms, intentions, and perceived behavioral control explain an individual's decision to consume AmED. In addition, this survey identified prevalence rates and demographic correlates associated with AmED consumption. Previously published literature on AmED consumption among college undergraduates has indicated prevalence rates between 24% and 48.4% (Atilla & Cakir, 2011; O'Brien et al., 2008; Oteri, Salvo, Patrizio Caputi, & Calapai, 2007; Price et al., 2010). The current study expanded findings on AmED consumption among undergraduate students. These results also offered further explication of demographic characteristics associated with the behavior. The results from this study, in combination with the theoretical findings, added to the existing literature and could be of use to public health professionals in determining methods to reduce this phenomenon on college campuses.

Research Questions

Research Question #1

What are the prevalence rates, in the last 30 days, for AmED use, ED use only, and alcohol use only among undergraduate students aged 18-24?

Prevalence was calculated by dividing the total number of subjects who endorsed AmED consumption by the total number of eligible respondents.

AmED Use among College Undergraduates

Results from these analyses partially support and extend previous findings on AmED consumption among college undergraduates. In this sample, the 21.3% prevalence of AmED consumption in the last 30 days prior to administration of the survey was slightly lower than the range of 24% to 48.4% reported in previous investigations of the behavior (Atilla & Cakir, 2011; O'Brien et al., 2008; Oteri, Salvo, Patrizio Caputi, & Calapai, 2007; Price et al., 2010). Although the majority of this sample is female (76%), this discrepancy in prevalence rates cannot be explained by the skewness of this sample. The fact that the sample is mostly female is, most likely, due to the limitations of using a convenience sample within CHES. The majors that are offered within this particular college, such as health science and fashion merchandising, are heavily comprised of females. Rather, the discrepancy in prevalence rates may be due to the fact that AmED consumers in this study are defined out of a total sample of students. Previous literature in the area defines AmED consumers in two ways; either those that consume AmED out of a total sample of students or out of those who only consume alcohol (Brache & Stockwell 2011; O'Brien 2008). Further examination intended to investigate these discrepancies in prevalence rates is certainly warranted.

Additionally, this study also examined prevalence rates for alcohol use only (79%) and ED use only (31.6%). Rates for alcohol use only are surprisingly consistent with what is reported in the college alcohol literature. Results from the most recent CORE survey report a prevalence rate of 68.8% for students reporting to engaging in alcohol consumption in the 30 days prior to survey administration (Presley, 2009). Furthermore, a study examining sorority alcohol consumption (Huchting et al., 2008) indicated that an astounding 91.9% of college students had participated in sorority alcohol consumption in the past month. The prevalence rates for this particular sample do fall within that range. Although univariately significant, Panhellenic affiliation was not a significant predictor of AmED consumption in multivariate analyses, in contrast to the existing literature (O'Brien et al., 2008).

A potential explanation for what seems to be a high prevalence of alcohol consumption among a female sample could possibly be explained by the fact that data collection for this study began at the start of football season. Due to the importance given to football on this particular college campus, and its association with college alcohol consumption, there is a possibility that college students consumed greater amounts of alcohol during this period of data collection when compared to other time periods during the school year. A longitudinal analysis, or time series design, that is able to assess differences between time periods is certainly needed.

In relation to ED consumption alone, the 31.6% prevalence rate among this particular sample is actually a bit lower than what is reported in the literature. Although the research in this area is limited, evidence highlights that college students represent the principal target population for energy drink marketing (Heckman, Sherry, & Gonzalez de Mejia, 2010). Although national studies do not currently investigate the prevalence of ED use among college students, regional efforts have documented that the past-month prevalence of ED consumption among college

students ranges from 39% to 57% (Malinauskas et al., 2007; Miller, 2008b; Oteri et al., 2007). These studies suggest that discrepancies in prevalence rates are largely attributable to school location as well as the demographics of the college or university (Malinauskas et al., 2007; Miller, 2008b; Oteri et al., 2007). The highest prevalence of ED consumption was found in Italy (Ferreira et al., 2006). The highest prevalence of ED consumption within the U.S. occurs in the Southeastern region among White males. This aforementioned finding concerning White males and ED consumption may be a potential explanation behind the lower prevalence rates among this particular college sample, as this particular sample was mostly female. Further research to examine gender differences and prevalence rates for ED consumption is certainly needed, while utilizing a more representative college sample.

Research Question #2

Are the theoretical variables of attitudes, subjective norms, behavioral intentions, and perceived behavioral control associated with AmED consumption?

This study addressed possible associations of theoretical constructs through the application of quantitative methods. The premise of this question was to address the influence of the constructs of the TPB on AmED consumption in the 30 days prior to survey administration. Because theory-based studies of AmED consumption had not been conducted previously, this study made a novel contribution to existing literature.

In the first set of analyses, four separate logistic regression models were conducted in order to examine the univariate significance of each theoretical construct. Results did indicate that all of the theoretical predictors of behavioral intention, attitudes, subjective norms, and perceived behavioral control were significant predictors of AmED consumption when incorporated into four separate bivariate logistic regression models.

Second, logistic regression analyses were used to determine the ability of theoretical variables to predict AmED consumption in the last 30 identified several key findings. In the final model, both behavioral intention and attitudes were predictors of AmED consumption in the 30 days prior to survey administration but perceived behavioral control and subjective norms did not remain significant predictors of the behavior. The lack of a significant association between perceived behavioral control and AmED consumption could be due to overlap or the fact that perceived behavioral control was also correlated with the other TPB constructs in the model. Although inconsistent with the assumptions of the TPB itself, perceived behavioral control may not be a significant predictor of AmED consumption in the last 30 days for a variety of potential reasons. Perhaps college students represented in this sample do not actually want to control their AmED intake. Azjen (1991) proposed that low perceived behavioral control is such a strong determinant of behavior that it can override a person's attitude and perceived social norms, but that was not the case in this sample. Studies using the TPB to examine heavy episodic drinking in college undergraduates found that attitudes, but not subjective norms significantly predicted baseline intention, and intention and past heavy episodic drinking did predict future episodic drinking (Collins et al., 2007). However, the study did not elaborate on findings related to perceived behavioral control and heavy episodic drinking in college students. Future examinations, including qualitative studies, that explore the relationship between perceived behavioral control and AmED consumption are needed.

Although univariately significant, this study did not find that subjective norms were significantly related to AmED consumption in multivariate analyses, when adjusting for other variables in the model. However, mediation analyses (research question #5) revealed that the effect of subjective norms on AmED consumption is completely mediated by behavioral

intentions, consistent with the propositions of the TPB. This mediation explains the lack of a direct association with AmED consumption.

Findings related to behavioral intention are consistent with Azjen (1991), who proposed that having greater positive intentions towards performing the behavior under study increases the likelihood of actually engaging in the behavior. Those students who reported greater intentions to consume AmED consumption in the next 30 days were more likely to actually consume AmED in the 30 days prior to survey administration. These findings related to behavioral intention do not differ from the original proposition of the TPB. The TPB states that behavioral intention is an individual's readiness to perform a given behavior and is assumed to be an immediate antecedent of behavior (Azjen, 1991). The cross-sectional nature of the present study and the way AmED use was operationalized did not allow for the assessment of future behavior. This study does indicate that those undergraduate students who reported greater intentions to consume AmED in the next thirty days were also those that were more likely to consume AmED in the 30 days prior to survey administration. Including past behavior in the TPB model may improve the prediction of future behavior, but this modification has engendered controversy (Collins et al., 2007). The debate regarding the role of past behavior in TPB models typically centers on challenges defining the past behavior construct and including a significant, but atheoretical predictor of future behavior (Collins et al., 2007; Oulette & Wood, 1998).

The TPB is based on attitude toward the behavior, subjective norm, and perceived behavioral control. Azjen (1991) also stated that a favorable intention produces the behavior only when perceived behavioral control is strong. Although perceived behavioral control was not a significant predictor in this study, behavioral intentions were still associated with the behavior.

Findings for attitudes were consistent with Azjen (1991). Students who reported having more positive attitudes about AmED consumption were more likely than those with less positive attitudes to report AmED consumption in the last 30 days.

Research Question #3

Are the demographic variables of age, sex, race, class year, place of residence, and fraternity or sorority membership associated with AmED consumption?

The purpose of this question was to address the influence of demographic variables in predicting AmED consumption of undergraduate students in the last 30 days. This question built on previous work examining demographics in predicting this behavior (Brache & Stockwell 2011; O'Brien et al., 2008).

First, bivariate associations indicated that 21.3% of the 605 students had engaged in AmED consumption in the last 30 days prior to survey administration. Bivariate results did not identify a statistically significant difference in AmED consumption by gender (males 26.1% vs. females 20.0%), race (White 22.8 % vs. 15.4% non-White %), and place of residence (on campus 17.1% vs. off campus 23.0%). However, these analyses did identify statistically significant group differences in AmED consumption for class year (1st year undergraduate 13.4% vs. 2nd year undergraduate 11.4% vs. 3rd year undergraduate 23.9% vs. 4th year undergraduate 25.6% vs. 5th year undergraduate or more plus other 36.8%, $p < .05$) and Panhellenic affiliation (Yes 25.7% vs. No 18.2%).

Logistic regression analyses confirmed the association between class rank and Panhellenic affiliation with AmED consumption in the 30 days prior to survey administration, while adjusting for all other variables in the model. In fact, class rank was the strongest demographic predictor of AmED use among college undergraduates. More specifically, first or

second year undergraduate status was most strongly (inversely) associated with AmED consumption in comparison to 5th year undergraduate students or higher, which were included in the analysis. Prior research has not widely examined the relationship between class rank and AmED consumption. The association between Panhellenic affiliation and AmED consumption remained consistent with the existing literature. However, further exploration of relationships between class rank, Panhellenic affiliation, and AmED consumption among college undergraduates is warranted.

Research Question #4

How are the combinations of TPB constructs and demographic variables predictive of AmEd consumption among undergraduate college students?

Logistic regression analyses were used to address the relationship of various demographic and TPB factors to AmED consumption. An all-inclusive regression model using predictors of class rank, Panhellenic affiliation, attitudes, and behavioral intention revealed that class rank, behavioral intention and attitudes remained significant in predicting AmED use in the 30 days prior to survey administration. When compared to the previous analyses that had been conducted, Panhellenic affiliation was no longer significant.

These findings are not entirely consistent with the literature. Previous research has indicated a significant association between Panhellenic affiliation and AmED use (O'Brien et al., 2008), whereas the present study did not find this to be the case despite the fact that nearly 40% of the study sample were members of a fraternity or sorority. Furthermore, seminal studies in the college alcohol literature such as the Harvard CAS (Wechsler, 1998) and the CORE Institute Survey (Presley et al., 2009) have also found positive associations between Panhellenic affiliation and alcohol consumption. Further research exploring the relationship between

fraternity and sorority membership and AmED consumption among college undergraduates is needed.

Results indicated that class rank remained a significant predictor of AmED use in the last 30 days prior to survey administration. More specifically, first year or second year undergraduate rank had the strongest negative association with AmED use while third year undergraduate status was marginally negatively associated with the outcome when compared to the referent category (fifth year or higher). The relationship between class rank and AmED consumption among undergraduate students has not been widely explored, but there are multiple factors that may contribute to this association. It is possible that this inverse association may be a result of being under the legal drinking age of 21 until a student reaches their senior year of college. Although place of residence was not a significant predictor, respondents who lived off campus reported higher rates of AmED consumption as compared to students who lived on campus. Further research examining relationships between class rank and AmED consumption among college undergraduates is also necessary.

Research Question #5

Does behavioral intention mediate the effect of attitudes, subjective norms, and perceived behavioral control on AmED consumption in the last 30 days?

To assess the role of behavioral intention as a possible mediating variable for the effect of attitude, subjective norms, and perceived behavioral control on AmED consumption in the last 30 days, a mediation analysis within a logistic regression model was conducted. Perceived behavioral control was thrown out of the meditational analysis, at the first step, due to failure to establish an association with the outcome variable, AmED consumption. Findings revealed that behavioral intention did mediate the effect of subjective norms on AmED consumption in the last

30 days. Additionally, behavioral intention was also a partial mediator for the effect of attitudes on AmED consumption in the last 30 days. These results were mostly consistent with previous findings reported in the literature, which have indicated that behavioral intention is a mediator of attitudes toward heavy episodic drinking (Collins, Witkiewitz, and Larimer 2011). Overall, results of this mediation analyses indicate that behavioral intention can be explained as the mechanism by which subjective norms is related to AmED consumption in the last 30 days. Additionally, behavioral intention could also partially explain the mechanism by which attitudes are related to AmED consumption in the last 30 days.

Somewhat similar to the aforementioned findings, results from a previous study exploring the TPB and sorority alcohol consumption found that behavioral intention was a total mediator of the effects of attitudes and subjective norms on sorority alcohol consumption. Also, perceived behavioral control was not a predictor for intentions in this particular study (Huchting et al., 2008). The fact that behavioral intention was a total mediator for the effect of subjective norms on AmED consumption is consistent with the literature in the area as well as the theory itself. The importance of the role of peer influences among college students and need to fit in with their referent group typically is an important factor in regards to college alcohol consumption. In fact, existing studies are actually in support of social norms being one of the greatest predictors of alcohol use (Neighbors, Lee, Lewis, Fossos, and Larimer, 2007). The current study confirms that subjective norms and attitudes predict AmED use through behavioral intention. This particular finding is consistent with the TPB. Further studies are warranted in order to gain a greater understanding of the association between social norms and AmED consumption.

The TPB proposes that behavioral intention is in fact, a predictor of future behavior. The TPB is a causal model, and due to the cross-sectional nature of this study, causal inferences

cannot be made. There are various assumptions for causality that were not met due to the cross-sectional design of this study. One must establish that the predictor variables are correlated with the outcome; that the associations with the outcome are not a result of confounding variables, and that there is a temporal order such that the predictor variables occur before the outcome variable (Cozby, 2011). A cross-sectional design is not the best way to examine the utility of the TPB since current intentions should predict future behavior. Furthermore, in this study, the behavior was defined as AmED consumption in the last 30 days prior to survey administration. As a result, further longitudinal research that explores mediating relationships, as well as differences in time periods, in regards to AmED consumption are also needed. For instance, one may choose to examine AmED consumption over the course of a one-year period, at three-month intervals instead of simply looking at the behavior at one point in time.

Limitations

There were several limitations that should be acknowledged regarding this research. First, students self-reported their use of alcohol mixed with energy drinks (AmED). Self-report data is subject to recall bias as well as underreporting (e.g., due to social acceptability bias). Because AmED is illegal for persons younger than 21 years of age, respondents in the current study may have been unwilling to provide an honest and accurate account of this behavior. To increase the probability that these students would provide truthful responses, study participants were provided anonymity and asked to refrain from providing any identifiable information on survey forms. Although presenting students with anonymity increased their likelihood of providing truthful responses, their self-reports could not be validated. Despite the limitations of self report, this method has been widely adopted by researchers exploring alcohol use, energy drink use, and AmED consumption among college students (Boyle & Castillo, 2007; Brache & Stockwell,

2011; Malinauskas, Aeby, Overton, Carpenter-Aeby, and Barber-Heidal, 2007; O'Brien, McCoy, Rhodes, Wagoner & Wolfson, 2008; Presley, 2009).

Second, the cross-sectional design of this study limited the inferences that could be made regarding AmED consumption behaviors. Cross-sectional studies can obtain data from only one particular point in time and one could only assess AmED consumption at one point in time. Ideally, studies of AmED consumption should adopt a time series design that can discern trends over the course of an academic semester, year, or career. Furthermore, a time series design would also allow for exploration of the utility of the TPB. One would be able to examine if TPB constructs, do in fact, predict future behavior. Because this study employed a cross-sectional study design, trends in AmED use over the course of a semester, as well as definitive conclusions regarding the utility of the TPB, could not be identified. The TPB model calls for examination of how current attitudes, subjective norms, and perceived behavioral control influence intentions to engage in a particular behavior and then how those intentions predict engaging in a given behavior.

Third, this sample was limited to students from one large public university in the Southeastern United States. For this reason, the findings may not be generalizable to the total population of undergraduate students in the United States between the ages of 18 and 24. Possibly as a result of this limitation, prevalence of AmED in this sample did not fall within the spectrum of rates in the published literature (Atilla & Cakir, 2011; O'Brien et al., 2008; Oteri, Salvo, Patrizio Caputi, & Calapai, 2007; Price et al., 2010).

The fourth limitation of this study is that a convenience sampling was utilized. Recruitment efforts for this study were limited to one college within the university at which the research took place. Furthermore, the final sample had a greater representation of female and

Panhellenic affiliated students than the university community overall. Therefore, this limitation also affects the generalizability of study results to the larger undergraduate population. Although random sampling is a much-preferred method, convenience sampling is not uncommon for studying this particular behavior (Brache & Stockwell, 2011).

Study Implications

Results of the current study in regard to AmED consumption in the last 30 days identified associations that can be incorporated into best practices for college health educators as well as other university professionals. First, findings of the study indicated students in lower class years were less likely than those in their 5th year or higher to consume AmED. Those working on university campuses could develop programs aimed at raising awareness of AmED consumption among undergraduate students. Outcomes of this study could also aid university professionals and health educators in tailoring health intervention messages to specific subpopulations that are deemed to be more at risk for engaging in AmED consumption. For example, information could be created to change attitudes associated with AmED behavior among those undergraduate students that are classified as being in their second year of college. Although, second year students were less likely to engage in AmED consumption, when compared to fifth year undergraduates or more, they were still more likely to engage in AmED consumption when compared to first and third year undergraduates.

Second, positive attitudes and intentions toward AmED were also associated with higher rates of actual AmED consumption in the last 30 days. Attitudes are influenced by beliefs about a particular behavior (Ajzen, 1991). This finding indicates that public health professionals could devise programs that are focused on targeting the dangers of AmED consumption.

Furthermore, results from the pilot study that was conducted to develop the survey instrument used in this study indicate that college students are engaging in AmED consumption both at home as well as in bars. Underage students may be more likely to drink at home than in bars. For a health educator, these pilot study findings have serious implications. For instance, one may decide to focus on preventive efforts related to AmED consumption prior to when an undergraduate student actually turns 21. In this case, implementation of programs targeted at college students that are younger than 21 may be efficacious. In addition to early preventive efforts, health educators may also design programs that are specifically tailored to those individuals that are 21 and older and their AmED consumption patterns.

Finally, study results indicated some usefulness of the TPB framework to explain AmED consumption. Although all TPB constructs were significantly associated with AmED behavior in univariate analyses, only behavioral intention and attitudes were significant predictors after controlling for the effects of the other variables. Additionally, results from mediation analyses showed that behavioral intention is a complete mediator for the effect of subjective norms on AmED consumption and is also a partial mediator for the effect of attitudes on AmED consumption in the last 30 days. The results of this study imply that further research is warranted to determine the ability of TPB constructs to predict AmED consumption among college undergraduates and to use the theory as a basis for intervention.

Future Research

Future research is warranted in several areas related to AmED consumption among undergraduate college students. First, the current study represents the first attempt to establish reliability of a newly modified survey instrument. Alterations to a combination of two previously validated instruments were made. As a result, a second examination of this survey is warranted.

Data obtained from this second examination should be used to further validate the reliability of the modifications.

Second, further research related to AmED consumption among undergraduate students is necessary. The present investigation was the first of its kind, using the TPB to examine AmED behavior. A replication of this study would assist in determining the theory's usefulness as a framework to explain this behavior. Investigation of AmED behavior should incorporate other health behavior models as well. Such studies would advance the knowledge behind the contextual factors related to this behavior and possibly illuminate additional avenues to reduce the prevalence of AmED consumption on college campuses.

Third, the majority of current literature has examined AmED behavior by cross-sectional data-collection methods. In these studies, college students have consistently reported recreational reasons, or the desire to stay up longer to party, as a significant motivation for consuming AmED. Therefore, future research implementing a longitudinal or time series design is warranted. Additionally, the need for studies examining past behavior as it relates to the TPB also provides a rationale for the need for longitudinal examinations. Use of this type of methodology would identify peak times during the academic year in which students may chose to engage in this behavior. Results of such studies would allow for the development of policies and health education efforts targeted to reduce this behavior.

Finally, although current research has explored consumption of ED alone among subgroups of college students, there is no similar literature regarding AmED consumption. Studies examining special populations, such as college athletes, are needed in order to understand the relationship between AmED and specific types of college students.

Conclusions

In sum, results from logistic regression analyses found that TPB constructs of behavioral intention and attitude were significant predictors ($p < .05$) of AmED consumption among undergraduate college students, but perceived behavioral control was not. Results from mediation analyses showed that that behavioral intention is a complete mediator for the effect of subjective norms on AmED consumption and is also a partial mediator for the effect of attitudes on AmED consumption in the last 30 days. Demographic variables of age, sex, and Panhellenic affiliation also did not predict AmED consumption, but class year did.

The primary strength of this study was its application of theory to better understand AmED use among college undergraduates. Findings from this study have implications for future intervention development aimed at targeting preventive efforts among college populations.

REFERENCES

- American Psychological Association. (2000). *Diagnostic and Statistical Manual of Psychiatric Disorders* (4th ed.). Washington DC: American Psychological Association.
- Arria, A. M., Caldeira, K. M., Kasperski, S. J., O'Grady, K. E., Vincent, K. B., Griffiths, R. R., et al. (2010). Increased alcohol consumption, nonmedical prescription drug use, and illicit drug use are associated with energy drink consumption among college students. *Journal of Addictive Medicine, 4*(2), 74-80.
- Arria, A. M., Caldeira, K. M., Kasperski, S. J., Vincent, K. B., Griffiths, R. R., & O'Grady, K. E. (2011). Energy drink consumption and increased risk for alcohol dependence. *Alcoholism, Clinical and Experimental Research, 35*(2), 365-375.
- Attila, S., & Cakir, B. (2011). Energy-drink consumption in college students and associated factors. *Nutrition, 27*(3), 316-322.
- Ajzen, I. (1985). From Intentions to Actions: a theory of planned behavior. In J Kuhl and J Beckman (EDs.), *Action control: from cognition to behavior* (p. 11-39). New York: Springer.
- Ajzen, I. (1991). The theory of planned behavior: *Organizational Behavior and Human Decision Processes, 50*(2), 179-211.
- Ajzen, I., & Driver, B.L. (1991). Prediction of leisure participation from behavioral, normative, and control beliefs: an application of the theory of planned behavior. *Leisure Science, 13*, 185-204.
- Baron, R. M., & Kenny, D. A. (1986). The moderator-mediator variable distinction in social psychological research: Conceptual, strategic and statistical considerations. *Journal of Personality and Social Psychology, 51*, 1173-1182.
- Barrett, S. P., Darredeau, C., & Pihl, R. O. (2006). Patterns of simultaneous polysubstance use in drug using university students. *Human Psychopharmacology Clinical and Experimental, 21*(4), 255-263.
- Beck, K. H., Kasperski, S. J., Caldeira, K. M., Vincent, K. B., O'Grady, K. E., & Arria, A. M. (2010). Trends in alcohol-related traffic risk behaviors among college students. *Alcoholism, Clinical and Experimental Research, 34*(8), 1472-1478.

- 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*(5), 516-519.
- Boyle M., Castillo, V.D. (2006). Monster on the Loose. *Fortune.*, 154: 116-122.
- Brache, K., & Stockwell, T. (2011). Drinking patterns and risk behaviors associated with combined alcohol and energy drink consumption in college drinkers. *Addictive Behaviors*, *36*(12), 1133-1140.
- Caldeira, K. M., Arria, A. M., O'Grady, K. E., Zarate, E. M., Vincent, K. B., & Wish, E. D. (2009). Prospective associations between alcohol and drug consumption and risky sex among female college students. *Journal of Alcohol and Drug Education*, *53*(2), nihpa115858.
- Collins, S. E., & Carey, K. B. (2007). The theory of planned behavior as a model of heavy episodic drinking among college students. *Psychology of Addictive Behaviors*, *21*(4), 498-507.
- Collins, S. E., Witkiewitz, K., & Larimer, M. E. (2011). The theory of planned behavior as a predictor of growth in risky college drinking. *Journal of Studies on Alcohol and Drugs*, *72*(2), 322-332.
- Cozby, P.C., (2011). *Methods in Behavioral Research*. (11th ed.). New York, NY: McGraw Hill Higher Education.
- Daniel, W.W., (2009). *Biostatistics: A Foundation for Analysis in the Health Sciences*. (9th ed.). Hoboken, NJ: John Wiley & Sons, Inc.
- Engs, R. C., & Aldo-Benson, M. (1995). The association of alcohol consumption with self-reported illness in university students. *Psychological Reports*, *76*(3 Pt 1), 727-736.
- Ferreira, S. E., de Mello, M. T., Pompeia, S., & de Souza-Formigoni, M. L. (2006). Effects of energy drink ingestion on alcohol intoxication. *Alcoholism, Clinical and Experimental Research*, *30*(4), 598-605.
- Ferreira, S. E., Hartmann Quadros, I. M., Trindade, A. A., Takahashi, S., Koyama, R. G., & Souza-Formigoni, M. L. (2004). Can energy drinks reduce the depressor effect of ethanol? An experimental study in mice. *Physiology & Behavior*, *82*(5), 841-847.
- Forbes, S. C., Candow, D. G., Little, J. P., Magnus, C., & Chilibeck, P. D. (2007). Effect of Red Bull energy drink on repeated Wingate cycle performance and bench-press muscle endurance. *International Journal of Sport Nutrition and Exercise Metabolism*, *17*(5), 433-444.

- Gruca, R.A., Norberg, K.E., & Bierut, L.J. (2009). Binge drinking among youth and young adults in the United States: 1979-2006. *Journal of the American Academy of Child and Adolescent Psychiatry, 48*(7), 692-702.
- Hingson, R., Heeren, T., Winter, M. R., & Wechsler, H. (2003). Early age of first drunkenness as a factor in college students' unplanned and unprotected sex attributable to drinking. *Pediatrics, 111*(1), 34-41.
- Hingson, R., Heeren, T., & Zakocs, R. (2001). Age of drinking onset and involvement in physical fights after drinking. *Pediatrics, 108*(4), 872-877.
- Hingson, R., Heeren, T., Zakocs, R., Winter, M., & Wechsler, H. (2003). Age of first intoxication, heavy drinking, driving after drinking and risk of unintentional injury among U.S. college students. *Journal of Studies on Alcohol, 64*(1), 23-31.
- Hingson, R. W., & Zha, W. (2009). Age of drinking onset, alcohol use disorders, frequent heavy drinking, and unintentionally injuring oneself and others after drinking. *Pediatrics, 123*(6), 1477-1484.
- Hingson, R. W., Zha, W., & Weitzman, E. R. (2009). Magnitude of and trends in alcohol-related mortality and morbidity among U.S. college students ages 18-24, 1998-2005. *Journal of Studies on Alcohol and Drugs Supplement*(16), 12-20.
- Huchting, K., Lac, A., & LaBrie, J. W. (2008). An application of the Theory of Planned Behavior to sorority alcohol consumption. *Addictive Behaviors, 33*(4), 538-551.
- Iyadurai, S. J., & Chung, S. S. (2007). New-onset seizures in adults: possible association with consumption of popular energy drinks. *Epilepsy & Behavior, 10*(3), 504-508.
- Jay, S. M., Petrilli, R. M., Ferguson, S. A., Dawson, D., & Lamond, N. (2006). The suitability of a caffeinated energy drink for night-shift workers. *Physiology & Behavior, 87*(5), 925-931.
- Kapner, DA. Ephedra and Energy Drinks on College Campuses. The Higher Education Center for Alcohol and Other Drug Abuse and Violence Prevention. Available at:<http://www.higheredcenter.org/pubs/>
- Kasperski, S. J., Vincent, K. B., Caldeira, K. M., Garnier-Dykstra, L. M., O'Grady, K. E., & Arria, A. M. (2011). College students' use of cocaine: results from a longitudinal study. *Addictive Behaviors, 36*(4), 408-411.
- Kennedy, D. O., & Scholey, A. B. (2004). A glucose-caffeine 'energy drink' ameliorates subjective and performance deficits during prolonged cognitive demand. *Appetite, 42*(3), 331-333.

- Knight, J. R., Wechsler, H., Kuo, M., Seibring, M., Weitzman, E. R., & Schuckit, M. A. (2002). Alcohol abuse and dependence among U.S. college students. *Journal of Studies on Alcohol*, 63(3), 263-270.
- Machado-Vieira, R., Viale, C. I., & Kapczynski, F. (2001). Mania associated with an energy drink: the possible role of caffeine, taurine, and inositol. *Canadian Journal of Psychiatry*, 46(5), 454-455.
- Malinauskas, B. M., Aeby, V. G., Overton, R. F., Carpenter-Aeby, T., & Barber-Heidal, K. (2007). A survey of energy drink consumption patterns among college students. *Nutrition Journal*, 6, 35.
- 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(8), 3232-3245.
- 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(4), 450-458.
- 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(7), 1282-1292.
- Marczinski, C. A., Fillmore, M. T., Henges, A. L., Ramsey, M. A., & Young, C. R. (2012). Effects of energy drinks mixed with alcohol on information processing, motor coordination and subjective reports of intoxication. *Experimental and Clinical Psychopharmacology*, 20(2), 129-138.
- McCusker, R. R., Goldberger, B. A., & Cone, E. J. (2006). Caffeine content of energy drinks, carbonated sodas, and other beverages. *Journal of Analytical Toxicology*, 30(2), 112-114.
- McLaughlin, M. P. (2010). Alcohol-associated illness and injury and ambulance calls in a Midwestern college town: a four-year retrospective analysis. *Prehospital Emergency Care*, 14(4), 485-490.
- Miller, K. E. (2008a). Energy drinks, race, and problem behaviors among college students. *J Journal of Adolescent Health*, 43(5), 490-497.
- Miller, K. E. (2008b). Wired: energy drinks, jock identity, masculine norms, and risk taking. *J Journal of American College Health*, 56(5), 481-489.
- Mitka, M. (2009). College binge drinking still on the rise. *JAMA*, 302(8), 836-837.

- Neighbors, C., Lee, C. M., Lewis, M. A., Fossos, N., & Larimer, M. E. (2007). Are social norms the best predictor of outcomes among heavy drinking college students? *Journal of Studies on Alcohol and Drugs*, 68, 556-565.
- Norman, P., Armitage, C. J., & Quigley, C. (2007). The theory of planned behavior and binge drinking: assessing the impact of binge drinker prototypes. *Addictive Behaviors*, 32(9), 1753-1768.
- 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(5), 453-460.
- Ouellette, J.A., & Wood, W. (1998). Habit and intention in everyday life: The multiple processes by which past behavior predicts future behavior. *Psychological Bulletin*, 124, 54-74.
- Perkins, H. W. (2002a). Subjective norms and the prevention of alcohol misuse in collegiate contexts. *Journal Studies on Alcohol Supplement*(14), 164-172.
- Perkins, H. W. (2002b). Surveying the damage: a review of research on consequences of alcohol misuse in college populations. *Journal Studies on Alcohol Supplement*(14), 91-100.
- Pettit, M. L., & DeBarr, K. A. (2011). Perceived stress, energy drink consumption, and academic performance among college students. *Journal of American College Health*, 59(5), 335-341.
- Poulson, R. L., Eppler, M. A., SatterWhite, T. N., Wuensch, K. L., & Bass, L. A. (1998). Alcohol consumption, strength of religious beliefs, and risky sexual behavior in college students. *Journal of American College Health*, 46(5), 227-232.
- 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(3), 331-333.
- Presley, C. A., Meilman, P. W., & Lyerla, R. (1994). Development of the Core Alcohol and Drug Survey: initial findings and future directions. *Journal of American College Health*, 42(6), 248-255.
- Reissig, C. J., Strain, E. C., & Griffiths, R. R. (2009). Caffeinated energy drinks--a growing problem. *Drug and Alcohol Dependence*, 99(1-3), 1-10.
- Reyner, L. A., & Horne, J. A. (2002). Efficacy of a 'functional energy drink' in counteracting driver sleepiness. *Physiology & Behavior*, 75(3), 331-335.
- Rigotti, N. A., Lee, J. E., & Wechsler, H. (2000). US college students' use of tobacco products: results of a national survey. *JAMA*, 284(6), 699-705.

- Rosser, W. W., Colwill, J. M., Kasperski, J., & Wilson, L. (2010). Patient-centered medical homes in Ontario. *New England Journal of Medicine*, 362(3), e7.
- Seidl, R., Peyrl, A., Nicham, R., & Hauser, E. (2000). A taurine and caffeine-containing drink stimulates cognitive performance and well-being. *Amino Acids*, 19(3-4), 635-642.
- Singleton, R. A. (2007). Collegiate alcohol consumption and academic performance. *Journal of Studies on Alcohol and Drugs*, 68(4), 548-555.
- Simon M, Mosher J. Alcohol, Energy Drinks, and Youth: A Dangerous Mix. San Rafael, CA: Marin Institute, 2007.
- Smit, H. J., Cotton, J. R., Hughes, S. C., & Rogers, P. J. (2004). Mood and cognitive performance effects of "energy" drink constituents: caffeine, glucose and carbonation. *Nutritional Neuroscience*, 7(3), 127-139.
- Sobell, L. C., Agrawal, S., Annis, H., Ayala-Velazquez, H., Echeverria, L., Leo, G. I., et al. (2001). Cross-cultural evaluation of two drinking assessment instruments: alcohol timeline followback and inventory of drinking situations. *Substance Use & Misuse*, 36(3), 313-331.
- Specterman, M., Bhuiya, A., Kuppuswamy, A., Strutton, P. H., Catley, M., & Davey, N. J. (2005). The effect of an energy drink containing glucose and caffeine on human corticospinal excitability. *Physiology & Behavior*, 83(5), 723-728.
- Stevens, J. (1992). *Applied Multivariate Statistics for the Social Sciences*. (2nd ed.). Hillsdale, NJ: Lawrence Erlbaum Associates.
- 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(1-3), 31-36.
- Thombs, D. L., O'Mara, R. J., Tsukamoto, M., Rossheim, M. E., Weiler, R. M., Merves, M. L., et al. (2010). Event-level analyses of energy drink consumption and alcohol intoxication in bar patrons. *Addictive Behaviors*, 35(4), 325-330.
- Velazquez, C. E., Poulos, N. S., Latimer, L. A., & Pasch, K. E. (2011). Associations between energy drink consumption and alcohol use behaviors among college students. *Drug and Alcohol Dependence*.
- Warburton, D. M., Bersellini, E., & Sweeney, E. (2001). An evaluation of a caffeinated taurine drink on mood, memory and information processing in healthy volunteers without caffeine abstinence. *Psychopharmacology (Berl)*, 158(3), 322-328.

- Wechsler, H., Dowdall, G. W., Maenner, G., Gledhill-Hoyt, J., & Lee, H. (1998). Changes in binge drinking and related problems among American college students between 1993 and 1997. Results of the Harvard School of Public Health College Alcohol Study. *Journal of American College Health, 47*(2), 57-68.
- Wechsler, H., & Kuo, M. (2000). College students define binge drinking and estimate its prevalence: results of a national survey. *Journal of American College Health, 49*(2), 57-64.
- Wechsler, H., Lee, J. E., Kuo, M., Seibring, M., Nelson, T. F., & Lee, H. (2002). Trends in college binge drinking during a period of increased prevention efforts. Findings from 4 Harvard School of Public Health College Alcohol Study surveys: 1993-2001. *Journal of American College Health, 50*(5), 203-217.
- Wechsler, H., & Nelson, T. F. (2001). Binge drinking and the American college student: what's five drinks? *Psychology of Addictive Behaviors, 15*(4), 287-291.
- Wechsler, H., & Nelson, T. F. (2008). What we have learned from the Harvard School Of Public Health College Alcohol Study: focusing attention on college student alcohol consumption and the environmental conditions that promote it. *Journal of Studies on Alcohol and Drugs, 69*(4), 481-490.
- Willis, J.W. (2008). *Qualitative Research Methods in Education and Educational Technology*. (1-380). Information Age Publishing.
- Wood, P. K., Sher, K. J., Erickson, D. J., & DeBord, K. A. (1997). Predicting academic problems in college from freshman alcohol involvement. *Journal of Studies on Alcohol, 58*(2), 200-210.

Appendix A

Final Version of Study Survey

SECTION 1: DEMOGRAPHIC CHARACTERISTICS

Please tell us about yourself:

1. What is your sex? **(Please circle the appropriate response):** Male Female

2. How old are you? _____ # of years

3. What is your class year? **(Please circle the appropriate response):**

1st year undergraduate

2nd year undergraduate

3rd year undergraduate

4th year undergraduate

5th year or more undergraduate

Other _____

4. Where do you reside? **(Please circle the appropriate response)**

On Campus (dorm, fraternity house, sorority house, etc)

Off Campus (Rented house, apartment, etc.)

Off Campus with parents

Other _____

5. Which one of these groups would you say best represents your race? **(Please circle only one option as the most appropriate response)**

White

Black or African American

Native Hawaiian or Other Pacific Islander

American Indian, Alaska Native

Other (specify): _____

6. Are you a member of a Fraternity or Sorority? **(Please circle the appropriate response)**

Yes No

SECTION 2: ALCOHOL USE QUESTIONS

For the following questions a drink is defined as a **bottle of beer, or other malt beverage (12oz.), a glass of wine (4oz.), a wine cooler (12 oz.), or a shot of liquor (1 oz. served straight or mixed in a drink)**

Answer Questions 8-9 in the following way. For example:

1	3
---	---

7. Have you consumed alcohol in the last 30 days? Yes No

8. During the past 30 days, on how many days did you have alcohol?

--	--

 #days

9. Think back over the last 30 days. How many times have you had five or more drinks at a sitting?

--	--

 #days

SECTION 3: ENERGY DRINK USE QUESTIONS

The following are some questions on your use of energy drinks. **COFFEE IS NOT AN ENERGY DRINK (Examples of Energy Drinks Include: Red Bull, Rockstar, Monster, Full Throttle, 5 Hour Energy)**

Answer Question 11 in the following way. For example,

1	3
---	---

10. Have you consumed non-alcoholic energy drinks in the last 30 days? Yes No

11. How many days in the past 30 days have you consumed non-alcoholic energy drinks (e.g. Red Bull, Monster, Rockstar, Full Throttle, etc)?

--	--

SECTION 4: QUESTIONS CONCERNING MIXING ALCOHOL WITH ENERGY DRINKS

Alcohol Mixed with Energy Drinks includes mixing an energy drink (**Red Bull, Monster, Rock Star, Full Throttle, etc**) with alcohol **IN THE SAME CUP/BOTTLE (Red Bull and Vodka, Jagermeister and Red Bull, etc)** **OR** drinking an energy drink and alcohol in the same sitting, but **IN SEPARATE CUPS/BOTTLES. COFFEE IS NOT AN ENERGY DRINK.**

Answer Questions 14-15 in the following way. For example,

1	3
---	---

12. In the past 30 days have you consumed **alcohol mixed with energy drinks (e.g. Red Bull and Vodka, Jagermeister and Red Bull, etc)**. Please circle Yes or No.

Yes No

13. In the past 30 days have you consumed alcohol mixed with energy drinks in the same sitting, but **IN A SEPARATE CUP/BOTTLE?**

Yes No

14. How many days in the past 30 days have you consumed alcohol mixed with an energy drink **IN THE SAME CUP/BOTTLE?**

--	--

15. How many days in the past 30 days have you consumed alcohol and then consumed an energy drink in the same sitting, but **IN A SEPARATE CUP/BOTTLE?**

--	--

BIM- Behavioral Intention Measures

Alcohol Mixed with Energy Drinks includes mixing an energy drink (**Red Bull, Monster, Rock Star, Full Throttle, etc**) with alcohol **IN THE SAME CUP/BOTTLE (Red Bull and Vodka, Jagermeister and Red Bull, etc) OR** drinking an energy drink and alcohol in the same sitting, but **IN SEPARATE CUPS/BOTTLES. COFFEE IS NOT AN ENERGY DRINK.**

16. In the next 30 days, I intend to consume alcohol mixed with energy drinks **IN THE SAME GLASS (Please circle one number)**

strongly disagree 1 2 3 4 5 strongly agree

17. In the next 30 days, I intend to consume alcohol mixed with energy drinks in the same sitting, but **IN A SEPARATE GLASS (Please circle one number)**

strongly disagree 1 2 3 4 5 strongly agree

SNQ-Subjective Norms Questions

If you were to drink **alcohol mixed with energy drinks** at least once in the next 30 days, how much would different groups of people approve? Please **circle** the most accurate answer.

Alcohol Mixed with Energy Drinks includes mixing an energy drink (**Red Bull, Monster, Rock Star, Full Throttle, etc**) with alcohol **IN THE SAME CUP/BOTTLE (Red Bull and Vodka, Jagermeister and Red Bull)**. **OR** drinking an energy drink and alcohol in the same sitting, but **IN SEPARATE CUPS/BOTTLES. COFFEE IS NOT AN ENERGY DRINK.**

18. How much would an average **American college student** approve of you drinking alcohol mixed with energy drinks?

Highly unimportant	Somewhat unimportant	Neither important nor unimportant	Somewhat important	Highly important
1	2	3	4	5

19. How important is it that an average **college student at UA** approve of you drinking alcohol mixed with energy drinks at least once in the next 30 days?

Highly unimportant	Somewhat unimportant	Neither important nor unimportant	Somewhat important	Highly important
1	2	3	4	5

20. How much **would your closest friend** approve of you drinking alcohol mixed with energy drinks at least once in the next 30 days?

Highly disapprove	Somewhat disapprove	Neither approve nor disapprove	Somewhat approve	Highly approve
1	2	3	4	5

21. How important is it that your **closest family member** approves of you drinking alcohol mixed with energy drinks at least once in the last 30 days?

Highly unimportant	Somewhat unimportant	Neither important nor unimportant	Somewhat important	Highly important
1	2	3	4	5

22. How much would **the person whose opinion you value the most** approve of you drinking alcohol mixed with energy drinks at least once in the next 30 days?

Highly disapprove	Somewhat disapprove	Neither approve nor disapprove	Somewhat approve	Highly approve
1	2	3	4	5

23. **IF YOU ARE A MEMBER OF A FRATERNITY OR SORORITY (only answer if applicable):** How much would an **average college student in your fraternity/sorosity** approve of you drinking alcohol mixed with energy drinks?

Highly disapprove	Somewhat disapprove	Neither approve nor disapprove	Somewhat approve	Highly approve
1	2	3	4	5

Please rate the following statements when considering drinking alcohol mixed with energy drinks at least once in the **next 30 days**.

24. It is expected of me that I drink alcohol mixed with energy drinks at least once in the next 30 days.

Completely false				Completely true
1	2	3	4	5

25. Most people that are important to me think that I should drink alcohol mixed with energy drinks at least once in the next 30 days.

Completely false				Completely true
1	2	3	4	5

AS-Attitudes Scale

Please **circle the number** that indicates **your overall opinion** about you mixing alcohol with energy drinks.

Alcohol Mixed with Energy Drinks includes mixing an energy drink (**Red Bull, Monster, Rock Star, Full Throttle, etc**) with alcohol **IN THE SAME CUP/BOTTLE (Red Bull and Vodka, Jagermeister and Red Bull/ Jagerbomb, etc)**. **OR** drinking an energy drink and alcohol in the same sitting, but **IN SEPARATE CUPS/BOTTLES. COFFEE IS NOT AN ENERGY DRINK.**

26. Please rate your overall opinion about you mixing alcohol with energy drinks. Is it **negative or positive?** (Please circle one number)

Negative					Positive
1	2	3	4	5	

27. Please rate your overall opinion about you mixing alcohol with energy drinks. Do you **like or dislike** the behavior? (Please circle one number)

Dislike					Like
1	2	3	4	5	

28. Please rate your overall opinion about you mixing alcohol with energy drinks. Is it **good or bad?** (Please circle one number)

Bad					Good
1	2	3	4	5	

29. Please rate your overall opinion about mixing alcohol with energy drinks. Do you think the behavior is **undesirable or desirable?**

Undesirable					Desirable
1	2	3	4	5	

AS- Attitudes Scale

Please **circle the number** that best indicates **your overall opinion** about you mixing alcohol with energy drinks.

Alcohol Mixed with Energy Drinks includes mixing an energy drink (**Red Bull, Monster, Rock Star, Full Throttle, etc**) with alcohol **IN THE SAME CUP/BOTTLE (Red Bull and Vodka, Jagermeister and Red Bull/ Jagerbomb, etc)**. **OR** drinking an energy drink and alcohol in the same sitting, but **IN SEPARATE CUPS/BOTTLES. COFFEE IS NOT AN ENERGY DRINK.**

31. Please rate your overall opinion about mixing alcohol with energy drinks. Do you think the behavior is **unpleasant or pleasant**?

Unpleasant					Pleasant
1	2	3	4	5	

32. Please rate your overall opinion about mixing alcohol with energy drinks. Do you think the behavior is **worthless or valuable**?

Worthless					Valuable
1	2	3	4	5	

33. Please rate your overall opinion about mixing alcohol with energy drinks. Do you think the behavior is **not enjoyable or enjoyable**?

Not Enjoyable					Enjoyable
1	2	3	4	5	

PBC- Perceived Behavioral Control Questions

Please **circle the number** that best describes your overall opinion about you mixing alcohol with energy drinks.

Alcohol Mixed with Energy Drinks includes mixing an energy drink with alcohol **IN THE SAME CUP/BOTTLE (Red Bull and Vodka, Jagermeister etc)**. **OR** drinking an energy drink and alcohol in the same sitting, but **IN SEPARATE CUPS/BOTTLES**.

34. If I wanted to, I could resist drinking alcohol mixed with energy drinks.

Strongly Agree					Strongly Disagree
1	2	3	4		5

35. I believe I have the ability to resist drinking alcohol mixed with energy drinks.

Strongly Agree					Strongly Disagree
1	2	3	4		5

36. For me, resisting drinking alcohol mixed with energy drinks would be:

Possible					Impossible
1	2	3	4		5

37. I feel in complete control of resisting drinking alcohol mixed with energy drinks

Strongly Agree					Strongly Disagree
1	2	3	4		5

38. It is mostly up to me whether or not I drink alcohol mixed with energy drinks.

Strong Agree					Strongly Disagree
1	2	3	4		5

39. I am in complete control over drinking alcohol mixed with energy drinks.

Strongly Agree					Strongly Disagree
1	2	3	4		5

Appendix B

IRB Approval

Office for Research
Institutional Review Board for the
Protection of Human Subjects

THE UNIVERSITY OF
ALABAMA
R E S E A R C H

September 7, 2012

Supriya Reddy, BA MPH
Dept. of Health Sciences
College of Human Environmental Sciences
Box 870311

Re: IRB#: 12-OR-303 "The Examination of Mixing Alcohol and Energy Drinks
among College Undergraduates Using the Theory of Planned Behavior"

Dear Ms. Reddy:

The University of Alabama Institutional Review Board has granted approval for your
proposed research.

Your application has been given expedited approval according to 45 CFR part 46.
You have also been granted the requested waivers. Approval has been given under
expedited review category 7 as outlined below:

*(7) Research on individual or group characteristics or behavior (including, but not
limited to, research on perception, cognition, motivation, identity, language,
communication, cultural beliefs or practices, and social behavior) or research
employing survey, interview, oral history, focus group, program evaluation, human
factors evaluation, or quality assurance methodologies*

Your application will expire on September 6, 2013. If your research will continue
beyond this date, complete the relevant portions of the IRB Renewal Application. If
you wish to modify the application, complete the Modification of an Approved
Protocol Form. Changes in this study cannot be initiated without IRB approval,
except when necessary to eliminate apparent immediate hazards to participants.
When the study closes, complete the appropriate portions of the IRB Request for
Study Closure Form.

Please use reproductions of the IRB approved stamped information sheets to obtain
consent from your participants.

Should you need to submit any further correspondence regarding this proposal,
please include the above application number.

Good luck with your research.

Sincerely,



358 Rose Administration Building
Box 870127
Tuscaloosa, Alabama 35487-0127
(205) 348-8461
FAX (205) 348-7189
TOLL FREE (877) 820-3066

Carpantaro T. Myles, MSM/CIM
Director & Research Compliance Officer
Office of Research Compliance
The University of Alabama