CONCURRENT POLYSUBSTANCE USE IN COLLEGE STUDENTS:

A BRIEF SOCIAL NORMS INTERVENTION TO ABATE USE

by

Jennifer L. Hernandez-Meier

A Dissertation Submitted in

Partial Fulfillment of the

Requirements for the Degree of

Doctor of Philosophy

in Social Work

at

The University of Wisconsin-Milwaukee

August 2016

ABSTRACT

CONCURRENT POLYSUBSTANCE USE IN COLLEGE STUDENTS:
A BRIEF SOCIAL NORMS INTERVENTION TO ABATE USE

by

Jennifer L. Hernandez-Meier

The University of Wisconsin-Milwaukee, 2016
Under the Supervision of Professor Laura Otto-Salaj

Introduction: Many college students engage in marijuana and alcohol use, as well as concurrent and simultaneous polysubstance use of both of these substances (CPU, SPU). The literature on CPU and SPU in this population has not been comprehensively reviewed. It is also unclear whether when compared with concurrent users, simultaneous users experience increased risk of substance-related problems (problems), and if a brief normative feedback (NF) intervention is feasible for and can impact marijuana and alcohol use by concurrent users. Methods: This study involved: Paper 1) a narrative review of literature on marijuana and alcohol use and CPU and SPU in college students, Paper 2) secondary analysis to compare odds of experiencing problems between concurrent and simultaneous users, and Paper 3) the development and provision of a Web-based NF intervention targeted at freshmen. Intervention conditions included marijuana-only NF, alcohol-only NF and both marijuana and alcohol NF, with a one-month follow-up assessment. Results: Paper 1 found that CPU may increase students' risk of experiencing problems and that more studies are needed to better understand CPU and SPU in college students. One-way ANOVA models in Paper 2 found that compared to concurrent users, simultaneous users engaged in more substance use. The odds of respondents in the two groups reporting some of the individual problems and experiencing four or more problems in the previous month were significantly different in multiple logistic regression models. Paper 3 found that provision of marijuana and alcohol NF to concurrent users is

feasible. Significant time effects were found for five of the nine outcome variables related to norms perceptions, substance use and problems during linear mixed-models for repeated analyses. No significant condition or condition*time effects were found. Conclusions: More research is needed to further understand CPU and SPU and the potential for experiencing increased substance use and problems. This knowledge could be used to tailor prevention interventions to these patterns of use. It appears possible to deliver marijuana NF, both alone and alongside alcohol NF, but more research is needed to determine if marijuana use can effectively be modified with brief interventions that have been supported for alcohol prevention.

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

ACKNOWLEDGEMENTS

This research was supported by a Graduate School Dissertation Fellowship from the University of Wisconsin-Milwaukee and departmental funding from the Department of Social Work in the Helen Bader School of Social Welfare at the University of Wisconsin-Milwaukee. Participants were recruited from a list of 2012-2013 incoming freshmen students that was approved and provided by the University of Wisconsin-Milwaukee's Registrar's Office. Peer norms for substance use behavior were based on responses collected by the 2009 University of Wisconsin System Alcohol and Other Drug Abuse Survey. The dataset was provided with permission from the Department of Academic & Student Services at the University of Wisconsin System.

I wish to thank the participants for making this study possible. I would also like to thank the members of my dissertation committee for their patience, guidance, and dedication to me and my research pursuits. A special thank you to Dr. Laura Otto-Salaj for your encouragement and unwavering commitment to helping me achieve my goals.

Thank you to my family for always encouraging me, even though you didn't always quite understand why I had to be in school for so many years. I dedicate this dissertation to my husband, Jason. Thank you for being a persistent source of encouragement throughout this journey – I couldn't have done this without you.

CHAPTER 1

Introduction

Statement of the Problem

Little is known about the concurrent use of multiple substances among college students in the United States. Concurrent polysubstance use (CPU) describes the consumption of more than one drug or substance within a designated timeframe. CPU can include both legal (e.g., alcohol, tobacco) and illicit (e.g., marijuana, methamphetamine) substances. The most common pair of substances used is alcohol and tobacco, followed by alcohol and marijuana (Martin, Clifford, & Clapper, 1992). Some evidence suggests that using more than one substance increases the risk of experiencing problems in college students (Shillington & Clapp, 2001, 2006). One impediment to researching CPU is a lack of agreement regarding patterns of use which can be described as CPU. Researchers and clinicians are unclear about how to identify students engaging in these patterns of use. CPU as a construct is compounded by the fact that consumption patterns of more than one substance must be considered, as well as the relative requirements regarding time constraints that substances must be consumed within to be considered CPU. As a consequence of these issues, prevalence rates of CPU in general student samples have not been well established.

Besides definitional and prevalence issues, the little research on CPU in general, and on college students specifically, means that potential substance-related problems associated with this pattern of use are not well understood. The findings that CPU is associated with increases in alcohol consumption (Shillington & Clapp, 2006) and substance-related problems (Shillington & Clapp, 2001, 2006), compared to using alcohol only, needs to be further examined to determine if targeted prevention efforts for CPU are required on college campuses. Students also use alcohol and marijuana at the same time, known as simultaneous polysubstance use (SPU; Schensul, Convey, & Burkholder, 2005), which may increase the risk of experiencing problems, over and above CPU. Potential synergistic effects of mixing alcohol and marijuana and overlapping psychoactive effects may result in more reported problems (Pape, Rossow, &

Storvoll, 2009; Schensul et al., 2005). How and why students engage in SPU and the potential consequences of this pattern of use is another area that requires more research.

Finally, there are few studies that have attempted to modify CPU through brief prevention interventions with college students. Typically only one substance is targeted or focused on during brief interventions and there is not enough evidence to conclude if more than one substance can be changed when targeted during the same brief intervention with college students. Before implementation of wide-scale, multi-component brief intervention studies for multiple substances, it may be prudent to test if CPU or use of the substances that make up the CPU pattern can be decreased with an intervention focused on a few theory-based components. Perceptions of social norms have been shown to be influential on college student substance use, and have been altered with brief interventions for alcohol use (Lewis & Neighbors, 2007; Lewis, Neighbors, Oster-Aaland, Kirkeby, & Larimer, 2007; Neighbors, Larimer, & Lewis, 2004; Neighbors, Lewis, Bergstrom, & Larimer, 2006). However, norms-only brief interventions have not been extended to decrease marijuana use or CPU. A pilot test of norms-based brief interventions for CPU may provide support for larger-scale attempts targeting CPU, which are likely to include norms components.

This dissertation study aims to further the understanding of CPU in college students by examining the construct of CPU, problems associated with CPU and SPU, and an intervention that could possibly decrease marijuana and alcohol use in college students who engage in CPU.

Importance of the Problem

Alcohol use among college students in the United States has been an area of public health concern and has been extensively researched, largely due to widespread problems associated with at-risk consumption. A great body of literature documents the high prevalence of alcohol use in college students, with approximately three out of four students reporting use in the previous year (Johnston, O'Malley, Bachman, Schulenberg, & Miech, 2015). Recent

surveys estimate that between 35 and 44% of college students report engaging in heavy episodic [binge] drinking (see Hingson, Zha, & Weitzman, 2009; Johnston et al., 2015; Wechsler et al., 2002), a consumption pattern associated with increased odds of experiencing negative consequences (Wechsler, Dowdall, Davenport, & Rimm, 1995). Despite increases in prevention and intervention on college campuses, heavy use has not decreased; HED rates have remained relatively constant over the past few decades (Hingson et al., 2009; Johnston et al., 2015; O'Malley & Johnston, 2002; Wechsler et al., 2002). The consequences of alcohol use on campuses are differentially associated with use patterns (Vik, Carrello, Tate, & Field, 2000), and affect a number of groups in addition to consumers (e.g., peers, institutions, society; Perkins, 2002b). Extant research supports alcohol use in this population as a significant public health concern (Dowdall, 2009).

Marijuana use among college students is also prevalent and associated with a number of negative consequences or problems. Recent results from the Monitoring the Future survey show that within the past year, approximately one-third of students reported using marijuana, and approximately one-fifth use in any given month (Johnston et al., 2015). Of great concern is that almost 6% of students reported daily use of marijuana, which is slightly greater than the 4% of students who reported daily use of alcohol. Fewer students engage in marijuana use overall, when compared to alcohol use, but the incidence of daily use of marijuana appears higher than for daily use of alcohol.

Marijuana and alcohol use often manifest similar problems, but marijuana appears to be associated with some unique consequences of use, including: academic (Kilmer, Hunt, Lee, & Neighbors, 2007), concentration (Caldeira, Arria, O'Grady, Vincent, & Wish, 2008), health (Taylor, Poulton, Moffitt, Ramankutty, & Sears, 2000) and social problems (Caldeira et al., 2008; Kilmer et al., 2007). Despite facilitating the development of prevalent problems, there has not been a paralleled shift in public concern for marijuana use, when compared to alcohol use.

Research is beginning to explicate the necessity of targeting marijuana use with prevention interventions to decrease use.

Students often times use both of these substances, which can be particularly hazardous. According to one study, almost 40% of college alcohol users, and 100% of marijuana users could use two or more substances (i.e., CPU), within the past year (Martin et al., 1992). Another study conducted at a single university found that approximately 30% of past month alcohol users also reported marijuana use in the same timeframe (Keith, Hart, McNeil, Silver, & Goodwin, 2015). Similar to Martin et al., only one student who used marijuana in this study did not also use alcohol in that month. CPU may enhance the risk of experiencing more frequent and severe drug-related problems (Shillington & Clapp, 2001, 2006). Further, use of two or more substances during the same session (i.e., simultaneous polysubstance use [SPU]) is of particular public health concern, due to potential additive and synergistic effects of two substances ingested at the same time (Pape et al., 2009; Schensul et al., 2005). In one study, approximately 14.7% of college students reported mixing alcohol and marijuana in the past year (Martin et al., 1992); in another study, 95% of drug-using college students reported lifetime alcohol and marijuana SPU (Barrett, Darredeau, & Pihl, 2006). It seems that some students who use alcohol, and almost all students who use marijuana, represent populations with increased risk of problems who may need specialized prevention approaches.

Shillington and Clapp (2001) found that students who engaged in CPU in the past 30 days had significantly increased risk for 11 of 15 alcohol and other drug (AOD) problems, compared to those who used alcohol only. Specifically, CPU was associated with increased odds of: having a hangover, experiencing memory loss, becoming nauseous or vomiting, passing out, being a passenger in a car with a drunk driver, getting in verbal arguments, being criticized for drinking behavior, and doing something they regret later, when compared to student who only used alcohol. Shillington and Clapp (2006) subsequently replicated these findings when they extended the timeframe of use to include the past year. The extension of

time resulted in students who engaged in CPU reporting significantly increased odds of all 14 AOD problems measured in this study, as well as all four items on the CAGE alcohol screening and assessment tool. Additionally, these researchers found that CPU users reported significantly more drinks consumed per occasion, compared to alcohol-only users (4.76 drinks vs. 3.0 drinks, respectively). These important studies are some of the few that have investigated CPU in college students. However, Shillington and Clapp (2006) classified students who used any alcohol in the previous year—even one drink—as alcohol users. Given the high prevalence rates of alcohol use in college students, the consideration of more regular patterns of alcohol use (e.g., at least one episode a month), or heavier drinking (e.g., HED) in study designs may provide more relevant and generalizable results for campuses to use.

Many covariates or predictors of both alcohol and marijuana use in college students have been supported by empirical research results. Further review of covariates of CPU, including: cognitive (e.g., expectancies, motives, self-efficacy, drug knowledge and attitudes), psychological/mental health (e.g., personality, anxiety, depression), health (e.g., health conditions, stress), social (e.g., peer norms, extracurricular activities, quality of relationships, sexual activity), and environmental (e.g., alcohol outlet density, drug availability) domains is necessary. Reviewing the literature to see if covariates differ between students who engage in only alcohol or marijuana use, CPU, and SPU could provide valuable information regarding the epidemiology of varying substance use patterns, as well as information that campuses can use to target intervention programs to segments of student populations at greater risk of use related problems.

For example, most colleges have implemented broad prevention, policy and environmental programming aimed at decreasing problematic alcohol use. Most individual prevention approaches involve the use of personalized normative feedback (PNF), a brief and cost-effective intervention that aims to increase problem recognition and readiness to change (Miller, Sovereign, & Krege, 1988). This approach has generally been supported for alcohol use

(see Carey, Scott-Sheldon, Carey, & DeMartini, 2007; Lewis & Neighbors, 2006, for reviews), but has seldom been adapted to address other substances in prevention approaches. Adolescent (Martin & Copeland, 2008) and adult (Stephens, Roffman, Fearer, Williams, & Burke, 2007) marijuana users have decreased marijuana use and marijuana dependence symptoms after provision of marijuana-focused PNF. Only one wide-scale study (Lee, Neighbors, Kilmer, & Larimer, 2010) has tested marijuana-focused PNF with a general sample (i.e., not required for treatment due to policy infractions) of college students. Given the brevity and flexibility of PNF, studies examining the feasibility of decreasing marijuana use and CPU with PNF approaches are necessary. Such studies would include both epidemiological (i.e., examining if social norms are influential on marijuana use and CPU), and intervention (i.e., provision of a norms-based intervention) perspectives.

Often during PNF, one substance receives more attention—usually alcohol—with much less attention paid to other substances. It is possible that if two substances were addressed in balanced proportions during PNF, decreases in use and associated problems for both substances could result with one intervention. PNF targeted at the use of multiple substances could utilize the interactional nature of CPU, potentially amplifying decreases in use and problems associated with use of one or both of the targeted substances. One may argue that the high CPU rates among college students behooves campuses to move beyond viewing alcohol and marijuana use as separate behaviors, and begin to intervene on broader patterns of substance use. This is not the current state of affairs, and it may well be that researchers—not to mention college campuses—need more information about CPU to initiate the required paradigm shift which would facilitate combined intervention on these issues.

In sum, CPU has been relatively overlooked in the literature. This dissertation study aims to provide insight into what is known about CPU, problems associated with CPU and SPU, and interventions that can be used to target marijuana use and CPU. Preliminary results from

this pilot study may shape campus interventions that aim to address more than one substance in a single session.

Research Questions

This study explored the following research questions:

1. What is the extent and nature of the literature on concurrent and simultaneous use of marijuana and alcohol among college students?
2. 2a. Do substance-related problems vary between concurrent and simultaneous users of alcohol and marijuana? 2b. After controlling for demographics, heavy episodic drinking and marijuana use, to what extent are college freshmen more likely to experience substance-related problems if they simultaneously use alcohol and marijuana?
3. 3a. Is it feasible to address marijuana use and CPU by delivering normative feedback reports of personal and peer marijuana and alcohol use? 3b. Are there intervention effects on perceptions of peer alcohol and marijuana use, personal alcohol and marijuana use and substance-related problems?

Methods

Overview

This exploratory study utilized a narrative literature review and randomized experimental study design. The experimental design allowed for the collection of baseline data from freshmen participants, introduction of varying feedback interventions and collection of one-month follow-up data from the same participants. Baseline data was also utilized to answer additional questions regarding variation in problems experienced by participants who engaged in CPU and SPU.

This study was carried out in three papers and a conclusion chapter, reported in Chapters 2-5. In Paper 1 (Chapter 2), a narrative review of the literature regarding marijuana and alcohol use served to direct research questions in succeeding examinations. Paper 2 (Chapter 3), an examination of substance-related problems experienced by concurrent and

simultaneous marijuana and alcohol users served to further examine and compare the epidemiology of the two substance patterns. Feasibility and outcome analyses of a brief, Web-based feedback intervention for alcohol and marijuana use among college students evaluated whether such an intervention could be utilized for marijuana and concurrent alcohol and marijuana use (Paper 3; Chapter 4). Information learned in the first three phases was compared and synthesized to provide an overall picture of concurrent and simultaneous use of alcohol and marijuana in college students (Chapter 5). The overall goal was to contribute knowledge regarding these substance use patterns, of which little is known. Chapter 2 provides a narrative review of literature on marijuana and alcohol use, CPU and SPU. Chapters 3 and 4 each have a detailed methods section, with a brief description of each provided below.

Chapter 2.

Chapter 2 aimed to address research question 1. A large narrative review of journal articles, reports and books related to college student marijuana and alcohol use and concurrent and simultaneous polysubstance use was conducted. The review aimed to better understand: 1) marijuana and alcohol use among college students, 2) how to target both alcohol and marijuana in interventions aimed at college students and 3) the theoretical orientations and/or key constructs supported by empirical research that require consideration when addressing combined marijuana and alcohol use. For three categories of substance use: 1) alcohol use, 2) marijuana use, and 3) combined alcohol and marijuana use, the review considers: prevalence rates of use, the consequences or problems of use, factors associated with use and theoretically-supported constructs that explain use. After synthesis of epidemiological literature, key theoretical areas of focus for targeting alcohol, marijuana and concurrent use interventions are discussed. In anticipation of growing interest in simultaneous use, as well as this pattern being a subset of concurrent use, literature on simultaneous is also provided when available. This review is focused on at-risk use of these substances, and its prevention—psychosocial

factors and theories are emphasized over clinical and biological-based factors and interventions often found in other areas of substance use research (i.e., genetic risk factors, medication).

Chapter 3.

Chapter 3 aimed to address research questions 2 a. and b. Chi-Squared tests, one-way ANOVA models and multiple logistic regression analyses were used to test bivariate and multivariate associations between substance use pattern (CPU vs. SPU) and individual substance-related problems.

Participants were 117 college students at a large Midwestern public university located in an urban area. Participants were newly enrolled freshman in the fall of 2012, with data collection commencing in October of the same year. Participants were recruited from an administrative list of enrolled freshman students. One hundred and seven participants provided enough data for analyses. All students were current users of both alcohol and marijuana (as operationalized by at least one episode of heavy episodic [binge] drinking and day of marijuana use in the previous 30 days).

Participants were deemed eligible for the overall study if they (a) were 18 years of age or older; (b) were a currently enrolled full-time (i.e., ≥ 12 credits) freshman student; (c) were a 'new' freshman (i.e., had not previously taken university courses for college credit, not including online courses and AP courses in high school); (d) had engaged in at least one heavy episodic drinking episode in the previous 30 days (five or more drinks during a single occasion for males, four or more for females), and (e) had used marijuana or hashish (hash) on at least one day in the previous 30. Given the inclusion criteria, all participants engaged in concurrent alcohol and marijuana use in the previous 30 days.

Measures included demographics, alcohol and marijuana use, polysubstance use pattern (CPU or SPU) and substance-related problems experienced. Chi-Squared tests and one-way ANOVA models were used to test bivariate associations between substance use pattern (CPU vs. SPU), substance use and each individual substance-related problem. Multiple

logistic regression analyses were used to investigate increased risk for problems among simultaneous users compared with concurrent users after controlling for HED, marijuana use days and demographics. For Model 1, gender, race and substance use pattern (CPU, SPU) were regressed on each problem found significant in the bivariate analyses. For Model 2, gender, race, HED frequency, marijuana use days and substance use pattern (CPU, SPU) were regressed on each problem found significant in the bivariate analyses.

Chapter 4

Utilizing the same dataset and sample as Chapter 3, Chapter 4 addressed research questions 3 a. and b. Feasibility and mixed-models for repeated analyses investigated the feasibility and outcomes of provision of a brief, Web-based normative feedback intervention for marijuana and concurrent marijuana and alcohol use.

As with Chapter 3, participants were 117 college students at a large Midwestern public university located in an urban area. Participants were newly enrolled freshman in the fall of 2012, with data collection commencing in October of the same year. Participants were recruited from an administrative list of enrolled freshman students. All students were current users of both alcohol and marijuana (as operationalized by at least one episode of heavy episodic drinking and day of marijuana use in the previous 30 days).

Eligible participants were randomly assigned to one of three intervention conditions: (a) marijuana norms feedback only (MO), (b) alcohol norms feedback only (AO), and (c) both marijuana and alcohol norms feedback (MA). The normative components have been used in a variety of feedback interventions that have been influenced by Motivational Interviewing (see Hustad, Barnett, Borsari, & Jackson, 2010; Miller, 1983; Miller & Rollnick, 1991). It was a brief (approximately 5-minute), Web-based prevention intervention designed to provide college students with information about how their peers use marijuana and alcohol. After participants answered questions on the baseline survey, the event-driven program pulled reported information regarding the participant's perceived norms, and the participant's reported

substance use and populated fields in the feedback section. Participant information was contrasted with information about actual peer norms for the campus. Feedback information varied according to study condition (see Table 4.2). The program was designed to provide students with information to contrast their perceptions of peer use with actual peer use, their own use with peer use, and their own use with perceived peer use. Actual norms were based on data collected on the same campus three years prior from a sample of randomly selected undergraduate students participating in an alcohol and drug survey funded by the university. Information was presented in both graph and text form. The intervention focused on normative perceptions and no other information was included in the feedback intervention.

All eligible participants were immediately invited to complete the baseline measures and intervention online. Participants in each condition were instructed to complete baseline survey measures, with the normative feedback intervention being displayed immediately afterwards. After the intervention was completed, participants were asked to answer questions related to the feasibility of the intervention. Feasibility questions aimed to investigate if the intervention should be recommended for efficacy testing (Bowen et al., 2009) and to solicit feedback regarding modifications to the website, assessments, and interventions. Participants were able to: complete the program on any computer with access to the internet, work at their own pace, log out of the program and return within 24 hours to complete the session, and opt out of answering any questions. Approximately four weeks after intervention completion, participants were emailed a link to the follow-up survey. Baseline and follow-up measures included demographics, perceived peer descriptive norms, alcohol and marijuana use, substance-related problems experienced and intervention feasibility domains (Bowen et al., 2009).

The focus of this study was to determine if normative feedback aimed at marijuana use, as well as combined alcohol and marijuana use was feasible as a prevention intervention for college students. Feasibility domains were analyzed with frequencies and percentages.

A secondary aim was to test the preliminary efficacy of the intervention by determining if exposure to the three feedback interventions produced changes in descriptive norms, substance use, and substance-related problems one month later. Descriptive norms for all participants were compared to gender-specific actual norms on the campus to determine if participants' normative beliefs differed from actual norms on campus. One-sample t-test procedures used actual gender-specific population estimates for norms taken from a previous survey of substance use at the same university.

Next, the three conditions were compared to determine intervention effects on peer norms perceptions, one model each for the three dependent variables of perceptions of peer: drinking frequency, number of drinks per occasion and days of marijuana use. Three linear mixed models for repeated measures analyses were performed using an intent-to-treat principle that included all participants who provided baseline data. For each dependent variable, a 3 (condition) X 2 (time) linear mixed model for repeated measures was performed.

For each model, the random effect was the intercept and the fixed effects were condition (AO, MO, MA), time (Baseline, Follow-up) and the condition by time interaction. Time was also included as a repeated measure. The restricted maximum likelihood estimate method and compound symmetry covariance structure were used. Type III fixed effects were used and statistical significance determined to be p values of less than .05. The same linear mixed models for repeated measures analyses procedures were performed for the dependent variables of personal substance use (alcohol frequency, drinks per occasion, HED frequency, peak number of drinks, marijuana frequency) and total scores on dichotomous substance-related-problems. Limitations of the study and implications were also described.

Chapter 5.

Chapters 2-4 provide information regarding the epidemiology of and addressing concurrent use of marijuana and alcohol among college students. The final chapter provides a synthesis of findings and research and policy implications.

CHAPTER 2

Marijuana and Alcohol Use Among College Students: A Narrative Review of the Empirical Literature

Introduction

Alcohol use, marijuana use, and concurrent use of both substances are salient public health concerns associated with a variety of problems and it is important to understand factors that may contribute to initiation and maintenance of these patterns of use. To my knowledge, a comprehensive literature review that simultaneously compares and contrasts the covariates, consequences and theoretical components of alcohol and marijuana use in college students does not exist. A parallel review of these areas may help uncover similarities and differences which could inform discussions of how to most effectively utilize supported constructs in prevention interventions, and special considerations for targeting different use patterns, including concurrent use of both substances.

This narrative review aims to better understand: 1) marijuana and alcohol use among college students, 2) how to target both alcohol and marijuana in interventions aimed at college students and 3) the theoretical orientations and/or key constructs supported by empirical research that require consideration when addressing combined marijuana and alcohol use. For three categories of substance use: 1) alcohol use, 2) marijuana use, and 3) combined alcohol and marijuana use, this review considers: prevalence rates of use, the consequences or problems of use, factors associated with use and theoretically-supported constructs that explain use. After synthesis of epidemiological literature, key theoretical areas of focus for targeting alcohol, marijuana and concurrent use interventions are discussed. In anticipation of growing interest in simultaneous use, as a subset pattern of concurrent use, literature on simultaneous use is also provided when available. This review is focused on at-risk use of these substances, and its prevention—psychosocial factors and theories are emphasized over clinical and biological-based factors and interventions often found in other areas of substance use research (e.g., genetic risk factors, medication).

Patterns of Use and Prevalence Rates

Patterns of Use

This paper focuses on three main patterns of substance use in college students: alcohol and marijuana use, and the combined use of both substances. There are a number of monikers for (e.g., marijuana, weed), preparations of (e.g, dried flower, hashish, resin) and alternative methods for consumption of (e.g., smoked, chewed) the byproducts of the cannabis plant (see Roffman, Schwartz, & Stephens, 2006) which will be broadly referred to as marijuana use in this review.

Concurrent polysubstance use (CPU) is a pattern of ingestion in which more than one substance is used within a designated timeframe (e.g., past year, month). There is no ceiling on the number of substances, but at least two different ones must be used. Note that CPU describes a pattern of substance use, and differs from the historical diagnostic conceptualizations of polysubstance use disorders, for example, where three or more substances were used maladaptively over the past year (American Psychiatric Association, 2000). CPU can be used to describe the consumption of different substances on separate occasions (e.g., use of marijuana one night, alcohol the next), or during the same use occasion (e.g., alcohol and marijuana at the same time). Further, CPU can refer to concurrent use of any substances. For this review, CPU will describe the use of both alcohol and marijuana on different occasions or more generally, when it is unclear if the two substances were used during the same use occasion.

Simultaneous polysubstance use (SPU) is a subset of CPU and refers to the ingestion of multiple drugs on a single occasion or session of use (Earleywine & Newcomb, 1997). Often, studies only measure CPU and do not inquire about SPU. Therefore, results related to CPU in this review may also relate to unmeasured SPU, though it cannot be known when. It is also important to add that studies have found high rates of alcohol use in marijuana users, (e.g.,

100% of a random sample of college students; Shillington & Clapp, 2001), which may indicate that much reported marijuana use is within CPU or SPU contexts. As researchers often do not measure CPU, it is unknown if results associated with marijuana use are due to use of marijuana alone, or CPU. These measurement oversights should be kept in mind when assessing findings in this review.

Clayton (1986) proposes four primary reasons for SPU: 1) to enhance the effects of another drug; 2) to counteract the effects of another drug; 3) as a substitute for preferred drugs that are not available; and 4) to conform to norms regarding the use of drugs. During a particular evening, one study found that mean alcohol use over a month, as well as alcohol use level during that evening significantly predicted the likelihood of marijuana use during the evening in question (O'Hara, Armeli, & Tennen, 2016). The authors conclude that this suggests complementary use of both substances, or to enhance the effects of another drug. The same study also found that students who reported using alcohol or marijuana to cope (e.g., stress reduction, alleviating negative affect, self-medicating) were less likely to use marijuana as their mean alcohol use or evening use increased, suggesting that these students are more likely to be engaging in substitution behavior.

It is apparent that when attempting to intervene on alcohol use, marijuana use, CPU, and SPU, knowledge of actual substances involved is required, as well as how the substances are incorporated into broader patterns of use. Much research attention has been devoted to determining the effects of alcohol on the human body. Additionally, standardization of alcoholic drinks disseminated by the NIAAA (see National Institute on Alcohol Abuse and Alcoholism, 2010) provides the means for precise measurement of alcohol use. In contrast, variation in preparations, methods of consumption, and potency of marijuana-based substances does not afford equivocal measurement precision. Naturally, CPU and SPU involving marijuana is also subject to the above deficit. It is even more difficult to measure the use of two or more

substances, especially when timeframes are not agreed upon and included in conventional definitions of CPU and SPU. The limitations of measuring these patterns of use should be considered alongside the literature described in this review.

Prevalence Rates

Alcohol prevalence rates. The 2014 Monitoring the Future (MTF) survey found that 76.1% of college students had used alcohol in the past year (60.5% had "been drunk"), 63.1% had used in the previous 30 days (42.6% had "been drunk"), and 4.3% were daily users. On the same survey, 35.4% of students reported at least one episode of heavy episodic [binge] drinking (HED) in the previous 2 weeks (Johnston et al., 2015). Of note is that MTF employed the gender-neutral HED definition (5 drinks for both males and females [5/5]). This figure is less than other surveys that have found 44% HED rates when using a gender-specific definition (5 drinks for men, 4 for women [5/4]; Wechsler, Davenport, Dowdall, Moeykens, & Castillo, 1994).

Research has demonstrated that approximately one ingested standard drink less is required for female college students to report similar rated of alcohol-related problems (alcohol problems) as male college students (Wechsler et al., 1995). To account for gender differences, the 5/4 definition of HED has been widely adopted in college drinking research. Some national studies (e.g., MTF), and researchers still use the 5/5 definition, resulting in variations in reported HED prevalence rates. Trends demonstrated by responses to the MTF survey suggest that HED rates among college students have remained relatively constant since the 1980s (Johnston, O'Malley, Bachman, & Schulenberg, 2009), with slight decreases seen since 2008 (MTF, 2015). However, HED has increased for all racial groups, with an alarming 18% increase from 1979 to 2006 among women aged 21 to 23 (Grucza, Norberg, & Bierut, 2009). Studies suggest that the majority of college students drink alcohol, and a large proportion of college students engage in HED, a pattern that increases the risk of experiencing problems. Of concern is the increase in HED rates among women and other racial groups. The increase in at-risk

drinking for some college segments has led to interest in measuring more frequent patterns of HED.

The term “frequent HED” describes a pattern of three or more episodes of HED in the previous 2 weeks, and was reported by 23% of students in 1999, significantly rising across the 1990s (Wechsler, Lee, Kuo, & Lee, 2000). Frequent HED accounted for 68% of all alcohol consumed by college students in one study (Wechsler, Molnar, Davenport, & Baer, 1999), and those who endorsed this pattern were 21 times as likely to experience 5 or more annual alcohol problems, compared to non-HED students (Wechsler et al., 2000). “Extreme HED” has also been measured, with 13% of students reporting 10 or more drinks in a row, and 5% reported 15 drinks or more, in the previous two weeks (Johnston et al., 2015).

Large proportions of students are drinking alcohol, and engaging in HED behaviors. The constant HED rates in general, increases in HED rates for among women and minorities, and prevalence of frequent HED in general suggest that heavy drinking in this population is not abating and requires continued attention in prevention efforts. Concern over drinking rates is probably best exemplified by arguments that drinking and alcohol related problems on campuses have reached or nearly reached epidemic levels (Sommers, 2005; Walters, Bennett, & Noto, 2000).

Marijuana prevalence rates. The 2014 MTF survey found that 34.4% of students used marijuana in the previous year and 20.8% used in the previous month. Daily use of marijuana in 2014 (5.9%) was the highest MTF had recorded since 1980 (7.2%) and was higher than daily use of alcohol (4.3%; Johnston et al., 2015). Since the year 2000, monthly marijuana rates have fluctuated between 16.7% (2006) and 20.8% (2014). MTF results suggest that marijuana use may be increasing on college campuses in general, and especially among females. Also of note is that Arria et al. (2008) found a 48% increase in self-reported lifetime marijuana use from pre-college to sophomore year. In sum, reported yearly and monthly marijuana use rates are

lower than alcohol, but it is noteworthy that nearly one-fifth of students used marijuana in the previous month and that daily marijuana use exceeds alcohol use. This represents a moderate proportion of college campuses that may be experiencing marijuana problems and be benefit from marijuana prevention efforts. Prevention early in undergraduate careers may also have the most impact, since many students initiate marijuana use in the first few years of college.

Concurrent and simultaneous alcohol and marijuana use rates. *CPU*. Not all individuals who use alcohol or marijuana engage in CPU or SPU. For CPU, 17% of a random sample of college students reported using both alcohol and marijuana in the previous 30 days (Shillington & Clapp, 2001). Another study of college students found that 100% of past-year marijuana users, and 49% of past-year alcohol users engaged in CPU (Martin et al., 1992). However, all possible drug combinations (i.e., alcohol, tobacco, marijuana & hallucinogens) in this study were combined to describe CPU, so it is unknown which proportion of the 49% of alcohol users who engaged in CPU only combined marijuana with alcohol, and not other substances. A recent study conducted at a single university found that approximately 30% of past month alcohol users also reported marijuana use in the same timeframe (Keith et al., 2015). Similar to Martin et al., only one student who used marijuana did not also use alcohol in that month. Another study found that 29% of students who reported HED in the previous 2 weeks, also engaged in past-month marijuana use. In comparison, only 6% of students who did not engage in HED reported past-month marijuana use in this study (Gledhill-Hoyt, Lee, Strote, & Wechsler, 2000). Finally, Midanik and colleagues (2007) found that 10% of a general population aged 18-29 reported CPU in the previous year.

SPU. A random sample of college students from a private university reported a 14.7% SPU rate (89% of marijuana and 40% of alcohol users) in the previous year (Martin et al., 1992). Of note, is that this freshmen sample reported on the year before matriculation, and therefore reported SPU occurrences were outside of the college context. A broader sample of data from

a national survey found that 14.8% of young adults aged 18-29 reported SPU (any substances) in the previous year (Midanik, Tam, & Weisner, 2007); these results are very similar to those reported by Martin et al. (1992). Assuming SPU is stable across young adulthood, these two studies may suggest that about 15% of college students engage in SPU in any given year (any two substances). This is concerning, given the relative increased risk of experiencing substance problems that is associated with using more than one substance (Earleywine & Newcomb, 1997). There appears to be a lack of studies that utilize random samples of college students to investigate CPU and SPU. Cross-sectional and longitudinal studies examining prevalence rates of CPU and SPU, in representative samples would provide needed information for determining prevention need for those engaging in CPU.

In efforts to detail SPU patterns, Barrett et al. (2006) included students who reported lifetime use of at least two drugs (not including tobacco). They found that 95% of their sample reported lifetime SPU of marijuana and alcohol, and that 38% of current marijuana users combined marijuana and alcohol during the last time they used marijuana. In addition, alcohol use typically preceded the use of marijuana during participants' most recent SPU episode. Compared to when alcohol was consumed alone, no significant increases in alcohol consumed during marijuana SPU were found, suggesting that mixing alcohol and marijuana did not increase amount of alcohol consumed. Additionally, marijuana was not usually interspersed with alcohol in one session, suggesting that alcohol was consumed first and perhaps later in a session, and that marijuana was used once alcohol is initiated, but only at one time (Barrett et al., 2006).

The Barrett et al. (2006) results may suggest that alcohol could be a key contributor to the use of marijuana during a single use session for students who use both substances. These findings may support the need to target both substances during prevention efforts. If alcohol is generally used first, efforts concentrating on preventing any alcohol use (i.e., abstinence), or

decreasing alcohol use, might also serve to also prevent some marijuana use in this population. Though this notion is potentially supported (see Magill, Barnett, Apodaca, Rohsenow, & Monti, 2009) it could be argued that if one behavior (e.g., alcohol use) is related to or influences another behavior (e.g., marijuana use), both behaviors should be targeted in interventions to maximize potential decreases the harm associated with both behaviors.

In conclusion, the above prevalence estimates suggest that, roughly 66% of college students have used alcohol, 20% have used marijuana and 17% have engaged in CPU in the previous month. About 35-44% of students have engaged in HED in the previous 2 weeks, and roughly 29% of these individuals also engaged in marijuana use in the previous month. Finally, roughly 15% of students may have engaged in SPU in the previous year. Interpretations of these prevalence rates are cautioned because there appears to be no single source that can supply all rates reported above. Again, this serves to advocate for comprehensive studies examining CPU to establish prevalence rates derived from the same samples, a cornerstone for discussions of prevention approaches for CPU in college students.

Substance-Related Problems

Substance related problems affect individuals, peers, college institutions and society, but damage to self will be focused upon in this review (see Perkins, 2002b, for other problem areas), within the following areas: 1) Academic impairment, 2) Physical health, 3) Sexual coercion/assault, 4) Social problems, 5) Mental health, and 6) Substance Use Disorders. Use of either alcohol or marijuana is associated with risk of experiencing many specific problems; however, in some instances, the risk of experiencing a specific problem appears associated with alcohol use, marijuana use, or CPU in particular.

A noteworthy and uncommon study by Shillington and Clapp (2001) examined alcohol and other drug problems in a random sample of college students, comparing those who used alcohol only with students who engaged in CPU in the previous 30 days. Students who

engaged in CPU were significantly more likely to report experiencing any problem (98% vs. 41%), as well as 11 of 15 individual problems. Given that all marijuana users in this study also engaged in alcohol use, as well as the high prevalence of CPU described above, this section will emphasize comparison of problems between alcohol use and CPU within this study, with additional substance-specific information included where appropriate.

Academic impairment

Shillington and Clapp (2001) found that college students who engaged in CPU were 2.37 times as likely to report doing poorly on a test or project (15% vs. 10%), and 3.29 times as likely to miss class (43% vs. 8%), compared to alcohol-only users. For freshmen who reported any past marijuana use, Kilmer, Hunt, Lee, and Neighbors (2007) found that 43% reported experiencing at least one academic consequence related to their use. In the same study, a greater percentage of participants who reported more frequent use of marijuana—use on five or more days in the previous 90—reported academic consequences (67%), compared to less frequent users (24%). Thus, alcohol and marijuana may impede academic performance in students who use these substances, which may be amplified for those engaging in CPU, or report more frequent marijuana use.

Physical health

In one study, college students who reported engaging in HED were 2.67 times as likely to have been hurt or injured as a result of their drinking, compared with students who did not engage in HED. Students who reported frequent HED in this study were 8.16 times as likely to have been hurt or injured (Wechsler et al., 2000). Shillington and Clapp (2001) found that students who engaged in CPU were more likely to have: had a hangover (27% vs. 23%; OR=1.35), experienced memory loss (34% vs. 8%; OR=2.08), gotten nauseous or vomited (36% vs. 11%; OR=1.68), passed out (36% vs. 8%; OR=2.18), and been a passenger in a car with a drunk driver (32% vs. 16%; OR=1.38), compared to alcohol-only users. There were no

significant differences between CPU and alcohol-only students for: impaired driving, getting into physical fights, and physical injuries.

The above results suggest that students who engaged in CPU report higher amounts of memory loss, an area that has received much investigation in marijuana research. In one study, 40% of at-risk marijuana users—defined as having used five or more times in the previous year—reported concentration problems after being high on marijuana (Caldeira et al., 2008). Pope and Yurgelun-Todd (1996) concluded that memory functions were somewhat compromised in students who used marijuana heavily, but retention of newly learned information after a temporal delay appeared to remain intact. Of note is that results of such studies do not indicate if premorbid cognitive abilities between light and heavy marijuana or between users and nonusers could explain these differences (Pope Jr & Yurgelun-Todd, 1996). More research is necessary to clarify potential cognitive consequences of marijuana use. Finally, Taylor, Poulton, Moffitt, Ramankutty and Sears (2000) found that respiratory symptoms in young adults increased from 61% to 144% for marijuana dependent smokers, compared to non-smokers, even after controlling for tobacco use. The frequency of respiratory symptoms in marijuana-dependent smokers was similar to those who smoked ten cigarettes a day.

Regarding impaired driving, McCarthy, Lynch and Pedersen (2007) reported that since fewer students use marijuana overall, similar self-reported driving rates after alcohol and marijuana use suggest that youth are more likely to drive after using marijuana, compared to youth using alcohol. During road tests, Ramaekers et al. (2000) found that the effects of *low* doses of THC on driving performance were not blatantly dangerous, but they were sufficient to pose higher than normal risks to traffic safety. The effects of combined marijuana and alcohol (approximate BACs of 0.04-0.05 g/dl during driving tests) were severe and equivalent to driving with a BAC of 0.09. The effects of combined alcohol and *high* dose of THC were equivalent to driving with a BAC of 0.14. The seriousness of some of the physical health problems affecting

college students is of great concern and the implications for public health (e.g., impaired driving accidents, fights) suggest that addressing college student substance use may have benefit both this specific subgroup, but also society.

Sexual coercion/sexual assault

In college populations, sexual assaults generally occur in social situations where both men and women are typically drinking together, and a variety of reasons have been proposed to explain the relationship between alcohol and sexual assault (see Abbey, 2002). Larimer, Lydum, Anderson and Turner (1999) explored unwanted sexual contact (USC) in a mixed-gender sample of college students who were new members of the Greek system. No gender differences were found in the reporting of five types of USC (females=28%, males=21%). However, greater alcohol quantities, alcohol-related problems and alcohol dependence symptoms were associated with more USC. Of note is that pre-USC incident(s) differences between victims and non-victims were not confirmed prospectively—alcohol-related behaviors could have increased following USC incident(s) (Larimer et al., 1999).

Further, Howard, Griffin and Boekeloo (2008) found that females who engaged in recent HED were 7.74 times as likely to report alcohol-related sexual assault, compared to those who did not engage in HED. For students who reported that they had been taken advantage of sexually, taken advantage of someone else sexually, or had participated in risky sex, Shillington and Clapp (2001) found similar rates between students who used alcohol only, and those that engaged in CPU. Thus, heavier alcohol use may to increase the likelihood of experiencing USC. However, lack of increased risk of USC for students reporting CPU may suggest that marijuana use does not increase the risk of USC, relative to the risk associated with alcohol use.

Social problems

Students who engaged in CPU, compared to those who used only alcohol, were more likely to: have gotten in a verbal argument (30% vs. 8%; OR=1.68), have been criticized for drinking behavior (30% vs. 8%; OR=2.03), and have done something they regretted (34% vs. 7%; OR=2.74; Shillington & Clapp, 2001). Reports of legal problems and property damage were relatively rare in this sample, and there were no significant differences between students who used only alcohol, and those who engaged in CPU. The addition of marijuana in use patterns may be related to increased risk of experiencing interpersonal difficulties, as well as regretful personal behaviors. Surprisingly, marijuana use also increased the odds of being criticized for personal alcohol use; perhaps marijuana use increases others' awareness of an individual's overall use and impairment pattern, leading to increased criticism of substance use overall. Further research explicating the mechanisms through which marijuana increases the risk of social problems may reveal important areas to target during prevention interventions.

Mental health

There is much research demonstrating strong associations of substance use, abuse and dependence with mental health disorders in community samples (Swendsen et al., 2010). There is debate, however, regarding the order of disorder onset (i.e., do mental health conditions antedate substance use disorders, or vice versa), and a full examination of this area of literature is beyond the scope of this paper. Some studies have found that mental health disorders predict later substance use, and others have found associations in the opposite direction (see Swendsen et al., 2010, for a literature review). Recognizing that the literature is inconclusive at this point, mental health disorders are presented here as potential consequences of use, influenced more by the fact that available literature on representative college populations predicted mental health disorders from use.

Alcohol. Only one study was found that provided estimates of DSM-IV mood, anxiety and personality disorders in a representative sample of college students (Dawson, Grant, Stinson, & Chou, 2005). Using the 2001-2002 National Epidemiologic Survey on Alcohol and Related Conditions, the authors categorized college students into: past-year drinkers, lifetime abstainers, those with alcohol abuse, those with alcohol dependence, and binge drinkers without a substance use disorder (i.e., abuse or dependence). Overall, there were few differences in the risks of meeting criteria for a mental health disorder across alcohol groups when education, marital status, tobacco and illicit drug use, age, gender, and race/ethnicity were controlled for. For example, compared to lifetime abstainers, binge drinkers without a substance use disorder, as well as those with alcohol abuse, did not have significantly elevated risks of any mental health disorder after controlling for the above variables. Differences emerged once alcohol dependence was examined. Compared to lifetime abstainers, those with alcohol dependence were 2.4 times as likely to have any mood/anxiety disorder, 4.4 times as likely to meet criteria for hypomania, and 3.5 times as likely to meet criteria for histrionic personality disorder (Dawson et al., 2005).

The author's parallel examination of differences in mental health disorders between alcohol use and lifetime abstinence among non-college young adults and adults over 30 in the same article revealed many more significant differences than those observed in college students. The authors suggest that the sheer prevalence of heavy drinking among college students may result in this pattern of use not being selective of individuals who have comorbid disorders, like what is seen in other populations. Further they contend that the lack of comorbid disorders may have contributed to students' ability to attend college in the first place, possibly leading to selection effects (Dawson et al., 2005).

The results of this study suggest that alcohol use does not significantly elevate the odds of experiencing mental health disorders, until perhaps use advances to dependence severity, for

which treatment and not prevention would most likely be called. Campus counseling centers could possibly screen for alcohol use in students presenting with mood or personality disorders, and provide treatment for possible comorbid disorders. For prevention purposes, any students meeting mood disorder diagnoses could be provided with alcohol prevention programming if intensive treatment for alcohol use is deemed unnecessary. Further research on treatment programs for students with comorbid disorders could be argued for.

CPU. Dawson et al. (2005) note that the odds ratios for mental health disorders decreased somewhat in the fully adjusted models (i.e., controlling for age, gender, race, education, marital status, tobacco and illicit drug use), compared to the partially adjusted models (i.e., controlling for age, gender, race)—though the decreases were much less prominent for college students compared to other adults. The authors suggest that the overall risk of experiencing mental health disorders is different than the risk that is directly attributable to drinking status. Though all increased risk cannot be contributed to tobacco and illicit drug use in the fully adjusted models, the authors note that students who drink could experience greater risks of mental health disorders as a result of their tobacco and other drug use.

Marijuana. Buckner, Ecker and Cohen (2010) examined mental health problems in a representative sample of freshmen and sophomore students, according to frequency of marijuana use. Students were characterized as: nonusers, infrequent users (less than weekly use) and frequent users (weekly or more marijuana use). Both infrequent use and frequent use were associated with greater mental health problems overall, and specifically: anxiety, phobia, depression, hostility, interpersonal sensitivity, paranoia, psychoticism, and somatization. There were no significant differences in the levels of mental health problems between infrequent users and frequent users, suggesting that mental health disorders may be associated more with any use of marijuana, and not use severity. Another study found that frequent marijuana use was associated with significantly increased odds of college student participants self-reporting being

diagnosed or treated for major depressive disorder (Keith et al., 2015). Further, students reporting any past month marijuana use had significantly increased odds of being diagnosed or treated for an anxiety disorder.

In sum, the above studies suggest even infrequent use of marijuana use is highly associated with a host of mental health problems, but alcohol use does not show similar increases in risk until students engage in more severe alcohol use (i.e., dependence). Therefore, there may be grounds to screen students who report even infrequent marijuana use for mental health disorders. The increased risk for those engaging relatively infrequent marijuana use may warrant inclusion of mental health components marijuana prevention efforts.

Substance use disorders

Development of substance use disorders as a result of alcohol or marijuana use is perhaps one of the clearest indicators that use has escalated to levels that have resulted in severe consequences for students. The 2001-2002 National Epidemiologic Survey on Alcohol and Related Conditions (Blanco et al., 2008) found that 20.37% of college students met criteria for an alcohol use disorder, comprising of 7.85% who met abuse criteria, and 12.52% dependence criteria. Reporting results from the College Life Study (CLS; Arria et al., 2008), Calderia et al. (2008) found that weighted estimates of cannabis use disorders in first-year college students were: $10\%_{wt}$ for any cannabis use disorder ($4\%_{wt}$ abuse, and $5.4\%_{wt}$ dependence), and $14.4\%_{wt}$ for meeting least one DSM-IV criterion for cannabis use disorder. More frequent use was related to cannabis use disorder—of regular marijuana users (six+ times in the past month), 39% met criteria for marijuana dependence, and 29% met criteria for marijuana abuse. In a different study, students who reported three or more days of marijuana use in the past month had significantly elevated odds of reporting that they had been diagnosed or treated for a substance use disorder in the previous year (Keith et al., 2015). In the first two studies above, cannabis use disorder prevalence estimates were half the rates of alcohol use

disorders; however, when annual use rates as measured on the MTF survey (Johnson et al., 2014) are considered, (i.e., 76.1% for alcohol, 34.4% for marijuana), risk of cannabis use disorder appears may be slightly higher than alcohol use disorder. It is also concerning that higher proportions of students met the criteria for both alcohol and marijuana dependence, compared to corresponding abuse criteria for these two substances.

CPU. Analyses of the CLS data showed that frequent drinking—defined as nine or more days in the past month—did not have a significant impact on rates of cannabis use disorder and other cannabis related problems (Caldeira et al., 2008). However, another study suggests that marijuana dependence may occur more often in the context of CPU (Smucker Barnwell, Earleywine, & Gordis, 2005, 2006). In an adult sample of weekly marijuana and alcohol users, both marijuana and alcohol use and their interaction predicted marijuana dependence symptoms. Slopes analyses revealed that at one standard deviation above the mean on alcohol use, the relation between marijuana use and marijuana dependence symptoms was positive and significant, but was non-significant at one standard deviation below the mean. The authors concluded that this confirms that alcohol moderates the link between marijuana use and dependence (Smucker Barnwell et al., 2006). However, the maximum number of marijuana symptoms was 2.4 symptoms at one standard deviation above the mean in regression analyses, lower than the required number of three symptoms for dependence in the DSM-IV (American Psychiatric Association, 2000). Alcohol use could be associated with cannabis use disorder symptoms, but more data is required to address association with actual diagnoses related to marijuana use.

For alcohol use disorders, a national survey of individuals ages 18 and older found that CPU (vs. no CPU) was not associated with increased odds of alcohol dependence (OR=1.48), but SPU (vs. no SPU) was (OR=3.55; Midanik et al., 2007). Finally, students who engaged in

CPU, compared to those who only used alcohol, were more likely to have thought they had a(n) alcohol/drug problem (32% vs. 4%; OR=8.43; Shillington & Clapp, 2001).

Approximately 20% of college students in the above studies met criteria for an alcohol use disorder (Blanco et al., 2008), and 10% met criteria for a cannabis use disorder (Caldeira et al., 2008). Programming could aim to curb heavy use before it becomes clinically problematic. The above results further provide support for increasing availability of substance use treatment on campuses, as well as research investigating strategies to increase awareness of treatment, because many college students appear receptive to a variety of treatment options (see Epler, Sher, Loomis, & O'Malley, 2009). Given the inconsistent findings regarding increased risk of substance use disorders in those engaging in CPU, further research should examine such associations.

Conclusion to consequences

Clearly, there is a wide range of problems associated with alcohol use, marijuana use, and CPU. Prevalence rates for most alcohol-related consequences do not appear to be declining nationally (Perkins, 2002b) and continued efforts to curb heavy alcohol use and subsequent problems are recommended. Of great concern is that students who engaged in CPU had significantly increased risk for 11 of 15 selected problems, compared to those that used alcohol only (Shillington & Clapp, 2001). This pattern of increased risk for students engaging in CPU was replicated in a later study by the same authors (Shillington & Clapp, 2006), with the study timeframe extended to one year. It is unclear if underlying mechanisms that lead to the problems are the same for students engaging in CPU and alcohol use only. Research should focus on further establishing the link of increased risk of problems for students engaging in CPU, reasons for differential reporting of problems, and how this information can be incorporated or utilized by prevention programs. Research should also investigate if SPU presents higher risk for problems compared with CPU.

Predictors of Use

There are a number of factors associated with college student alcohol use, marijuana use, and CPU. Understanding of influences on these patterns of use provides a better understanding of the development of at-risk use, as well as those related to continuation of use. Predictors can also be used by prevention efforts to target programming to particular groups of individuals who are at heightened risks of developing problematic use. This section is organized into two broad groups of factors associated with patterns of use (see Borsari, Murphy, & Barnett, 2007): 1) those at are likely to have preceded college attendance (i.e., moderators), including: gender, race, age, and religiosity, and 2) those that affect use after matriculation (i.e., mediators), including: polysubstance use, Greek and athletic participation, peer relationships and influences, and living arrangement.

Gender

Literature consistently documents that males drink more often, and consume greater quantities of alcohol (O'Malley & Johnston, 2002). Males engage in more HED (43% vs. 30%), extreme HED of 10 or more drinks in the previous 2 weeks (22% vs. 7%), extreme HED of 15 or more drinks (9.5% vs. 1.9%), and daily use of alcohol (5.4% vs. 3.5%; Johnston et al. 2015). Some studies report that men and women experience similar amounts of alcohol problems (Wechsler et al., 1994), some report that men indicate higher instances of alcohol problems (Read, Wood, Davidoff, McLacken, & Campbell, 2002; Vik et al., 2000). Despite men endorsing higher instances of alcohol problems overall in some studies, there is evidence to suggest that women have increased odds of experiencing problems at similar levels of consumption (i.e., drinks per week) and intoxication (i.e., BAC). For example, Sugarman, DeMartini and Carey (2009) found that when controlling for consumption, women were 1.5 to 2 times as likely to develop tolerance, experience blackouts and passing out, drinking after promising not to, and to get hurt or injured (i.e., damage to self). This pattern was identical when intoxication and not

consumption was controlled for. In these analyses, males were more likely to report going to school drunk and damaging property (i.e., antisocial behaviors), when consumption and BAC were controlled for. The increased trends for women to engage in HED (Grucza et al., 2009) and to deliberately attempt to match their consumption to that of male peers (Young, Morales, McCabe, Boyd, & D'Arcy, 2005), may serve to decrease the potential gender gap in overall alcohol problems experienced, and possibly increase the risk for females to experience self-harm problems.

In general, large gender differences are not found for annual marijuana use (Bell, Wechsler, & Johnston, 1997; Johnston, O'Malley, Bachman, & Schulenberg, 2010), but compared to females, males report higher monthly marijuana use (23.5% vs. 18.8%), and daily marijuana use (8.7% vs. 3.9%; Johnston et al., 2015). No gender differences in marijuana problems were found across several studies (Simons, Correia, Carey, & Borsari, 1998; Simons, Gaher, Correia, Hansen, & Christopher, 2005; Simons, Neal, & Gaher, 2006). No gender differences were found for prevalence rates between college students who engaged in CPU and alcohol-only users (Shillington & Clapp, 2001). Collins, Ellickson and Bell (1998) found that male 12th graders engaged in significantly more SPU than females (21% vs. 17%; OR=.75 for females), after other salient predictors of SPU were controlled for.

Males often drink more alcohol, but gender appears to be an independent risk factor for alcohol problems, and research should move beyond attributing gender differences in alcohol problems merely to higher rates of consumption on behalf of men (Sugarman et al., 2009). Emphasizing increased risk of self-harm during prevention interventions with women is also recommended. Gender differences may be less pronounced for marijuana use overall, but increased daily use on behalf of males may suggest gender differences for heavier marijuana use, and potentially prevention need.

Race

When discussing differences in drinking behaviors by race/ethnicity, one study found that White students consistently reported the highest rates of heavy drinking, followed by Hispanic and African American students, respectively (O'Malley & Johnston, 2002). White students were also 1.32 times as likely to use marijuana as were non-white students (Bell et al., 1997). No differences in race were found for prevalence rates between college students who engaged in CPU and alcohol-only users (Shillington & Clapp, 2001). Collins, Ellickson and Bell (1998) found that Asian American 12th graders were significantly less likely to engage in SPU than White, African American, and Mexican American students (OR=.47).

Age

McCabe (2002) found that sophomore, junior, and senior male undergraduates engaged in heavier and more frequent HED, compared to freshmen males. The trend was reversed for females. Using multivariate analyses, Bell et al. (1997) found that students under the age of 24 reported marijuana use similar to that of students over the age of 24. Other researchers found that 17% of students over the age of 24, and 10.5% of those under the age of 24, reported past year marijuana use (Gledhill-Hoyt et al., 2000), suggesting some age differences that may be mediated through other variables in multivariate analyses (e.g., living situation, marital status). Finally, Shillington and Clapp (2001) found in their study that polysubstance users (mean age=24) were significantly younger than alcohol-only users (mean age=26.5). Of note is that their sample was older than most college samples.

In summary, compared to other races, White students appear more likely to engage in alcohol and marijuana use. Additionally, younger males and older females appear to engage in heavier alcohol use. Age may be related to marijuana use, though other variables (e.g., living situation) may account for such differences in analyses. CPU may be more prevalent in younger students, but more studies utilizing representative samples are needed to further

solidify this finding. Targeted alcohol prevention for White students, younger males, older females, as well as marijuana and CPU prevention for all students could be recommended.

Religiosity

Galen and Rogers (2004) found modest but significant inverse correlational relationships between alcohol consumed and various religious measures (e.g., church attendance [r = -.23], frequency of prayer [-.23], intrinsic religiosity [-.35]). Another study found that students who rated religion as "not very important" were more 2.73 times as likely to use marijuana as students who stated that religion was very important to them (Bell et al., 1997). Finally, religiosity did not predict SPU in 12th graders, relative to no SPU (Collins et al., 1998). No information on religiosity's influence on CPU was found. Religiosity may be a protective factor against the use of alcohol and marijuana. Perhaps colleges could work with community-based faith organizations to promote faith-based programming and awareness of proximal churches and other faith-based activities.

Polysubstance use

College students who engaged in HED were 3.38 times as likely to use marijuana compared to students who did not engage in HED (Bell et al., 1997). In another study, nine out of 10 students who used marijuana in the past 30 days also used other illicit drugs, smoked cigarettes, and/or engaged in HED (Gledhill-Hoyt et al., 2000). Research suggests that those who use marijuana or engage in heavier drinking are more likely to use other substances. Research targeting broader patterns of substance use may prove to be socially and fiscally responsible for colleges and society in general.

Greek and athletic participation

Monitoring the Future panel data reported by McCabe et al. (2005) from 10 college cohorts found that in the first few years of college, Greek members engaged in significantly more alcohol use, HED, and marijuana use, compared to non-Greek members. Greek

members, relative to non-members, also experienced greater linear increases over the course of college attendance for HED and marijuana use.

Regarding athletic participation, male intercollegiate athletes engaged in HED more than non-athlete students (66%, and 43% respectively) and female rates were 50%, and 36% respectively (Wechsler, Davenport, Dowdall, Grossman, & Zanakos, 1997). In contrast, Nelson and Wechsler (2001) found significant differences between athletes and non-athletes only when frequent HED was considered. Athletes were more likely to experience 17 different alcohol problems, compared to non-athletes (Nelson & Wechsler, 2001). In a study of marijuana use, fewer male athletes than non-athletes reported marijuana use (12% vs.16%), with non-significant differences for females (10% vs. 11%; Wechsler et al., 1997). The increased engagement in substance use for Greek members and athletes supports the various targeted efforts for these groups on campuses (e.g., LaBrie, Hummer, Huchting, & Neighbors, 2009; Larimer et al., 2001; Lewis & Neighbors, 2006). When the potential detriments to athletics are blatant (e.g., inhaling marijuana smoke), athletic participation does not increase risk of use. Perhaps the negative influence on athletic performance is more salient for marijuana use. Targeted efforts for athletes should emphasize the potential detriments of alcohol use, including long-term ones.

Peer relationships and influences

Peer relationships are consistently linked to alcohol use in college students (Borsari & Carey, 2006). Peers appear influential under a number of conditions (i.e., drinking reported in combination with both the presence and absence of social support, heavy drinking reported in both social and solitary settings, and use during pleasant times as well as conflict with others), which has provided difficulties for establishing associations between peer relationships and drinking (Borsari & Carey, 2006). Examining peer influence and alcohol use, Duncan, Boisjoly, Kremer, Levy and Eccles (2005) found that males who engaged in HED in high school drank

more in college if their assigned roommate also engaged in HED in high school, compared to roommates who did not engage in high school HED. This relationship was not seen for females, for those who did not engage in high school HED, and for marijuana use across both genders.

Borsari and Carey (2001) provided an extensive review of peer influences on college drinking and identified three areas of peer influence: 1) direct, 2) indirect modeling, and 3) indirect perceived norms. Direct peer influence, defined as drink offers by peers was found to be significantly associated with alcohol use and alcohol problems (Wood, Read, Palfai, & Stevenson, 2001). Modeling and perceived norms are included in various psychosocial theories applied to predict alcohol use. These will be described in detail in a theory section below.

Living arrangement

Students living in Greek housing were 1.30 times as likely to use marijuana as students who did not live in Greek housing (Bell et al., 1997). For alcohol, Ward and Gryczynski (2009) utilized 2001 College Alcohol Survey data from 119 colleges across the country (Wechsler et al., 2002). The authors found that living in Greek housing and living with a roommate were associated with increased odds of HED, compared to living with a parent, spouse, or in alcohol-free housing. This study also found increased odds of HED for students living off-campus, compared to on-campus. Further investigation revealed that students who lived less than one mile from campus (but not “on-campus”), or between two and five miles from campus, had higher odds of HED than students living on-campus, between one and two miles, or outside a five-mile campus radius (Ward & Gryczynski, 2009).

The authors did not fully speculate about these interesting findings. It could be that students living close to campus, but not on campus are residing in houses with other college students, which may be environments that are permissive of alcohol use. Further, there is likely to be less enforcement of alcohol policies and laws off-campus, than within on-campus housing

(e.g., dormitories). The relationships between alcohol use and other distances from campus are interesting, and apparently not specific to a single campus, as the data was from 119 colleges.

The above findings suggest that living in Greek housing may increase the odds of HED and marijuana use. Additionally, living on campus may decrease the odds of engaging in HED, compared to off-campus housing, but more research is needed regarding the mechanisms that increase the odds of HED when certain distances to campus are examined in detail.

Conclusion to predictors

There appear to be several personal and environmental attributes associated with alcohol and marijuana use, and CPU. Both genders could be targeted with prevention efforts across the three substance use patterns. White students may also require targeted alcohol and marijuana efforts, and all races could be targeted with CPU interventions. Perhaps freshmen and sophomore females, and junior and senior males would benefit from prevention, and younger students for CPU interventions. Students who do not feel religion is important or who do not take part in religious activities appear at higher-risk for alcohol and marijuana use, and could be targeted. Students who engage in either alcohol or marijuana use appear to be at higher risk of using the other corresponding substance and students reporting use of one could be screened for the use of the other and be provided prevention if appropriate. Targeted alcohol programming for Greek members and athletes may be beneficial, and marijuana programming for Greek members and non-athletes. Finally, students living in Greek housing or off-campus could be targeted with both alcohol and marijuana prevention. It is clear that a number of subpopulations of college students could be targeted with prevention programming, but that there is less information to inform CPU intervention targeting at this point. Until more is known about predictors of CPU, researchers may need to rely on predictors of alcohol and marijuana use when developing interventions targeting CPU.

Theoretical Models

Introduction

Alcohol and marijuana use are complex phenomena, with personal, social, and environmental influences playing key roles in behavior expression. As such, a number of psychosocial theories have been utilized to explain, predict, and change patterns of college student substance use behavior. Many behavior change models and theories have overlapping or similar constructs, with some supported as particularly influential for the targeted group of college students (see Table 2.1). No widely-tested model that has incorporated all the theoretically-based constructs listed below was found.

To account for a number of potential influences on substance use behaviors in college students, this review utilizes a multi-theoretical approach to explain college student substance use. The multi-theoretical model proposed here encapsulates elements of the following theories: Social Cognitive Theory, Social Norms Theory, the Reasoned Action Approach, Motivational Models, and Expectancy Theory. The contribution of each of these theories to this approach is described below. As seen in Figure 2, there are a number of pathways in the proposed multi-theoretical model that attempt to explain and influence substance use behaviors. As comprehensive models are not often tested, it is unknown which components are most influential when a number of other constructs are considered in analyses. It is important for the college substance use field to begin to develop and test more comprehensive substance use behavior models. The various components and proposed paths to problematic substance use are described below.

Expectancies

Expectancy is a cognitive factor that refers to the anticipated consequences of some behavior (e.g., marijuana use; Brown, Goldman, Inn, & Anderson, 1980). Simply, it is an estimate that a behavior will lead to certain outcomes (Bandura, 1977, p. 79). Expectancies

held regarding a behavior (e.g., the effects of drinking alcohol or using marijuana) vary and are often thought to mediate actual behaviors. Expectancies are a part of four main models: Expectancy Theory (Brown et al., 1980), Motivational Models (Cooper, Frone, Russell, & Mudar, 1995; Cox & Klinger, 1988), Reasoned Action Models (Fishbein & Ajzen, 2010), and Social Cognitive Theory (Bandura, 1977).

As depicted in Figure 2, expectancies within these models can directly influence substance use, or can be mediated through motives or attitudes (described below). Much research has concentrated on direct influence of expectancies on substance use; however research on Motivational Models, and to a lesser extent, Reasoned Action Models, supports expectancies as more distal influences on proximal determinants of substance use (e.g., motives, attitudes). Research that examines multiple pathways of influence for expectancies may provide information regarding how this construct is related to college student substance use, especially when other constructs are considered.

A decision to engage in substance use is made by weighing up both the positive and negative expected consequences (i.e., beliefs that use will lead to negative or undesirable outcomes; Leigh, 1989). According to Expectancy Theory, positive associations should be found between positive expectancies and consumption (i.e., positive expectancies should be associated with higher degrees of actual substance use), and negative associations should be found between negative expectancies and consumption (i.e., negative expectancies should be associated with less actual substance use; Jones, Corbin, & Fromme, 2001).

Endorsement of negative expectancy domains should theoretically act as a deterrent to substance use—that is, if additional positive expectancies in which an individual believes do not outweigh believed negative results of alcohol use, during a cognitive cost-benefit analysis engaged in during the decision to use alcohol. Both positive and negative beliefs regarding the likely results of using substances is important and should be incorporated into predictive models

of college student substance use. Seven main domains of alcohol expectancies (see Brown et al., 1980; Demmel & Hagen, 2003) and six for marijuana (see Schafer & Brown, 1991) have been identified. Schafer and Brown (1991) found marijuana expectancy domains that overlapped considerably with those found in alcohol expectancy research.

While expectancies have been established for alcohol and marijuana use separately, little work has been done on the influence of expectancies for both substances on CPU/SPU, or on expectancies of combining substances during CPU/SPU. It may be that individuals hold unique sets of expectancies for each substance, or at have more variation in expectancies than those who use single substances. This appears plausible, as there should be reasons for adding a substance while under the influence of another (Smucker Barnwell & Earleywine, 2006), even if just social facilitation. If overlapping expectancies are held for both substances, the addition of another substance may be more for functional reasons (e.g., one may be cheaper or available).

Smucker Barnwell and Earleywine (2006) found that simultaneous alcohol and marijuana expectancies marginally increased the accuracy of predicting SPU, compared to single substance expectancies alone in a community sample of adults. This sole example of investigating expectancies for SPU supports further investigation of the influence of simultaneous expectancies and non-pharmacological reasons that may contribute to SPU (Stacy, 1997). Given the little research on SPU expectancies, and the measurement of this construct, initial research could include expectancies for both substances in behavior change models to account for the influence of expectancies corresponding to each substance (CPU). As research progresses, SPU expectancies can also be developed and examined. More work on identifying and measuring SPU expectancies is needed before the construct is included in models.

Motives

Motivational Models (Cooper et al., 1995; Cox & Klinger, 1988) include both expectancies and motives. These two constructs are highly correlated, but are conceptually and statistically distinct (see Kuntsche, Wiers, Janssen, & Gmel, 2010). Expectancies are beliefs about the effects of a substance, and motives are values placed on the effects of a drug that individuals want to achieve, thereby motivating them to use. Cox and Klinger (1988) developed a motivational model which posits substance motives as proximal factors that mediate the effects of more distal expectancies on substance use (see Figure 2). Expectancies are distal because they are thought to be formulated well before the initiation of use (Kong & Bergman, 2010), and precede the development of substance motives (Leigh, 1990).

Temporally, expectancies are implied by drinking motives. That is, if individuals use substances in order to feel a certain way, then they must believe that the substance will make them feel that way. Therefore, expectancies are a necessary condition to use a substance, but not vice versa—an individual can expect an effect from a substance but not use a substance to obtain that effect. Motivational models propose that motives are a necessary cognition for decision-making (Kong & Bergman, 2010), and people do or do not use substances based on whether the expected positive consequences or expected avoidance or escape of negative consequences outweigh those that a person expects to obtain from not drinking (Cox & Klinger, 1988). Motivational Models are the only widely-used behavior change models that utilize motives.

Motivational Models (Cooper et al., 1995; Cox & Klinger, 1988) often find two domains of drinking motives: drinking to reduce or regulate negative mood states (coping motives), and drinking to or regulate positive emotions or moods (enhancement motives). Expanding this, Cooper (1994) proposed a four-factor model of drinking motives: 1) coping, 2) conformity, 3) enhancement, and 4) social motives. In general, adolescents and adults more frequently

endorse social motives, compared to coping motives, and social motives are associated with light, infrequent, nonproblematic alcohol use in social situations. Coping motives have been related to heavier, problem drinking and drinking alone in adolescents and adults (Cooper, 1994).

Motives have been found to be influential on alcohol and marijuana use in college students. Simons et al. (2005) compared differences in a motivational model across two groups of students: students who only used alcohol, and students who used both alcohol and marijuana (CPU). The researchers' overall motivational model—which included expectancies and other antecedents of motives—explained twice as much variance in alcohol use for the group that only used alcohol, compared to students who engaged in CPU. These results suggest that constructs outside of motivational models may be more influential on CPU. Further, motives for CPU and SPU have not been examined in the literature; currently only motives for a single substance have been modeled. Further research should attempt to measure and investigate motives for engaging in CPU and SPU, and if any motive domains are associated with increased CPU or SPU, and substance-related problems.

Attitudes

Attitudes can be thought of as positive or negative evaluations of performing a particular behavior (e.g., drinking alcohol). In Reasoned Action Models, attitudes are influenced by expectancies, with positive expectances hypothesized to result in positive attitudes, with negative expectances resulting in negative attitudes towards the behavior. As discussed below, attitudes are theorized to directly influence intentions to use substances (see Figure 2).

Several studies have investigated the influence of attitudes on college student substance use within Reasoned Action-type models (Armitage, Conner, Loach, & Willetts, 1999; Conner & McMillan, 1999; Norman, Armitage, & Quigley, 2007; Norman, Bennett, & Lewis, 1998; Norman & Conner, 2006). Two studies that examined a full Reasoned Action-type model (Armitage et

al., 1999; Norman et al., 1998) did not find that expectancies were significantly predictive of attitudes, reducing support of this pathway in Reasoned Action Models. Other studies found that attitudes were inconsistent predictors of intentions to use alcohol (Armitage et al., 1999; Norman et al., 2007; Norman et al., 1998; Norman & Conner, 2006) but more consistent predictors of intentions to use marijuana (Armitage et al., 1999; Conner & McMillan, 1999). More research could reveal the potential influence of attitudes on intentions to use alcohol or marijuana, and could elaborate on the potential discrepancies in this construct's influence on intentions by substance (i.e., marijuana, alcohol). No studies were found that measured attitudes towards CPU or SPU use, and how these relate to other constructs when predicting CPU. In general, prevention programs could attempt to address attitudes (e.g., increase negative attitudes towards use), if research shows a consistent influence on intentions or substance use in college students.

Perceived social norms and normative pressure

Social Norms Theory, (SNT; Perkins, 1991, 1997, 2002a), Reasoned Action Approach (Fishbein & Ajzen, 2010), and Social Cognitive Theory (SCT; Bandura, 1986, 1997) all include the construct of perceived social norms. These theories posit that beliefs (i.e., perceptions) of social peer norms influence personal substance use and behaviors that can result in substance-related problems. Perceptions of social norms can directly influence substance use, or their influence can be mediated by a perception of pressure to engage in substance use, likely due to misperceptions of social norms. There are two different types of norms: injunctive and descriptive. Injunctive (attitudinal) norms refer to widely shared beliefs or expectations in a social group about how individuals in general or members of a group should behave in various circumstances. Descriptive (behavioral) norms refer to the most common behaviors actually exhibited in a social group (Perkins, 2002a). Though usually correlated, both types have been shown to uniquely influence substance use (see Borsari & Carey, 2003).

While actual social norms (e.g., family and peer use) are influential on personal use, use and subsequent problems may increase when individuals misperceive social norms. Research demonstrates pervasive differences between what students believe to be peer norms and actual norms collected on college substance use surveys (Borsari & Carey, 2003). Most students believe their peers hold more permissive injunctive norms, or attitudes towards substance use than is the case. Further, most students believe in inflated descriptive norms, or that that peers use substances more frequently and more heavily than they actually do (Perkins, 2002a). SNT and SCT both directly posit that that these misperceptions translate into internalized indirect peer pressure to use substances, or that students engage in increased use to meet their misperceptions of peer expectations (Fishbein & Ajzen, 2010; Perkins, 2002a). This perceived normative pressure construct mediates the influence of perceived social norms on substance use.

Norms-based intervention strategies that communicate actual student norms to dispel myths have received significant research attention (Perkins, 2002a). The premise of such interventions is to communicate the truth about what the majority of students actually think and do concerning substance use (Perkins, 2002a). Four RCTs using provision of correct alcohol norms in the context of SNT as an intervention strategy (Lewis & Neighbors, 2007; Lewis et al., 2007; Neighbors et al., 2004; Neighbors et al., 2006) showed that relative to assessment only, between-subjects effect sizes ranged from 0.61 to 0.96 for altering inflated normative perceptions, and from 0.35 to 0.97 for reducing drinking (Neighbors et al., 2010).

These studies had relatively short follow-up periods, ranging from one to six months. No studies were found that exclusively targeted norms misperceptions of marijuana use with norms interventions. While a few marijuana-focused interventions have included norms components during comprehensive personalized normative feedback with college students and adults (Lee

et al., 2010; Stephens et al., 2007), no results can be attributed to normative components, because influence on perceived norms was not measured.

Likewise, for CPU, a few PNF interventions have included both alcohol and marijuana norms components (White et al., 2006; White, Mun, & Morgan, 2008), without measuring perceived norms. Also, no studies comparing alcohol and marijuana norms perceptions, for those who do not use substances, use only alcohol, and those who engage in CPU have been carried out. Differences in misperceptions related to patterns of use may or may not support targeting more than one substance in norms interventions.

Overall, research has demonstrated misperceptions for both alcohol and marijuana use, and for most students, regardless of personal use. Norms-based interventions appear promising for addressing alcohol, but have yet to be tested for addressing marijuana use and CPU. Despite potential support, previous studies are not without limitations. In feedback interventions, discrepancy is assumed to be facilitated through reliance of the perceived norm construct—if perceived norms decrease, such models assume that discrepancy (facilitated by norms information) is what leads to the altering of perceived norms. Despite common practice, norms-based models should also include a discrepancy measure to ensure that perceived norms were indeed altered by discrepancy between beliefs and actual student norms. Finally, these models rely on perceived pressure to engage in use, due to misperceptions of peer norms. Future studies should attempt to measure perceived pressure associated with misperceptions of norms, to test this influence that is implied in models that include perceived norms constructs.

Control beliefs

Control beliefs are a third set of beliefs within Reasoned Action Models (Fishbein & Ajzen, 2010). These beliefs consider personal and environmental factors that can facilitate or impede one's attempts to carry out the behavior. Control beliefs are hypothesized to influence

perceived behavioral control (discussed below), and are sometimes modeled to also predict actual use. Norman et al. (1998) found positive control beliefs to be significant predictors of college student heavy episodic drinking. Additional research may support the influence of control beliefs on alcohol and marijuana use, but the belief constructs are often omitted in studies employing Reasoned Action Models.

Self-Efficacy

Self-efficacy is the belief that one can initiate a behavior at a level required to obtain a desired outcome (Bandura, 1977, 1986), such as drink refusal (Maisto et al., 1999). Self-efficacy is a component incorporated in SCT and Reasoned Action Approaches, and is thought to vary depending on the behavior in question, as well as the context in which the behavior occurs. In SCT, an increase in substance use may result if a student's social cognitions (e.g., self-efficacy) produce a belief that substances are a viable option to ameliorate or handle the difficulties one is experiencing, such as a lack of peer social support to cope with difficulties in life. When considering a course of action, it is believed that if more facilitating than impeding factors to carrying out a behavior exist, self-efficacy for that behavior should be high (Fishbein & Ajzen, 2010).

Most research on college students has concentrated on substance refusal self-efficacy, or a belief that one can successfully resist using substances. Young, Connor, Ricciardelli and Saunders (2006) found that drink refusal self-efficacy added a significant proportion of additional variance in college student alcohol dependence, alcohol quantity and alcohol frequency, over and above what positive and negative expectancies contributed. Additionally, in a community sample of women aged 18 to 24, Hayaki et al. (2011) found medium negative correlations between marijuana refusal self-efficacy and marijuana use days ($r = -.45$), marijuana problems ($r = -.31$), and marijuana dependency ($r = -.46$). As self-refusal efficacy appears influential on

college student substance use, inclusion in model testing may be appropriate. No studies appear to have investigated self-efficacy for multiple substance refusal.

Perceived behavioral control

Perceived behavioral control (PBC) is hypothesized to mediate the influence of control beliefs on substance use in Reasoned Action Models. In Reasoned Action Models, PBC is conceptualized the same as self-efficacy in SCT—the belief that one can initiate a behavior at a level required to obtain a desired outcome (Bandura, 1977, 1986). PBC is a direct determinant of Behavioral Intentions in Reasoned Action Models.

Studies testing Reasoned Action type models (Armitage et al., 1999; Conner & McMillan, 1999; Norman et al., 2007; Norman et al., 1998; Norman & Conner, 2006) have found PBC to be a consistent predictor of intentions and use of alcohol and marijuana use in college students. Interestingly, inverse relationships between PBC and intention, and PBC and use were seen for all studies and for predicting both alcohol and marijuana use. These results are contrary to what reasoned action models would predict, and also to what the majority of studies testing the Theory of Planned Behavior (a Reasoned Action type model; Ajzen, 1985, 1991) have found (see Armitage & Conner, 2001). Reasoned Action Models hypothesize low PBC to be associated with weaker intentions to use and lower levels of actual use (Fishbein & Ajzen, 2010). On the contrary, for college alcohol and marijuana use, study findings suggest that low perceptions of control are associated with both stronger intentions to use and higher levels of actual use. Norman and Conner (2006) suggest that intentions may be influenced by external pressures, over which the student perceives to have little control.

The contradictory findings above lead some researchers to argue that self-efficacy is indeed different than PBC, and that self-efficacy is important to consider in behavior change models. Three studies (Armitage et al., 1999; Norman et al., 2007; Norman & Conner, 2006) subsequently included self-efficacy in their models, in addition to PBC. Armitage et al. (1999)

argued that PBC is an individual's judgment of control over external barriers to (or facilitators of) behavior ("Whether I use marijuana is entirely up to me"). These authors describe self-efficacy as perceived levels of internal or personal control over a behavior (i.e., "I believe I have the ability to use marijuana"). Norman and Conner (2006), and Norman et al. (2007) conceptualized self-efficacy and PBC similarly, and used similar measurement questions in their studies. Overall, self-efficacy was predictor of HED and marijuana intentions and use in two studies (Armitage et al., 1999; Norman & Conner, 2006). This could be argued as support for the conceptualization that self-efficacy and PBC tap into different constructs and require consideration during model testing. Comprehensive model testing that includes both of these constructs, as conceptualized in the above distinct ways, with appropriate measures, may provide more information regarding the distinction of these concepts, their influence on intentions and use, and potential influences on CPU.

Actual control

Actual control over performance of a behavior (e.g., skills, environmental factors) is hypothesized to moderate the effect of intentions on behavior in Reasoned Action Models. Actual control measures are rarely available, and PBC is used as a proxy and it is assumed that PBC accurately reflects actual control. No research that attempted to directly measure actual control within Reasoned Action frameworks was found. This construct is included in the comprehensive model to acknowledge the influence of actual control on substance use behaviors in college students.

Behavioral intentions

The construct of behavioral intentions has been conceptualized as readiness or motivation required to engage in a behavior (e.g., I intend/expect/plan to use marijuana). Intentions are the single best predictor of behavior according to the Reasoned Action models (Fishbein & Ajzen, 2010). Attitudes, perceived norms, and PBC constructs described above

guide behavioral intentions. The more favorable attitudes, perceived norms and PBC towards using are, the stronger intentions are to perform the behavior (Fishbein & Ajzen, 2010).

In studies, intentions appear to be significant predictors of marijuana use and alcohol use frequency (Armitage et al., 1999; Conner & McMillan, 1999), but not HED (Norman et al., 2007; Norman & Conner, 2006). Norman and Conner (2006) found that intention*past HED was a significant predictor of HED, indicating that the intention-behavior relationship became weaker as the frequency of past HED increased. Intention significantly predicted HED under low and moderate levels of past HED, but not at high levels of past HED. This may suggest that HED is a pattern of use that differs from frequency of alcohol or marijuana use, and that reasoned action models do not fully account for all influences on more frequent engagement of HED. The interaction of HED and intentions in Norman and Conner's (2006) model may support further study of the effects of past behavior on the explanatory utility of reasoned action models. Additionally, intentions to engage in CPU or SPU have not been examined in the literature.

Background factors

Limitations of the above theories and constructs are that some personal, social, and environmental influences on engaging in substance use are not accounted for. Not accounting for additional influences suggests that the modeled constructs are independent of any predispositions or environmental factors that could add variation in how substance use is ultimately influenced—either through influencing constructs in the pathways, or outside of modeled mechanisms of change. Indeed, the college literature has demonstrated a number of background factors that could potentially influence alcohol and marijuana use in college students. Table 2.2 lists a number of background factors and studies that have shown certain relationships between the factors and alcohol and marijuana use. Given the evidence, studies aiming to explain college substance use should include relevant factors in analyses, if they are available. Few investigations of factors associated with CPU and SPU have been performed; it

is then unknown whether predictors of alcohol and marijuana use will therefore predict CPU and SPU.

Conclusion to Summary of Theoretical Approaches

It is common in college substance use literature to only examine a few constructs in a model—with some investigators lending support for the full model based off of support for those few constructs. Theoretical modeling is limited by the resources available for novel data collection and variables contained in the existing datasets in secondary analyses. Adequate funding, sample size, and available measures may influence decisions to not engage in comprehensive model testing. The model shown in Figure 2 is comprehensive, but not exhaustive and meant to inform the current narrative literature review. Support for the constructs in the comprehensive model was obtained from a number of studies which vary in theoretical influences and in quantity of constructs tested—relationships between the constructs may change from those found in existing literature when measures differ, more constructs are considered in study designs or different study populations are utilized.

Conclusions

Summary of Findings

The reviewed literature suggests that 20.8% of students use marijuana in any given month (Johnston et al., 2015), and that the great majority of these individuals also use alcohol concurrently and some simultaneously. Using alcohol or marijuana appears to be related to the development of substance use disorders and appears to increase the risk of experiencing negative consequences. Further, students who engage in CPU appear to have increased risk of experiencing problems, and possibly use disorders.

Several theoretical constructs appear to be particularly salient in facilitating alcohol and marijuana use behavior change, and could aid in successfully addressing CPU. In general, expectancies, motives, norm perceptions, self-efficacy/perceived behavioral control, and

discrepancy during self-evaluation, are important theoretical constructs for interventions to consider in this population. Further, the explication of functional and circumstantial explanations for SPU (Clayton, 1986) provides a framework to begin exploring reasons for SPU in college students. In sum, the field appears to include a number of constructs that can be utilized to create interventions that are efficacious in addressing CPU.

Gaps in the Literature and Underdeveloped Areas of Study

Theory base and model testing. A number of underdeveloped areas in the college substance use literature can be noted. First, use of a clear theoretical base for development of testable models and related interventions, as well as testing of these models and interventions is particularly underdeveloped across the college substance use literature. For example, most personalized normative feedback studies cited MI influence in intervention development and delivery. In practice, authors generally provided a description of MI, described how MI techniques influenced the delivery of interventions, and mentioned that utilized components were those commonly used. No further theoretical explanations for intervention components were provided and outcome variables focused on behavior change, and not the mediating factors of change. Therefore, it was often unclear why interventions worked or did not work, and which specific behavior change mechanisms were influenced when behavior change did happen.

Salient constructs. The review of literature suggests that specific expectancies and motives are differentially associated with patterns of use and risk levels. For the most part, it appears that interventions have failed to utilize this to tailor interventions according to specific personal reasons for use. Indeed, this may be a function of time requirements, and potential necessity for interactive in-person modalities. However, the field should investigate how to utilize the strong influence these cognitive constructs appear to have on substance use. Indeed, efficacy tests of new approaches, and dismantling multi-component interventions that

utilize cognitive constructs is advisable. New avenues of research should examine efficient ways of using interventions to address norms perceptions, discrepancy, self-efficacy, expectancies, motives, attitudes, risk perception, goal-setting, and coping skills. Rigorous examination of individual change components through use of dismantling studies could provide a knowledge base that could be used to inform tailoring of interventions with combinations of these components.

Marijuana and CPU foci. Finally, alcohol use has received more research attention in college students, compared to marijuana and other drug use; thus, prevention interventions for marijuana use are not as developed and have not been tested as extensively. Because of this, the field cannot conclusively state what is efficacious for decreasing marijuana use, and what populations would benefit most. For example, norms misperceptions have been documented for marijuana use, and components have been included in comprehensive personalized normative feedback interventions. However, no pure test of altering perceptions has been carried out, and so it is unclear if marijuana norms perceptions can be corrected, and if this leads to reduced marijuana use. Given the support for intervening with adolescents and adults, further study of marijuana interventions is justified. As CPU is a pertinent topic, research focusing on establishing the effectiveness of individual marijuana intervention components would support inclusion of them in both marijuana and CPU interventions.

Prevalence rates. Most of the implications discussed earlier also translate to studies targeting CPU. However, there are specific areas that are unique to this pattern of use. First, CPU and SPU are relatively not well understood and are underrepresented in current literature. This deficiency exists across all domains of substance use, but it appears to be particularly lacking in college student populations. For example, there are relatively few sources for estimating prevalence rates for college student CPU and SPU. Indeed, most studies on prevalence rates for CPU and SPU (e.g., Martin et al., 1992; Shillington & Clapp, 2001) are

arguably outdated. The Monitoring the Future survey does assess SPU in high school students, but does not publish CPU and SPU results from follow-up surveys assessing college students. Establishing treatment need requires survey data from random samples of college students that measure CPU and SPU.

Definitions, correlates, and problems. Further investigation should also examine how marijuana use may or may not involve a qualitatively different use pattern from CPU in college students, if it is indeed rare for marijuana use to not be comorbid with alcohol use. CPU studies have not provided enough data to support any conclusions at this point.

There is also clear disagreement regarding definitions of CPU and SPU, with no found discussion of how at-risk use is defined within these use patterns. Perhaps the literature on CPU can prevent the inconsistencies described in the alcohol literature (e.g., HED definitions), by establishing clear definitions while investigations are still callow. As a function of lack of CPU and SPU data, related problems and psychosocial and demographic factors are also not well established. This makes it difficult to identify and target individuals with increased odds of having these use patterns. Problems are often times attributed to use of one substance (e.g., alcohol) in instances where impairment is established (e.g., BAC) or use was self-reported. However, it is important to measure all substances used, and establish how specific substances and varying use patterns influence substance related problems experienced (Clayton, 1986). The practice of classifying and attributing associations according to a perceived “more serious” drug used (e.g., marijuana), conceals the fact that alcohol may also be heavily used and play a role in manifestation of problems and associations (see Clayton, 1986). Indeed, these recommendations call for a paradigm shift in how substance use is viewed, measured and studied.

Theory testing. Similarly, it is also unknown if prominent psychosocial theories are applicable to CPU and SPU, as attempts to expand models to these patterns of use are rarely

found (e.g., Smucker Barnwell & Earleywine, 2006). Currently, it is relatively unknown if CPU and SPU constitute use patterns that are all together theoretically different than those for alcohol and marijuana. Attempts to predict these patterns from current theories are required, which may suggest the necessity for unique theoretical development. Until constructs are examined specifically for CPU (e.g., CPU intentions, motives, expectancies, norms), it may suffice to include construct measures for each substance to predict CPU. Such investigations may begin to reveal individual influences on broader patterns of use. Finally, functional and circumstantial reasons for SPU (e.g., substitution, enhancement of effects) require further investigation, which may inform intervention development. Indeed, if enhancement of effects is an important predictor of SPU, interventions could incorporate information on the harms of mixing substances and facilitate discussions about alternatives to enhancing experiences.

CPU-focused interventions. College student interventions have traditionally focused on providing information around use of one substance, with use of other substances addressed to a lesser degree. Balanced proportions of content on multiple substances may be necessary for addressing CPU. For marijuana users, this appears to be particularly important. Alcohol appears to generally precede marijuana use in use sessions (Barrett et al., 2006). Attempts to address marijuana use may prove to be more effective when alcohol is also concurrently addressed. Advances in technology and the flexibility of in-person interventions (e.g., MI interviews) appear to have the means of accommodating different use patterns. Lack of rudimentary information on CPU (e.g., prevalence rates, correlates) may impede consideration or implementation of interventions which address use of multiple substances. As CPU becomes more understood, research designs may become more prevalent in addressing CPU.

Table 2.1.
Salient Theoretical Components for College Student Alcohol and Marijuana Use

Construct	**Theory**	**Path to Problematic Substance Use**
Expectancies	Expectancy Theory, Motivational Models, Reasoned action models, Social Cognitive Theory	Perhaps all but solely endorsing social expectancies and negative expectancies
Perceived Social Norms	Social Norms Theory, Reasoned action models, Social Cognitive Theory	Misperceptions
Control Beliefs	Reasoned action models	Positive control beliefs
Attitudes	Reasoned action models	Positive attitudes towards use
Perceived Normative Pressure	Social Norms Theory, Reasoned action models	If perceived pressure is felt
Perceived Behavioral Control	Reasoned action models	Low self-efficacy
Self-efficacy	Social Cognitive Theory	Low self-efficacy
Actual Control	Reasoned action models	Low PBC (proxied)
Intentions	Reasoned action models	High intentions to use
Motives	Motivational Models	Enhancement, coping, and expansion motives

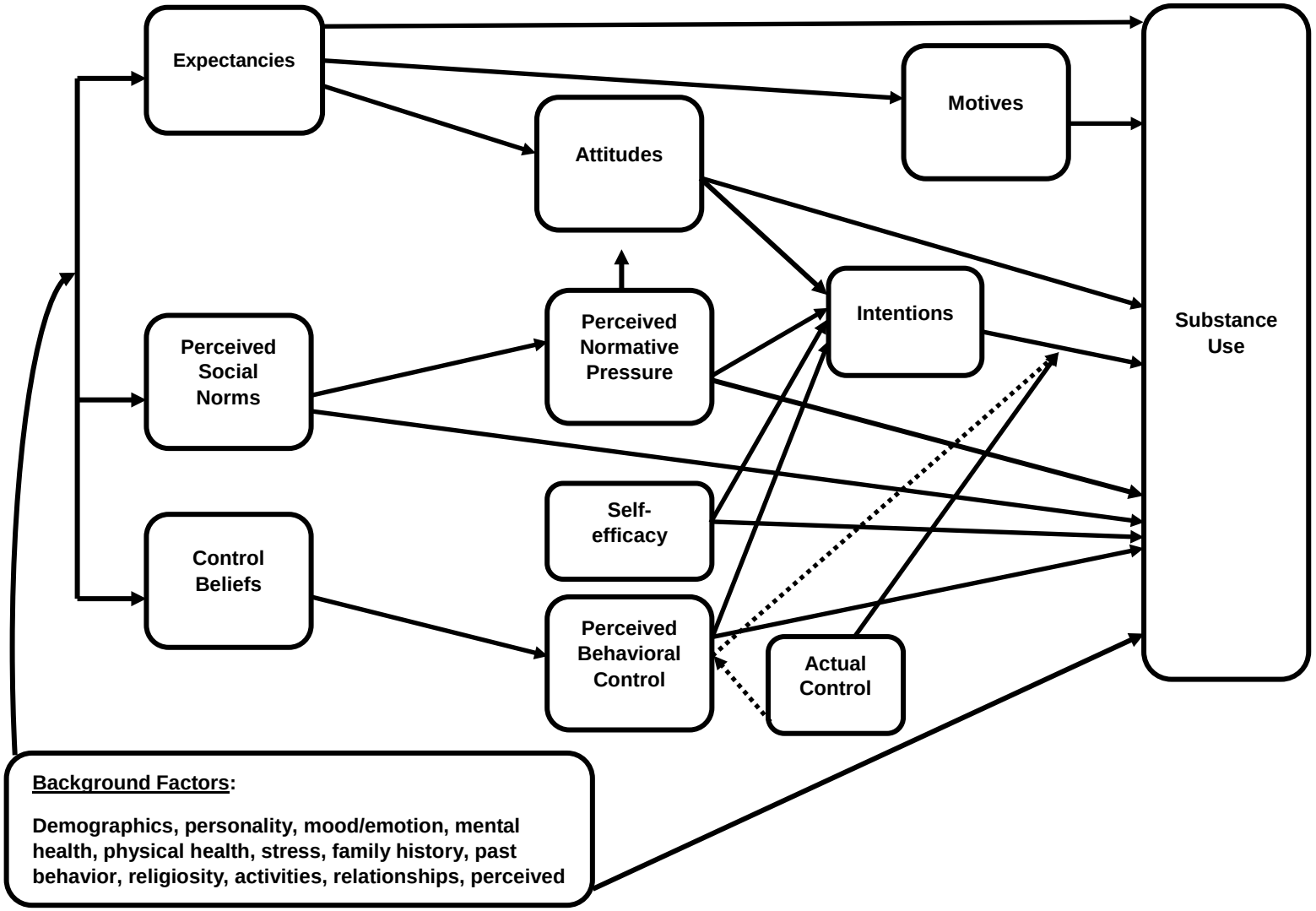


Figure 2. A multi-theoretical approach to explain college student substance use. Includes constructs from: Social Cognitive Theory, Social Norms Theory, the Reasoned Action Approach, Motivational Models, and Expectancy Theory.

Table 2.2
Background Factors Associated with Alcohol and Marijuana Use in College Students

Domain	Alcohol	Marijuana
Behavioral Dysregulation	• Dietary restraint (1) • Self-injury (2) • Alcohol problems: Eating disorders (3)	• Self-injury (2); • Cannabis problems: Eating disorders (3)
Personality and Temperament • Sensation-Seeking • NEO-FFI	• High sensation-seeking (4); inconsistent relationships (see 5)	• Various personality traits: (6, 7)
Social Phobia	• Alcohol dependence (8)	• Cannabis dependence (8)
Family History of Substance Use Problems	• See (9)	• See (10)
Academic Performance in College (i.e., GPA)	• Modest impact: (11)	• Adolescents: (12)
Conduct Problems	• Associated with use: (13)	Associated with use: (14)
Demographics: • Gender • Age • Race	• Males (15) • Older males, younger females (16) • White (15)	• No differences (17) • All ages (18) • White (19)
Religiosity	Low associated with use (20)	Low associated with use: (19)
Health	Expectancies that use will relieve discomfort/pain: (21, 22)	Expectancies that use will relieve discomfort/pain: (23)
Involvement in Extracurricular Activities	Use associated with Greek/athletic involvement: (24, 25)	• Use associated with Greek involvement: (25) • Less use associated with athletic involvement: (24)
Stress and Life Events	Higher stress: (26)	Higher stress: (7, 27)
Mental Health • Anxiety • Depression	• Female students: anxiety sensitivity = more use (28) • No relationship: (29) • Alcohol Problems: (30)	• No relationship: Buckner, Ecker and Cohen (31) • Cannabis problems: (4, 30, 32)
Perceptions of Drug Use • Perceived harmfulness	Perceived vulnerability & risk: (33, 34)	Perceived risk of harm: (34, 35)
Peer & social relationships	Various associations: (36-38)	Various associations: (36-38)

References: **(1)** Stewart, Angelopoulos, Baker & Boland (2000); **(2)** Serras, Saules, Cranford & Eisenbert (2010); **(3)** Dunn, Larimer & Neighbors (2002); **(4)** Simons et al. (2005); **(5)** see Baer (2002); **(6)** Ravert et al. (2009); **(7)** Berg, Buchanan, Grimsley, Rodd & Smith (2011); **(8)** Buckner et al. (2008); **(9)** Courtney & Polich (2009); **(10)** Bierut et al. (1998) ; **(11)** Wood, Sher & McGowan (2000) ; **(12)** Lynskey & Hall (2000); **(13)** Marlatt et al. (1998) ; **(14)** Shelton et al. (2007) ; **(15)** O'Malley & Johnston (2002); **(16)** McCabe (2002); **(17)** Johnston et al. (2010) ; **(18)** Glendhill-Hoyt et al. (2000); **(19)** Bell et al. (1997); **(20)** Galen & Rogers (2004); **(21)** Brown et al. (1980); **(22)** Demmel & Hagen (2003); **(23)** Schafer & Brown (1991); **(24)** Wechsler et al. (1997); **(25)** McCabe et al. (2005); **(26)** Hussong, Hicks, Levy & Curran (2001); **(27)** Hyman & Sinha (2009); **(28)** Stewart, Peterson & Pihl (1995); **(29)** Dawson et al. (2005); **(30)** Buckner, Keough & Schmidt (2007); **(31)** Buckner, Ecker & Cohen (2010); **(32)** Caldiera et al., (2008); **(33)** Wild, Hinson, Cunningham & Bacchiochi (2001); **(34)** Gonzalez & Haney (1990); **(35)** Bauchman, Johnston & O'Malley (1998); **(36)** Borsari & Carey (2001); **(37)** Borsari & Carey (2006); **(38)** Hawkins et al. (1992).

CHAPTER 3

Problems Related to Concurrent and Simultaneous Use of Alcohol and Marijuana in College Freshmen

Introduction

Alcohol and marijuana use among college students is highly prevalent and associated with various consequences. The 2014 Monitoring the Future survey found that 63.1% of college students reported alcohol use in the past month, 4.3% reported daily use, and 35.4% reported heavy episodic drinking (HED) in the previous two weeks, as defined by five or more drinks in one occasion for both males and females (Johnston et al., 2015). The survey also found that 20.8% of college students reported marijuana use in the past month and daily use of marijuana (5.9%) was the highest the survey had recorded since 1980 (7.2%).

A compounding public health concern is the fact that students often times use both of these substances, also known as concurrent polysubstance use (CPU), which can be particularly hazardous. CPU is a pattern of ingestion in which more than one substance is used within a designated timeframe (e.g., past year, month). The consumption of different substances may be on separate occasions (e.g., use of marijuana one night, alcohol the next), or during the same use occasion (e.g., alcohol and marijuana at the same time). There is no ceiling on the number of substances, but at least two different ones must be used. According to one study, almost 40% of college alcohol users and 100% of cannabis users reported engaging in CPU within the past year (Martin et al., 1992). CPU may enhance the risk of experiencing more frequent and severe drug-related problems such as memory loss, intoxicated driving, getting in trouble with the police, missing class and experiencing hangovers (Shillington & Clapp, 2001, 2006).

Further, use of two or more substances during the same use session, or simultaneous polysubstance use (SPU) is of particular public health concern, due to potential additive and synergistic effects of two substances ingested at the same time (Pape et al., 2009; Schensul et al., 2005). SPU is a subset of CPU. Aside from coinciding use of alcohol and tobacco, alcohol and marijuana appears to be the most prevalent pair of substances mixed during SPU in college

students. In one study, approximately 14.7% of college students reported mixing alcohol and marijuana in the past year (Martin et al., 1992); in another study, 95% of drug-using college students reported lifetime alcohol and marijuana SPU (Barrett et al., 2006). Research suggests that some students who use alcohol, and almost all students who use marijuana, could represent populations with increased risk of problems who may need specialized prevention approaches.

Few studies have examined the problems experienced by college students who engage in concurrent marijuana and alcohol use. Two studies reported that college students who engaged in concurrent alcohol and marijuana use experienced higher likelihood of many substance-related problems, compared with students who only used alcohol (Shillington & Clapp, 2001, 2006). Little is known about whether or not simultaneous alcohol and marijuana users experience increased risk for substance-related problems, compared to concurrent alcohol and marijuana users. Potential synergistic effects and increased risk of experiencing problems, and potential long-term effects into and beyond early adulthood underscore the importance of investigating this issue. The purpose of this research was to examine if: 1) substance-related problems varied between concurrent and simultaneous users of alcohol and marijuana and 2) after controlling for demographics, heavy episodic drinking and marijuana use, to what extent are college freshmen more likely to experience substance-related problems if they simultaneously use alcohol and marijuana.

Methods

Participants

Participants were 117 college students at a large Midwestern public university located in an urban area. Participants were newly enrolled freshmen in the fall of 2012, with data collection commencing in October of the same year. Data were collected for a normative feedback intervention study (see Chapter 4). The university's institutional review board

approved all study procedures and design. Participants were recruited via email from an administrative list of enrolled freshman students at the university. Prior to the study, it was estimated that a sample consisting of two-thirds of the university's freshman students would be needed to achieve our targeted sample of 112. After a month of recruiting the initial sample, all remaining students were invited to participate—thus, the entire freshman class was invited to participate in this study. Overall, 489 individuals fully completed the screening questions, of whom 164 were eligible and were invited to participate in the study. A total of 117 individuals began the baseline survey, of which 107 provided enough data for the current analyses.

Procedures

Participants were deemed eligible for the overall study if they (a) were 18 years of age or older; (b) were currently enrolled full-time (i.e., ≥ 12 credits) freshman student; (c) were a 'new' freshman (i.e., had not previously taken university courses for college credit, not including online courses and AP courses in high school); (d) had engaged in at least one heavy episodic [binge] drinking episode in the previous 30 days (five or more drinks during a single occasion for males, four or more for females), and (e) had used marijuana or hashish (hash) on at least one day in the previous 30. Given the inclusion criteria, all participants engaged in concurrent alcohol and marijuana use in the previous 30 days.

All eligible participants were immediately invited to complete Web-based baseline measures. Participants were able to: complete the assessment on any computer with access to the internet, work at their own pace, log out of the program and return within 24 hours to complete the session, and opt out of answering any questions.

Measures

Demographics. Participants answered questions regarding their gender, housing situation (i.e., dormitory, parents, off-campus), age and racial/ethnic background (White,

Hispanic or Latino(a), Asian, African American, American Indian or Alaska Native, Native Hawaiian or Other Pacific Islander, Other).

Alcohol use. Questions for quantity and frequency of alcohol use were adapted from the Daily Drinking Questionnaire (Collins, Parks, & Marlatt, 1985). Frequency of alcohol use was measured with the question 'How many times did you drink any alcohol during the past 30 days?' Response options ranged from 0 to 60. HED was measured with the following question, 'In the past 30 days, how many times did you drink five or more (four for females) standard drinks during a single occasion?' Peak drinking was measured by asking participants 'Think of the occasion you drank the most during the past 30 days – How many standard drinks did you have during that occasion?'

Marijuana use. Marijuana use days were measured with the following question 'In the past 30 days, on how many days did you use any kind of marijuana or hashish (hash)?' Frequency of marijuana use (i.e., use occasions) was measured with the question 'How many times did you use marijuana/hash during the past 30 days?' Participants typed responses in a text box.

Polysubstance Use Patterns. All participants engaged in concurrent alcohol and marijuana use in the previous 30 days. Simultaneous alcohol and marijuana use was determined with two questions, each with similar format. The online program auto-populated the participants' reported alcohol and marijuana use frequency into the following questions: 'Of the [reported alcohol use frequency] times that you drank alcohol in the past 30 days, how many times did you also use marijuana/hash during the same occasion?' and 'Of the [reported marijuana use frequency] times that you used marijuana/hash in the past 30 days, how many times did you also use alcohol during the same occasion?" Participants who reported zero occasions on both questions were coded as concurrent users (0) and participants who reported one or more occasion on either of the above questions were coded as simultaneous users (1)

on a dichotomous polysubstance use pattern variable. Of the 107 participants, 25 had engaged in concurrent use and 82 in simultaneous use.

Substance related problems. Substance-related problems (problems) were assessed with a modified version of the Rutgers Alcohol Problems Index (RAPI; White & Labouvie, 1989). Participants were asked how often they had experienced 24 problems over the previous month as a result of their alcohol or marijuana/hash use. Responses ranged from 0 (*never*) to 4 (*more than 5 times*). Problem distributions were significantly positively skewed, so each problem item was dichotomized for analyses. A total problems score was created which summed all dichotomized items (range 0-24). An additional dichotomous variable of experiencing four or more problems was developed from the total sum problems scores (0 = ≤ 3 problems; 1 = ≥4 problems) and used in analyses. Alphas were 0.87 for the original scale and 0.82 for the dichotomized scale.

Analyses

Analyses were conducted using SPSS v.22. One-way ANOVA models and Chi-Squared tests were used to test bivariate associations between substance use pattern (CPU vs. SPU) and substance use and each substance-related problem. Multivariate analyses were conducted using multiple logistic regression models.

Results

Sample descriptive data are presented in Table 3.1. Participants (N=107) were on average 18.4 years of age (SD = 0.55). Most were women (50.5%) and self-identified as White (79.4%). A great majority of participants were residing in university dormitories (n=92; 86.0%). An analysis of variance found no significant differences in age between concurrent and simultaneous users. Chi-squared tests also revealed no differences in race or gender between the two groups.

On average during the previous 30 days, participants drank on 8.27 occasions, engaged in 6.10 HED occasions and drank 9.69 drinks during the heaviest occasion (Table 3.2). Participants also used marijuana on average 14.92 occasions during 8.23 days, or approximately 1.81 times a day on use days. On average, SPU participants reported that they simultaneously used alcohol during 4.23 of 18.88 occasions of marijuana use in the previous 30 days (22.4% of use occasions). On average, simultaneous users used marijuana during almost half (44.4%) of their average reported alcohol use occasions in the previous thirty days (3.96 of 8.91).

Using analysis of variance, it was found that simultaneous users significantly had more alcohol occasions compared to concurrent users ($F=7.21$, $p=.008$) and engaged in HED more frequently ($F=13.29$, $p<.001$). Simultaneous users also significantly used marijuana on more days ($F=19.27$, $p<.001$) and on more occasions ($F=8.65$, $p=.004$) than concurrent users. Concurrent and simultaneous users did not differ on number of standard drinks consumed during the heaviest occasion.

Bivariate Substance-Related Problem Results

As seen in Table 3.3, simultaneous users were more likely to have experienced five individual problems when compared to concurrent users. Approximately 35% of simultaneous users went to work or school drunk or high, while only 8% of concurrent users did ($\chi^2(1) = 6.97$, $p < .01$). Nearly 38% of simultaneous users had suddenly found themselves somewhere they couldn't remember going to, compared with 12% of concurrent users ($\chi^2(1) = 5.89$, $p < .05$). Approximately 24% of simultaneous users had been in trouble with police, dorm or college authorities while only 4% of concurrent users had ($\chi^2(1) = 5.05$, $p < .05$). About 33% of simultaneous users had driven under the influence, compared with 12% of concurrent users ($\chi^2(1) = 4.16$, $p < .05$). Finally, about 80% of simultaneous users had experienced a hangover

or felt physically ill, while 56% of concurrent users had ($\chi^2(1) = 5.37$, $p < .05$). Concurrent users were more likely to have caused shame or embarrassment, compared with simultaneous users (32% vs. 10%; $\chi^2(1) = 7.45$, $p < .01$). Overall, simultaneous users were more likely to report experiencing four or more problems than concurrent users (76% vs. 52%; $\chi^2(1) = 5.10$, $p < .05$).

Multivariate Results

Multiple logistic regression analyses were used to investigate increased risk for problems among simultaneous users compared with concurrent users after gender and race. Since Table 3.3 showed significant differences in substance use between the two groups, a second set of multiple logistic regression analyses controlled for gender and race as well as HED frequency and marijuana use days. This was to investigate if the odds of one group reporting problems may be related to substance use patterns—for example, the SPU group reported significantly more HED episodes and marijuana use days, which may increase the risk of experiencing problems. For these analyses, substance use pattern (0, CPU; 1, SPU), gender, race, HED frequency and marijuana use days were regressed on each problem found significant in the bivariate analyses. Tables 3.4 and 3.5 shows the odds ratio and 95% confidence intervals for simultaneous users compared with concurrent users for each problem.

Each problem found significant in the bivariate analyses remained significant in multivariate analyses that controlled for gender and race (Model 1). The odds of SPU participants reporting the five problems and four or more total problems were significantly greater than CPU participants. Interestingly, the odds of CPU participants reporting that they had caused shame or embarrassment to someone were over four times greater than SPU participants.

Only three problems remained significant after the second set of multivariate analyses that controlled for HED frequency and marijuana use days in addition to gender and race (Model 2). The odds of CPU participants reporting that they had caused shame or embarrassment to

someone were nearly five times greater than SPU participants (SPU OR = 0.21). After controlling for other variables, the odds of SPU participants reporting finding themselves somewhere where they couldn't remember being and experiencing a hangover or feeling ill were over four times greater than CPU participants. Going to school drunk or high, trouble with authorities, driving under the influence and experiencing four or more problems were no longer significant during multivariate analyses that controlled for HED frequency and marijuana use days in addition to gender and race.

Discussion

Literature suggests that college students engage in CPU and SPU. After a slightly declining trend in the first decade of this century, prevalence of monthly marijuana use among college students began to rise starting at around 2011. Daily use of marijuana in 2014 (5.9%) was the highest that the Monitoring the Future Survey had recorded since 1980 (7.2%) and was higher than daily use of alcohol (4.3%; Johnston et al., 2015). Studies have found that students who use both marijuana and alcohol report experiencing more problems than students who only use alcohol (Shillington & Clapp, 2001, 2006). Research also suggests that simultaneous use may increase the likelihood of experiencing problems (Pape et al., 2009; Schensul et al., 2005). The current study is the first to investigate whether students who engage in SPU have increased odds of experiencing problems, compared with students who engage in CPU.

The results of this study suggest that there were differences between the CPU and SPU groups for reporting that they experienced four or more problems, as well as five of twenty-four individual problems including: going to work or school drug or high; suddenly finding themselves somewhere to which they couldn't remember going; getting in trouble with police, dorm or college authorities; driving under the influence; and experiencing a hangover or feeling physically ill. Concurrent users more often reported causing shame or embarrassment to someone, compared to simultaneous users. The significant findings held in Model 1

multivariate analyses that controlled for gender and race, with the odds of participants reporting four or more problems, and five of the individual problems being significantly elevated for the SPU group. The odds of the CPU group reporting that they had caused same or embarrassment to someone were also still significantly elevated, compared to the SPU group.

Three problems and experiencing four or more problems were no longer significant in the Model 2 multivariate analyses that controlled for gender, race, HED and marijuana use days. This may suggest that the substance use pattern effect was explained by other variables in the more comprehensive model, such as HED or marijuana use days. SPU participants engaged in significantly more HED and marijuana use days (Table 3.2), which may increase the risk of experiencing many problems, going to work drug or high, getting in trouble with authorities or driving under the influence. Univariate and Model 1 differences between CPU and SPU may have been due more to a tendency for SPU participants to use more alcohol and marijuana, than to other differences between these groups. Future studies should investigate whether these preliminary findings are consistent in other samples and whether any increased risk of certain problems is due to synergistic effects of the two substances during use occasions, to an overall tendency to engage in heavier substance use than concurrent users or any other reasons.

In all analyses CPU participants were more likely to report that they had caused shame or embarrassment to someone. It is unknown if the participants felt that they had done this to themselves or others, such as friends or family. Regardless, this is an interesting finding that should be investigated further. Perhaps excessive single substance use may increase a user's ability to recognize when shame or embarrassment has occurred. It may also be that those who engage in SPU are more likely to have progressed to a point in their substance use where shame and embarrassment are no longer experienced. Future studies could collect event-level

or daily diary data from CPU and SPU users to determine if this and other problems discussed in this study are associated with different patterns of substance use.

This study did not find the overwhelming increase in problem risk that past studies did among those who concurrently use alcohol and marijuana compared to students who use alcohol only (Shillington & Clapp, 2001, 2006). Perhaps individuals who use more than one substance are more likely to engage in risky activities or experience problems. It is possible that the measurable differences in problems are more pronounced when alcohol only users are compared with concurrent users, instead of concurrent users with simultaneous users like in this study. Future research could examine differences between single-substance users, CPU and SPU, which was not possible with the data that we used.

This study found that nearly 77% of the sample that reported using both alcohol and marijuana in the previous month engaged in simultaneous use of both substances at least once. Both groups engaged in concerning levels of marijuana and alcohol use, especially HED behavior in the SPU group. The odds of blackouts and hangovers were significantly elevated for SPU participants in Model 2. These problems represent significant personal safety and health concerns with potential long-term impacts. For example, Mundt & Zakletskaia (2012) found that students who had experienced one to two blackouts in the past were 1.5 times more likely to experience an alcohol-related injury over the 2-year follow-up period. Students who reported six or more blackouts were 2.5 times more likely to have experienced an injury. Students engaging in CPU and SPU may be populations at increased risk of problems and require specialized or more intensive prevention and treatment approaches.

Substance use interventions on college campuses often educate students on potential problems associated with substance use behaviors. Investigating links between CPU, SPU and increased risk of problems provides additional data that can be used in current and future campus programming. Using representative samples, future research should seek to further

understand CPU and SPU, including: estimating prevalence rates, investigating problems related to these patterns of use, detail how students use marijuana and alcohol together in a use session, and the impact of concurrent use on substance use behavior. Further research should investigate how CPU and SPU may impact society in general, especially in the modern policy climate where policy and public opinion surrounding marijuana use is changing. Legal recreational marijuana use in tandem with alcohol consumption on campuses may be associated with personal and public safety concerns or other consequences. Finally, there are a number of theoretical and conceptual models to explain and predict alcohol and marijuana use in college students. Future research should adapt, develop and test these and potentially other models for use by prevention and intervention efforts.

Limitations

This study had several limitations. First, only incoming freshman students at one Midwestern university were invited to participate in the study and it is unknown how study results would generalize to other populations of college students. A larger, national study could be used to further investigate these research questions, as well as include concurrent or simultaneous use of other substances. Second, eligibility criteria required at least one episode of heavy episodic drinking in the previous month and at least one day of marijuana use. Substance use and problems within the past month were measured shortly after college matriculation and may have included use and problems that occurred before college commenced. If the relationship between use pattern and problems is affected by environment (e.g., college campus, home before college), results may more readily generalize to those transitioning to college and not freshmen throughout the academic year. Finally, the cross-sectional, self-reported data is subject to the well-described limitations of these methodologies for substance use (Brener, Billy, & Grady, 2003; Harrison, 1997).

Table 3.1.
Descriptive Data for the Freshmen Sample

	Sample		CPU		SPU	
	N	%				
Gender						
Male	53	50.5%	12	48%	41	50.0%
Female	54	49.5%	13	52%	41	50.0%
Race						
White	85	79.4%	19	76%	66	80.5%
Non-White/Other	22	20.6%	6	24%	16	19.5%
Age						
Mean (SD)	18.4(.55)	-	18.4(.58)	-	18.4(.54)	
Median	18.0	-	18	-	18	
Range	2	-	2	-	2	

Table 3.2.

Past 30 Day Substance Use Behavior for the Sample and Concurrent and Simultaneous Users

	Total (N=107)	CPU (N=25)	SPU (N=82)
Marijuana Use Days			
Mean (SD)	8.23(9.21)	1.76(1.17)	**10.21(9.57)*** **
Median	4	1	6
Range	29	4	29
Marijuana Use Occasions			
Mean (SD)	14.92(26.13)	1.92(1.92)	**18.88(28.72)** **
Median	5.0	1	7.50
Range	159	5	159
Alcohol Use Occasions			
Mean (SD)	8.27(4.62)	6.16(4.34)	**8.91(4.54)** **
Median	7.0	5	8
Range	19	19	19
Heavy Episodic Drinking Occasions			
Mean (SD)	6.10(3.61)	3.92(2.81)	**6.77(3.58)*** **
Median	6.0	3	6
Range	15	9	15
Number of Standard Drinks at Peak			
Mean (SD)	9.69(5.74)	8.64(5.63)	10.01(5.77)
Median	8.0	6	8.00
Range	33	23	33
Alc+MJ Simultaneous Use Occasions			
Mean (SD)	-	-	3.96(4.03)
F (df) p			
Median	-	-	2
Range	-	-	18
MJ+Alc Simultaneous Use Occasions			
Mean (SD)	-	-	4.23(5.18)
F (df) p			
Median	-	-	2
Range	-	-	35

*p<.05.

**p<.01.

***p<.001.

Table 3.3.
Chi-Square Results for Substance-Related Problems in Concurrent and Simultaneous Users

Problem variable	CPU (n=25)	SPU (n=82)	$\chi^2(1)$, **p**
	n, %	n, %	
Caused shame or embarrassment	8 (32.0%)	8 (9.8%)	**7.45****
Went to work or school drunk or high	2 (8.0%)	29 (35.4%)	**6.97****
Suddenly found somewhere couldn't remember	3 (12.0%)	31 (37.8%)	**5.89***
Hangover or physically ill	14 (56.0%)	65 (79.3%)	**5.37***
In trouble with police, dorm or college authorities	1 (4.0%)	20 (24.4%)	**5.05***
Driven under the influence	3 (12.0%)	27 (32.9%)	**4.16***
Missed a day of school or work	7 (28.0%)	40 (48.8%)	3.36
Felt physically or psychologically dependent	0 (0.0%)	9 (11.0%)	3.00
Got into fights, acted bad, did mean things	2 (8.0%)	18 (22.0%)	2.45
Needed more to get the same effect	5 (20.0%)	30 (36.6%)	2.39
Had unprotected sex	4 (16.0%)	25 (30.5%)	2.04
Experienced unwanted sexual contact	1 (4.0%)	12 (14.6%)	2.03
Neglected responsibilities	7 (28.0%)	36 (43.9%)	2.02
Felt had a problem	2 (8.0%)	14 (17.1%)	1.24
Told by another to stop or cut down	2 (8.0%)	14 (17.1%)	1.24
Noticed a change in personality	5 (20.0%)	25 (30.5%)	1.04
Passed out or fainted suddenly	2 (8.0%)	13 (15.9%)	0.98
Neglected schoolwork	8 (32.0%)	35 (42.7%)	0.91
Missed out because spent money on alcohol or marijuana	4 (16.0%)	20 (24.4%)	0.78
Avoided by friends, neighbors or relatives	3 (12.0%)	6 (7.3%)	0.55
Kept using after promising not to	3 (12.0%)	15 (18.3%)	0.54
Been hurt or injured	3 (12.0%)	15 (18.3%)	0.54
Tried to control use	9 (36.0%)	28 (34.1%)	0.03
Had withdrawal symptoms	2 (8.0%)	6 (7.3%)	0.01
Four or more problems	13 (52.0%)	62 (75.6%)	**5.10***

*p<.05.
**p<.01.
***p<.001.

Table 3.4.
Model 1: Odds ratios for Problems and Simultaneous Use, Controlling for Gender and Race

Problem variable	*B*	Odds ratios	CI
Caused shame or embarrassment	-1.48	**0.23***	0.08, 0.70
Went to work or school drunk or high	1.88	**6.52***	1.14, 30.19
Suddenly found somewhere couldn't remember	1.50	**4.49***	1.24,16.23
In trouble with police, dorm or college authorities	2.14	**8.51***	1.06, 68.63
Driven under the influence	1.31	**3.72***	1.01, 13.74
Hangover or physically ill	1.18	**3.27***	1.23, 8.70
Four or more problems	1.05	**2.85***	1.11, 7.31

*p<.05

Table 3.5.
Model 2: Odds ratios for Problems and Simultaneous Use, Controlling for Gender, Race, Heavy Episodic Drinking and Marijuana Use Days

Problem variable	*B*	Odds ratios	CI
Caused shame or embarrassment	-1.55	**0.21***	0.05, 0.85
Went to work or school drunk or high	0.22	1.25	0.22, 7.01
Suddenly found somewhere couldn't remember	1.55	**4.72***	1.18, 18.81
In trouble with police, dorm or college authorities	1.48	4.38	0.49, 38.98
Driven under the influence	0.45	1.57	0.37, 6.68
Hangover or physically ill	1.41	**4.10***	1.14, 13.62
Four or more problems	0.25	1.28	0.44, 3.76

*p<.05

Chapter 4

A Brief, Web-Based Normative Feedback Intervention for Concurrent Use of Alcohol and Marijuana

Introduction

Alcohol use among college students in the United States has been an area of public health concern and has been extensively researched, largely due to widespread problems associated with at-risk consumption. A great body of literature documents the high prevalence of alcohol use in college students (see O'Malley & Johnston, 2002), with approximately three out of four students reporting use in the previous year (Johnston et al., 2015). Further, about 35-44% of college students report engaging in heavy episodic [binge] drinking (HED; Hingson et al., 2009; Johnston et al., 2015; Wechsler et al., 2002) a consumption pattern associated with increased odds of experiencing negative consequences (Wechsler et al., 1995).

Depending on which definition is used, HED rates have remained relatively constant over the past few decades (Hingson et al., 2009; Johnston et al., 2010; O'Malley & Johnston, 2002; Wechsler et al., 2002). The high rates are in spite of increased prevalence of prevention and intervention approaches on college campuses. Consequences of alcohol use on campuses are differentially associated with use patterns (Vik et al., 2000) and affect a number of groups in addition to consumers (e.g., peers, institutions, society; Perkins, 2002b). Extant research supports alcohol use in this population as a significant public health concern (Dowdall, 2009).

Marijuana is the most commonly used illicit substance among college students in the United States. In 2014, approximately 21% of college students reported using marijuana in the past 30 days and approximately 7% reported daily use (Johnston et al., 2015). Marijuana is associated academic (Kilmer et al., 2007), concentration (Caldeira et al., 2008), health (Taylor et al., 2000) and social problems (Caldeira et al., 2008; Kilmer et al., 2007). Despite being associated with prevalent problems, marijuana use by college students has not seen a paralleled level of public concern that has been seen for alcohol use. Research is beginning to explicate the necessity of targeting marijuana use with prevention interventions to decrease use and related problems.

Compounding public health concern is the fact that students often use both alcohol and marijuana, a pattern sometimes labeled concurrent polysubstance use (CPU). CPU is broadly defined as the use of two or more substances within a designated time period, which may or may not include overlapping periods of ingestion (e.g., use of alcohol one day, marijuana the next week).[1] Little research has reported on the concurrent use of alcohol and marijuana (concurrent use) in college students. One study found that nearly 40% of college alcohol users, and 100% of marijuana users in their sample reported using two or more substances in the previous year (Martin et al., 1992). Two studies found that concurrent use may enhance the risk of experiencing more frequent and severe drug-related problems (Shillington & Clapp, 2001, 2006), which may be due to the potential for dangerous additive and synergistic effects of mixing two substances (Pape et al., 2009; Schensul et al., 2005). Preliminary evidence suggests that students who engage in concurrent use may represent a population with increased risk of problems, who may also need specialized prevention approaches.

To address problematic alcohol use, many colleges have implemented individual prevention approaches that involve the use of personalized normative feedback (PNF), a brief and cost-effective intervention that aims to increase problem recognition and readiness to change (Miller et al., 1988). This approach has generally been supported for alcohol use (Carey et al., 2007; Lewis & Neighbors, 2006) but has seldom been adapted to address other substances, including marijuana (Lee et al., 2010). Despite preliminary evidence that PNF-type interventions can decrease marijuana use in adolescents (Martin & Copeland, 2008) and use and dependence symptoms in adults (Stephens et al., 2007), few PNF interventions for college student marijuana use have been studied. Lee et al. (2010) appears to be the only wide-scale study that has tested marijuana-focused PNF with a general sample of college students, not

[1] CPU in this context describes a pattern of substance use and differs from historic diagnostic conceptualizations of polysubstance use disorders, for which three or more substances were used maladaptively over the past year (American Psychiatric Association, 2000).

mandated to receive treatment or presenting to student health services. The investigators did not find differences in perceptions of peer marijuana use, personal marijuana use, or problems at follow-up between those who completed the PNF intervention and those who did not. These findings could suggest that brief feedback interventions may not be as effective for marijuana as they are for alcohol use in college populations. However, given the brevity and flexibility of PNF, as well as its effectiveness for addressing alcohol use, additional studies examining the feasibility of decreasing marijuana use with PNF approaches are necessary.

Further, while many PNF interventions have included information on more than one substance, there is often one substance that receives the majority of attention. If two substances were addressed in balanced proportions during PNF, it may be possible to decrease use and associated problems for both substances with a single intervention. PNF targeted at multiple substances could utilize the interactional nature of CPU, potentially amplifying decreases in use and problems for one or both of the targeted substances. High CPU rates among college students suggests that campuses should move beyond viewing alcohol and marijuana use as separate behaviors, and begin to intervene on broader patterns of substance use.

Previous studies of brief marijuana interventions have, for the most part, tested multi-component PNF interventions. These interventions include a number of components (e.g., calorie counters, information on tolerance and past consequences), most of which are present in alcohol-focused feedback interventions. Before implementation of wide-scale multi-component interventions for marijuana, it may prudent to continue to study whether marijuana can be influenced by the same theory-based components as alcohol. Results of these studies could provide valuable information regarding which components appear to be most salient for specific substances.

Research has demonstrated pervasive differences between what students believe to be peer norms and actual norms collected on college substance use surveys (Borsari & Carey, 2003). Most students believe that peers use substances more frequently and more heavily than they actually do (Perkins, 2002a). Researchers have posited that that these misperceptions translate into internalized indirect peer pressure to use substances, or that students engage in increased use to meet their misperceptions of peer expectations (Fishbein & Ajzen, 2010; Perkins, 2002a).

Perceptions of social norms have been shown to be influential on personal college student substance use (Borsari & Carey, 2001; Neighbors, Lee, Lewis, Fossos, & Larimer, 2007; Page & Scanlan, 1999; Perkins & Wechsler, 1996). Normative intervention strategies communicate how the majority of students actually use substances (Perkins, 2002a). This can be done in the context of multicomponent feedback interventions, or as a stand-alone intervention. Studies have shown that feedback related to social norms alone can impact normative perceptions and drinking behaviors (Lewis & Neighbors, 2007; Lewis et al., 2007; Neighbors et al., 2004; Neighbors et al., 2010; Neighbors et al., 2006). No intervention studies have exclusively targeted norms misperceptions for marijuana use.

Palfai et al. (2014) found that a brief marijuana intervention can reduce perceived peer marijuana use norms in a college student health services sample. A few other marijuana-focused interventions have included norms components during comprehensive PNF with college students and adults (Lee et al., 2010; Stephens et al., 2007), but results cannot be attributed to normative components, because influence on perceived norms was not measured and the interventions included multiple components. Finally, a few PNF interventions have included both alcohol and marijuana norms components without measuring perceived norms (White et al., 2006; White et al., 2008).

Overall, research has demonstrated misperceptions for both alcohol and marijuana use, and that norms-based interventions appear promising for addressing alcohol. The purpose of this research was to examine if it is feasible to address marijuana use and CPU by delivering standalone normative feedback reports of personal and peer marijuana and alcohol use. Secondary objectives included preliminary investigation of intervention effects on perceptions of peer alcohol and marijuana use, personal alcohol and marijuana use and substance-related problems (Figure 3). It was hypothesized that at the 4-week follow-up, participants who received marijuana feedback would reduce perceptions of peer and personal marijuana use relative to those who only received alcohol feedback. It was also hypothesized that that the follow-up, participants who received alcohol feedback report would have reduced perceptions of peer and personal alcohol use relative to those who only received marijuana feedback. Finally, it was hypothesized that the effect of receiving both alcohol and marijuana feedback would be greater than the effect of receiving alcohol or marijuana feedback alone.

Methods

Participants

Participants were 117 college students at a large Midwestern public university located in an urban area. Participants were newly enrolled freshman in the fall of 2012, with data collection commencing in October of the same year. The university's institutional review board approved all study procedures and design. Participants were recruited from an administrative list of enrolled freshman students. Prior to the study, it was estimated that a sample consisting of two-thirds of the university's freshman students would be needed to achieve the targeted sample of 112. After a month of recruitment of the initial sample, the remaining one-third of students were invited to participate, resulting in the entire freshman class being invited to participate in this study. Overall, 489 individuals fully completed the screening, of which 164 were eligible and were invited to participate. A total of 117 individuals began the baseline

survey and 114 completed the survey and intervention portions. Ninety-four individuals started the 4-week follow-up and ninety-three individuals completed both baseline and 4-week follow-up surveys (79.49% of the 117).

Participants were on average 18.38 years of age (SD = 0.54), all of which were new freshman who had not previously been enrolled in college courses (Table 4.1). Most were women (53.0%) who self-identified as White (79.5%). All students were current users of both alcohol and marijuana (as operationalized by at least one episode of heavy episodic drinking and day of marijuana use in the previous 30 days). On average, participants used alcohol 8.25 times (SD=4.67) in the previous 30 days. Participants also used marijuana/hash an average of 15.06 (SD=26.82) times on 7.94 days (SD=8.87).

Procedures

Participants were deemed eligible if they (a) were 18 years of age or older; (b) were a currently enrolled full-time (i.e., ≥ 12 credits) freshman student; (c) were a 'new' freshman, meaning they had not previously taken university courses for college credit, not including online courses and AP courses in high school); (d) had engaged in at least one heavy episodic [binge] drinking episode in the previous 30 days , as defined by five or more drinks during a single occasion for males and four or more for females; and (e) had used marijuana or hashish (hash) on at least one day in the previous 30. The program used simple, unrestricted random assignment to assign eligible participants to one of three intervention conditions: (a) marijuana norms feedback only, (b) alcohol norms feedback only, and (c) both marijuana and alcohol norms feedback (see Table 4.2).

All eligible participants were immediately invited to complete the baseline measures and intervention online. Participants in each condition were instructed to complete baseline survey measures, with the normative feedback intervention being displayed immediately afterwards. All participants viewed the corresponding feedback and were then asked to answer questions

related to the feasibility of the intervention. Feasibility questions aimed to investigate if the intervention should be recommended for efficacy testing (Bowen et al., 2009) and to solicit feedback regarding modifications to the website, assessments, and interventions.

Participants were able to: complete the program on any computer with access to the internet, work at their own pace, log out of the program and return within 24 hours to complete the session, and opt out of answering any questions. Approximately four weeks after intervention completion, participants were emailed a link to the follow-up survey, which included outcome measures and questions related to their use of the normative feedback information since baseline.

Missing data

Attrition was the primary reason for missing data. Participants were contacted up to a total of four times via email for completion of the follow-up session. One hundred and seventeen individuals started the baseline session. The 4-week follow-up session was started by 94 participants (80.34%).

Measures

Demographics. At baseline, participants answered questions regarding their gender, age and racial/ethnic background (White, Hispanic or Latino(a), Asian, African American, American Indian or Alaska Native, Native Hawaiian or Other Pacific Islander, Other). Copies of the baseline and follow-up surveys are included in Appendices A-B.

Perceived peer norms. Perceived norms were measured at both baseline and follow-up with a modified version of the Drinking Norms Rating Form (Baer, Stacy, & Larimer, 1991). For all norms questions, participants were asked to provide perceived estimates for a typical student who attends the same university, of the same gender as the participant. Participants were asked to estimate the frequency of alcohol consumption by a typical student, measured on a scale from ‘not at all’ to ‘every day’. Participants were also asked estimate the number of

standard drinks consumed by a typical student during a typical occasion of drinking. For marijuana, participants were asked to estimate the frequency of use by a typical student, measured on a scale from 'not at all' to 'every day'. To ease interpretation, scales for frequency of use were translated to monthly estimates (e.g., 'every day' to 28; 'once a week' to 4; '3 times a week' to 12).

Alcohol use. Questions for quantity and frequency of alcohol use were adapted from the Daily Drinking Questionnaire (DDQ; Collins, Parks & Marlatt, 1985). Participants reported the average number of drinks consumed on each day of the week for the previous month. Frequency of alcohol use was measured with the question 'How many times did you drink any alcohol during the past 30 days?' Response options ranged from 0 to 60. HED was measured with the following question, 'In the past 30 days, how many times did you drink five or more (four for females) standard drinks during a single occasion?' Peak drinking was measured by asking participants 'Think of the occasion you drank the most during the past 30 days – How many standard drinks did you have during that occasion?'

Marijuana use. Frequency of marijuana use at both baseline and follow-up was measured with the question 'In the past month, on how many days did you use any kind of marijuana or hashish (hash)?'

Substance related problems. Substance-related problems were assessed with a modified version of the Rutgers Alcohol Problems Index (RAPI; White & Labouvie, 1989). Participants were asked how often they had experienced 24 consequences over the previous month as a result of their alcohol or marijuana/hash use. Responses ranged from 0 (*never*) to 4 (*more than 5 times*). The RAPI was scored by taking the sum of all items with possible scores ranging from 0 to 96. Data were significantly positively skewed, so problems items were dichotomized. Alpha for the non-dichotomized scales were .863 and .800 at baseline and one-month follow-up. Alphas for dichotomized scales were .821 at baseline and .801 for the one-

month follow-up. A final sum of all dichotomized items (rage 0-24) was computed and used for analyses. Participants with at least 21 non-missing values on the 24 problems were included in total scores (SPSS, probdtotal = sum.21(prob1d to prob24d). A missing value for total problems was returned for participants with four or more missing individual problems.

Intervention feasibility. The feasibility of the intervention was evaluated according to a number of criteria or domains described by Bowen et al. (2009), including acceptability, demand, implementation, practicality and limited efficacy. The majority of feasibility items were scored on a scale from 0 (strongly disagree) to 5 (strongly agree). Items were dichotomized with 0 including strongly disagree to somewhat disagree and 1 including somewhat agree to strongly agree. Open-ended questions were used to supplement some of the domains. Small variation in sample sizes in Table 4.3 reflects missing data on the feasibility questions.

Acceptability describes how the intended participants react to the intervention, including the extent to which the intervention was judged as suitable, satisfying or attractive (Bowen et al., 2009). Acceptability was measured with questions in five domains: (a) useful, (b) helpful, (c) recommend, (d) satisfaction, and (e) perceived appropriateness. Full survey questions for the feasibility domains are listed in Table 4.3.

Demand describes the extent to which the web-based intervention is likely to be used (Bowen et al., 2009). Demand was measured by two domains: (a) actual use, and (b) intent to continue use. We measured the actual use of the print feature on the intervention website, by asking participants if they printed their feedback report.

Implementation describes the extent to which the intervention can successfully be delivered to intended participants (Bowen et al., 2009). Execution was measured with two questions at baseline and one at the 4-week follow-up. We also asked if the intervention information was consistent with real-life experiences of the participant. The following open-ended question was also asked a baseline: ‘What would you change about the intervention?’

Practicality describes the extent to which the intervention can be carried out with intended participants using existing means, resources, and circumstances and without outside intervention (Bowen et al., 2009). This study employed a posttest to determine the (a) positive and negative effects of the intervention on participations, as well as their (b) overall ability to complete the intervention session

Adaptation describes the extent to which an existing intervention performs when changes are made for a new format or with a different population. *Expansion* describes the extent to which a previously tested normative feedback for alcohol could be expanded to include feedback on marijuana, and both substances (Bowen et al., 2009). This study investigated how well the normative feedback with marijuana and when delivered with both substances perform, compared to previous studies that examined similar normative feedback with alcohol only. For these domains, general narrative assessments of study findings were compared with previous studies of normative feedback, located in the discussion section.

Finally, *limited efficacy* examined whether the intervention showed promise of being successful with the intended population (Bowen et al., 2009). This domain measured cognitive factors underlying the conceptual model: (a) intentions to change alcohol and marijuana use, (b) self-reflection, and (c) dissonance or conflict between perceptions and actual norms were also measured. Further, intervention effects were analyzed on the outcome variables of perceived social norms, alcohol and marijuana use and substance-related problems.

Qualitative. Participants were also asked an open-ended question regarding what they would change about the feedback report. Fifty-six participants either did not respond, indicated nothing, or provided responses unrelated to the intervention. A variety of answers were reported by the other 61 participants. Many dealt with the length of the baseline surveys and the credibility of the information presented.

Intervention

The intervention used in the study was based on Social Norms Theory, (SNT; Perkins, 1991, 1997, 2002a) and adapted from the alcohol-only normative feedback used by Neighbors et al. (2004), except that marijuana norms were included in two of the three conditions. Normative components have been used in a variety of feedback interventions that have been influenced by Motivational Interviewing (see Hustad et al., 2010; Miller, 1983; Miller & Rollnick, 1991). The feedback was a brief (approximately 5-minute), web-based prevention intervention designed to provide college students with information about how their peers use marijuana and alcohol. After participants answered questions on the baseline survey, the event-driven program pulled reported information regarding the participant's perceived norms, and the participant's reported substance use and populated fields in the feedback section.

Participant information was contrasted with information about actual peer norms for the campus. Actual norms were based on data collected on the same campus three years prior from a sample of randomly selected undergraduate students (freshmen-senior) that participated in an alcohol and drug survey funded by the university. Feedback information varied according to study condition and gender (see Table 4.2). The program was designed to provide students with information to contrast their perceptions of peer use with actual peer use, their own use with peer use, and their own use with perceived peer use. Information was presented in both graph and text form. The intervention focused on normative perceptions and no other information was included in the feedback intervention. A sample feedback report is included in Appendix A.

Analysis Strategy

The focus of this study was to determine if normative feedback aimed at marijuana use, as well as combined alcohol and marijuana use was feasible as a prevention intervention for college students. Therefore, the majority of the analyses focused on the feasibility domains. A

secondary aim was to test the preliminary efficacy of the intervention by determining if exposure to the three feedback interventions produced changes in descriptive norms, substance use, and substance-related consequences one month later.

Frequency counts and percentages were analyzed for feasibility domains: acceptability, demand, implementation, practicality and limited efficacy. These analyses are descriptive in nature and no hypothesis testing was conducted. Additional quantitative analyses for limited efficacy were carried out to evaluate changes in perceived marijuana norms, perceived alcohol norms, alcohol use, marijuana use, and substance-related consequences as a function of intervention group. All analyses used an intent-to-treat principle that included all participants who provided baseline data. Data were tested for normality, and log and square root normalizing transformations were applied to all nine outcome variables.

Before limited efficacy testing began, analyses to determine whether attrition was related to intervention group, baseline alcohol or marijuana use, baseline norms, or baseline substance-related problems were performed. A dichotomous 'loss to follow-up' variable was created and participants were coded as 1 if data were missing at the 1-month follow-up, or 0 if data was present. Analyses suggested that attrition rates did not vary by intervention group $\chi 2$ (df=2, n=117)=.902, p=.637. A logistic regression analysis was conducted to evaluate whether loss to follow-up at 1-month was related to baseline measures, where loss to follow-up was regressed on non-transformed baseline: problems, drinks per occasion, peak drinks, HED frequency, days of marijuana use and perceived norms for drinks per occasion, monthly drinking frequency, and monthly marijuana frequency. Drinking frequency in the past month was removed as a predictor because it was highly correlated with HED—removal of either HED or drinking frequency in different analyses did not affect the following conclusions. When included in a linear regression model, tolerance and VIF statistics among the remaining eight variables were acceptable, with tolerance ranging from 0.485-0.707 and VIF ranging from 1.269-2.060. The overall logistic

regression model was significant, $\chi 2$ (df=8, n=113)=18.598, p=.017, indicating that the one or more of predictors reliably distinguished between those who fully completed the follow-up and those who fully completed baseline and were loss to follow-up. However, no individual predictors were significantly associated with loss to follow-up. Substance-related problems neared significance (B= -.178, p=.053, CI [0.700,1.002], Exp[B]=.837) was significantly associated with loss to follow-up.

Descriptive norms for all participants were compared to gender-specific actual norms on the campus to determine if participants' normative beliefs differed from actual norms on campus. One-sample t-test procedures used actual gender-specific population estimates for norms taken from a previous survey of substance use at the same university. Of note is that population norms were estimated for the entire undergraduate population at this university and were not freshman-specific. Populations estimates included: drinking frequency (6 times per month for males, 4 times for females), drinks per occasion (6 drinks for males, 3.5 for females) and days of marijuana use per month (5 days for males, 1.5 for females).

Next, the three conditions were compared to determine intervention effects on peer norms perceptions, one model each for the three transformed dependent variables of perceptions of peer: drinking frequency, number of drinks per occasion and days of marijuana use. Three linear mixed models (LMM) for repeated measures analyses were performed. For each dependent variable, a 3 (condition) X 2 (time) LMM for repeated measures was performed.

For each model, the random effect was the intercept and the fixed effects were condition (AO, MO, MA), time (Baseline, Follow-up) and the condition by time interaction. Time was also included as a repeated measure. The restricted maximum likelihood estimation and compound symmetry covariance structure were used. Type III fixed effects interpreted used and statistical significance was determined to be p values of less than .05. The same LMM for repeated measures analyses procedures were performed for the dependent variables of personal

substance use (alcohol frequency, drinks per occasion, HED frequency, peak number of drinks, marijuana frequency) and total scores on dichotomous substance-related-problems.

Results

Feasibility Measures

Acceptability. *Satisfaction:* As shown in Table 4.3, the majority of participants (78.2%) were at least somewhat satisfied with the feedback reports. Dissatisfaction was fairly consistent across the three conditions, suggesting that dissatisfaction possibly wasn't associated with specific conditions, but potentially feedback or substance-related interventions in general. The majority of participants found the feedback reports *useful* (64.6%) and *helpful (*67.9%) Interestingly, participants overall appear to believe that information about peer alcohol use is more helpful than information on peer marijuana/hash use when making decisions about engaging in use. *Recommend*: The majority of participants (66.7%) indicated that they would not recommend the website to a friend. A higher percentage of participants in the AO condition reported that they would recommend the website to a friend. *Perceived appropriateness*: The majority of participants agreed that the feedback reports included enough information on alcohol (76.6%) and marijuana (75.7%). As expected, a lower percentage of participants in the MO group agreed that there was enough information on alcohol (64.3%) when compared to the AO and MA groups. Despite not receiving information on marijuana, the proportion of participants in the AO group who agreed that there was enough information on marijuana was at about the proportion as the MO and MA group (72.0%, 82.1% and 75.8%, respectively).

Acceptability Qualitative: When participants were asked what they liked about the feedback reports or website in general, 25 out of 78 valid comments (32.1%) were related to how the feedback reports were easy to understand, straightforward, and concise. Nine participants (11.5%) stated that they liked the comparisons in the feedback reports. Six participants (7.7%) liked that the information was provided in charts. Three individuals

commented that the feedback made them feel like they used substances ‘a lot’ or were ‘alcoholics.’ These included the following statements: ‘I don’t see my self [sic] as a heavy drinker or heavy smoker. I use these socially, but not on a dependent way [sic]. The feedback made it seam [sic] as if I were addicted’; ‘It made me seem like I drink a lot’; and ‘making me feel like an alcoholic.’

Demand. *Actual use*: Only three participants (2.7%) reported that they printed their feedback report after the intervention. *Intent to continue use*: 58% of participants indicated that they would like to use the website again. The majority of participants (71.3%) did not think that they would use the information provided in the feedback reports in any way.

Implementation. *Execution*: One major requirement to feedback interventions is that the participants must believe that the norms provided by the researcher are accurate and believable. When asked if the information in the reports was believable, 33.9% of participants disagreed. In general, higher proportions of participants who received marijuana feedback (MO, MA) reported that the information was believable, when compared with AO participants.

Implementation Qualitative: Despite a majority of participants reporting that the information was believable in the implementation domain, a number of participants provided qualitative comments that questioned the reliability and credibility of the norms. Ten participants specifically challenged the reliability and/or credibility of the survey that was used to gather campus peer norms. Some examples include: ‘Gave poor estimates’; ‘I don’t feel the graphs are reliable’; ‘The charts were not at all reasonable’; and ‘The question if students answered honestly in the survey [sic].’ *Real-life experiences*. At follow-up, the majority (64%) reported that the information in the feedback reports accurately reflected their experiences with peers since the baseline session.

Participants must also perceive that the intervention program is accurate when reporting back information participants submitted during baseline survey collection. Overall, 80.2% of

participants felt that the reports accurately reflected information they reported. When provided an opportunity to comment on what they would change about the website, the following comments were provided: “I don't drink as much as it told me I did, I feel like I drink an average amount for a Male student at [study university].”

Practicality. *Ability to complete:* Over 95% of participants agreed that the intervention as simple to do online. This supports web-based formats for brief social norms interventions. Nine participants (8.1%) did not feel that the feedback reports were easy to understand. *Effects on Participants:* 28.5% believed that it took too long to read the feedback reports. Many participants (40.9%) felt that it took too long to gather the necessary substance-related behavioral information used to populate the feedback reports. It is noteworthy to add that this study collected more baseline information than what was required for the feedback reports. Out of the 61 participants with valid comments, 11 (18%) suggested that the baseline survey be shortened.

Limited Efficacy. *Alcohol Intentions*: 42.9% of participants felt that they would reduce how often they use alcohol and 51.4% the amount they use. Few participants reported intentions to increase alcohol use frequency (10.8%) and amount (10.8%).

Marijuana Intentions: 39.6% of participants felt that they would reduce how often they use marijuana and 38.7% the amount of marijuana they use. Few participants reported intentions to increase marijuana use frequency (12.7%) and amount (12.6%).

Alcohol Reflection: The majority of participants (68.8%) indicated that the reports facilitated reflection about their alcohol use, with a higher proportion of AO participants reporting this than in the MO and MA conditions (78.4%, 60.7% and 60.6%, respectively). *Marijuana Reflection*: Approximately half of participants (51.8%) indicated that the reports facilitated reflection about their marijuana use, with little variation across the conditions. *Qualitative*

Reflection: Eight participants (13.1%) commented that they liked that the feedback make them reflect on their own or peers' substance use.

Alcohol dissonance: The majority of participants reported that the feedback information conflicted with that they expected or believed about peer alcohol use (61.3%). Despite not receiving information on alcohol norms, 53.6% of participants in the MO group agreed with this statement. *Marijuana dissonance*: Approximately half of the participants (48.6%) reported that the feedback information conflicted with that they expected or believed about peer marijuana use. Again, despite not receiving information on marijuana norms, 44.0% of participants in to AO group agreed with this statement.

Quantitative Results

Participants perceived that their peers used alcohol more frequently than the previous campus survey indicated (females: $t(60)=4.811$, $p<.001$; males: $t(52)=3.422$, $p=0.001$). However, both female and male participants did not believe that their peers drank more drinks per drinking occasion than the previous survey indicated, $t(61)=0.685$, $p=0.496$ and $t(52)= -0.259$, $p=.796$, respectively. Both female and male participants also did not significantly differ from the population estimates for marijuana use, suggesting that they did not believe that their peers used marijuana more often than the previous survey indicated, $t(60)=1.757$, $p=.084$ and $t(52)=0.809$, $p=.422$, respectively.

LMMs for repeated measures analyses evaluated changes in perceptions of peer norms, personal use and substance-related problems from baseline to the 1-month follow-up. As shown in Table 4.4, no significant main effects were seen for treatment condition. Significant main effects of time were seen for perceptions of peer drinks $F(1,92)=7.786$, $p=.006$, frequency of personal HED, $F(1,97)=29.216$, $p<.001$, personal typical drinks per occasion $F(1,99)=4.611$, $p=.034$, personal peak number of drinks per occasion, $F(1,95)=21.559$, $p<.001$ and substance-related problems, $F(1,94)=42.819$, $p<.001$. Analyses indicated no main effect of time for

perceptions of peer alcohol use frequency occasions, perceptions of peer marijuana use frequency, frequency of personal drinking, and frequency of personal marijuana use. There were no significant time by treatment condition interactions for perceptions or personal use, indicating that type of feedback did not lead to variations in perceptions and use over time.

Discussion

Feasibility Domains

The current study was the first to examine a norms-only feedback intervention for marijuana use and combined alcohol and marijuana use in college students. Overall, it appears that provision of MO and MA feedback is feasible. The majority of participants were at least somewhat satisfied with the feedback reports and found them useful and helpful when making decisions about engaging in use. The majority of participants agreed that the feedback reports included enough information on alcohol and marijuana and indicated that they would like to use the website again. Most participants reported that the information in the intervention was believable and that the program accurately reported back information they had reported during the baseline survey. The great majority of participants agreed that the intervention was simple to do online and that the reports were easy to understand. Most didn't think that it took too long to read the reports, but 28.5% did. The estimated time to read the feedback reports was five minutes, so it is difficult to speculate about the amount of time that these individuals would prefer for a brief intervention.

While it appears feasible to target marijuana use and CPU with a brief norms-based intervention, there were some areas that may require additional investigation. The majority of participants did not think that they would use the information provided in the feedback reports in any way, nor would they recommend the website to a friend. Given that the majority of participants were satisfied with the feedback and found it useful, it is surprising that so few would recommend the website to a friend. Perhaps there are perceived negative consequences

for recommending a website aimed at decreasing substance use to a friend, or that friends may not feel comfortable addressing these issues with friends.

Despite no alcohol information at all, 64.3% participants in the MO condition at least somewhat agreed that there was enough information about alcohol use. The same pattern held for the AO group when asked if there was enough information on marijuana/hash use. It is unknown if these participants believed that a lack of information on the substances was acceptable or even desirable, or perhaps, whether or not they read the question fully.

Approximately one-third of participants in the MO group thought that they would use the information. It is unknown if participants believed that they would be more likely to use information related to alcohol to a higher degree than the information about marijuana, or vice versa. Perhaps an additional question asking the MA participants to specify which substance they believe they would use the information for would have added additional information.

Many participants reported that it took too long to gather the necessary substance-related behavioral information used to populate the feedback reports. This is not surprising for this study because the baseline survey collected much more information than was required for the feedback reports. Future studies on and campus programming with feedback interventions should examine the necessity of each item that data is being collected on.

Limited Efficacy

Normative feedback interventions are designed to provide students with information to contrast their perceptions of peer use with actual peer use, their own use with peer use, and their own use with perceived peer use. This process is hypothesized to facilitate reflection of one's personal use, conflict or dissonance with perceived norms and ultimately to increase intentions to reduce substance use. The majority of participants reported that the intervention facilitated personal reflection about personal alcohol and marijuana use. Almost half of participants reported that the information conflicted with their perceptions of peer marijuana use

and over half reported conflicts between the information and their perceptions of peer alcohol use. Finally, after the intervention, many participants felt that they would reduce how often and the amount of alcohol and marijuana they used. Therefore, it appears that the intervention was at least somewhat successful in facilitating the conceptual components that underlie normative feedback interventions.

Researchers have considered the potential for iatrogenic effects from normative feedback delivered to light or moderate substance users (Walters, Vader, & Harris, 2007; Wild, Cunningham, & Roberts, 2007). It is possible that communicating to students who hold realistic or "optimistic" perceptions that their peers use more than was thought may result in compensation of behaviors closer to or above actual norms. While the majority of participants in this study did not intend to increase their marijuana and alcohol use after the feedback intervention, 10.8%-12.7% reported that they would (Table 4.3). Future analyses and studies could further investigate the mechanisms by which some participants may increase intentions to increase substance use behavior after brief norms-based interventions and potential associations with perceived norms and personal substance use behaviors at the time of the intervention.

As predicted, results showed that, participants reduced their perceptions of peer drinks, their own HED occasions, typical drinks per drinking occasion, their own peak number of drinks and substance-related problems over the 4-week follow-up. Contrary to what was expected, participants did not reduce their perceptions of peer alcohol and marijuana use frequency, and frequency of personal drinking and marijuana use. In addition, the intervention conditions did not show reductions in norms perceptions, personal marijuana and alcohol use and problems across conditions.

The current findings did not support previous literature that supported norms-only feedback for impacting normative perceptions and drinking behaviors (Lewis & Neighbors, 2007;

Lewis et al., 2007; Neighbors et al., 2004; Neighbors et al., 2010; Neighbors et al., 2006). Findings are consistent with Lee et al. (2010), who found no overall intervention effects for a multicomponent marijuana feedback intervention in a similar sample of incoming college freshmen. Finally, in a randomized controlled trial of students presenting to student health services, Palfai et al. (2014) found no significant time or intervention effects for marijuana use frequency or significant decrease in marijuana related problems. The brief intervention did significantly reduce perceived peer marijuana norms. Like the current study, students were generally satisfied with the intervention. Perhaps information on marijuana norms is not useful or salient information for college students or that they choose to use marijuana for reasons besides peer norms and perceived pressure to fit in. However, a lack of interaction effects in support of established AO feedback may suggest validity issues and the current study should be replicated.

Observational studies of drinking patterns among incoming freshman suggest that on average, drinking behavior begins to decline in the months following commencement of college (Borsari et al., 2007; Del Boca, Darkes, Greenbaum, & Goldman, 2004). Since this study did not include a control group, it is unknown if the intervention, natural fluctuations in behavior over time or any other factors resulted in the positive outcomes seen from baseline to follow-up, or whether or not the intervention served to speed up a natural phenomenon.

Lack of misperceptions for peer drinks and marijuana use could potentially account for lack of intervention effects. Normative feedback leverages consistent findings that college students overestimate how often and how much their peers use substances and corresponding interventions aim to correct these misperceptions. It is likely that the intervention had no effect on participants who lacked misperceptions. Other studies and follow-up analyses could investigate whether or not there are differential effects on outcome variables across levels of norms perceptions.

Contrary to what was predicted, the MA condition did not appear to provide any 'added benefit' when compared with the MO and AO conditions. Since there is a lack of brief feedback interventions that balance information on two substances, it is unknown if this finding is expected or not. Nye et al. (1999) found that presentation of two methods for developing discrepancy—PNF and self-focusing—at the same time actually decreased intervention effects on problem recognition, compared to when either was presented alone. When speculating post-hoc about these results, the authors thought that receiving both types of information may have aroused defenses. Increased defenses may serve to abate initiation of behavior change mechanisms. More information may not lead to higher degrees or additive intervention effects, and very well could serve to 'wash out' the impact of some of the normative information.

Over time, participants did not decrease how often they drank, but did decrease more risky behaviors of HED and peak number of drinks. Decreases in these more risky behaviors may have accounted for overall decreases in substance-related problems. Perhaps intervention effects are more concentrated on the amount of alcohol participants drank and not frequency of drinking. Since our problems measure did not specify which substance the reported problems were associated with, it is unknown if the changes over time in problems were related to decreases in alcohol problems, marijuana problems, or both.

Limitations and Future Directions

This study had several limitations. First, our sampling procedures failed to produce our targeted number of participants. While including all members of the incoming class as potential participants decreases sampling bias, there was a period of time between when the initial sample was invited and when the rest of the class was invited. It is possible that late responders were already naturally decreasing their use over time (Borsari et al., 2007; Del Boca et al., 2004) or received exposure to the intervention by peers. Eligibility criteria required at least one episode of HED in the previous month and at least one day of marijuana use. Our low

threshold for marijuana use resulted in substantial variability in this variable (1-30); perhaps intervention efficacy was somewhat dependent on level of baseline substance use. Future studies should investigate the efficacy of brief web-based feedback interventions across different patterns of alcohol and marijuana use.

Only incoming freshman students were invited to participate in the study and it is unknown how study results would generalize to other populations of college students. Further, this study required utilization of norms from an entire population of students from the same university, not just a freshmen class. Previous studies have suggested that the reference group is of importance for normative interventions (Larimer et al., 2011; Lewis & Neighbors, 2004, 2007). Perhaps this study's utilization of more general norms motivated the ten participants to comment on the reliability and credibility of the institutional survey and peer norms used for the intervention. Additional studies could investigate this intervention with other classes and with more specific normative referent groups.

Substance use within the past month served as inclusion criteria. For early responders, this period of time may have included time before college commenced and it is unknown if these students continued to engage in use while on campus. If college matriculation served as a natural cutoff point for engaging in such behaviors for some participants, any natural decrease could have erroneously been attributed to the intervention or could have led to a misidentification of college freshman who concurrently use alcohol and marijuana.

Table 4.1.
Sample Demographics

	n, % invited sample (N=3,435)	n, % Started baseline (n=117)	n, % loss to follow-up (n=23)	n, % Complete Baseline & FU (n=94)
Race				
White	2,407 (70.1%)	93 (79.5%)	20 (87.0%)	73 (77.7%)
Hispanic/Latino(a)	112 (3.3%)	10 (8.5%)	1 (4.30%)	9 (9.6%)
Asian	86 (2.5%)	2 (1.7%)	0	2 (2.1%)
African American	250 (7.3%)	11 (9.4%)	2 (8.7%)	9 (9.7%)
Native Hawaiian/ Pacific Islander	132 (3.8%)	1 (0.9%)	0	1 (1.1%)
American Indian	13 (0.4%)	-	-	-
International	91 (2.6%)	-	-	-
Multiethnic	340 (9.9%)	-	-	-
Unknown	4 (0.1%)	-	-	-
Gender				
Female	*	62 (53%)	11 (47.8%)	51 (54.3%)
Male	*	55 (47%)	12 (52.2%)	43 (45.7%)
Age				
Mean	18.3	18.38	18.22	18.41
Range	*	18-20	18-19	18-20
SD	*	.537	.422	0.557

*Unknown

Figure 3.
Proposed Social Norms Theory-Influenced Model

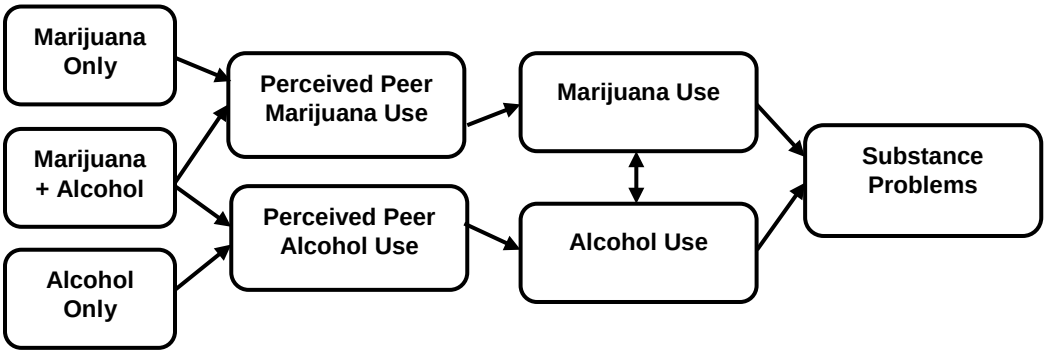


Table 4.2.
Information Presented to Participants by Condition

Normative feedback components presented during intervention	**Marijuana Only (MO)**	**Alcohol Only (AO)**	**Marijuana + Alcohol (MA)**
Number of days participant used marijuana in previous 30 days	X		X
Participant's perception of number of days of marijuana use in past 30 days for typical student at the same university (of the same gender)	X		X
Actual number of days in past 30 days typical student at the same university used marijuana (of the same gender)	X		X
Percentile ranking of the participant for days of marijuana use compared to typical students at the same university (of the same gender)	X		X
Average weekly frequency of alcohol use reported by the participant over the past 30 days		X	X
Average drinks per episode reported by the participant over the past 30 days		X	X
Participant's perception of frequency (episodes) of drinking per week for typical student at the same university (of the same gender)		X	X
Participant's perception of drinks per episode for typical student at the same university (of the same gender)		X	X
Actual frequency of alcohol use (episodes) per week for typical student at the same university (of the same gender)		X	X
Actual number of drinks per episode for typical student at the same university (of the same gender)		X	X
Percentile ranking of the participant for total drinks per week compared to a typical student at the same university		X	X

Table 4.3.
Feasibility Question Frequencies and Valid Percentages by Feasibility Domain

	MO (n=28)	AO (n=51)	MA (n=38)	Total (N=117)
Acceptability				
Useful: I found the feedback reports useful.				
Agree	16 (57.1%)	35 (68.6%)	22 (64.7%)	73 (64.6%)
Disagree	12 (42.9%)	16 (31.4%)	12 (35.3%)	40 (35.4%)
Helpful: Information about how my peers use alcohol is helpful when I make decisions about engaging in alcohol use.				
Agree	20 (71.4%)	34 (66.7%)	22 (66.7%)	76 (67.9%)
Disagree	8 (28.6%)	17 (33.3%)	11 (33.3%)	36 (32.1%)
Helpful: Information about how my peers use marijuana/hash is helpful when I make decisions about engaging in marijuana/hash use.				
Agree	15 (53.6%)	28 (54.9%)	17 (51.5%)	60 (53.6%)
Disagree	13 (46.4%)	23 (45.1%)	16 (58.5%)	52 (46.4%)
Recommend: Would you recommend the Website to a friend?				
Yes	7 (25.9%)	19 (40.4%)	10 (29.4%)	36 (33.3%)
No	20 (74.1%)	28 (59.6%)	24 (70.6%)	72 (66.7%)
Satisfaction: How satisfied were you with the feedback reports?				
Satisfied	21 (77.8%)	39 (78.0%)	26 (78.8%)	86 (78.2%)
Dissatisfied	6 (22.2%)	11 (22.0%)	7 (21.2%)	24 (21.8%)
Perceived appropriateness: The feedback reports included enough information about alcohol use.				
Agree	18 (64.3%)	42 (84.0%)	25 (75.8%)	85 (76.6%)
Disagree	10 (35.7%)	6 (12.0%)	7 (21.2%)	23 (20.7%)
N/A	-	2 (4.0%)	1 (3.0%)	3 (2.7%)
Perceived appropriateness: The feedback reports included enough information about marijuana/hash use.				
Agree	23 (82.1%)	36 (72.0%)	25 (75.8%)	84 (75.7%)
Disagree	5 (17.9%)	12 (24.0%)	6 (18.2%)	23 (20.7%)
N/A	-	2 (4.0%)	2 (6.1%)	4 (3.6%)

Table 4.3 Continued	MO (n=28)	AO (n=51)	MA (n=38)	Total (N=117)
Demand				
Actual use: Did you print the feedback reports when you were given the option?				
Yes	1 (3.6%)	2 (3.9%)	-	3 (2.7%)
No, no printer	5 (17.9%)	9 (18.0%)	10 (29.4%)	24 (21.4%)
No, no desire	22 (78.6%)	39 (78.0%)	24 (70.6%)	85 (75.9%)
Intent to continue use: I would like to use the feedback report Website again.				
Agree	16 (57.1%)	32 (64.0%)	17 (50%)	65 (58.0%)
Disagree	12 (42.9%)	18 (36.0%)	17 (50%)	47 (42%)
Intent to continue use: Do you think you will use the information from the feedback reports in any way?				
Yes	6 (22.2%)	14 (29.2%)	11 (33.3%)	31 (28.7%)
No	21 (78.8%)	34 (70.8%)	22 (66.7%)	77 (71.3%)
Implementation				
Execution: The information in the feedback reports was believable.				
Agree	19 (67.9%)	30 (58.8%)	25 (75.8%)	74 (66.1%)
Disagree	9 (32.1%)	21 (41.2%)	8 (24.2%)	38 (33.9%)
Execution: The feedback reports accurately reflected the information I reported when I filled out the survey questions.				
Agree	24 (85.7%)	39 (76.5%)	26 (78.8%)	89 (80.2%)
Disagree	4 (14.3%)	11 (22.0%)	7 (21.2%)	22 (19.8%)
Real-life Experiences, follow-up: The information in the feedback reports accurately reflected my experiences with peers since the first study session.				
Agree	15 (65.2%)	25 (67.6%)	17 (58.6%)	57 (64.0%)
Disagree	8 (34.8%)	12 (32.4%)	12 (41.4%)	32 (36.0%)
Practicality				
Ability to complete: Completing the intervention was simple to do online.				
Agree	28 (100%)	47 (94.0%)	31 (93.9%)	106 (95.5%)
Disagree	-	3 (6.0%)	2 (6.1%)	5 (4.5%)
Ability to complete: The feedback reports were easy to understand.				
Agree	26 (92.9%)	46 (92.0%)	30 (90.9%)	102 (91.9%)
Disagree	2 (7.1%)	4 (8.0%)	3 (9.1%)	9 (8.1%)

Table 4.3 Continued	MO (n=28)	AO (n=51)	MA (n=38)	Total (N=117)
Effects on participants: It took too long to read the feedback reports.				
Agree	10 (35.7%)	13 (26.0%)	9 (27.3%)	32 (28.8%)
Disagree	18 (64.3%)	37 (74.0%)	24 (72.7%)	79 (71.2%)
Effects on participants: It took too long to answer the questions that came before the feedback reports.				
Agree	12 (44.4%)	22 (44.0%)	11 (33.3%)	45 (40.9%)
Disagree	15 (55.6%)	28 (56.0%)	22 (66.7%)	65 (59.1%)
Limited Efficacy				
Alcohol Intentions: After seeing the feedback reports, I feel that I will reduce how often I drink alcohol.				
Agree	10 (35.7%)	25 (49.0%)	13 (39.4%)	48 (42.9%)
Disagree	18 (64.3%)	26 (51.0%)	20 (60.6%)	64 (57.1%)
Alcohol Intentions: After seeing the feedback reports, I feel that I will reduce the amount of alcohol I drink (i.e., the number of standard drinks).				
Agree	13 (46.4%)	30 (60.0%)	14 (42.4%)	57 (51.4%)
Disagree	15 (53.6%)	20 (40.0%)	19 (57.6%)	54 (48.6%)
Alcohol Intentions: After the feedback, I feel that I will increase how often I drink alcohol.				
Agree	3 (10.7%)	6 (11.8%)	3 (9.4%)	12 (10.8%)
Disagree	25 (89.3%)	45 (88.2%)	29 (90.6%)	99 (89.2%)
Alcohol Intentions: After the feedback, I feel that I will increase how much alcohol I drink (i.e., standard drinks).				
Agree	5 (17.9%)	4 (7.8%	3 (9.4%)	12 (10.8%)
Disagree	23 (82.1%)	47 (92.2%)	29 (90.6%)	99 (89.2%)
Marijuana Intentions: After seeing the feedback reports, I feel that I will reduce how often I use marijuana/hash.				
Agree	11 (39.3%)	19 (38.0%)	14 (42.4%)	44 (39.6%)
Disagree	17 (60.7%)	31 (62.0%)	19 (57.6%)	67 (60.4%)
Marijuana Intentions: After the feedback reports, I feel that I will reduce the amount (e.g., the number of 'hits,' the size of a 'bowl' or 'joint') of marijuana/hash I use.				
Agee	12 (42.9%)	17 (34.0%)	14 (42.4%)	43 (38.7%)
Disagree	16 (57.1%)	33 (66.0%)	19 (57.6%)	68 (61.3%)

Table 4.3 Continued		MO (n=28)	AO (n=51)	MA (n=38)	Total (N=117)
Marijuana Intentions: After the feedback, I feel that I will increase how often I use marijuana/hash.					
	Agree	3 (10.7%)	8 (16.0%)	3 (.6%)	14 (12.7%)
	Disagree	25 (89.3%)	42 (84.0%)	29 (90.6%)	96 (87.3%)
Marijuana Intention: After the feedback, I feel that I will increase the amount (e.g., the number of 'hits,' the size of a 'bowl' or 'joint') of marijuana/hash I use.					
	Agree	2 (7.1%)	11 (21.6%)	1 (2.9%)	14 (12.6%)
	Disagree	26 (92.9%)	40 (78.4%)	31 (88.6%)	97 (87.4%)
Self-reflection: The feedback reports made me think about the amount of alcohol I drink.					
	Agree	17 (60.7%)	40 (78.4%)	20 (60.6%)	77 (68.8%)
	Disagree	11 (39.3%)	11 (21.6%)	12 (36.4%)	34 (30.4%)
	N/A	-	-	1 (3.0%)	1 (0.9%)
Self-reflection: The feedback reports made me think about the amount of marijuana/hash I use.					
	Agree	14 (50%)	27 (52.9%)	17 (51.5%)	58 (51.8%)
	Disagree	14 (50%)	19 (37.3%)	15 (45.5%)	48 (42.9%)
	N/A	-	5 (9.8%)	1 (3.0%)	6 (5.4%)
Dissonance: The information about how my peers use alcohol was in conflict with what I expected or what I believed.					
	Agree	15 (53.6%)	30 (60.0%)	23 (69.7%)	68 (61.3%)
	Disagree	12 (42.9%)	18 (36.0%)	8 (24.2%)	38 (34.2%)
	N/A	1 (3.6%)	2 (4.0%)	2 (6.1%)	5 (4.5%)
Dissonance: The information about how my peers use marijuana/hash was in conflict with what I expected or what I believed.					
	Agree	12 (42.9%)	22 (44.0%)	20 (60.6%)	54 (48.6%)
	Disagree	14 (50.0%)	23 (46.0%)	10 (30.3%)	47 (42.3%)
	N/A	2 (7.1%)	5 (10.0%)	3 (9.1%)	10 (9.0%)

Table 4.4

Group Means, SDs, and Type III Fixed Effects for the Three Conditions

Outcome	Assessment Time, Estimated Marginal Group Mean (SE)			Type III Tests of Fixed Effects, LMM Statistical Tests: F (df) [p]		
	Group	Baseline (T1)	Follow-up (T2; 4 wk)	Condition Effect	Time Effect	Condition*Time Interaction
Peer Marijuana Norms (log)	MA	.488 (.052)	.482 (.056)	2.713 (2,111) [.071]	1.357 (1,99) [.247]	.545 (2,99) [.582]
	MO	.503 (.058)	.477 (.061)			
	AO	.647 (.043)	.570 (.047)			
Peer Drink Norms (log)	MA	.637 (.033)	.618 (.036)	2.587 (2,106) [.080]	7.786 (1,92) **[.006]**	1.409 (2,92) [.250]
	MO	.571 (.037)	.523 (.039)			
	AO	.686 (.028)	.596 (.030)			
Peer Alcohol Frequency Norms (sqrt)	MA	2.425 (1.20)	2.549 (.131)	.088 (2,108) [.916]	.010 (1,100) [.919]	1.960 (2,100) [.146]
	MO	2.492 (.134)	2.608 (.144)			
	AO	2.617 (.100)	2.404 (.111)			
Personal Marijuana Days (sqrt)	MA	2.135 (.236)	2.378 (.246)	.977 (2,114) [.379]	.000 (1,93) [.990]	1.867 (2,93) [.160]
	MO	2.369 (.274)	2.206 (.281)			
	AO	2.673 (.203)	2.597 (.211)			
Personal Alcohol Freq. (sqrt)	MA	2.624 (.143)	2.594 (.158)	1.686 (2,114) [.190]	.415 (1,103) [.521]	1.297 (2,103) [.278]
	MO	2.786 (.164)	2.521 (.175)			
	AO	2.832 (.122)	2.942 (.133)			
Personal Typical Drinks (log)	MA	.692 (.037)	.655 (.042)	1.686 (2,112) [.190]	4.611 (1,99) **[.034]**	.114 (2,99) [.893]
	MO	.621 (.043)	.560 (.047)			
	AO	.699 (.032)	.639 (.035)			
Personal Peak Drinks (log)	MA	.925 (.041)	.798 (.045)	.607 (2,112) [.547]	21.559 (1,95) **[<.001]**	.619 (2,95) [.541]
	MO	.871 (.047)	.752 (.050)			
	AO	.905 (.035)	.831 (.037)			
Personal HED Frequency (sqrt)	MA	2.181 (.121)	1.841 (.132)	2.360 (2,113) [.099]	29.216 (1,97) **[<.001]**	.056 (2,97) [.945]
	MO	2.231 (.141)	1.862 (.148)			
	AO	2.498 (.104)	2.106 (.112)			
Personal Problems (sqrt)	MA	2.275 (.128)	2.013 (.138)	2.911 (2,109) [.059]	42.819 (1,94) **[<.001]**	2.492 (2,94) [.088]
	MO	2.335 (.145)	1.793 (.153)			
	AO	2.735 (.107)	2.104 (.117)			

Chapter 5

Conclusion

The purpose of this study was to investigate concurrent use of alcohol and marijuana in terms of: (a) what is known about this pattern of use, (b) the problems associated with CPU and SPU, and (c) whether a brief social norms intervention is feasible for modifying norms perceptions, use and problems related to marijuana use and concurrent alcohol and marijuana use in college students who engage in CPU. For the most part, results of the three papers are complementary and suggest that concurrent use of alcohol and marijuana is a complex pattern of use that is associated with risk of negative outcomes, which may require more comprehensive intervention beyond brief social norms correction and personal feedback.

The first review paper suggested that while a number of predictors of alcohol and marijuana use are similar, and that some of the same theoretical components have been used to address use of these two substances in college students, there are unique aspects of concurrent use of both alcohol and marijuana and that not much research has been applied to understanding these patterns of use. Paper 2 revealed marked differences in negative outcomes experienced by students who engaged in CPU and SPU. Results revealed that students who engage in CPU and SPU report experiencing a number of substance-related problems. Further, the odds of students who engaged in SPU reporting some of the problems were significantly elevated, when compared to students who engaged in CPU. Paper 3 supported previous literature on brief social norms only interventions' ability to modify alcohol-related outcomes and substance-related problems over time in college students. The selected marijuana outcomes, however, were not impacted and no condition or condition*time effects were seen for the three different types of norms feedback. These results support the complex nature of marijuana use and concurrent use of marijuana and alcohol in college students and helps clarify the impact of brief norms correction information for marijuana use and CPU.

Paper 1 suggested that a number of college students use alcohol and marijuana, both concurrently and simultaneously. However, not many epidemiological studies were found that asked college students how they used these substances in tandem. Some literature suggested

that concurrent use of marijuana and alcohol increased the risks of experiencing substance-related problems (Shillington & Clapp, 2001, 2006). These findings beseeched the question of whether the increased risk was due to combined use overall, or whether the risks are associated with the types of individuals who typically engaged in these behaviors.

Paper 2 found that the odds of hangovers and blackouts were significantly elevated for simultaneous users in multivariate analyses. These problems represent significant safety and health concerns that are often the target of substance use interventions on college campuses. The differences between concurrent and simultaneous users were not as stark as when concurrent and alcohol-only users were contrasted in other studies (Shillington & Clapp, 2001, 2006). Paper 2 suggests that not only are concurrent users a population at increased risk of problems, that simultaneous users may be a population at additional risk. As demonstrated in Paper 1, there is little research being conducted on CPU and SPU. Epidemiological research could serve to further demonstrate how SPU differs from CPU, as well as how these represent unique patters that differ from single marijuana or alcohol use.

Paper 3 attempted to determine the feasibility of addressing alcohol and marijuana use in concurrent users with a brief social norms only intervention. Paper 1 demonstrated that in general, college students misperceive peer norms related to marijuana and alcohol use, which is required for norms correction to have an impact on these patterns of use. Paper 2 demonstrated that student who engage in CPU and SPU experience a number of substance-related problems, which is often the most salient outcome being targeted with norms-based interventions. Studies have shown support for norms-only interventions targeted at alcohol use but no testing was found for marijuana use and concurrent alcohol and marijuana use. Overall ratings provided by participants suggested that it is feasible to target marijuana use and combined alcohol and marijuana use with norms-only feedback. Participants were generally satisfied and found the feedback useful, but alcohol-only feedback was rated as more useful than marijuana only and combined marijuana and alcohol feedback. These ratings correspond

with overall significant decreases in time-related effects for most alcohol related outcomes, including perceived peer drink norms, personal use: typical drinks per occasion, peak drinks and HED frequency. In contrast, perceived peer marijuana use norms and personal marijuana use days did not decrease in the sample over time, which may reflect the relatively lower ratings for usefulness of marijuana feedback reported by the participants.

While feasibility ratings overall supported the feasibility of the intervention, the absence of condition and condition*time effects was contrary to hypothesized benefits of targeting different use patterns. Participants who received marijuana feedback did not decrease marijuana perceptions or use to higher degrees than participants who received alcohol feedback only. The same held true for alcohol only feedback and alcohol-related outcomes. Finally, students who received both marijuana and alcohol feedback did not report any added benefit to the enhanced feedback over participants who received single substance feedback. Lee and colleagues failed to find overall intervention effects for a more comprehensive multicomponent marijuana feedback intervention (Lee et al., 2010). It may be that while college students misperceive peer use of marijuana, norms-based interventions may not impact personal use because peer marijuana use does not influence personal decisions to use marijuana, or at least to the degree that has been supported for alcohol use.

Implications

Understanding Concurrent Use of Marijuana and Alcohol. Paper 1 included a narrative review on what is known about concurrent use of alcohol and marijuana in college students. As mentioned a number of times throughout this study, little information was found. As alcohol use, marijuana use, and CPU are all salient public health concerns associated with a variety of problems, it is important to understand factors that may contribute to initiation and maintenance of these patterns of use. Paper 1 concludes with a called for additional research on CPU, especially: defining CPU and its subsets, its epidemiology (e.g., prevalence rates,

correlates, related problems), theory testing to examine why students engage in CPU, and the development and testing of interventions targeted at this pattern of use. Conclusions regarding how to target CPU should be made after a thorough understanding of the predictors, supported theoretical orientations/key constructs, and existing interventions for marijuana and alcohol use in college students. Integration of the findings may reveal necessary considerations when targeting marijuana use and CPU. Indeed, lack of pattern-specific knowledge may explain why alcohol-based PNF interventions have sometimes been unable to show comparatively positive results for use and problems when translated to other substances (e.g., Lee et al., 2010). Further, it is important to consider the unique attributes of college students who, for a variety of reasons, may exhibit unique risk factors compared to other populations.

For example, as described in Paper 1, Smucker Barnwell and Earleywine (2006) altered alcohol and marijuana expectancy questionnaires to yield responses of participant beliefs regarding how use of the other substance would impact their experiences. The researchers found that simultaneous alcohol and marijuana expectancies marginally increased the accuracy of predicting SPU, compared to single substance expectancies alone in a community sample of adults. This sole example of investigating expectancies for SPU supports further investigation of the influence of simultaneous expectancies and non-pharmacological reasons that may contribute to SPU (Stacy, 1997). A similar process can be undertaken to examine other theoretical components such as motives, perceived social norms and others described in Paper 1. Initial examination of components could start by modifying existing marijuana and alcohol measures, many of which have been studied extensively.

Paper 2 demonstrated that students who engaged in CPU and SPU experienced many substance-related problems and that the odds of blackouts and hangovers were significantly elevated for students who engaged in SPU. More research is required to determine why SPU appears associated with greater increases in these problems. Additive and synergistic effects of two substances ingested at the same time (Pape et al., 2009; Schensul et al., 2005) may

explain the differential pattern of problems for CPU and SPU users. However, given the lack of investigation into theoretical components, other reasons may influential. For example, motives or expectancies for simultaneous use may influence consumption patterns and/or related problems. Indeed, Paper 2 also found that simultaneous users, when compared with concurrent users, engaged in significantly more frequent marijuana and alcohol use, as well as heavy episodic drinking. Additional research on sociodemographics or personality constructs, as well as consumption within the CPU and SPU could reveal salient reasons for use, as well as domains to target during interventions.

Social Norms Correction for Marijuana and Concurrent Use. Paper 3 suggested that it is feasible to target marijuana use in college students with provision of a brief norms correction intervention. Model testing supported previous findings that social norms correction can influence most alcohol-related perceptions and personal use outcomes over time (Lewis & Neighbors, 2007; Lewis et al., 2007; Neighbors et al., 2004; Neighbors et al., 2010; Neighbors et al., 2006). Like Lee et al. (2010), provision of norms correction did not affect marijuana perceptions or personal use. Substance-related problems significantly decreased over time. Participants reported experiencing problems attributed to either marijuana or alcohol, so it is it is unknown if either or both substances were responsible for the decline.

Paper 1 detailed the lack of testing for marijuana interventions in general and for social-norms only type feedback interventions. This brief intervention is cost-effective and has the ability to be delivered in multiple modalities (e.g., in-person, Web-based) and is generally acceptable to college students (see Paper 3). Previous studies have found favorable results for multicomponent marijuana feedback in adolescent (Martin & Copeland, 2008) and adult (Stephens et al., 2007) populations. Lack of significant findings for marijuana outcomes in Paper 3 and other existing literature may suggest that this intervention is more effective for other populations or alcohol use among college students. However, more studies that investigate social norms correction for marijuana use among college students are needed

before solid conclusions on this intervention's utility can be made. More null findings may suggest that other types of interventions are more effective for targeting marijuana use among college students.

As mentioned in Paper 1, Barrett et al. (2006) found that alcohol use typically preceded the use of marijuana during college student participants' most recent SPU episode, suggesting that alcohol may be a key contributor to the use of cannabis during a single use session for students who use both substances. Since alcohol could generally be used first, efforts that concentrate on preventing any alcohol use (i.e., abstinence), or decreasing alcohol use, would also serve to also prevent some cannabis use in this population.

Stephens et al. (2007) found a significant decrease in alcohol related problems in their study of a brief marijuana intervention for adults, despite no inclusion of alcohol components in the interventions. This is intriguing as there was no corresponding significant decrease in alcohol or other drug use, and cannabis problems did not decrease in any condition. Magill et al. (2009) found that alcohol-based PNF can influence cannabis use by way of decreasing alcohol use. These studies appear to support secondary effects, or generalization of treatment effects, of brief feedback on other substances not addressed during provision of brief interventions. Paper 3 was in a position to further investigate the implications of these previous studies.

Paper 3 did not find condition effects or condition*time effects, which could have been used to investigate secondary effects. The significant time effects for perceived alcohol norms, personal alcohol use and problems and marginal group means reported in Table 4.4 suggest that these variables decreased across conditions, even for the participants who only received marijuana-only norms feedback. However, perceived marijuana norms and personal use days did not decrease over time, which also does not support notions that decreases in alcohol use facilitates decreases in marijuana use. Future studies should examine the potential for

secondary effects of provision of interventions targeted at single- and multi-substances, as well as the potential mechanisms through which secondary effects are seen.

Limitations

Previous studies have used various referent groups to target feedback and make comparisons between participants' personal use and norms during the provision of brief feedback interventions. Groups vary from broad, unspecified norms (i.e., general US norms), to norms collected from the same sample at baseline. It is unlikely that these will be equally convincing when attempting to correct misperceptions and develop discrepancy for personal use, due to differences in saliency of referent group (i.e., US norms are less salient and not as specific as campus-specific norms). The current study utilized gender-specific norms from the same university, which have been shown to increase effectiveness of normative feedback interventions (Lewis & Neighbors, 2004, 2007). However, Neighbors et al. (2010) found few significant differences between gender-specific and gender-nonspecific PNF norms.

Further targeting on year in school can be performed to increase relevancy to participants. Norms for freshmen students are likely to be more relevant for this group than norms from other classes or overall university norms. The current study had to rely on norms for an entire population of students from the same university, not just a freshmen class. This requires students to process norms for a variety of ages, life situations, maturity levels and academic standings during the feedback intervention. Perhaps the sample of freshmen did not believe the norms to be applicable to the freshmen class, which would have decreased the impact of the intervention.

Prevention programs are beginning to target and tailor feedback interventions on some of the important correlates of at-risk college alcohol and cannabis use that were reviewed in Paper 1 (e.g., race, age, housing situation, Greek/athletic affiliation). For example, Bingham et al. (2010) tailored a brief Web-based alcohol prevention program on each student's alcohol-related risk, which determined whether the intervention promoted risk reduction (i.e.,

intervention) or risk avoidance (i.e., prevention). Further tailoring was performed on constructs of the program's conceptual model (e.g., stage of change, self-efficacy) to determine the intervention's intended effect (e.g., increase low levels of self-efficacy, support existing high levels of self-efficacy). Finally, PNF norms were targeted on individual participants' demographics (e.g., gender and Greek affiliation). Paper 3 did not find significant condition*time interactions. However, perceptions of peer drinks per occasion, typical and peak personal drinks per occasion, HED and substance-related problems decreased over time. Since it is unknown if these changes were a result of exposure to norms feedback—regardless of condition—or decreases in use during the course of the freshmen year, future studies could utilize year in class-specific norms (e.g., freshmen) to continue to investigate the utility of targeted norms-only interventions for marijuana use and CPU. Studies could also include more objective referent groups (i.e., "the friends that you spend most of your time with"), which may increase intervention saliency, particularly for students who do not identify with peer groups based on year in school.

Social norms interventions are premised on consistent empirical evidence that college students misperceive how often their peers use substances (frequency) and the amount of alcohol used. Norms correction during brief social norms feedback aims to correct these misperceptions, leading to reduced substance consumption and substance related problems. While participants in Paper 3 significantly misperceived the frequency at which their peers used alcohol at baseline, it is noteworthy that they did not significantly misperceive the number of drinks that their peers use per drinking occasion or the number of days that peers used marijuana. These findings are contrary to what was hypothesized and found in past literature (Kilmer et al., 2006; Lewis & Neighbors, 2007; Lewis et al., 2007; Neighbors et al., 2004; Neighbors et al., 2006) and may account for lack of intervention effects. The lack of misperceptions could have been due to the study utilizing norms from an entire undergraduate cohort, and not freshmen only. Despite significant baseline misperceptions for perceived

frequency of peer alcohol use, there were no significant decreases in norms over time or by condition, as would have been seen if the intervention successfully corrected misperceptions.

Conclusion

Studies indicate that many college students engage in concurrent and simultaneous use of alcohol and marijuana. More studies are beginning to test marijuana-focused interventions, include both alcohol and marijuana components into interventions, and measure both substances during assessments. However, more work is needed to further legitimize CPU and SPU as at-risk patterns of use that require targeted investigation and prevention. This study aimed to contribute information in areas that currently are underrepresented in the literature.

Paper 1 identified important similarities and differences between CPU, SPU and alcohol and marijuana use, including consequences, factors associated with use and theoretically-supported constructs that explain and predict use. This information can be used during the development of research studies and interventions to increase the likelihood of effective targeting of desired populations. Paper 2 built upon previous studies to investigate whether simultaneous and concurrent users differed on substance use behaviors and in experiencing problems. Importantly, simultaneous users engaged in significantly higher amounts of substance use and the odds blackouts and hangovers were significantly elevated for this group. This important information can potentially inform decisions related to the tailoring of campus interventions for at-risk groups and potentially, modifications to current prevention programming.

Paper 3 was the first study found to provide norms-only feedback for marijuana use in college students, as well as provide this alongside norms-only feedback for alcohol. Importantly, this study found that this intervention can feasibility be translated to target marijuana use in college students. However, overall results did not support hypothesized changes in outcomes across the conditions. Importantly, these results are consistent with previous studies that suggest limited impact of brief interventions for marijuana use in college students (Lee et al., 2010; Palfai et al., 2014). Perhaps as research continues, results may

indicate marijuana use in this population cannot be consistently modified with brief interventions. Finally, the alcohol-only condition did not outperform the two conditions with marijuana feedback. This contrasts with previous support of alcohol-only normative feedback. It is noteworthy that inclusion criteria in other studies relied on alcohol use behaviors only. It may be that norms-only feedback is not as effective with concurrent users, when compared with samples that were only selected on alcohol use behaviors. In conclusion, this dissertation—with its broad focus on previous literature, substance-related problems, and brief interventions—hopefully contributes to current knowledge of CPU and SPU, as well as efforts to address these patterns of use.

References

Abbey, A. (2002). Alcohol-related sexual assault: A common problem among college students. *Journal of Studies on Alcohol, Suppl. 14*, 118-128.

Ajzen, I. (1985). From intentions to actions: A Theory of Planned Behavior. In J. Kuhl & J. Beckmann (Eds.), *Action control: From cognition to behavior* (pp. 11-39). New York: Springer-Verlag.

Ajzen, I. (1991). The Theory of Planned Behavior. *Organizational Behavior and Human Decision Processes, 50*(2), 179-211.

American Psychiatric Association. (2000). *Diagnostic and statistical manual of mental disorders (4th ed., text rev.)*. Washington, DC: Author.

Armitage, C. J., & Conner, M. (2001). Efficacy of the Theory of Planned Behaviour: A meta-analytic review. *British Journal of Social Psychology, 40*(4), 471-499.

Armitage, C. J., Conner, M., Loach, J., & Willetts, D. (1999). Different perceptions of control: Applying an extended Theory of Planned Behavior to legal and illegal drug use. *Basic and Applied Social Psychology, 21*(4), 301-316.

Arria, A., Caldeira, K., O'Grady, K., Vincent, K., Fitzelle, D., Johnson, E., & Wish, E. (2008). Drug exposure opportunities and use patterns among college students: Results of a longitudinal prospective cohort study. *Substance Abuse, 29*(4), 19-38.

Bachman, G. J., Johnston, L. D., & O'Malley, P. M. (1998). Explaining recent increases in students' marijuana use: Impacts of perceived risks and disapproval, 1976 through 1996. *American Journal of Public Health, 88*(6), 887-892.

Baer, J. S. (2002). Student factors: Understanding individual variation in college drinking. *Journal of Studies on Alcohol, Suppl. 14*, 40-53.

Baer, J. S., Stacy, A., & Larimer, M. (1991). Biases in the perception of drinking norms among college students. *Journal of Studies on Alcohol, 52*(6), 580-586.

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

Bandura, A. (1986). *Social foundations of thought and action: A social cognitive theory*. Englewood Cliffs, N.J.: Prentice-Hall.

Bandura, A. (1997). *Self-efficacy: The exercise of control*. New York: Freeman.

Barrett, S. P., Darredeau, C., & Pihl, R. O. (2006). Patterns of simultaneous polysubstance use in drug using university students. *Human Psychopharmacology, 21*(4), 255-263.

Bell, R., Wechsler, H., & Johnston, L. D. (1997). Correlates of college student marijuana use: Results of a US national survey. *Addiction, 92*(5), 571-581.

Berg, C. J., Buchanan, T. S., Grimsley, L., Rodd, J., & Smith, D. (2011). Personality characteristics and health risk behaviors associated with current marijuana use among college students. *Open Journal of Preventive Medicine, 1*(3), 101-108. Retrieved from doi:10.4236/ojpm.2011.13015

Bierut, L. J., Dinwiddie, S. H., Begleiter, H., Crowe, R. R., Hesselbrock, V., Nurnberger Jr, J. I., . . . Reich, T. (1998). Familial transmission of substance dependence: Alcohol, marijuana, cocaine, and habitual smoking: A report from the Collaborative Study on the Genetics of Alcoholism. *Archives of General Psychiatry, 55*, 982-988.

Bingham, C. R., Barretto, A. I., Walton, M. A., Bryant, C. M., Shope, J. T., & Raghunathan, T. E. (2010). Efficacy of a web-based, tailored, alcohol prevention/intervention program for college students: Initial findings. *Journal of American College Health, 58*(4), 349-356.

Blanco, C., Okuda, M., Wright, C., Hasin, D. S., Grant, B. F., Liu, S. M., & Olfson, M. (2008). Mental health of college students and their non-college-attending peers: Results from the National Epidemiologic Study on Alcohol and Related Conditions. *Archives of General Psychiatry, 65*(12), 1429-1437.

Borsari, B., & Carey, K. B. (2001). Peer influences on college drinking: A review of the research. *Journal of Substance Abuse, 13*(4), 391-424.

Borsari, B., & Carey, K. B. (2003). Descriptive and injunctive norms in college drinking: A meta-analytic integration. *Journal of Studies on Alcohol, 64*(3), 331-341.

Borsari, B., & Carey, K. B. (2006). How the quality of peer relationships influences college alcohol use. *Drug and Alcohol Review, 25*(4), 361-370.

Borsari, B., Murphy, J. G., & Barnett, N. P. (2007). Predictors of alcohol use during the first year of college: implications for prevention. *Addictive Behaviors, 32*(10), 2062-2086.

Bowen, D. J., Kreuter, M., Spring, B., Cofta-Woerpel, L., Linnan, L., Weiner, D., . . . Fabrizio, C. (2009). How we design feasibility studies. *American Journal of Preventive Medicine, 36*(5), 452-457.

Brener, N. D., Billy, J. O., & Grady, W. R. (2003). Assessment of factors affecting the validity of self-reported health-risk behavior among adolescents: Evidence from the scientific literature. *Journal of adolescent health, 33*(6), 436-457.

Brown, S. A., Goldman, M. S., Inn, A., & Anderson, L. R. (1980). Expectations of reinforcement from alcohol: Their domain and relation to drinking patterns. *Journal of Consulting and Clinical Psychology, 48*(4), 419-426.

Buckner, J. D., Ecker, A. H., & Cohen, A. S. (2010). Mental health problems and interest in marijuana treatment among marijuana-using college students. *Addictive Behaviors, 35*(9), 826-833.

Buckner, J. D., Keough, M. E., & Schmidt, N. B. (2007). Problematic alcohol and cannabis use among young adults: The roles of depression and discomfort and distress tolerance. *Addictive Behaviors, 32*(9), 1957-1963.

Buckner, J. D., Schmidt, N. B., Lang, A. R., Small, J. W., Schlauch, R. C., & Lewinsohn, P. M. (2008). Specificity of social anxiety disorder as a risk factor for alcohol and cannabis dependence. *Journal of Psychiatric Research, 42*(3), 230-239.

Caldeira, K. M., Arria, A. M., O'Grady, K. E., Vincent, K. B., & Wish, E. D. (2008). The occurrence of cannabis use disorders and other cannabis-related problems among first-year college students. *Addictive Behaviors, 33*(3), 397-411.

Carey, K. B., Scott-Sheldon, L., Carey, M. P., & DeMartini, K. S. (2007). Individual-level interventions to reduce college student drinking: A meta-analytic review. *Addictive Behaviors, 32*(11), 2469-2494.

Clayton, R. R. (1986). Multiple drug use: Epidemiology, correlates and consequences. In M. Galanter (Ed.), *Recent Developments in Alcoholism* (Vol. 4, pp. 7-38). New York, NY: Plenum Press.

Collins, R. L., Ellickson, P. L., & Bell, R. M. (1998). Simultaneous polydrug use among teens: Prevalence and predictors. *Journal of Substance Abuse, 10*(3), 233-253.

Collins, R. L., Parks, G. A., & Marlatt, G. A. (1985). Social determinants of alcohol consumption: The effects of social interaction and model status on the self-administration of alcohol. *Journal of Consulting and Clinical Psychology, 53*(2), 189-200.

Conner, M., & McMillan, B. (1999). Interaction effects in the Theory of Planned Behaviour: Studying cannabis use. *British Journal of Social Psychology, 38*(2), 195-222.

Cooper, M. L. (1994). Motivations for alcohol use among adolescents: Development and validation of a four-factor model. *Psychological Assessment, 6*(2), 117-128.

Cooper, M. L., Frone, M. R., Russell, M., & Mudar, P. (1995). Drinking to regulate positive and negative emotions: A motivational model of alcohol use. *Journal of Personality and Social Psychology, 69*(5), 990-1005.

Courtney, K. E., & Polich, J. (2009). Binge drinking in young adults: Data, definitions, and determinants. *Psychological Bulletin, 135*(1), 142.

Cox, W. M., & Klinger, E. (1988). A motivational model of alcohol use. *Journal of Abnormal Psychology, 97*(2), 168-180.

Dawson, D. A., Grant, B. F., Stinson, F. S., & Chou, P. S. (2005). Psychopathology associated with drinking and alcohol use disorders in the college and general adult populations. *Drug and Alcohol Dependence, 77*(2), 139-150.

Del Boca, F. K., Darkes, J., Greenbaum, P. E., & Goldman, M. S. (2004). Up close and personal: Temporal variability in the drinking of individual college students during their first year. *Journal of Consulting and Clinical Psychology, 72*(2), 155-164.

Demmel, R., & Hagen, J. (2003). The Comprehensive Alcohol Expectancy Questionnaire: I. Scale development. *SUCHT--Zeitschrift fur Wissenschaft und Praxis, 49*(5), 292-299.

Dowdall, G. W. (2009). *College Drinking: Reframing a Social Problem*. Westport, CT: Praeger Publishers.

Duncan, G. J., Boisjoly, J., Kremer, M., Levy, D. M., & Eccles, J. (2005). Peer effects in drug use and sex among college students. *Journal of Abnormal Child Psychology, 33*(3), 375-385.

Dunn, E. C., Larimer, M. E., & Neighbors, C. (2002). Alcohol and drug related negative consequences in college students with bulimia nervosa and binge eating disorder. *International Journal of Eating Disorders, 32*(2), 171-178.

Earleywine, M., & Newcomb, M. D. (1997). Concurrent versus simultaneous polydrug use: Prevalence, correlates, discriminant validity, and prospective effects on health outcomes. *Experimental and Clinical Psychopharmacology, 5*(4), 353-364.

Epler, A. J., Sher, K. J., Loomis, T. B., & O'Malley, S. S. (2009). College student receptiveness to various alcohol treatment options. *Journal of American College Health, 58*(1), 26-32.

Fishbein, M., & Ajzen, I. (2010). *Predicting and changing behavior: The Reasoned Action Approach*. New York: Psychology Press.

Galen, L. W., & Rogers, W. M. (2004). Religiosity, alcohol expectancies, drinking motives and their interaction in the prediction of drinking among college students. *Journal of Studies on Alcohol, 65*(4), 469-476.

Gledhill-Hoyt, J., Lee, H., Strote, J., & Wechsler, H. (2000). Increased use of marijuana and other illicit drugs at US colleges in the 1990s: Results of three national surveys. *Addiction, 95*(11), 1655-1667.

Gonzalez, G. M., & Haney, M. L. (1990). Perceptions of risk as predictors of alcohol, marijuana, and cocaine use among college students. *Journal of College Student Development, 31*(4), 313-318.

Grucza, R. A., Norberg, K. E., & Bierut, L. J. (2009). Binge drinking among youths and young adults in the United States: 1979-2006. *Journal of the American Academy of Child and Adolescent Psychiatry, 48*(7), 692-702.

Harrison, L. (1997). The validity of self-reported drug use in survey research: An overview and critique of research methods. *NIDA Res Monogr, 167*, 17-36.

Hawkins, J. D., Catalano, R. F., & Miller, J. Y. (1992). Risk and protective factors for alcohol and other drug problems in adolescence and early adulthood: Implications for substance abuse prevention. *Psychological Bulletin, 112*(1), 64-105.

Hayaki, J., Herman, D. S., Hagerty, C. E., de Dios, M. A., Anderson, B. J., & Stein, M. D. (2011). Expectancies and self-efficacy mediate the effects of impulsivity on marijuana use outcomes: An application of the acquired preparedness model. *Addictive Behaviors, 36*(4), 389-396.

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, Suppl. 16*, 12-20.

Howard, D. E., Griffin, M. A., & Boekeloo, B. O. (2008). Prevalence and psychosocial correlates of alcohol-related sexual assault among university students. *Adolescence, 43*(172), 733-750.

Hussong, A. M., Hicks, R. E., Levy, S. A., & Curran, P. J. (2001). Specifying the relations between affect and heavy alcohol use among young adults. *Journal of Abnormal Psychology, 110*(3), 449-461.

Hustad, J. T. P., Barnett, N. P., Borsari, B., & Jackson, K. M. (2010). Web-based alcohol prevention for incoming college students: A randomized controlled trial. *Addictive Behaviors, 35*(3), 183-189.

Hyman, S. M., & Sinha, R. (2009). Stress-related factors in cannabis use and misuse: Implications for prevention and treatment. *Journal of Substance Abuse Treatment, 36*(4), 400-413.

Johnston, L. D., O'Malley, P. M., Bachman, J. G., & Schulenberg, J. E. (2009). *Monitoring the Future national survey results on drug use, 1975-2008: Volume II, College students and adults ages 19-50 (NIH Publication No. 09-7403)*: Bethesda, MD: National Institute on Drug Abuse.

Johnston, L. D., O'Malley, P. M., Bachman, J. G., & Schulenberg, J. E. (2010). *Monitoring the Future national survey results on drug use, 1975–2009:Volume I, Secondary school students (NIH Publication No. 10-7584)*. Bethesda, MD: National Institute on Drug Abuse.

Johnston, L. D., O'Malley, P. M., Bachman, J. G., Schulenberg, J. E., & Miech, R. A. (2015). *Monitoring the Future national survey results on drug use, 1975–2014: Volume II, College students and adults ages 19-55*. Ann Arbor: Institute for Social Research: University of Michigan.

Jones, B. T., Corbin, W., & Fromme, K. (2001). A review of Expectancy Theory and alcohol consumption. *Addiction, 96*(1), 57-72.

Keith, D. R., Hart, C. L., McNeil, M. P., Silver, R., & Goodwin, R. D. (2015). Frequent marijuana use, binge drinking and mental health problems among undergraduates. *The American Journal on Addictions, 24*(6), 499-506.

Kilmer, J. R., Hunt, S. B., Lee, C. M., & Neighbors, C. (2007). Marijuana use, risk perception, and consequences: Is perceived risk congruent with reality? *Addictive Behaviors, 32*(12), 3026-3033.

Kilmer, J. R., Walker, D. D., Lee, C. M., Palmer, R. S., Mallett, K. A., Fabiano, P., & Larimer, M. E. (2006). Misperceptions of college student marijuana use: Implications for prevention. *Journal of Studies on Alcohol, 67*(2), 277-281.

Kong, G., & Bergman, A. (2010). A motivational model of alcohol misuse in emerging adulthood. *Addictive Behaviors, 35*(10), 855-860.

Kuntsche, E., Wiers, R. W., Janssen, T., & Gmel, G. (2010). Same wording, distinct concepts? Testing differences between expectancies and motives in a mediation model of alcohol outcomes. *Experimental and Clinical Psychopharmacology, 18*(5), 436-444.

LaBrie, J. W., Hummer, J. F., Huchting, K. K., & Neighbors, C. (2009). A brief live interactive normative group intervention using wireless keypads to reduce drinking and alcohol consequences in college student athletes. *Drug and Alcohol Review, 28*(1), 40-47.

Larimer, M. E., Lydum, A. R., Anderson, B. K., & Turner, A. P. (1999). Male and female recipients of unwanted sexual contact in a college student sample: Prevalence rates, alcohol use, and depression symptoms. *Sex Roles, 40*(3/4), 295-308.

Larimer, M. E., Neighbors, C., LaBrie, J. W., Atkins, D. C., Lewis, M. A., Lee, C. M., . . . Montoya, H. (2011). Descriptive drinking norms: For whom does reference group matter? *Journal of Studies on Alcohol and Drugs, 72*(5), 833-843.

Larimer, M. E., Turner, A. P., Anderson, B. K., Fader, J. S., Kilmer, J. R., Palmer, R. S., & Cronce, J. M. (2001). Evaluating a brief alcohol intervention with fraternities. *Journal of Studies on Alcohol, 62*(3), 370-380.

Lee, C. M., Neighbors, C., Kilmer, J. R., & Larimer, M. E. (2010). A brief, Web-based personalized feedback selective intervention for college student marijuana use: A randomized clinical trial. *Psychology of Addictive Behaviors, 24*(2), 265-273.

Leigh, B. C. (1989). In search of the seven dwarves: Issues of measurement and meaning in alcohol expectancy research. *Psychological Bulletin, 105*(3), 361-373.

Leigh, B. C. (1990). Alcohol expectancies and reasons for drinking: Comments from a study of sexuality. *Psychology of Addictive Behaviors, 4*(2), 91-96.

Lewis, M. A., & Neighbors, C. (2004). Gender-specific misperceptions of college student drinking norms. *Psychology of Addictive Behaviors, 18*(4), 334-339.

Lewis, M. A., & Neighbors, C. (2006). Social norms approaches using descriptive drinking norms education: A review of the research on personalized normative feedback. *Journal of American College Health, 54*(4), 213-218.

Lewis, M. A., & Neighbors, C. (2007). Optimizing personalized normative feedback: The use of gender-specific referents. *Journal of Studies on Alcohol and Drugs, 68*(2), 228-237.

Lewis, M. A., Neighbors, C., Oster-Aaland, L., Kirkeby, B. S., & Larimer, M. E. (2007). Indicated prevention for incoming freshmen: Personalized normative feedback and high-risk drinking. *Addictive Behaviors, 32*(11), 2495-2508.

Lynskey, M., & Hall, W. (2000). The effects of adolescent cannabis use on educational attainment: A review. *Addiction, 95*(11), 1621-1630.

Magill, M., Barnett, N. P., Apodaca, T. R., Rohsenow, D. J., & Monti, P. M. (2009). The role of marijuana use in brief motivational intervention with young adult drinkers treated in an emergency department. *Journal of Studies on Alcohol and Drugs, 70*(3), 409-413.

Marlatt, G. A., Baer, J. S., Kivlahan, D. R., Dimeff, L. A., Larimer, M. E., Quigley, L. A., . . . Williams, E. (1998). Screening and brief intervention for high-risk college student drinkers: Results from a 2-year follow-up assessment. *Journal of Consulting and Clinical Psychology, 66*(4), 604-615.

Martin, C. S., Clifford, P. R., & Clapper, R. L. (1992). Patterns and predictors of simultaneous and concurrent use of alcohol, tobacco, marijuana, and hallucinogens in first-year college students. *Journal of Substance Abuse, 4*(3), 319-326.

Martin, G., & Copeland, J. (2008). The Adolescent Cannabis Check-up: Randomized trial of a brief intervention for young cannabis users. *Journal of Substance Abuse Treatment, 34*(4), 407-414.

McCabe, S. E. (2002). Gender differences in collegiate risk factors for heavy episodic drinking. *Journal of Studies on Alcohol, 63*(1), 49-56.

McCabe, S. E., Schulenberg, J. E., Johnston, L. D., O'Malley, P. M., Bachman, J. G., & Kloska, D. D. (2005). Selection and socialization effects of fraternities and sororities on US college student substance use: A multi-cohort national longitudinal study. *Addiction, 100*(4), 512-524.

McCarthy, D. M., Lynch, A. M., & Pedersen, S. L. (2007). Driving after use of alcohol and marijuana in college students. *Psychology of Addictive Behaviors, 21*(3), 425-430.

Midanik, L. T., Tam, T. W., & Weisner, C. (2007). Concurrent and simultaneous drug and alcohol use: Results of the 2000 National Alcohol Survey. *Drug and Alcohol Dependence, 90*(1), 72-80.

Miller, W. R. (1983). Motivational interviewing with problem drinkers. *Behavioural Psychotherapy, 11*(2), 147-172.

Miller, W. R., & Rollnick, S. (1991). *Motivational Interviewing: Preparing people to change addictive behavior*. New York: Guilford Press.

Miller, W. R., Sovereign, R. G., & Krege, B. (1988). Motivational interviewing with problem drinkers: II. The Drinker's Check-up as a preventive intervention. *Behavioural Psychotherapy, 16*(4), 251-268.

Mundt, M. P., & Zakletskaia, L. I. (2012). Prevention for college students who suffer alcohol-induced blackouts could deter high-cost emergency department visits. *Health Affairs, 31*(4), 863-870.

National Institute on Alcohol Abuse and Alcoholism. (2010). Rethinking drinking: Alcohol and your health. (NIH Publication No. 10-3770). Retrieved from http://pubs.niaaa.nih.gov/publications/RethinkingDrinking/Rethinking_Drinking.pdf

Neighbors, C., Larimer, M. E., & Lewis, M. A. (2004). Targeting misperceptions of descriptive drinking norms: Efficacy of a computer-delivered personalized normative feedback intervention. *Journal of Consulting and Clinical Psychology, 72*(3), 434-447.

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*(4), 556-565.

Neighbors, C., Lewis, M. A., Atkins, D. C., Jensen, M. M., Walter, T., Fossos, N., . . . Larimer, M. E. (2010). Efficacy of Web-based personalized normative feedback: A two-year randomized controlled trial. *Journal of Consulting and Clinical Psychology, 78*(6), 898-911.

Neighbors, C., Lewis, M. A., Bergstrom, R. L., & Larimer, M. E. (2006). Being controlled by normative influences: Self-determination as a moderator of a normative feedback alcohol intervention. *Health Psychology, 25*(5), 571-579.

Nelson, T. F., & Wechsler, H. (2001). Alcohol and college athletes. *Medicine & Science in Sports & Exercise, 33*(1), 43-47.

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.

Norman, P., Bennett, P., & Lewis, H. (1998). Understanding binge drinking among young people: An application of the Theory of Planned Behaviour. *Health Education Research, 13*(2), 163-169.

Norman, P., & Conner, M. (2006). The Theory of Planned Behaviour and binge drinking: Assessing the moderating role of past behaviour within the Theory of Planned Behaviour. *British Journal of Health Psychology, 11*(1), 55-70.

Nye, E. C., Agostinelli, G., & Smith, J. E. (1999). Enhancing alcohol problem recognition: A self-regulation model for the effects of self-focusing and normative information. *Journal of Studies on Alcohol, 60*(5), 685-693.

O'Hara, R. E., Armeli, S., & Tennen, H. (2016). Alcohol and cannabis use among college students: Substitutes or complements? *Addictive Behaviors, 58*, 1-6.

O'Malley, P. M., & Johnston, L. D. (2002). Epidemiology of alcohol and other drug use among American college students. *Journal of Studies on Alcohol, Suppl. 14*, 23-39.

Page, R. M., & Scanlan, A. (1999). Perceptions of the prevalence of marijuana use among college students: A comparison between current users and nonusers. *Journal of Child & Adolescent Substance Abuse, 9*(2), 1-12.

Palfai, T. P., Saitz, R., Winter, M., Brown, T. A., Kypri, K., Goodness, T. M., . . . Lu, J. (2014). Web-based screening and brief intervention for student marijuana use in a university health center: Pilot study to examine the implementation of eCHECKUP TO GO in different contexts. *Addictive Behaviors, 39*(9), 1346-1352.

Pape, H., Rossow, I., & Storvoll, E. E. (2009). Under double influence: Assessment of simultaneous alcohol and cannabis use in general youth populations. *Drug and Alcohol Dependence, 101*(1-2), 69-73.

Perkins, H., & Wechsler, H. (1996). Variation in perceived college drinking norms and its impact on alcohol abuse: A nationwide study. *Journal of Drug Issues, 26*(4), 961-974.

Perkins, H. W. (1991). *Confronting misperceptions of peer drug use norms among college students: An alternative approach for alcohol and other drug education programs*. Fort Worth: Higher Education Leaders/Peers Network, Texas Christian University.

Perkins, H. W. (1997). College student misperceptions of alcohol and other drug norms among peers: Exploring causes, consequences, and implications for prevention programs *In Designing alcohol and other drug prevention programs in higher education* (pp. 177-206). Newton, MA: Higher Education Center for Alcohol and Other Drug Prevention, U.S. Department of Education.

Perkins, H. W. (2002a). Social norms and the prevention of alcohol misuse in collegiate contexts. *Journal of Studies on Alcohol, Suppl. 14*, 164-172.

Perkins, H. W. (2002b). Surveying the damage: A review of research on consequences of alcohol misuse in college populations. *Journal of Studies on Alcohol, Suppl. 14*, 91-100.

Pope Jr, H. G., & Yurgelun-Todd, D. (1996). The residual cognitive effects of heavy marijuana use in college students. *Journal Of The American Medical Association, 275*(7), 521-527.

Ramaekers, J. G., Robbe, H. W. J., & O'Hanlon, J. F. (2000). Marijuana, alcohol and actual driving performance. *Human Psychopharmacology Clinical and Experimental, 15*(7), 551-558.

Ravert, R. D., Schwartz, S. J., Zamboanga, B. L., Kim, S. Y., Weisskirch, R. S., & Bersamin, M. (2009). Sensation seeking and danger invulnerability: Paths to college student risk-taking. *Personality and Individual Differences, 47*(7), 763-768.

Read, J. P., Wood, M. D., Davidoff, O. J., McLacken, J., & Campbell, J. F. (2002). Making the transition from high school to college: The role of alcohol-related social influence factors in students' drinking. *Substance Abuse, 23*(1), 53-65.

Roffman, R. A., Schwartz, S., & Stephens, R. S. (2006). Themes in the history of cannabis dependence. In R. A. Roffman & R. S. Stephens (Eds.), *Cannabis dependence: Its nature, consequences, and treatment* (pp. 3-20). Cambridge, United Kingdom: Cambridge University Press.

Schafer, J., & Brown, S. A. (1991). Marijuana and cocaine effect expectancies and drug use patterns. *Journal of Consulting and Clinical Psychology, 59*(4), 558.

Schensul, J. J., Convey, M., & Burkholder, G. (2005). Challenges in measuring concurrency, agency and intentionality in polydrug research. *Addictive Behaviors, 30*(3), 571-574.

Serras, A., Saules, K. K., Cranford, J. A., & Eisenberg, D. (2010). Self-injury, substance use, and associated risk factors in a multi-campus probability sample of college students. *Psychology of Addictive Behaviors, 24*(1), 119.

Shelton, K., Lifford, K., Fowler, T., Rice, F., Neale, M., Harold, G., . . . van den Bree, M. (2007). The association between conduct problems and the initiation and progression of marijuana use during adolescence: A genetic analysis across time. *Behavior Genetics, 37*(2), 314-325.

Shillington, A. M., & Clapp, J. D. (2001). Substance use problems reported by college students: Combined marijuana and alcohol use versus alcohol-only use. *Substance Use and Misuse, 36*(5), 663-672.

Shillington, A. M., & Clapp, J. D. (2006). Heavy alcohol use compared to alcohol and marijuana use: Do college students experience a difference in substance use problems? *Journal of Drug Education, 36*(1), 91-103.

Simons, J., Correia, C. J., Carey, K. B., & Borsari, B. E. (1998). Validating a five-factor marijuana motives measure: Relations with use, problems, and alcohol motives. *Journal of Counseling Psychology, 45*(3), 265-273. doi:10.1037/0022-0167.45.3.265

Simons, J. S., Gaher, R. M., Correia, C. J., Hansen, C. L., & Christopher, M. S. (2005). An affective-motivational model of marijuana and alcohol problems among college students. *Psychology of Addictive Behaviors, 19*(3), 326-334.

Simons, J. S., Neal, D. J., & Gaher, R. M. (2006). Risk for marijuana-related problems among college students: An application of zero-inflated negative binomial regression. *American Journal of Drug and Alcohol Abuse, 32*(1), 41-53.

Smucker Barnwell, S., & Earleywine, M. (2006). Simultaneous alcohol and cannabis expectancies predict simultaneous use. *Substance Abuse Treatment, Prevention, and Policy, 1:29*.

Smucker Barnwell, S. V., Earleywine, M., & Gordis, E. B. (2005). Alcohol consumption moderates the link between cannabis use and cannabis dependence in an internet survey. *Psychology of Addictive Behaviors, 19*(2), 212-216.

Smucker Barnwell, S. V., Earleywine, M., & Gordis, E. B. (2006). Confirming alcohol-moderated links between cannabis use and dependence in a national sample. *Addictive Behaviors, 31*(9), 1695-1699.

Sommers, M. S. (2005). Measurement of alcohol consumption: issues and challenges. *Annual Review of Nursing Research, 23*, 27-64.

Stacy, A. W. (1997). Memory activation and expectancy as prospective predictors of alcohol and marijuana use. *Journal of Abnormal Psychology, 106*(1), 61-73.

Stephens, R. S., Roffman, R. A., Fearer, S. A., Williams, C., & Burke, R. S. (2007). The Marijuana Check-up: Promoting change in ambivalent marijuana users. *Addiction, 102*(6), 947-957.

Stewart, S. H., Angelopoulos, M., Baker, J. M., & Boland, F. J. (2000). Relations between dietary restraint and patterns of alcohol use in young adult women. *Psychology of Addictive Behaviors, 14*(1), 77.

Stewart, S. H., Peterson, J. B., & Pihl, R. O. (1995). Anxiety sensitivity and self-reported alcohol consumption rates in university women. *Journal of Anxiety Disorders, 9*(4), 283-292.

Sugarman, D. E., DeMartini, K. S., & Carey, K. B. (2009). Are women at greater risk? An examination of alcohol-related consequences and gender. *The American Journal on Addictions, 18*(3), 194-197.

Swendsen, J., Conway, K. P., Degenhardt, L., Glantz, M., Jin, R., Merikangas, K. R., . . . Kessler, R. C. (2010). Mental disorders as risk factors for substance use, abuse and

dependence: Results from the 10-year follow-up of the National Comorbidity Survey. *Addiction, 105*(6), 1117-1128.

Taylor, D. R., Poulton, R., Moffitt, T., Ramankutty, P., & Sears, M. (2000). The respiratory effects of cannabis dependence in young adults. *Addiction, 95*(11), 1669-1677.

Vik, P. W., Carrello, P., Tate, S. R., & Field, C. (2000). Progression of consequences among heavy-drinking college students. *Psychology of Addictive Behaviors, 14*(2), 91-101.

Walters, S. T., Bennett, M. E., & Noto, J. V. (2000). Drinking on campus. What Do we know about reducing alcohol use among college students? *Journal of Substance Abuse Treatment, 19*(3), 223-228.

Walters, S. T., Vader, A. M., & Harris, T. R. (2007). A controlled trial of web-based feedback for heavy drinking college students. *Prevention Science, 8*(1), 83-88.

Wechsler, H., Davenport, A., Dowdall, G., Moeykens, B., & Castillo, S. (1994). Health and behavioral consequences of binge drinking in college. A national survey of students at 140 campuses. *Journal Of The American Medical Association, 272*(21), 1672-1677.

Wechsler, H., Davenport, A. E., Dowdall, G. W., Grossman, S. J., & Zanakos, S. I. (1997). Binge drinking, tobacco, and illicit drug use and involvement in college athletics. A survey of students at 140 American colleges. *Journal of American College Health, 45*(5), 195-200.

Wechsler, H., Dowdall, G., Davenport, A., & Rimm, E. (1995). A gender-specific measure of binge drinking among college students. *American Journal of Public Health, 85*(7), 982-985.

Wechsler, H., Lee, J. E., Kuo, M., & Lee, H. (2000). College binge drinking in the 1990s: A continuing problem. Results of the Harvard School of Public Health 1999 College Alcohol Study. *Journal of American College Health, 48*(5), 199-210.

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., Molnar, B. E., Davenport, A. E., & Baer, J. S. (1999). College alcohol use: A full or empty glass? *Journal of American College Health, 47*(6), 247-252.

White, H. R., & Labouvie, E. W. (1989). Towards the assessment of adolescent problem drinking. *Journal of Studies on Alcohol, 50*(1), 30-37.

White, H. R., Morgan, T. J., Pugh, L. A., Celinska, K., Labouvie, E. W., & Pandina, R. J. (2006). Evaluating two brief substance-use interventions for mandated college students. *Journal of Studies on Alcohol, 67*(2), 309-317.

White, H. R., Mun, E. Y., & Morgan, T. J. (2008). Do brief personalized feedback interventions work for mandated students or is it just getting caught that works? *Psychology of Addictive Behaviors, 22*(1), 107-116.

Wild, T. C., Cunningham, J. A., & Roberts, A. B. (2007). Controlled study of brief personalized assessment-feedback for drinkers interested in self-help. *Addiction, 102*(2), 241-250.

Wild, T. C., Hinson, R., Cunningham, J., & Bacchiochi, J. (2001). Perceived vulnerability to alcohol-related harm in young adults: Independent effects of risky alcohol use and drinking motives. *Experimental and Clinical Psychopharmacology, 9*(1), 117.

Wood, M. D., Read, J. P., Palfai, T. P., & Stevenson, J. F. (2001). Social influence processes and college student drinking: The mediational role of alcohol outcome expectancies. *Journal of Studies on Alcohol, 62*(1), 32-43.

Wood, M. D., Sher, K. J., & McGowan, A. K. (2000). Collegiate alcohol involvement and role attainment in early adulthood: Findings from a prospective high-risk study. *Journal of Studies on Alcohol, 61*(2), 278-289.

Young, A. M., Morales, M., McCabe, S. E., Boyd, C. J., & D'Arcy, H. (2005). Drinking like a guy: Frequent binge drinking among undergraduate women. *Substance Use and Misuse, 40*(2), 241-267.

Young, R. M. D., Connor, J. P., Ricciardelli, L., & Saunders, J. B. (2006). The role of alcohol expectancy and drinking refusal self-efficacy beliefs in university student drinking. *Alcohol and Alcoholism, 41*(1), 70-75.

APPENDIX A:

Brief Social Norms Intervention: Baseline Survey and Sample Intervention

[SCREENING]

1. Are you a currently enrolled freshman student at UWM?
    a. No
    b. Yes

2. How many credits are you taking this semester at UWM? (dropdown box 0-18; more than 18)

3. Did you take any university courses for college credit (not online) prior to your enrollment as a freshman at UWM?
    a. No
    b. Yes

4. What is your age? (dropdown box of ages)

5. What is your gender?
    a. Female
    b. Male

The next question will ask you about your use of alcoholic drinks in the **past month** (or about 30 days). By standard alcoholic drinks, we mean beer, wine, or liquor. A standard drink typically means:

- one 12-ounce can or bottle of beer or
- one 5-ounce glass of wine or
- one 12-ounce wine cooler or
- one 1.5-ounce shot of liquor served straight or in a mixed drink

6. (question dependent on response to question 5)
    If 5=Male: In the past month, how many times did you drink five or more standard alcohol drinks during a single occasion? (pulldown box; 0-60)

    If 5=Female: In the past month, how many times did you drink four or more standard alcohol drinks during a single occasion? (pulldown box; 0-60)

7. In the past month, on how many days did you use any kind of marijuana or hashish (hash)? (pulldown box 0-30)

8. In the past month, on how many days did you use any synthetic marijuana products (commonly known as ‘Spice,’ ‘K2,’ ‘Genie,’ ‘legal weed’ or ‘herbal highs’)? (pulldown box 0-30)

NOTE** Students will not be eligible if:

1. = No; 2.<12; 3. = Yes; 4. is < 18 or > 20; 6. = 0; 7. = 0

[BASELINE MEASURES]
[for eligible participants]

[Demographic]

9. Please check the following category that most describes your racial or ethnic backround.
    a. White
    b. Hispanic or Latino(a)
    c. Asian
    d. Black or African American
    e. American Indian or Alaska Native
    f. Native Hawaiian or Other Pacific Islander
    g. Other
    Please specify (text box)

[Personal Substance Use]

The next question will ask you about your use of alcoholic drinks in the **past month**. By standard alcoholic drinks, we mean beer, wine, or liquor. A standard drink typically means:

- one 12-ounce can or bottle of beer or
- one 5-ounce glass of wine or
- one 12-ounce wine cooler or
- one 1.5-ounce shot of liquor served straight or in a mixed drink

10. How many times did you drink alcohol during the **past month**? (pulldown box 0-60; more than 60)

11. Think of a typical occasion that you drank in the **past month**. How many standard drinks did you have during that drinking occasion? (dropbox; 0-25 drinks)

Think of the occasion you drank the most during the **past month**.

12. How many standard drinks did you have during that occasion? (dropbox; 0-25; 25 or more

The following question will ask about the number of times you used marijuana/hash in the past month. For this, please count the number of different occasions that you used marijuana/hash. For example, if you used marijuana twice a day in the past month, you would put 60 (2 x 30 days).

13. How many times did you use marijuana/hash during the **past month**? (text box)

You told us that in the past month, you drank alcohol about [response to 10.] times and that you used marijuana about [response to 13.] times. Now we would like to know a little more about your use of alcohol and marijuana/hash during the same use occasion. Some examples of using alcohol and marijuana on the same occasion include: using marijuana shortly after using alcohol (or vice versa), or using one of these substances while still feeling the effects of the other substance (e.g., intoxication, feeling "high").

14. Of the [response to 10.] times that you drank alcohol in the past month, how many times did you also use marijuana/hash during the same occasion? (textbox)

15. Of the [response to 13.] times that you used marijuana/hash in the past month, how many times did you also use alcohol during the same occasion? (textbox)

Now we would like to know a little more about how you used alcohol during a typical week. Please follow the below instructions to complete the alcohol use log.

16.

INSTRUCTIONS FOR RECORDING DRINKING DURING A TYPICAL WEEK

IN THE CALENDAR BELOW, PLEASE FILL-IN YOUR DRINKING RATE AND TIME DRINKING DURING A **TYPICAL WEEK** IN THE PAST MONTH.

First, think of a *typical week* in the past month. (Where did you live? What were your regular weekly activities? Where you working or going to school? Etc.) Try to remember as accurately as you can, *how much* and for *how long* you *typically drank* in a week during that one month period.

For each day of the week in the calendar below, fill in the **number of standard drinks typically consumed on that day** in the upper box and the **typical number of hours you drank** that day in the lower box.

Day of Week	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday	Sunday
Number of *Drinks*							
Number of *Hours Drinking*							

Now we would like to know a little more about how you used marijuana/hash during a typical week. Please follow the below instructions to complete the marijuana/hash use log.

17.

INSTRUCTIONS FOR RECORDING MARIJUANA/HASH USE DURING A TYPICAL WEEK

IN THE CALENDAR BELOW, PLEASE FILL-IN HOW MANY TIMES YOU USED MARIJUANA/HASH DURING A **TYPICAL WEEK** IN THE PAST MONTH.

First, think of a *typical week* in the past month. (Where did you live? What were your regular weekly activities? Where you working or going to school? Etc.) Try to remember as accurately as you can, *how many times you used marijuana/hash i*n a week during that one month period?

For each day of the week in the calendar below, fill in the **number of times you typically used marijuana/hash on that day**. Each different use occasion counts as one time. For example, if you typically smoked marijuana once on Friday mornings and once on Friday afternoons, you would put a '2' in the Friday box.

Day of Week	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday	Sunday
Times used Marijuana/hash							

[Substance-related Problems]

Now we would like to know if you have experienced any events while, or after you were using alcohol or marijuana. For the following questions, please answer how many times the following things happened to you while you were using alcohol or marijuana/hash during the past month.
[in the following format]

37. Not able to do your homework, study for a test or complete a work assignment?
    a. 0 times
    b. 1 to 2 times
    c. 3 to 5 times
    d. more than 5 times

How many times did the following things happen to you while you were **using alcohol or marijuana/hash** during the past month? Please circle the correct answer.	**Past Month** **a = 0 times,** **b = 1-2 times** **c = 3-5 times** **d = more than 5 times**
37. Not able to do your homework, study for a test or complete a work assignment?	**a b c d**
38. Got into fights, acted bad, or did mean things?	**a b c d**
39. Missed out on other things because you spent too much money on alcohol or marijuana?	**a b c d**
40. Went to work or school drunk or high?	**a b c d**
41. Caused shame or embarrassment to someone?	**a b c d**
42. Neglected your responsibilities?	**a b c d**
43. Friends, neighbors, or relatives avoided you?	**a b c d**
44. Felt that you needed more alcohol or marijuana than you used to use in order to get the same effect?	**a b c d**

45. Tried to control your alcohol or marijuana use by trying to use only at certain times of the day or in certain places?	**a b c d**
46. Had withdrawal symptoms, that is, felt sick because you stopped or cut down on alcohol or marijuana?	**a b c d**
47. Noticed a change in your personality?	**a b c d**
48. Felt that you had a problem with alcohol or marijuana?	**a b c d**
49. Missed a day (or part of a day) of school or work?	**a b c d**
50. Suddenly found yourself in a place that you could not remember getting to?	**a b c d**
51. Passed out or fainted suddenly?	**a b c d**
52. Kept using alcohol or marijuana when you promised yourself not to?	**a b c d**
53. Felt physically or psychologically dependent?	**a b c d**
54 Was told by a friend, relative, or neighbor to stop or cut down your alcohol or marijuana use?	**a b c d**
55. Driven a car while under the influence of alcohol or marijuana?	**a b c d**
56. Had unprotected sex?	**a b c d**
54. Experienced unwanted sexual contact?	**a b c d**
55. Been hurt or injured?	**a b c d**
56. Had a hangover or felt physically ill the next day?	**a b c d**
57. Been in trouble with the police, residence hall, or other college authorities?	**a b c d**

[Social Norms]

We are interested in your estimates of (A) <u>how often</u>, and (B) <u>how much</u> your peers use alcohol and marijuana/hash. For the following questions, please assume whenever possible that you are rating a typical freshman student at UWM the same gender as you.

58.

[Males] How often do you think a **typical male freshman** student at UWM drinks alcohol?

[Females] How often do you think a **typical female freshman** student at UWM drinks alcohol?

a. Not at all
b. Less than once a month
c. About once a month
d. Two times a month
e. Three times a month
f. Once a week
g. Twice a week
h. Three times a week
i. Four times a week

j. Five times a week
k. Six times a week
l. Every day

The next question will ask you to estimate how many standard drinks other freshmen use at UWM. By alcoholic drinks, we mean beer, wine, or liquor. By standard alcoholic drinks, we mean beer, wine, or liquor. A standard drink typically means:

- **one 12-ounce can or bottle of beer or**
- **one 5-ounce glass of wine or**
- **one 12-ounce wine cooler or**
- **one 1.5-ounce shot of liquor served straight or in a mixed drink**

59.

[Males] How many standard drinks do you think the **typical male freshman** uses during a typical occasion of drinking? (dropdown box 0-30)

[Females] How many standard drinks do you think the **typical female freshman** uses during a typical occasion of drinking? (dropdown box 0-30)

60.

[Males] How often do you think a **typical male freshman** student at UWM uses marijuana/hash?

[Females] How often do you think a **typical female freshman** student at UWM uses marijuana/hash?

a. Not at all
b. Less than once a month
c. About once a month
d. Two times a month
e. Three times a month
f. Once a week
g. Twice a week
h. Three times a week
i. Four times a week
j. Five times a week
k. Six times a week
l. Every day

[INTERVENTION PORTION]

[SAMPLE INTERVENTION]

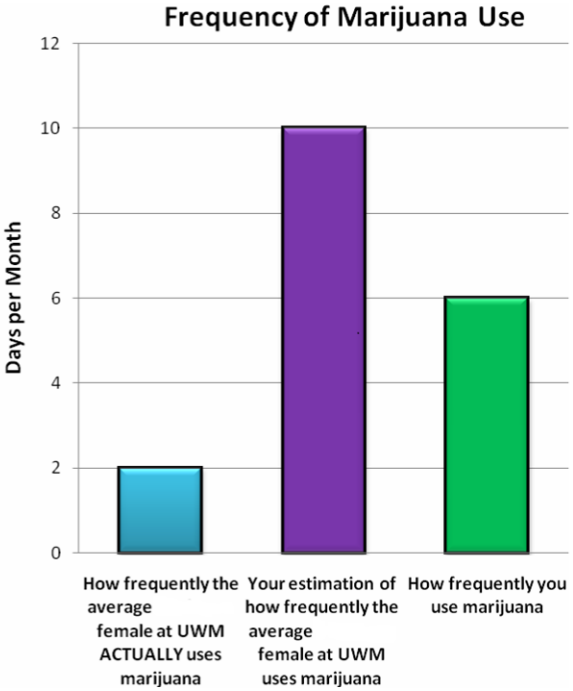
Your Marijuana Use

According to the information you provided us a few minutes ago, **you used marijuana** on **6 days** in the past month.

We asked you how many days **you believe** the average female at UWM uses marijuana in a month. You told us that you believed the average female UWM student uses marijuana **10 times** a month.

The **actual marijuana use norm** for a female at UWM is **2 days** a month.

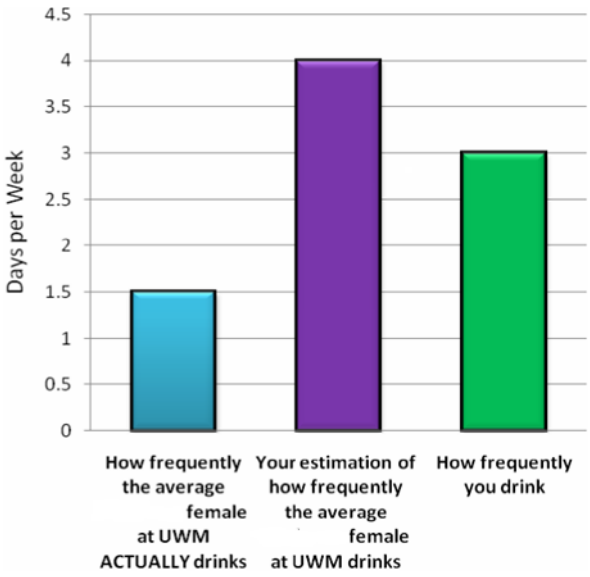
Your percentile rank (comparing you to other females at UWM) is **95%**, which suggests that you use marijuana more than 95% of other females at UWM.



Your Alcohol Use

According to the information you provided us a few minutes ago, on average, **you drank 3 times** a week (frequency) in the last month. The average amount you drank during each occasion was **6 drinks** (quantity). That means you drank **18 drinks** per week on average.

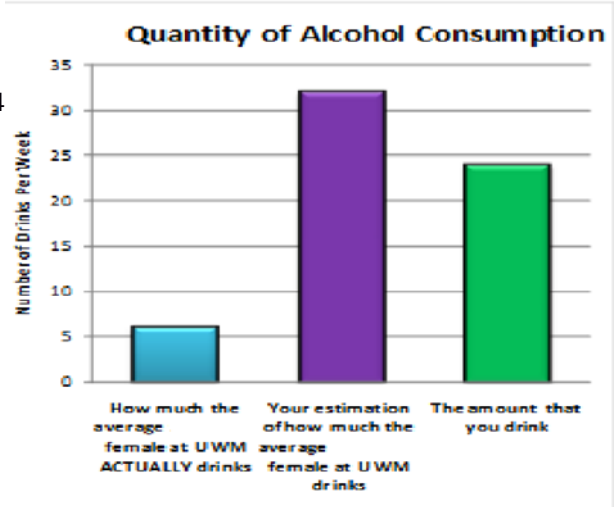
Frequency of Alcohol Consumption



We asked you **what you believe** the frequency and quantity of alcohol consumed by the average female at UWM was. You told us that you believed the average female at UWM drinks **4 times** a week and during each occasion she drinks **8 drinks**. That means you believe the average female at UWM drinks 32 drinks per week.

The **actual drinking norm** for females at UWM is **1.5 times** a week, drinking about 4 drinks on each occasion. That means the average female at UWM drinks **6 drinks** a week.

Your percentile rank (comparing you to other females at UWM) is **85%**, which suggests that you drink more than 85% of other females at UWM.



We would like to know about your experience with the Website and with the feedback reports. For the following questions, the 'feedback reports' refer to the Webpages that included the graphs and information about your personal, as well as peer substance use.

61. I found the feedback reports useful.
    a. Strongly Agree
    b. Agree
    c. Somewhat Agree
    d. Somewhat Disagree
    e. Disagree
    f. Strongly Disagree

62. I would like to use the feedback report Website again.
    a. Strongly Agree
    b. Agree
    c. Somewhat Agree
    d. Somewhat Disagree
    e. Disagree
    f. Strongly Disagree

63. Would you recommend the Website to a friend?
    a. No
    b. Yes
    a. Why would you recommend the website to a friend? (textbox)

64. Completing the intervention was simple to do online.
    a. Strongly Agree
    b. Agree
    c. Somewhat Agree
    d. Somewhat Disagree
    e. Disagree
    f. Strongly Disagree

65. Did you print the feedback reports when you were given the option?
    a. Yes
    b. No, I didn't want to
    c. No, I wanted to but I did not have access to a printer

66. The feedback reports made me think about the amount of alcohol I drink.
    a. Strongly Agree
    b. Agree
    c. Somewhat Agree
    d. Somewhat Disagree
    e. Disagree
    f. Strongly Disagree

67. After seeking the feedback reports, I feel that I will reduce how often I drink alcohol.
    a. Strongly Agree
    b. Agree
    c. Somewhat Agree
    d. Somewhat Disagree
    e. Disagree
    f. Strongly Disagree

68. After seeking the feedback reports, I feel that I will reduce the amount of alcohol I drink (i.e., the number of standard drinks).
    a. Strongly Agree
    b. Agree
    c. Somewhat Agree
    d. Somewhat Disagree
    e. Disagree
    f. Strongly Disagree

69. After the feedback, I feel that I will increase how often I drink alcohol.
    a. Strongly Agree
    b. Agree
    c. Somewhat Agree
    d. Somewhat Disagree
    e. Disagree
    f. Strongly Disagree

70. After the feedback, I feel that I will increase the how much alcohol I drink (i.e., standard drinks).
    a. Strongly Agree
    b. Agree
    c. Somewhat Agree
    d. Somewhat Disagree
    e. Disagree
    f. Strongly Disagree

71. The feedback reports made me think about the **amount** of **marijuana/hash** I use.
    a. Strongly Agree
    b. Agree
    c. Somewhat Agree
    d. Somewhat Disagree
    e. Disagree
    f. Strongly Disagree

72. After the feedback reports, I feel that I will reduce how often I use marijuana/hash.
    a. Strongly Agree
    b. Agree
    c. Somewhat Agree
    d. Somewhat Disagree
    e. Disagree
    f. Strongly Disagree

73. After the feedback reports, I feel that I will reduce the amount (e.g., the number of 'hits,' the size of a 'bowl' or 'joint') of marijuana/hash I use.
    a. Strongly Agree
    b. Agree
    c. Somewhat Agree
    d. Somewhat Disagree
    e. Disagree
    f. Strongly Disagree

74. After the feedback, I feel that I will increase how often I use marijuana/hash.
    a. Strongly Agree
    b. Agree
    c. Somewhat Agree
    d. Somewhat Disagree
    e. Disagree
    f. Strongly Disagree

75. After the feedback, I feel that I will increase the amount (e.g., the number of 'hits,' the size of a 'bowl' or 'joint') of marijuana/hash I use.
    a. Strongly Agree
    b. Agree
    c. Somewhat Agree
    d. Somewhat Disagree
    e. Disagree
    f. Strongly Disagree

76. The information in the feedback reports was believable.

    a. Strongly Agree
    b. Agree
    c. Somewhat Agree
    d. Somewhat Disagree
    e. Disagree
    f. Strongly Disagree

77. Information about how my peers use **alcohol** is helpful when I make decisions about engaging in alcohol use.
    a. Strongly Agree
    b. Agree
    c. Somewhat Agree
    d. Somewhat Disagree
    e. Disagree
    f. Strongly Disagree

78. The information about how my peers use **alcohol** was in conflict with what I expected or what I believed.
    a. Strongly Agree
    b. Agree
    c. Somewhat Agree
    d. Somewhat Disagree

e. Disagree
f. Strongly Disagree

79. Information about how my peers use **marijuana/hash** is helpful when I make decisions about engaging in marijuana/hash use.
    a. Strongly Agree
    b. Agree
    c. Somewhat Agree
    d. Somewhat Disagree
    e. Disagree
    f. Strongly Disagree

80. The information about how my peers use **marijuana/hash** was in conflict with what I expected or what I believed.
    a. Strongly Agree
    b. Agree
    c. Somewhat Agree
    d. Somewhat Disagree
    e. Disagree
    f. Strongly Disagree

81. The feedback reports accurately reflected the information I reported when I filled out the survey questions.
    a. Strongly Agree
    b. Agree
    c. Somewhat Agree
    d. Somewhat Disagree
    e. Disagree
    f. Strongly Disagree

82. The feedback reports included enough information about alcohol use.
    a. Strongly Agree
    b. Agree
    c. Somewhat Agree
    d. Somewhat Disagree
    e. Disagree
    f. Strongly Disagree

83. The feedback reports included enough information about marijuana/hash use.
    a. Strongly Agree
    b. Agree
    c. Somewhat Agree
    d. Somewhat Disagree
    e. Disagree
    f. Strongly Disagree

84. Is there any additional information that you would like to have been told during the feedback reports that was not there? (textbox)

85. The feedback reports were easy to understand.
    a. Strongly Agree
    b. Agree
    c. Somewhat Agree
    d. Somewhat Disagree
    e. Disagree
    f. Strongly Disagree

86. It took too long to read the feedback reports.
    a. Strongly Agree
    b. Agree
    c. Somewhat Agree
    d. Somewhat Disagree
    e. Disagree
    f. Strongly Disagree

87. It took too long to answer the questions that came before the feedback reports.
    a. Strongly Agree
    b. Agree
    c. Somewhat Agree
    d. Somewhat Disagree
    e. Disagree
    f. Strongly Disagree

88. How satisfied were you with the feedback reports?
    a. Very satisfied
    b. Satisfied
    c. Somewhat Satisfied
    d. Somewhat Dissatisfied
    e. Dissatisfied
    f. Very unsatisfied

89. Do you think you will use the information from the feedback reports in any way?
    a. No
    b. Yes
        i. How? (textbox)

90. What did you like about the feedback reports, or the Website in general? (text box)

91. What did you dislike about the feedback reports, or the Website in general? (text box)

92. What would you change about the feedback reports, or the Website in general? (text box)

APPENDIX B:

Brief Social Norms Intervention: Follow-up Survey

[Demographic]

18. What is your gender?
    c. Female
    d. Male

[Personal Substance Use]

The next question will ask you about your use of alcoholic drinks in the **past 30 days**. By standard alcoholic drinks, we mean beer, wine, or liquor. A standard drink typically means:

- one 12-ounce can or bottle of beer or
- one 5-ounce glass of wine or
- one 12-ounce wine cooler or
- one 1.5-ounce shot of liquor served straight or in a mixed drink

19. How many times did you drink <u>any alcohol</u> during the **past 30 days**? (pulldown box 0-60; more than 60)

20. Think of a <u>typical occasion</u> that you drank in the **past 30 days**. How many standard drinks did you have during that drinking occasion? (dropbox; 0-25 drinks)

21. (question dependent on response to question 1)
    If 1=Male: In the **past 30 days**, how many times did you drink <u>five or more</u> standard alcohol drinks during a single occasion? (pulldown box; 0-60)

    If 1=Female: In the **past 30 days**, how many times did you drink <u>four or more</u> standard alcohol drinks during a single occasion? (pulldown box; 0-60)

Think of the occasion you drank the most during the **past 30 days**.

22. How many standard drinks did you have during that occasion? (dropbox; 0-25; 25 or more

23. For approximately how many hours did you drink during this occasion? (dropbox; 0 to 16)

24. In the past 30 days, on how many **days** did you use any kind of marijuana or hashish (hash)? (pulldown box 0-30)

The following question will ask about the number of times you used marijuana/hash in the past 30 days. For this, please count the number of different occasions that you used marijuana/hash. For example, if you used marijuana twice a day in the past 30 days, you would put 60 (2 x 30 days).

25. How many times did you use marijuana/hash during the past 30 days? (text box)

You told us that in the past 30 days, you drank alcohol about [response to 2.] times and that you used marijuana about [response to 8.] times. Now we would like to know a little more about your use of alcohol and marijuana/hash during the same occasion. Some examples of using alcohol and marijuana on the same occasion include: using marijuana shortly after using alcohol (or vice versa), or using one of these substances while still feeling the effects of the other substance (e.g., intoxication, feeling "high").

26. Of the [response to 2.] times that you drank alcohol in the past 30 days, how many times did you also use marijuana/hash during the same occasion? (textbox)

27. Of the [response to 8.] times that you used marijuana/hash in the past 30 days, how many times did you also use alcohol during the same occasion? (textbox)

Now we would like to know a little more about how you used alcohol during a typical week. Please follow the below instructions to complete the alcohol use log.

By standard alcoholic drinks, we mean beer, wine, or liquor. A standard drink typically means:

- **one 12-ounce can or bottle of beer or**
- **one 5-ounce glass of wine or**
- **one 12-ounce wine cooler or**
- **one 1.5-ounce shot of liquor served straight or in a mixed drink**

28.

INSTRUCTIONS FOR RECORDING DRINKING DURING A TYPICAL WEEK

IN THE CALENDAR BELOW, PLEASE FILL-IN YOUR DRINKING RATE AND TIME DRINKING DURING A **TYPICAL WEEK** IN THE PAST MONTH.

First, think of a *typical week* in the past month. (Where did you live? What were your regular weekly activities? Where you working or going to school? Etc.) Try to remember as accurately as you can, *how much* and for *how long* you *typically drank* in a week during that one month period.

For each day of the week in the calendar below, fill in the **number of standard drinks typically consumed on that day** in the upper box and the **typical number of hours you drank** that day in the lower box.

Day of Week	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday	Sunday
Number of *Drinks*							
Number of *Hours Drinking*							

Now we would like to know a little more about how you used marijuana/hash during a typical week. Please follow the below instructions to complete the marijuana/hash use log.

29.

INSTRUCTIONS FOR RECORDING MARIJUANA/HASH USE DURING A TYPICAL WEEK

IN THE CALENDAR BELOW, PLEASE FILL-IN HOW MANY TIMES YOU USED MARIJUANA/HASH DURING A **TYPICAL WEEK** IN THE PAST MONTH.

First, think of a *typical week* in the past month. (Where did you live? What were your regular weekly activities? Where you working or going to school? Etc.) Try to remember as accurately as you can, *how many times you used marijuana/hash i*n a week during that one month period?

For each day of the week in the calendar below, fill in the **number of times you typically used marijuana/hash on that day**. Each different use occasion counts as one time. For example, if you typically smoked marijuana once on Friday mornings and once on Friday afternoons, you would put a '2' in the Friday box.

Day of Week	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday	Sunday
Times used Marijuana/hash							

[Substance-related Problems]
Now we would like to know if you have experienced any events while, or after you were using alcohol or marijuana. For the following questions, please answer how many times the following things happened to you while, or after you were using alcohol or marijuana/hash during the past 30 days**.**

[in the following format]
37. Not able to do your homework, study for a test or complete a work assignment?

a. 0 times
b. 1 to 2 times
c. 3 to 5 times
d. more than 5 times

How many times did the following things happen to you <u>while you were</u> **<u>using alcohol or marijuana/hash</u>** during the past 30 days? Please circle the correct answer. **a = 0 times, b = 1-2 times, c = 3-5 times, d = more than 5 times**	past 30 days
24. Not able to do your homework, study for a test or complete a work assignment?	**a b c d**
25. Got into fights, acted bad, or did mean things?	**a b c d**
26. Missed out on other things because you spent too much money on alcohol or marijuana?	**a b c d**
27. Went to work or school drunk or high?	**a b c d**
28. Caused shame or embarrassment to someone?	**a b c d**
29. Neglected your responsibilities?	**a b c d**
30. Friends, neighbors, or relatives avoided you?	**a b c d**
31. Felt that you needed more alcohol or marijuana than you used to use in order to get the same effect?	**a b c d**
32. Tried to control your alcohol or marijuana use by trying to use only at certain times of the day or in certain places?	**a b c d**
33. Had withdrawal symptoms, that is, felt sick because you stopped or cut down on alcohol or marijuana?	**a b c d**
34. Noticed a change in your personality?	**a b c d**
35. Felt that you had a problem with alcohol or marijuana?	**a b c d**
36. Missed a day (or part of a day) of school or work?	**a b c d**
37. Suddenly found yourself in a place that you could not remember getting to?	**a b c d**
38. Passed out or fainted suddenly?	**a b c d**
39. Kept using alcohol or marijuana when you promised yourself not to?	**a b c d**
40. Felt physically or psychologically dependent?	**a b c d**
50 Was told by a friend, relative, or neighbor to stop or cut down your alcohol or marijuana use?	**a b c d**

51. Driven a car while under the influence of alcohol or marijuana?	**a b c d**
52. Had unprotected sex?	**a b c d**
53. Experienced unwanted sexual contact?	**a b c d**
54. Been hurt or injured?	**a b c d**
55 Had a hangover or felt physically ill the next day?	**a b c d**
56. Been in trouble with the police, residence hall, or other college authorities?	**a b c d**

[Social Norms]

We are interested in your estimates of (A) <u>how often</u>, and (B) <u>how much</u> your peers use alcohol and marijuana/hash. For the following questions, please assume whenever possible that you are rating a typical student at UWM the same gender as you.

57.

[Males] How often do you think a **<u>typical male</u>** student at UWM drinks alcohol?

[Females] How often do you think a **<u>typical female</u>** student at UWM drinks alcohol?

m. Not at all
n. Less than once a month
o. About once a month
p. Two times a month
q. Three times a month
r. Once a week
s. Twice a week
t. Three times a week
u. Four times a week
v. Five times a week
w. Six times a week
x. Every day

The next question will ask you to estimate how many standard drinks other students use at UWM. By alcoholic drinks, we mean beer, wine, or liquor. By standard alcoholic drinks, we mean beer, wine, or liquor. A standard drink typically means:

- **one 12-ounce can or bottle of beer or**
- **one 5-ounce glass of wine or**
- **one 12-ounce wine cooler or**
- **one 1.5-ounce shot of liquor served straight or in a mixed drink**

58.

[Males] How many standard drinks do you think the **<u>typical male student at U</u>WM** uses during a typical occasion of drinking? (dropdown box 0-30)

[Females] How many standard drinks do you think the **typical female** student at UWM uses during a typical occasion of drinking? (dropdown box 0-30)

59.
[Males] How often do you think a **typical male** student at UWM uses marijuana/hash?

[Females] How often do you think a **typical female** student at UWM uses marijuana/hash?

m. Not at all
n. Less than once a month
o. About once a month
p. Two times a month
q. Three times a month
r. Once a week
s. Twice a week
t. Three times a week
u. Four times a week
v. Five times a week
w. Six times a week
x. Every day

[POSTTEST – FEASIBILITY QUESTIONS]

We would like to know about your use of the information of the feedback reports since the first study session. For the following questions, the 'feedback reports' refer to the Webpages from the first session that included the graphs and information about your personal, as well as peer substance use.

60. Since the first study session, have you used the information from the feedback reports in any way?
    c. No
    d. Yes
        i. How? (textbox)

61. Did you talk to your friends about the feedback reports?
    g. No
    h. Yes
        i. What did you tell your friends?

62. The feedback reports made me think about the amount of alcohol I drink.
    g. Strongly Agree
    h. Agree
    i. Somewhat Agree
    j. Somewhat Disagree
    k. Disagree
    l. Strongly Disagree
    m. Not applicable

63. The feedback reports made me think about the amount of marijuana I use.
    g. Strongly Agree
    h. Agree
    i. Somewhat Agree
    j. Somewhat Disagree
    k. Disagree
    l. Strongly Disagree
    m. Not applicable

64. The information in the feedback reports accurately reflected my experiences with peers since the first study session.
    g. Strongly Agree
    h. Agree
    i. Somewhat Agree
    j. Somewhat Disagree
    k. Disagree
    l. Strongly Disagree

65. Information about how my peers' use of **alcohol** is helpful when I make decisions about engaging in alcohol use.
    g. Strongly Agree
    h. Agree
    i. Somewhat Agree
    j. Somewhat Disagree
    k. Disagree
    l. Strongly Disagree

66. Information about how my peers' use of **marijuana or hash** is helpful when I make decisions about engaging in marijuana/hash use.
    g. Strongly Agree
    h. Agree
    i. Somewhat Agree
    j. Somewhat Disagree
    k. Disagree
    l. Strongly Disagree

67. Since the first study session, have you thought of any additional information that you would like to have been told during the feedback reports that was not there? (textbox)

Jennifer Lynn Hernandez-Meier, MSW
Curriculum Vitae

Medical College of Wisconsin
Injury Research Center
Department of Emergency Medicine
8701 Watertown Plank Road
Milwaukee, WI 53226-0509

Office: 414-955-7655
Fax: 414-955-6470
Email: jhernandez@mcw.edu

Formal Education

9/2008 – 8/2016 Doctor of Philosophy
University of Wisconsin-Milwaukee, Milwaukee, Wisconsin
Social Work
Dissertation: *Concurrent Polysubstance Use in College Students: A Brief Social Norms Intervention to Abate Use*
Committee: Laura Otto-Salaj (Chair), Michael Brondino, Michael Fendrich, Lisa Berger, Virginia Stoffel

9/2006 – 5/2008 Master of Social Work
University of Wisconsin-Milwaukee, Milwaukee, Wisconsin
Macro & Direct Methods; Concentration: Physical, Mental & Behavioral Health

9/2000 – 5/2004 Bachelor of Science
University of Wisconsin-Madison, Madison, Wisconsin
Psychology; Minor: Criminal Justice

License

5/2007 – 2/2013 Substance Abuse Counselor-In Training, Wisconsin State Certification

Professional and Research Appointments

6/2013 – Current Injury Research Center, Department of Emergency Medicine, Medical College of Wisconsin, Milwaukee, Wisconsin
Role: Research Scientist

7/2011 – 8/2012 Center for Applied Behavioral Health Research (formerly the Center for Addiction and Behavioral Health Research), Helen Bader School of Social Welfare, University of Wisconsin-Milwaukee, Milwaukee, Wisconsin
Distinguished Professor Program Fendrich (PI) 7/01/11 – 6/3/16
University of Wisconsin System and Concordia University
The Social & Economic Impact of Prescription Drug Misuse: Building Linkages to Training and Research
Role: Research Assistant

1/2010 – 6/2011 Center for Addiction and Behavioral Health Research, Helen Bader School of Social Welfare, University of Wisconsin-Milwaukee, Milwaukee, Wisconsin
NIAAA-R44AA016463-02 Plate (PI) 9/20/09 – 8/31/11
Hair Ethyl Glucuronide as a Long Term Alcohol Biomarker
Role: Research Assistant

5/2010 – 9/2010 Terra Nova Learning Systems, LLC, Wauwatosa, WI
NIDA-R44DA022907-03 Roberts (PI) 7/1/2008 – 3/31/2011
NIDA – Getting Started in Drug Abuse Research: A Multidisciplinary Introduction
Role: Science writing, editing, and assistance with project related materials and activities

2/2009 – 12/2009 Center for Addiction and Behavioral Health Research, Helen Bader School of Social Welfare, University of Wisconsin-Milwaukee, Milwaukee, WI
101-343029-4 Berger (PI) 7/1/08 – 10/31/09
UW-Milwaukee/Graduate School Research Committee Award
Social Worker and Physician Administered Brief Alcohol Intervention for Hospitalized Patients
Role: Study Coordinator

5/2008 – 8/2008 Alcohol Diversion Program, University of Wisconsin-Milwaukee Police Department, University of Wisconsin-Milwaukee, Milwaukee, WI
Role: Program Coordinator

2/2007 – 2/2009 Center for Addiction and Behavioral Health Research, Helen Bader School of Social Welfare, University of Wisconsin-Milwaukee, Milwaukee, Wisconsin

The Lois and Samuel Silberman Fund Begun (PI) 7/1/07 – 6/30/08
Development of a Lifecourse Timeline Followback Approach to Assessing Alcohol Dependence Recovery and Change Attempts
Role: Participant Recruiter

CMP-MD-06B Berger (PI) 1/15/07 – 6/30/10
Forest Research Institute
Acamprosate Treatment of Alcohol Dependence in a Family Medicine Setting: A Randomized, Double-Blind, Placebo-Controlled Study
Role: Conducted screening of participants, retention, and recruitment

Current Research Support

1/2015—Current National Institute of Justice
#2014-IJ-CX-0110 Hargarten & Hernandez-Meier (Co-PIs)
1/1/2015-12/31/2016
Integrating Emergency Department Data with Law Enforcement, Emergency Medical Service and Community Data to Reduce Violence
Role: Principal Investigator

4/2014 – Current New Venture Fund
#NVF FSF MCW GA 03272014 Hargarten (PI) 04/15/2014-08/31/2016
Criminal Background Characteristics of Homicide Perpetrators and Victims and Suicide Decedents: A Model State Analysis
Role: Co-Investigator

6/2013 – Current Healthier Wisconsin Partnership Program
#5510128 Zosel (PI) 01/01/2012 – 12/31/2016
Kenosha County Suicide Prevention Initiative
Role: Evaluation Specialist

Completed Research Support

6/2013 – 6/2015 Advancing a Healthier Wisconsin
#9510117 Meurer (PI) 02/01/2010 – 06/30/2015
Youth Violence Prevention Initiative
Role: Research Scientist

Pending Federal Grant Submissions

6/2016 Centers for Disease Control & Prevention WI DHS (PI) 2016-2018
Prescription Drug Overdose Prevention for States - Supplement
Subcontract: MCW-Health Care System (HCS) Approach—Waukesha ProHealth
Role: Co-Investigator; Evaluator

6/2016 Bureau of Justice Assistance Hargarten & Hernandez-Meier (Co-PIs) 2016-2018
The Cardiff Model: Building Capacity for Law Enforcement-Public Health Partnerships to Address Violence
Role: Co-Principal Investigator

6/2016 National Institute on Drug Abuse (R01) Fendrich (PI) 2017-2019
PDMPs: Impact on Opioid & Benzodiazepine Use, Overdose, Mortality & Treatment
Role: Co-Investigator

Unfunded Federal Grant Submissions

Centers for Disease Control and Prevention Layde (PI) 11/2013
Toward a Better Prescription Drug Monitoring Program
Role: Co-Investigator

NIDA-1R36DA030613 Hernandez-Meier (PI) 2/2010 & 11/2010
Web-based PNF Intervention for Substance Use in College Students
Role: Principal Investigator

Peer-Reviewed Publications

Berger, L. K., Sedivy, S. K., **Hernandez-Meier**, J. & Karnes, S. (2010). Employee alcohol use: Confirmatory factor analyses of the General Work-Stress Paradigm. *Journal of Workplace Behavioral Health, 25*(2), 146-153.

Berger, L. K, Otto-Salaj, L. L., Stoffel, V. C., **Hernandez-Meier**, J., & Gromoske, A. N. (2009). Barriers and facilitators of transferring research to practice: An exploratory case study of Motivational Interviewing. *Journal of Social Work Practice in the Addictions, 9*(2), 145-162.

Manuscripts in Preparation or Under Review

Kopatich, D. D., **Hernandez-Meier**, J. L. & Hargarten, S. (under review). Violent deaths in children and youth of Wisconsin: Regional and statewide trends, 200-2012.

Hernandez-Meier, J. L., Muscott, R. & Zosel, A. (under review). Use of a statewide prescription drug monitoring program by emergency department physicians.

Levas, M. N., **Hernandez-Meier**, J. L., Piotrowski, N., Kohlbeck, S. & Hargarten, S. Integration of emergency department, law enforcement, and emergency medical service data: Feasibility and initial findings.

Hernandez-Meier, J. L. Problems related to concurrent and simultaneous use of alcohol and marijuana in college freshmen.

Hernandez-Meier, J. L. A brief, Web-based normative feedback intervention for concurrent use of alcohol and marijuana.

Published Abstracts

Zosel, A., **Hernandez-Meier**, J. & Muscott, R. (2015). Emergency physician use of statewide prescription drug monitoring program (PDMP): Barriers to use and changes to practice. *Clinical Toxicology*, 53(7), 639-777.

Kopatich, D., **Hernandez-Meier**, J., & Hargarten, S. (2015). Geographic fluctuations of violent deaths in children and youth over time. *Injury Prevention*, 21, A8.

Halverson, J., Czinner, M., **Hernandez-Meier**, J., Young, S., & Polace, K. (2015). Measuring an initiative's impact on organizations' capacity to deliver violence prevention activities. *Injury Prevention*, 21, A16.

Hernandez-Meier, J., Fuhrmann, D., Berger, L. & Fendrich, M. (2011). At risk alcohol use criteria: Prevalence, correlates, and utility for predicting problems in college students. *Substance Abuse*, 33(2), 223.

Refereed Conference Presentations

Hernandez-Meier, J. L., Smith, B., Guse, C., Layde, P. & Hargarten, S. (November, 2016). Legal firearm possession status of individuals involved in violent deaths. To be delivered at the 144th Annual Meeting and Exposition of the American Public Health Association, Denver, CO.

Hernandez-Meier, J. L., Xu, Z., Kohlbeck, S., Levas, M. & Hargarten, S. (2016, September). The Cardiff Model: Building capacity for enhanced law enforcement, health care and public health surveillance system to address violence. To be delivered at the 2016 International Association of Crime Analysts Training Conference, Louisville, KY.

Schlotthauer, A., **Hernandez-Meier**, J., Rafenstein, K., Rueber., D & Zosel, A. *Development of a Self-Harm and Death Analysis Review Team and Data System to Identify Trends in Suicides and Drug Poisonings and Inform Community Prevention Activities.* 143rd Annual Meeting and Exposition of the American Public Health Association; 2015 November 3; Chicago, IL

Polace, K., Corr, J., Hedgwood, A., Young, S., & **Hernandez-Meier**, J. (2014, November). *Milwaukee's Collaboratively Run Holton Youth & Family Center: A Community-Academic Approach to Youth Violence Prevention*. Roundtable presentation at the 142nd Annual Meeting and Exposition of the American Public Health Association, New Orleans, LA.

Gromoske, A. N., Janczewski, C. E., & **Hernandez-Meier**, J. (2010, October). *Empowering Clients Through Evidence-based Client Choice: An Informed & Shared Decision-making Framework.* Presentation at the 36th Annual National Association of Social Workers-Wisconsin Chapter State Conference, Madison, WI.

Gromoske, A. N**., Hernandez-Meier**, J., Berger, L. K., & Topitzes, J. (2009, October). *Evidence Based Practice: Strategies for Finding Answers Now!* Presentation at the 35th Annual National Association of Social Workers-Wisconsin Chapter State Conference, Madison, WI.

Berger, L. K., **Hernandez-Meier**, J. L., & Scanlan, G. (2009, October). *Community Reinforcement and Family Training (CRAFT) Model for Individuals with Substance Abuse Problems.* Presentation at the 35th Annual National Association of Social Workers-Wisconsin Chapter State Conference, Madison, WI.

Hernandez-Meier, J., Gromoske, A. N., Berger, L. K., Otto-Salaj, L., & Stoffel, V. (2008, May). *Transferring Social Work Research Into Practice: Real World Strategies.* Presentation at the 34th Annual National Association of Social Workers-Wisconsin Chapter State Conference, Madison, WI.

Refereed Conference Poster Presentations

Levas, M. N., Piotrowski, N., **Hernandez-Meier**, J. L., Kohlbeck, S. & Hargarten, S. (April, 2016). Integrating hospital and police data to reduce violence. Poster presented at the 24th Annual Emergency Medicine Research Forum, Sponsored by the Department of Emergency Medicine, Medical College of Wisconsin, Milwaukee, WI.

Hernandez-Meier JL, Levas M, Hargarten SW, Rubin J. (November, 2015). Interpreting the Affordable Care Act, other federal healthcare policies and hospital missions to improve the surveillance of violence. 143rd Annual Meeting and Exposition of the American Public Health Association, Chicago, IL.

Hernandez-Meier JL, Schlotthauer A, Hargarten S, Layde P, Guse C. (2015, November). Linking data from multi-sector partnerships for a comprehensive investigation of firearm possession policies: Benefits and challenges. 143rd Annual Meeting and Exposition of the American Public Health Association, Chicago, IL.

Hernandez-Meier, J. (2013, January). Mental health, physical health, and social support as predictors of concurrent use of alcohol and marijuana in college students. Presentation delivered at the 17th Annual Conference of the Society for Social Work and Research, San Diego, CA.

Hernandez-Meier, J., Berger, L., & Fendrich, M., (2012, February). The influence of marijuana use on alcohol use and related problems in college students. Presentation delivered at the 12th Annual Guze Symposium on Alcoholism, presented by the Midwest Alcoholism Research Center and Washington University School of Medicine, St. Louis, MO.

Hernandez-Meier, J., Fendrich, M., & Avci, O. (2011, January). College student awareness of alcohol programs and policies: Prevalence and correlates. Presentation delivered at the 15th Annual Conference of the Society for Social Work and Research, Tampa, FL.

Other Presentations

Hernandez-Meier, J. & Kohlbeck, S. (June, 2016). Integrating Data to Reduce Violence. Educational Seminar, Sharing Data for Violence Prevention: Lessons from Milwaukee. Hosted by the Strengthening Chicago's Youth Violence Landscape Project. Sponsored by the Joyce Foundation. Ann & Robert H. Lurie Children's Hospital of Chicago, Chicago, IL.

Hernandez-Meier, J. Linking Data to Evaluate Firearm Policies (2015, November). 2015 Summit of the Midwest Injury Prevention Alliance, Madison, WI

Hernandez-Meier, J. (2015, April 2). Linking Data from Multi-Sector Partnerships to Comprehensively Investigate Firearm Possession Policies. Research Seminar for the Clinical & Translational Science Institute of Southeast Wisconsin, Medical College of Wisconsin, Milwaukee, WI

Hargarten, S. & **Hernandez-Meier**, J. (2014, June 11). Reducing the Burden of Suicide: Reducing Access to Lethal Means. Grand Rounds for Psychiatry, Wheaton Franciscan Wauwatosa Outpatient Center, Milwaukee, WI

Hernandez-Meier, J., & Fendrich, M. (2010, January). Campuses & Communities: Multilevel Influences on Heavy Episodic Drinking. Food for Thought. Sponsored by the University of Wisconsin-Milwaukee Center for Addiction and Behavioral Health Research.

Kelter, R. & **Hernandez-Meier**, J. (2007, September). *The Seamless Transition of Operation Enduring/Iraqi Freedom Troops Home*. Presentation at the County Veterans Service Officers Association of Wisconsin Fall 2007 Conference, Madison, WI.

Awards & Honors

8/2012 – 5/2013 Dissertation Fellowship, University of Wisconsin-Milwaukee, Milwaukee, Wisconsin.

11/2011 Graduate Student Travel Award, University of Wisconsin-Milwaukee, to attend the 35th Annual National Conference of the Association for Medical Education and Research in Substance Abuse (AMERSA), Washington, DC, November 3-5, 2011.

11/2010 AMERSA Travel Award, 34th Annual National Conference of the Association for Medical Education and Research in Substance Abuse, Bethesda, MD, November 4-6, 2010.

8/2008 – 8/2009 Dean's Fellowship, Helen Bader School of Social Welfare, University of Wisconsin-Milwaukee, Milwaukee, Wisconsin.

9/2000 – 5/2004 Powers-Knapp Full Academic Scholarship, University of Wisconsin-Madison, Madison, Wisconsin.

Medical Student Mentoring – Scholarly and Summer Research Projects

1/1/2015 – 4/2016 Aristotle Leonhard: Criminal backgrounds and firearms deaths: Policy implications

6/2014 – Current Daniel Kopatich: Violent deaths in children and youth of regional Wisconsin: Trends, risk factors, and policy recommendations

Rachel Muscott: Emergency Physicians' Utilization and Attitudes Regarding the Wisconsin Prescription Drug Monitoring Program

Teaching Experience

3/2016 Guest Lecturer, Topic: Program Evaluation
MS in Clinical and Translational Science Program 20256A: Research Methods in Epidemiology

9/2013 – Current Fourth-Year Medical Student (M4) Toxicology Rotation Learning Session (monthly): Accessing and Analyzing State Poisoning Data

9/2012 – 12/2012 Instructor, Department of Social Work, University of Wisconsin-Milwaukee, Milwaukee Wisconsin
Social Work 794: Evaluation of Programs

1/2012 – 5/2012 Co-Instructor, School of Pharmacy, Concordia University-Wisconsin, Mequon, Wisconsin
Pharmacy 442: Social & Behavioral Pharmacy*
*First time this course was offered

8/2010 – 12/2010 Teaching Assistant, Department of Social Work, University of Wisconsin-Milwaukee, Milwaukee Wisconsin
Social Work 250: Human Behavior and the Social Environment

8/2009 – 12/2009 Teaching Assistant, Department of Social Work, University of Wisconsin-Milwaukee, Milwaukee Wisconsin
Social Work 250: Human Behavior and the Social Environment

9/2009 Guest Lecturer, Topic: Screening, Prevention, and Interventions for College Student Alcohol and Other Substance Use
Social Work 820: Interventions for Alcohol Use Disorders

Master of Social Work Field Experience

9/2007 – 4/2008 William S. Middleton Memorial Veterans Hospital, Madison, WI
Macro-level placement under Chief of Social Work and Chaplain Service (640 supervised hours).

1/2007 – 8/2007 Aurora Psychiatric Hospital, Intensive Outpatient Adolescent Substance Abuse Treatment Program, Wauwatosa, WI
Direct practice placement under Licensed Clinical Social Worker (520 supervised clinical hours).

Service

2/2015 – Current Board Member, Midwest Injury Prevention Alliance.

10/2010 – 5/2013 Member, Awards Committee, Helen Bader School of Social Welfare, University of Wisconsin-Milwaukee.

8/2008 – 5/2013 Member, University of Wisconsin-Milwaukee Alcohol and Other Drug Task Force.

9/2008 – 5/2009 Member, Workshop Planning Committee for *Reducing Risk in Young Adult Drinking: Campus and Community Prevention Strategies.* Sponsored by the Center for Addiction and Behavioral Health Research.

11/2007 – 4/2008 Member, Workshop Planning Committee for *Coming Home: Helping OEF/OIF* [Operation Enduring Freedom/Operation Iraqi Freedom] *Families Through the Transition.* Sponsored by The National Alliance on Mental Illness – Wisconsin Chapter, Madison, Wisconsin.