

A Dissertation  
entitled  
Medical Marijuana: The Impact on College Students  
by  
Alexis A. Blavos

Submitted to the Graduate Faculty as partial fulfillment of the requirements for the  
Doctor of Philosophy Degree in Health Education

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August 2015

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An Abstract of  
Medical Marijuana: The Impact on College Campuses

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**Introduction:** Marijuana represents the most widely-used illicit drug on college campuses. Repeated use can impair students' physical and mental health, intelligence, memory, and academic performance (Arria et al., 2013a; Arria et al., 2013c; Beck et al., 2009; Buckner et al., 2012; Caldeira et al., 2013; Falls et al., 2013; Hall & Dagenhardt, 2008; Jacobus et al., 2013; Meier et al., 2012; Morbidity and Mortality Weekly Report, 1983; Office of National Drug Control Policy, 2004). People who use marijuana heavily in their teens and early twenties are especially vulnerable to experiencing reductions in intelligence quotient (I.Q.) and memory impairment (Meier et al., 2012). Further, marijuana use has been associated with reductions in college graduation, skipping class, early conduct problems, and lower grade point averages (Arria et al., 2013a; Arria et al., 2013b; Arria et al., 2013c). The current political landscape and public opinions indicate more permissive attitudes toward marijuana use, with several states voting to legalize recreational use of marijuana (Alaska, Colorado, Oregon, Washington; Governing, 2015) and many others supporting decriminalization and medicinal marijuana licenses (ProCon.org, 2015). Additionally, the U.S. Attorney General issued a memorandum indicating that the Department of Justice will not challenge state marijuana laws (Reilly,

2013), leading many to speculate that widespread legalization appears imminent.

**Purpose:** The aim of this study was twofold. First, to evaluate the outcomes medical marijuana laws have within the college student population. Specifically, the difference in marijuana use between states with and without medical marijuana laws as well as other drug use, grade point average (GPA), location of use, negative outcomes, and normative influences. Second, to determine which variables (negative outcomes, normative influence, location of use, and substance use) predicted marijuana use. **Methods:** Data from the 2013 Core Alcohol and Drug Survey Long Form national data set were obtained after receiving IRB approval. Institutions of higher education self-select to administer the Core and each campus determined their own method of administration (online vs. in the classroom) and implementation (random sample vs. convenience sample). ). The survey consists of 39 items assessing college student demographics and experiences with alcohol and other drugs. Martens and colleagues (2005) assessed the psychometrics and the results indicate the instrument is both reliable and valid. **Results:** The odds ratio results indicate the location of drug use differed in states with medical marijuana laws. Students who attended college in states with medical marijuana laws were more than twice as likely to use marijuana on campus, in the residence halls, where they live, in bar/restaurant, and in a car than students in states without laws. Odds ratio analysis also revealed that students who attended college in states with medical marijuana laws were more likely to experience negative consequences (memory loss, being hurt or injured, doing something they regretted, or doing poorly on an exam) than students who did not. Logistic regressions were used to assess marijuana and other drug use and suggest that student use also differed by state medical marijuana laws. Students in states with laws

were more likely to have used hallucinogens and designer drugs while students in states without laws were more likely to have used legal substances (alcohol and tobacco).

Finally, logistic regressions also evaluated social norms revealing that students who believed that their friends would approve of their marijuana use were more likely to live in states with medical marijuana laws. **Conclusions:** Students in states with medical marijuana laws are more likely to have used marijuana in the past year, use on campus, suffer academic challenges, and believe that their friends would approve of their use.

With impending passage of future more permissive marijuana laws, it is recommended that college health practitioners, campus administrators, researchers, grantors, and the state and federal governments begin to address the negative impact that these laws have on college students.

To all of my family, most importantly my dad who has always been my biggest fan and best friend. To all of my mentors; Drs. Glassman, Kerr, Thompson, Sutton, and Ott-Walter. Each of you have given me that one chance that I needed to succeed at something new. Thank you all for believing in me.

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## List of Abbreviations

ACHA .....	American College Health Association
AIC.....	Akaike Information Criterion
CFI .....	Comparative Fit Index
CI.....	Confidence Interval
DC .....	District of Columbia
DEA .....	Drug Enforcement Administration
df .....	Degrees of Freedom
DUI .....	Driving Under the Influence
DWI.....	Driving While Intoxicated
ECVI .....	Expected Cross-Validation Index
FDA.....	Food and Drug Administration
FMIN.....	Minimum of Discrepancy Function
GPA.....	Grade Point Average
IFI.....	Incremental Fit Index
I.Q. ....	Intelligence Quotient
MDMA.....	3,4-methylenedioxy-methamphetamine also known as ecstasy
MM .....	States with Medical Marijuana Laws
MTF .....	Monitoring the Future
NCHA II.....	National College Health Assessment II
NCP.....	Non-Centrality Parameters
n.d.....	No Date
NFI .....	Normed Fit Index

NIAAA.....	National Institutes on Alcohol Abuse and Alcoholism
NMM.....	States without Medical Marijuana Laws
PCFI.....	Parsimony-Adjusted Comparative Fit Index
PNFI.....	Parsimony-Adjusted Normed Fit Index
RFI .....	Relative Fit Index
RMSEA.....	Root Mean-Square Error of Approximation
SE.....	Standard Error
SPSS.....	Statistical Package for the Social Sciences
TFI.....	Tucker-Lewis Index
THC.....	Tetrahydrocannabinol
US .....	United States

## List of Symbols

$\alpha$  .....Alpha

$\beta$  .....Beta

$X^2$  .....Chi-square

$R^2$  .....Coefficient of determination

$r$  .....Correlation coefficient

$<$  .....Less than

$\leq$  .....Less than or equal to

$>$  .....More than

$p$  .....Probability

® .....Trademark

$n$  .....Sample size

## **Chapter One**

### **Introduction**

This chapter presents the study topic, research purpose, and a synopsis of the issues regarding, “Medical marijuana: The impact on college campuses.” Sections within this chapter include the following: Medical Marijuana Cost and Exposure, Impact of Marijuana Use, Marijuana Use and the Law, Purpose of the Study, Definition of Terms, Research Questions and Hypotheses. Additionally, Delimitations and Limitations are discussed.

### **Marijuana Use and Related Consequences**

**Estimates of Marijuana Use.** Marijuana represents the most widely-used illicit drug on college campuses and when used repeatedly can impair students’ physical and mental health, intelligence, memory, and academic performance (Arria, et al., 2013; Beck et al., 2009; Buckner, et al., 2012; Caldeira et al, 2013; Falls et al., 2013; Hall & Dagenhardt, 2008; Jacobus et al., 2013; Meier. et al., 2012; Morbidity and Mortality Weekly Report, 1983; Office of National Drug Control Policy, 2004). Regardless of universities best efforts, the marijuana prevalence rates have been stable for decades. Results from the 2014 National College Health Assessment II (NCHA) survey indicate that 40% of college students have used marijuana at some point in their lifetime, with 19% using in the last 30 days. Similarly, the 2013 CORE Alcohol and Drug Survey report that 45% of students used marijuana, 33% used marijuana in the past year with 20% reporting current use in the past 30 days.

**Impact of Marijuana Use.** When used habitually, marijuana can impair students’ physical and mental health, intelligence, and memory (Arria, et al., 2013; Beck et al., 2009; Buckner et al., 2012; Caldeira et al, 2013; Falls et al., 2013; Hall & Dagenhardt, 2008; Higher Education Center, 2008; Jacobus et al., 2013; Meier et al., 2012; Morbidity and Mortality

Weekly Report, 1983; Office of National Drug Control Policy, 2004). Marijuana use has proven to increase the risk of schizophrenia (Hall & Dagenhardt, 2008). Buckner and colleagues (2012) report a close relation between anxiety and marijuana craving, specifically, craving marijuana and having anxiety leads to marijuana use. Beck and colleagues (2009) reported similar findings with consistent cannabis users reporting marijuana use in the context of emotional pain and depression.

Beyond emotional pain, marijuana use has been linked to reductions in college graduation, skipping class, early conduct problems, and lower GPA (Arria, et al., 2013a; Arria, et al., 2013b; Arria, et al., 2013c; Falls et al., 2011; Hunt, Eisenberg, & Kilbourne, 2010). While grades and retention may be impacted, it is more alarming that marijuana is proven to impair mental functioning (Jacobus, et al., 2013; Medina et al., 2007; Solowij, et al., 2011; Thoma et al., 2011). Jacobus and colleagues (2013) indicate that heavy marijuana users have an inferior ability for complex attention, storing memory, and planning and sequencing abilities, even after a month of abstinence, as well as deficits on tests of verbal and visual memory when compared to non-users. Further, research suggests that even after one month of abstinence from marijuana, subtle deficits remain in psychomotor speed, complex attention, planning and sequencing, and verbal story memory when compared to nonusers (Medina, et al., 2007; Thoma, et al., 2011). Memory impairment has also been linked specifically to cannabis use and was not attributable to co-use of cannabis and alcohol or cannabis and other drugs (Solowij et al., 2011).

**Marijuana use and the Law.** As of August 2015, 20 states passed legislation allowing medicinal marijuana (ProCon.org, 2015) and four states and the District of Columbia (DC) have enacted legislation allowing for recreational use of marijuana (Governing, 2015). Seventeen more states failed to pass legislative measures with one state still pending in 2015 (ProCon.org,



2015). While there are no studies examining medicinal marijuana, the law, and college campuses at this time, Cerda and colleagues (2012) reported that the passage of state medicinal marijuana laws lead to higher levels of dependence and abuse in those states. Further, societal normative influences are significantly more permissive of recreational marijuana use in states with medicinal marijuana laws (Cerda, et al., 2012). A related public health issues involves the increase in drugged driving on college campuses in the past years with white males at most risk for driving while drugged on marijuana (Arria et al., 2011).

### **Purpose of the Study**

**Article 1:** To date a dearth of research exists summarizing marijuana's associated effects on college students. These issues include college retention, reduced academic performance, health outcomes, and increased legal or conduct issues. The purpose of this systematic review was to assess the topics published on this subject, as well as the methods researchers employed, including: study design, location, target population, psychometrics, measured outcomes, and limitations.

**Article 2:** Next to alcohol, marijuana is the most widely used substance on college campuses. Currently, 20 states have passed medicinal marijuana laws with several more anticipating ballot initiatives in the next few years (ProCon.org, 2015). The aim of this investigation involves exploring the impact of medical marijuana use on college campuses. The purpose of this research is to determine the marijuana usage habits and related consequences among students who reside in states, which permit medical marijuana compared to those who do not. More specifically, do differences exist between states who permit medical marijuana versus those who do not in the following areas: (a) college student marijuana use; (b) perceived college student marijuana use; (c) negative consequences related to substance use (e.g., performing

poorly on exams, driving a car under the influence, or missing a class); (d) grade point average; (e) rates of other drug use (e.g. tobacco, alcohol, or cocaine); (f ) peer injunctive norms; (g) location of use; (h) permissive social atmosphere; (i) level of concern by the student for problems associated with AOD use; and (j) perceived risk associated with use.

### **Definition of Terms**

- Cannabis - any of the preparations (as marijuana or hashish) or chemicals (as THC) that are derived from the hemp and are psychoactive (Merriam Webster, n.d.).
- Marijuana – dried leaves and flowers of the hemp plant that are smoked as a drug (Merriam Webster, n.d.).
- Medical/Medicinal Marijuana - Medical Marijuana refers to the use of cannabis or marijuana, including constituents of cannabis, THC and other cannabinoids, as a physician-recommended form of medicine or herbal therapy (USLegal, n.d.).
- Recreational Drug – the use of marijuana without medical justification for its psychoactive effects often in the belief that occasional use of such a substance is not habit-forming or addictive (Merriam Webster, n.d.).
- Tetrahydrocannabinol (THC) –either of two physiologically active isomers  $C_{21}H_{30}O_2$  from hemp plant resin; especially : one that is the chief intoxicant in marijuana (Merriam Webster, n.d.).

### **Research Question for Chapter Two**

This research includes the following research questions and hypothesis:

*Research Question 1:* What impact does marijuana use have on college students?

**Hypothesis 1.1:** Marijuana has no impact on college students.

*Research Question 2:* What is the rigor of the current research on the outcomes of college student marijuana use?

**Hypothesis 2.1:** There is no difference in rigor among the current research on the outcomes of college student marijuana use.

### **Research Questions for Chapter Three**

This research includes the following research questions and hypothesis:

*Research Question 1:* Do college students in states with medical marijuana laws and college students in states without medical marijuana laws use marijuana at equal rates after controlling for past year other drug use, social norms, grade classification, residential status, working status, and student status?

**Hypothesis 1.1:** College students in states with medical marijuana laws and college students in states without medical marijuana laws used marijuana at the same rate in the past 30 days after controlling for past year other drug use, social norms, grade classification, residential status, working status, and student status..

**Hypothesis 1.2:** College students in states with medical marijuana laws and college students in states without medical marijuana laws used marijuana at than equal rate in the last year after controlling for past year other drug use, social norms, grade classification, residential status, working status and student status.

*Research Question 2:* Do college students in states with medical marijuana and college students in states without medical marijuana laws perceive peer use of marijuana at equal rates after controlling for past 30 day and past year marijuana use, grade classification, age, gender, residential status, working status, living arrangements, campus situation on alcohol and drugs (is

there a policy, is it enforced, etc.), place of permanent residence (including enforcement and prevention) and injunctive norms constant?

**Hypothesis 2.1:** College students in states with medical marijuana laws and college students in states without medical marijuana laws perceived peer use of marijuana at an equal rate after controlling for past 30 day and past year marijuana use, grade classification, age, gender, residential status, working status, living arrangements, campus situation on alcohol and drugs (is there a policy, is it enforced, etc.), place of permanent residence (including enforcement and prevention) and injunctive norms constant?

*Research Question 3:* Do college students in states with medical marijuana laws and college students in states without medical marijuana laws use other substance in the past year at equal rates?

**Hypothesis 3.1:** College students in states with medical marijuana laws and college students in states without medical marijuana laws used tobacco at an equal rate after controlling for past year other drug use (tobacco, alcohol, marijuana, cocaine, amphetamines, sedatives, hallucinogens, opiates, inhalants, designer drugs, steroids, and other illegal drugs), social norms, grade classification, residential status, working status, and student status.

**Hypothesis 3.2:** College students in states with medical marijuana laws and college students in states without medical marijuana laws used alcohol at an equal rate after controlling for past year other drug use (tobacco, alcohol, marijuana, cocaine, amphetamines, sedatives, hallucinogens, opiates, inhalants, designer drugs, steroids, and other illegal drugs), social norms, grade classification, residential status, working status, and student status.

**Hypothesis 3.3:** College students in states with medical marijuana laws and college students in states without medical marijuana laws used cocaine at an equal after controlling for past year other drug use (tobacco, alcohol, marijuana, cocaine, amphetamines, sedatives, hallucinogens, opiates, inhalants, designer drugs, steroids, and other illegal drugs), social norms, grade classification, residential status, working status, and student status. .

**Hypothesis 3.4:** College students in states with medical marijuana laws and college students in states without medical marijuana laws used amphetamines at an equal rate after controlling for past year other drug use (tobacco, alcohol, marijuana, cocaine, amphetamines, sedatives, hallucinogens, opiates, inhalants, designer drugs, steroids, and other illegal drugs), social norms, grade classification, residential status, working status, and student status.

**Hypothesis 3.5:** College students in states with medical marijuana laws and college students in states without medical marijuana laws used sedatives at an equal rate after controlling for past year other drug use (tobacco, alcohol, marijuana, cocaine, amphetamines, sedatives, hallucinogens, opiates, inhalants, designer drugs, steroids, and other illegal drugs), social norms, grade classification, residential status, working status, and student status..

**Hypothesis 3.6:** College students in states with medical marijuana laws and college students in states without medical marijuana laws used hallucinogens at an equal rate after controlling past year other drug use (tobacco, alcohol, marijuana, cocaine, amphetamines, sedatives, hallucinogens, opiates, inhalants, designer drugs, steroids, and

other illegal drugs), social norms, grade classification, residential status, working status, and student status.

**Hypothesis 3.7:** College students in states with medical marijuana laws and college students in states without medical marijuana laws used opiates at an equal rate after controlling for past year other drug use (tobacco, alcohol, marijuana, cocaine, amphetamines, sedatives, hallucinogens, opiates, inhalants, designer drugs, steroids, and other illegal drugs), social norms, grade classification, residential status, working status, and student status..

**Hypothesis 3.8:** College students in states with medical marijuana laws and college students in states without medical marijuana laws used inhalants at an equal rate after controlling for past year other drug use (tobacco, alcohol, marijuana, cocaine, amphetamines, sedatives, hallucinogens, opiates, inhalants, designer drugs, steroids, and other illegal drugs), social norms, grade classification, residential status, working status, and student status..

**Hypothesis 3.9:** College students in states with medical marijuana laws and college students in states without medical marijuana laws used designer drugs at an equal rate after controlling for past year other drug use (tobacco, alcohol, marijuana, cocaine, amphetamines, sedatives, hallucinogens, opiates, inhalants, designer drugs, steroids, and other illegal drugs), social norms, grade classification, residential status, working status, and student status.

**Hypothesis 3.10:** College students in states with medical marijuana laws and college students in states without medical marijuana laws used steroids at an equal rate after controlling for past year other drug use (tobacco, alcohol, marijuana, cocaine,

amphetamines, sedatives, hallucinogens, opiates, inhalants, designer drugs, steroids, and other illegal drugs), social norms, grade classification, residential status, working status, and student status.

**Hypothesis 3.11:** College students in states with medical marijuana laws and college students in states without medical marijuana laws used other illegal drugs at an equal rate after controlling past year other drug use (tobacco, alcohol, marijuana, cocaine, amphetamines, sedatives, hallucinogens, opiates, inhalants, designer drugs, steroids, and other illegal drugs), social norms, grade classification, residential status, working status, and student status.

*Research Question 4:* Do college students in states with medical marijuana laws and college students in states without medical marijuana laws have equal GPA rates after controlling for institutional location, current residence, working status, social norms, and previous year other drug use.

**Hypothesis 4.1:** College students in states with medical marijuana laws and college students in states without medical marijuana laws have equal GPA rates after controlling for age, ethnic origin, gender, marital status, grade classification, residential station, and working status.

*Research Question 5:* What is the difference between college students in states with medical marijuana laws and college students in states without medical marijuana laws on locations of marijuana use?

**Hypothesis 5.1:** There is no difference between college students in states with medical marijuana laws and college students in states without medicinal marijuana laws using marijuana on campus.

**Hypothesis 5.2:** There is no difference between college students in states with medical marijuana laws and college students in states without medicinal marijuana laws using marijuana in a residence hall.

**Hypothesis 5.3:** There is no difference between college students in states with medical marijuana laws and college students in states without medicinal marijuana laws using marijuana in a fraternity or sorority.

**Hypothesis 5.4:** There is no difference between college students in states with medical marijuana laws and college students in states without medicinal marijuana laws using marijuana in a bar or restaurant.

**Hypothesis 5.5:** There is no difference between college students in states with medical marijuana laws and college students in states without medicinal marijuana laws using marijuana where they live.

**Hypothesis 5.6:** There is no difference between college students in states with medical marijuana laws and college students in states without medicinal marijuana laws using marijuana in a car.

**Hypothesis 5.7:** There is no difference between college students in states with medicinal marijuana laws and college students in states without medicinal marijuana laws using marijuana at private parties.

**Hypothesis 5.8:** There is no difference between college students in states with medicinal marijuana laws and college students in states without medicinal marijuana laws using marijuana in other locations.



*Research Question 6:* What is the difference between college students in states with medical marijuana laws and college students in states without medical marijuana laws on negative consequences?

**Hypothesis 6.1:** There is no difference between college students in states with medical marijuana laws and college students in states without medical marijuana laws on performing poorly on a test or important project.

**Hypothesis 6.2:** There is no difference between college students in states with medical marijuana laws and college students in states without medical marijuana laws on being in trouble with police, residence hall, or other college authorities.

**Hypothesis 6.3:** There is no difference between college students in states with medical marijuana laws and college students in states without medical marijuana laws on getting into an argument or a fight.

**Hypothesis 6.4:** There is no difference between college students in states with medical marijuana laws and college students in states without medical marijuana laws on driving a car while under the influence.

**Hypothesis 6.5:** There is no difference between college students in states with medical marijuana laws and college students in states without medical marijuana laws on missing a class.

**Hypothesis 6.6:** There is no difference between college students in states with medical marijuana laws and college students in states without medical marijuana laws on thinking they might have a drinking or other drug problem..

**Hypothesis 6.7:** There is no difference between college students in states with medical marijuana laws and college students in states without medical marijuana laws on having memory loss.

**Hypothesis 6.8:** There is no difference between college students in states with medical marijuana laws and college students in states without medical marijuana laws on doing something they later regretted.

**Hypothesis 6.9:** There is no difference between college students in states with medical marijuana laws and college students in states without medical marijuana laws on being arrested for DWI/DUI.

**Hypothesis 6.10:** There is no difference between college students in states with medical marijuana laws and college students in states without medical marijuana laws on trying unsuccessfully to stop using.

**Hypothesis 6.11:** There is no difference between college students in states with medical marijuana laws and college students in states without medical marijuana laws on seriously thinking about suicide.

**Hypothesis 6.12:** There is no difference between college students in states with medical marijuana laws and college students in states without medical marijuana laws on seriously trying to commit suicide.

**Hypothesis 6.13:** There is no difference between college students in states with medical marijuana laws and college students in states without medical marijuana laws on being hurt or injured.

*Research Question 7:* Do college students in states with medical marijuana laws and college students in states without medical marijuana laws have equal perception rates on peer injunctive

norms after controlling age, gender, residential status, working status, living arrangements, campus situation on alcohol and drugs, student status, permanent residence, and social norms?

**Hypothesis 7.1:** College students in states with medical marijuana laws and college students in states without medical marijuana laws perceive how their close friends would think about them trying marijuana once or twice at equal rates after controlling age, gender, residential status, working status, living arrangements, campus situation on alcohol and drugs, student status, permanent residence, and social norms.

**Hypothesis 7.2:** College students in states with medical marijuana laws and college students in states without medical marijuana laws perceive how their close friends would think about them smoking marijuana occasionally at equal rates after controlling age, gender, residential status, working status, living arrangements, campus situation on alcohol and drugs, student status, permanent residence, and social norms.

**Hypothesis 7.3** College students in states with medical marijuana laws and college students in states without medical marijuana laws perceive how their close friends would think about them smoking marijuana regularly at equal rates after controlling age, gender, residential status, working status, living arrangements, campus situation on alcohol and drugs, student status, permanent residence, and social norms.

*Research Question 8:* What is the path model that predicts marijuana usage among college students based on the Core Alcohol and Drug Survey, in states with and without medical marijuana laws?

**Hypothesis 8.1:** The path model that predicts marijuana usage does not reach goodness of fit indicators for college students in states with marijuana.

**Hypothesis 8.2:** The path model that predicts marijuana usage does not reach goodness of fit indicators for college students in states without marijuana.

### **Delimitations**

**Article 1:** This study is concerned with college students in the United States, therefore, only articles including US college students aged 18-24 published between 2000 and the present were included.

**Article 2:** Only schools in the United States who administered the CORE Alcohol and Drug Survey Long Form on their campus were included in the analysis. As a result, findings may not be reflective of all universities in the United States and cannot be generalized to institutions outside of the United States. Further, this inquiry examined the differences between college campuses in states with and without medical marijuana laws; therefore, conclusions regarding states with recreational marijuana laws are not considered.

### **Limitations**

**Article 1:** As with any type of research, there are inherent limitations, this also is true of systematic reviews. First, it is possible that despite the systematic review search strategy, some relevant articles were not included. The chance of this occurring was minimized by using a diverse database search strategy. Second, focusing on a limited area of research methods may have left other areas under assessed or reported. For example, perhaps too much emphasis was placed on sample size and not enough on measuring effect size. Third, there was significant variation in study population, response rates, campus size, and reliability and validity measures. This could lead to varying interpretations of the literature. Fourth, because of the nature of this inquiry, the inclusion/exclusion criteria omitted marijuana prevention, intervention, or education

programs. Fifth, undoubtedly unpublished studies exist, which is not related to the methods used for this study, but leaves in question what other research on this subject is being conducted.

In spite of these limitations, the findings from this systematic literature review provide an overall assessment of the research conducted on marijuana use and its impact on college students. The field would benefit from a meta-analysis of the literature focusing on intervention-based research to ascertain best practices for marijuana prevention similar to the National Institutes on Alcohol Abuse and Alcoholism *tiers of effectiveness* for alcohol prevention on college campuses (NIAAA, 2002). The tiers were classified as follows: “effective among college students (tier 1; p.16); effective with general populations that could be applied to college environments (tier 2; p. 17); logical and theoretical promise, but require more comprehensive evaluation (tier 3; p. 20); and, ineffective (tier 4; p. 23).” A nationally convened team created this classification protocol and developed the initiative, termed: *A Call to Action: Changing the Culture of Drinking on US Colleges* (NIAAA, 2002), researchers and practitioners need to employ similar methods to address marijuana.

## **Article 2:**

Several noteworthy limitations exist due to the inherent constraints associated with secondary data analyses. First, self-reported data were collected for this study, which, because of the sensitive nature of questions, may have led respondents to underreport, over-report, or experience imperfect recall of their substance use. Second, causal inferences cannot be gleaned from cross-sectional data analysis. For example, whether the findings from this study are the result of medical marijuana laws or differences in culture from state to state, is impossible to surmise, based on the methods employed for this study. Third, a set of questions asked how often students experienced negative outcomes in relation to all substances use, not just marijuana. This

is problematic because it is impossible to determine if the negative outcomes experienced were due exclusively to marijuana and/or some other drug(s). Fourth, another item from the survey (how do you think your close friends feel – or would feel – about you...) utilized a double negative response option (don't disapprove) which may have confused some respondents. Finally, the use of only one item to measure perceived risk, descriptive norms, and injunctive norms, limits the assessment of these constructs (mono-method biases).

### **Conclusions**

Despite these limitations, this study provides information concerning the impact of medical marijuana on college campuses. Students in states with medical marijuana laws are more likely to have used marijuana in the past year, use on campus, suffer academic challenges and believe that their friends would approve of their use. The current study focused on medical marijuana, therefore, future research should also include the impact that recreational marijuana laws have on college students. Further, a time-series analysis should be conducted to determine exactly when behavior change occurs to more accurately assess the impact of marijuana policies. Intervention research needs also needs to be conducted to evaluate and improve upon the impact of social norms marketing interventions (Buckner, 2013; Comello, 2013; Ecker, Richter, & Buckner, 2014; LaBrie, Hummer, & Lac, 2011; Napper et al., 2014; Neighbors et al., 2013) and programs such as BASICS (SAMHSA, n.d.), focusing exclusively on marijuana use.

Because of the discrepancies between state and federal law, campuses in states with medical marijuana laws face the challenge of meeting the federal standards of the safe and drug free schools act while still allowing their students to access their “medication.” So while the state may allow the medical use of marijuana, the federal government, who provides substantial funding to public institutions of higher education, view marijuana as a schedule one drug that is

prohibited on federally funded college campuses (Adele, 2015). As the issue of medical marijuana laws continue to be in the media and most likely in the federal courts, college campuses are going to have to re-evaluate their policies on use of this substance in order to maintain healthy campuses whose policies are in agreement with federal law. Indeed, as medical and recreational marijuana laws continue to be part of state and federal legislative discussions, findings from this study and others can be used to help guide future law and policy.

### **Summary**

This chapter presented information on medical marijuana costs and exposure, the impact of marijuana use, marijuana use and the law, the purpose of this study, a definition of terms, research questions and hypothesis as well as delimitations and limitations.

## **Chapter 2**

### **Marijuana and College Students: A Systematic Review of the Literature**

The purpose of this study was to evaluate the existing literature concerning marijuana's associated effects on college students' academics, conduct or legal issues, negative outcomes, normative perceptions, and physical and mental health in the United States. The initial section of this chapter includes an abstract and overview of how marijuana use impacts college students. The second section presents a detailed account of the methods utilized for this systematic literature review. The results are discussed including two tables which highlight the data extracted from the included studies. The chapter concludes with a summary paragraph, references, and tables and figures. A copy of the Journal of Studies on Alcohol and Drugs publication guidelines can be found in Appendix A.



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## **Abstract**

**Objective:** The purpose of this study was to evaluate existing literature examining the associated effects of marijuana use on college student's academics, conduct/legal issues, negative outcomes, normative perceptions, and physical and mental health in the United States. **Methods:** A systematic literature review was conducted in January 2015 using the PubMed, Academic Search Complete, Electronic Journal Center, ProQuest, and Google Scholar databases. Studies were included if they focused on epidemiological outcomes of marijuana use on United States undergraduate college students aged 17-24. **Results:** Overall, the studies lacked scientific rigor. In a number of studies researchers used convenience samples, did not report response rates, used small sample sizes, did not report the psychometrics of the instrument, and the majority of the studies were conducted at one institution limiting the external validity of the results. **Conclusions:** Based on the results from this study, future research needs to be conducted with more scientific rigor. Areas to focus on include using randomized sampling methods, collecting representative response rates, and employing appropriate reliability and validity measures. It is also recommended that state and federal policy makers, grant funders, and journal editors and reviewers require more rigorous research practices and encourage the advocacy of more funding in this area.

## **Introduction**

Marijuana represents the most widely-used illicit drug on college campuses. Repeated use can impair students' physical and mental health, intelligence, memory, and academic performance (Arria et al., 2013a; Arria et al., 2013c; Beck et al., 2009; Buckner et al., 2012; Caldeira et al., 2013; Falls et al., 2013; Jacobus et al., 2013; Hall & Dagenhardt, 2008; Meier et al., 2012; Morbidity and Mortality Weekly Report, 1983; Office of National Drug Control Policy, 2004). A longitudinal study suggests that people who use marijuana heavily in their teens and early twenties—that is, during high school and college—are especially vulnerable to experiencing reductions in intelligence quotient (I.Q.) and memory impairment (Meier et al., 2012). Marijuana use has also been linked to deficits in complex attention, storing memory, planning sequencing abilities, and verbal and visual memory (Arria et al., 2013a; Arria et al., 2013b; Arria et al., 2013c; Falls et al., 2011; Hunt et al., 2010; Jacobus et al., 2013; Solowij et al., 2011). Further, marijuana use has been associated with reductions in college graduation, skipping class, early conduct problems, and lower grade point averages (Arria et al., 2013a; Arria et al., 2013b; Arria et al., 2013c).

The Surgeon General's ground-breaking Warning on Marijuana (Morbidity and Mortality Weekly Report, 1983) was the first report to discuss marijuana's impacts on multiple aspects of mental functioning, including performing skilled tasks (e.g., driving), short-term memory impairment (see also Office of National Drug Control Policy, 2004), and academic performance (see also Office of National Drug Policy, 2004). According to the Core Institute, approximately one-third of students fail to return to their respective universities after their freshmen year because of substance abuse issues, which often include marijuana use (Upcraft, 2002). Furthermore, Arria and colleagues (2013a) concluded that students who use drugs, especially

marijuana, spend less time studying, skip more classes, and earn lower GPA's. As a result of poor attendance, students who regularly used marijuana had fewer interactions with faculty and their peers. Additionally, those who use drugs are more likely to have disruptions in obtaining their degree because substances commandeer the brain reward pathways leading to less academic motivation (Arria et al., 2013a).

The Office of National Drug Control Policy in 2004 addressed popular rationalizations for marijuana use. Common myths college students believe include: marijuana is harmless; marijuana is not addictive; marijuana is not as harmful as tobacco; marijuana makes you mellow; marijuana is a safe medicine; everyone uses marijuana; and, buying marijuana doesn't hurt anyone (Arbour-Nicitopoulos et al., 2010; Gold and Nguyen, 2009; Kilmer et al., 2006; Labrie, et al, 2009; Lewis & Clemens, 2008). Results from Monitoring the Future (MTF; 2014) indicate that over 64% of 12th graders do not perceive marijuana use as harmful.

Regardless of universities best efforts, past 30 day marijuana use prevalence rates have been stable for the last two decades ranging from 14% in 1993 to 20% in 2013 (Johnston et al., 2014). Results from the 2014 National College Health Assessment II (NCHA II) survey indicate that 40% of college students have used marijuana at some point in their lifetime, with 20% using in the last 30 days. Similarly, results from the 2013 Core Alcohol and Drug Survey reveal that 45% of students used marijuana in their lifetime, 33% in the past year, and 19% reported current use – during the past 30 days. Marijuana has been associated with high-risk activities such as riding with a high driver or driving while high (Arria et al, 2011; Glascoff, 2013; Whitehall, 2014). Further, Fielder and colleagues (2013) found that students who use marijuana are more likely to engage in unprotected or unwanted sexual contact.

The current political landscape and public opinions indicate more permissive attitudes toward marijuana use, with several states voting to legalize recreational use of marijuana (Alaska, Colorado, Oregon, Washington; Governing, 2015) and many others supporting decriminalization and medicinal marijuana licenses (ProCon.org, 2015). Additionally, the U.S. Attorney General issued a memorandum indicating that the Department of Justice will not challenge state marijuana laws (Reilly, 2013), leading many to speculate that widespread legalization appears imminent.

To date, a dearth of research exists summarizing marijuana's associated effects on college students. These issues include college retention, reduced academic performance, health outcomes, and increased legal or conduct issues. The purpose of this systematic review was to assess the topics published on this subject, as well as the methods researchers employed, including: study design, location, target population, psychometrics, measured outcomes, and limitations.

## **Methods**

The search technique for this systematic literature review included the use of specific inclusion/exclusion criteria, databases, and key words. PubMed, Academic Search Complete, Electronic Journal Center, ProQuest, and Google Scholar were the five data bases used for this investigation. Search terms included: marijuana or cannabis and college students; marijuana or cannabis and college students and academics; marijuana or cannabis and college students and health; marijuana or cannabis and college students and law or legal; marijuana or cannabis and college students and conduct or judicial; marijuana or cannabis and college students and negative outcomes or consequences; marijuana or cannabis and college students and cognition; and marijuana or cannabis and college students and perceived norms. The reference section of each

of the articles was also reviewed to identify additional studies to include for the systematic review. The database examination occurred in December 2014.

Studies were included if they were published after 2000 and specifically focused on 17-24 year old US undergraduate students who used marijuana and reported on the associated effects. Studies were excluded from the analysis if the sample population used did not include exclusively US college students, the article was published before 2000, or if the research was intervention based. An intervention was defined as any study in which researchers employed an experimental design attempting to reduce marijuana use. While findings from these studies are important, their inclusion goes beyond the scope of the current analysis, which focuses on associated outcomes of marijuana use.

An initial assessment of all study titles to determine eligibility for inclusion and to eliminate duplicates across databases (n=70). If a study title was considered potentially eligible, the abstract was reviewed (n=61). Upon completion of abstract review, if a study was still appropriate for inclusion, the full-text article was obtained and reviewed (n=39). Next, a standardized data abstraction form was reviewed to attain study design, location, population, sample size, methods, measured outcomes, main results, and study limitations (n=35). Once the data forms were complete (see table 1 and 2), the second author reviewed all information and returned to original sources as needed for clarification. Researchers analyzed the descriptive statistics from the various studies to answer the aforementioned research questions.

## **Results**

Figure 1 illustrates the study selection process. Of the seventy articles identified in the literature search, nine were excluded by initial title review. After abstract review was complete, 22 articles were excluded because they were either not relevant (n=3), did not include US college

students as study participants (n=13), or were intervention based research (n=6). Thirty-nine full article texts were reviewed with four being excluded because they were not relevant to this inquiry. Search parameters included all studies published after 2000; however, the eligible studies were each published after 2006. The final number of articles included for systematic analysis was 35.

Study design, location, population, sample size, grant funding, and methods for each study are delineated in Table 1. The 35 articles included a variety of study designs: six included mixed methods (17%), seven were growth mixture models (20%), 13 were longitudinal (37%), and twenty were cross-sectional (57%). Sampling styles varied from random sampling (n=5; 14%), population/census (n=11; 31%) (seven of the 11 incorporated stratified-random sampling with their longitudinal surveys) and convenience (n=17; 49%). The institutions used a variety of data collection methods, including paper pencil (n=3); online software (n=16); mixed methods, specifically paper and pencil surveys and personal interviews (n=9); online mixed methods, specifically software that collected qualitative and quantitative data (n=3); and telephone interviews (n=1). Three institutions did not define the type of method used. Response rates were reported in 19 (54%) of the studies. Overall, surveys administered onsite elicited higher response rates than online surveys. For example, surveys administered onsite generated response rates greater than 50% the majority of the time (63%, n=12), while the online surveys yielded dismal response rates of less than a 20% approximately a third of the time (37%, n=7). Cronbach's Alpha Levels were reported on all measures in eight (23%) studies, some measures in 16 (46%) and no measures in 11 (31%). None of the 35 articles included information on expert review or test-retest measures.

Institutional locations varied from the West Coast (n=4), East Coast (n=10), Northeast (n=3), Southeast (n=5), Northwest (n=3), Southwest (n=2), Midwest (n=2), with eight institutions identifying multiple regions (n=3) or undefined regions (n=4). University size varied as well, 21 institutions were identified as large (10,000 or more students), three mid-sized (3,000-9,999 students), two small (1,000-2,999 students), nine were undefined, and two included participants from both large and small institutions (The Carnegie Classification of Institutions of Higher Education, 2010). There were 22 public and three private institutions with nine not identifying size and two including participants from both public and private. Target populations also varied from first year students or freshmen (n=15), undergraduate students in general (n=12), undergraduate college students who used marijuana (n=2), athletic status (n=2), female freshmen (n=1), students in a personal health class (n=1), and freshmen and sophomores (n=1).

### **Measured outcomes**

Table 2 highlights the primary outcomes, results, and limitations associated with the studies. Each of the 35 studies included marijuana use indicators. Nineteen examined normative influence, five assessed negative outcomes, four explored legal and safety issues, four examined physical and mental health, and three focused on academic influence. Common topics emerged from the primary measures. Risk factors for marijuana use were examined in 19 studies with measures including intention to use, campus social atmosphere, approval, age of first marijuana use, exposure opportunity, positive perception of users, low perceived risk, self-identification as a marijuana user, positive attitude toward use, and positive expectancies. Protective factors included 10 studies with measures of high perceived risk, interest in intervention, parental monitoring, religiosity, striving assessments, future self-orientation, negative perception of users, negative attitudes toward use, and negative expectancies. In 13 articles, the researchers examined



the influence of social norms including perceptions of use, and user and non-user status. Mental health problems included measures of cannabis use disorder, anxiety, depression, and schizotypy were addressed in nine of the articles. Negative consequences were discussed in seven studies and included measures of academic, legal/conduct, enrollment disruptions, and unsafe sexual practice. Four studies focused on substance related traffic risk including driving while high or riding with a high driver. Two studies each examined neurobiological consequences and reasons for marijuana use while only one focused on health outcomes.

### **Discussion**

The focus of this systematic review was to examine the existing literature concerning associated effects of marijuana use on college student academics, conduct and legal issues, negative outcomes, normative perceptions, and physical and mental health in the United States. After assessing four databases, 70 non-duplicate inquiries emerged. Upon evaluation of article titles, 61 abstracts were reviewed followed by a full text analysis of 39 studies. Thirty-five papers met the inclusion criteria. Data were obtained using a standardized extraction form including columns focused on study design, location, target population, sample size, study methods, measured outcomes, results, and limitations. Overall, articles were analyzed based on topical areas and scientific rigor.

The articles, which met the inclusion criteria, were conducted with varying degrees of rigor. Almost half of the studies (48%) used convenience samples, the majority (57%) were cross-sectional, and 45% used online data collection methods only. Consistent with Blair and colleagues research (2014) online surveys received lower response rates than survey's administered in person. None of the studies were based from a national sample limiting the external validity of the findings. Nearly half of the studies (47%) did not included response rates

calling into question the generalizability of the results. When response rates were included, they were low, with approximately half of the studies eliciting a response rate below 50%. Response bias is a particular concern, considering marijuana users are less likely to go to class or to complete an online survey, thus potentially skewing the data (Arria et al., 2013a; Arria et al., 2013b; Arria et al., 2013c). Indeed, Zhao et al. (2009) suggest it is necessary to evaluate any effect of non-response bias on every survey with a low response rate, something none of the researchers reported addressing in the current analysis. The authors in 31% of the studies failed to provide any information on reliability measures. Of the 46%, which provided reliability information, all of them adapted previously validated items from different surveys to create a new survey without conducting or reporting any additional reliability assessment(s). Sample sizes also varied. More than one quarter (n=10) of the studies included participant totals less than 300, which is problematic because the majority of studies (60%) were conducted at large institutions.

The capricious degrees of scientific rigor employed in the studies may reflect the funding associated with this topic. Federal grant funding supported 29 (83%) studies, which appears high, however, 10 (35%) of those studies were supported by the same National Institutes of Health grant. More funding is necessary to help researchers conduct a national study where results would be generalizable, beyond the institution where the research was conducted. This data would help inform grant funders, other researchers, as well as, inform practitioners in their decisions to spend what little prevention funds exist.

The Core, MTF and NCHA II provide prevalence rates of marijuana use, but they don't include specific information on important behavior change items such self-efficacy, expectancies, or other behavior change theoretical concepts. Although the Core and the NCHA II

each have large national datasets, institutions self-select to use these surveys. This self-selection is problematic as not all states are represented and each campus chooses their own method of administration. For example, one school may implement the survey using a convenience sample, another may use a random sample, while still another uses a cluster sample (e.g., administered in the classroom). Moreover, some of the surveys are implemented electronically while others are collected using a traditional paper/pencil format. While a national data set exists, the data are not collected uniformly limiting the external validity. Further, none of the standardized instruments asks students if they have a medical marijuana card or if they plan to get a medical marijuana card in the future. Perhaps this is due to how quickly states are adopting and implementing these policies and the research lag is temporary, nevertheless this represents a significant gap in the literature.

One of the challenges in securing funding for marijuana research is the federal scheduling of this substance. A U.S. District Judge (Mueller) upheld the federal classification of marijuana as a Schedule I Drug (Ferner, 2015) under the 1970 Controlled Substance Act (FDA, 2015). While this scheduling makes it more challenging for citizens to procure and use marijuana in many places, it also makes it very difficult to secure funding to conduct scientific research. The need for marijuana prevention and treatment has never been greater with more states legalizing medical and recreational marijuana. Currently 20 states have medical permissive laws (ProCon.org, 2015) and four states and the District of Columbia have enacted legislation allowing for recreational use of marijuana (Governing, 2015).

As with any type of research, there are inherent limitations, this also is true of systematic reviews. First, it is possible that despite the systematic review search strategy, some relevant articles were not included. The chance of this occurring was minimized by using a diverse

database search strategy. Second, focusing on a limited area of research methods may have left other areas under assessed or reported. For example, perhaps too much emphasis was placed on sample size and not enough on measuring effect size. Third, there was significant variation in study population, response rates, campus size, and reliability and validity measures. This could lead to varying interpretations of the literature. Fourth, because of the nature of this inquiry, the inclusion/exclusion criteria omitted marijuana prevention, intervention, or education programs. Fifth, undoubtedly unpublished studies exist, which is not related to the methods used for this study, but leaves in question what other research on this subject is being conducted.

In spite of these limitations, the findings from this systematic literature review provide an overall assessment of the research conducted on marijuana use and its impact on college students. The field would benefit from a meta-analysis of the literature focusing on intervention-based research to ascertain best practices for marijuana prevention similar to the National Institutes on Alcohol Abuse and Alcoholism *tiers of effectiveness* for alcohol prevention on college campuses (NIAAA, 2002). The tiers were classified as follows: “effective among college students (tier 1; p.16); effective with general populations that could be applied to college environments (tier 2; p. 17); logical and theoretical promise, but require more comprehensive evaluation (tier 3; p. 20); and, ineffective (tier 4; p. 23).” A nationally convened team created this classification protocol and developed the initiative, termed: *A Call to Action: Changing the Culture of Drinking on US Colleges* (NIAAA, 2002), researchers and practitioners need to employ similar methods to address marijuana.

Marijuana use continues to have a negative effect on college students across the US. Students who use marijuana report attending class less often, higher rates of disenrollment, and experiencing a myriad of other consequences more frequently. These negative outcomes are

likely to escalate as access continues to increase. Based on the results from this study, future research needs to be conducted with more scientific rigor. Areas to focus on include using randomized sampling methods, collecting representative response rates, and employing appropriate reliability and validity measures. The authors of this study recommend that state and federal policy makers, grant funders, and journal editors and reviewers require more rigorous research practices and encourage the advocacy of more funding in this area.

Table 1: Study Design and Characteristics

Academics					
<u>Author, Year</u>	<u>Study Design</u>	<u>Study Location</u>	<u>Target Population</u>	<u>Sample Size</u>	<u>Methods</u>
Arria, 2013a*	<ul style="list-style-type: none"> <li>Longitudinal, mixed method.</li> <li>Population sample for baseline.</li> <li>Stratified-random sampling for annual follow-up.</li> </ul>	<ul style="list-style-type: none"> <li>Large public university.</li> <li>East coast.</li> </ul>	First year freshmen.	1145	<ul style="list-style-type: none"> <li>2 hour baseline assessment included both interviews and surveys in a computer lab.</li> <li>Interviewed annually for 4 years.</li> </ul>
Arria, 2013b*	<ul style="list-style-type: none"> <li>Longitudinal, mixed method.</li> <li>Population sample for baseline.</li> <li>Stratified-random sampling for annual follow-up.</li> </ul>	<ul style="list-style-type: none"> <li>Large public university.</li> <li>East coast.</li> </ul>	First year freshmen.	1145	<ul style="list-style-type: none"> <li>2 hour baseline assessment included both interviews and surveys in a computer lab.</li> <li>Interviewed annually for 4 years</li> <li>Items adapted from Beck Depression Inventory Scale, Beck Anxiety Inventory Scale, and the Conduct Disorder Screener scale.</li> </ul>
Arria, 2013c*	<ul style="list-style-type: none"> <li>Longitudinal, mixed method.</li> <li>Population sample for baseline.</li> <li>Stratified-random sampling for annual follow-up.</li> </ul>	<ul style="list-style-type: none"> <li>Large public university.</li> <li>East coast.</li> </ul>	First year freshmen.	1133	<ul style="list-style-type: none"> <li>2 hour baseline assessment included both interviews and surveys in a computer lab.</li> <li>Interviewed annually for 4 years.</li> <li>Items related to marijuana were adapted from the NEO-Five Factor Inventory with <math>\alpha \geq 0.73</math>; Zuckerman-Kuhlman Personality Questionnaire Short form <math>\alpha \geq 0.68</math>; Dysregulation Inventory measure <math>\alpha \geq 0.84</math>.</li> </ul>
Legal/Safety					
Arria, 2011*	<ul style="list-style-type: none"> <li>Longitudinal, mixed method.</li> <li>Population sample for baseline.</li> <li>Stratified-random sampling for annual follow-up.</li> </ul>	<ul style="list-style-type: none"> <li>Large public university.</li> <li>East coast</li> </ul>	First year freshmen.	1194	<ul style="list-style-type: none"> <li>2 hour baseline assessment included both interviews and surveys in a computer lab.</li> <li>Annual follow-up for 3 years.</li> </ul>
Falls, 2011*	<ul style="list-style-type: none"> <li>Cross-sectional design.</li> <li>Population sample.</li> </ul>	<ul style="list-style-type: none"> <li>Large public university.</li> <li>East coast.</li> </ul>	First year freshmen.	1067	<ul style="list-style-type: none"> <li>2 hour baseline assessment included both interviews and surveys in a computer lab.</li> <li>Dysregulation inventory scale <math>\alpha \geq 0.84</math></li> <li>College early conduct problems index <math>\alpha = .765</math></li> <li>DSM-IV criteria for conduct disorder used.</li> </ul>

Glascoff, 2013	<ul style="list-style-type: none"> <li>• Cross-sectional, online survey.</li> <li>• Convenience sample.</li> </ul>	<ul style="list-style-type: none"> <li>• Large public university.</li> <li>• Southeast region.</li> </ul>	Students enrolled in a personal health class.	1446	<ul style="list-style-type: none"> <li>• Students were recruited from a university required personal health course to take an online survey one time. Participation was voluntary.</li> </ul>
Whitehall, 2014*	<ul style="list-style-type: none"> <li>• Cross-sectional pre-posttest telephone survey.</li> <li>• Random sample.</li> </ul>	<ul style="list-style-type: none"> <li>• 2 large public universities.</li> <li>• Multiple regions.</li> </ul>	First year freshmen.	315	<ul style="list-style-type: none"> <li>• Pretest/posttest design. One year interval.</li> </ul>
Negative Outcomes					
Buckman, 2011	<ul style="list-style-type: none"> <li>• Athletes – population survey.</li> <li>• Non-athlete – convenience sample.</li> <li>• Cross-sectional.</li> </ul>	<ul style="list-style-type: none"> <li>• Large public university.</li> <li>• Northeast region.</li> </ul>	Undergraduate athletes.	392 athletes. 504 non.	<ul style="list-style-type: none"> <li>• Paper pencil survey.</li> <li>• Items adapted from Rutgers Health and Human Development Project, the Harvard School of Public Health College Alcohol Study; Sensation Seeking items (<math>\alpha = 0.88</math>), the Profile of Mood States Brief Form (<math>\alpha \geq 0.71</math>), body image stress subscale (<math>\alpha = 0.87</math>), academic stress subscale (<math>\alpha = 0.74</math>), and Marijuana motives Measure (<math>\alpha \geq 0.76</math>).</li> </ul>
Caldeira, 2008*	<ul style="list-style-type: none"> <li>• Longitudinal, growth mixture modeling.</li> <li>• Population sample for baseline.</li> <li>• Stratified-random sampling for annual follow-up.</li> </ul>	<ul style="list-style-type: none"> <li>• Large public university.</li> <li>• East coast</li> </ul>	First year freshmen.	1253	<ul style="list-style-type: none"> <li>• 2 hour baseline assessment included both interviews and surveys in a computer lab.</li> <li>• Annual follow-up for 7 years.</li> <li>• College Life Study was used along with items adapted from National Survey on Drug Use and Health.</li> </ul>
Fielder, 2013*	<ul style="list-style-type: none"> <li>• Prospective longitudinal design.</li> <li>• Convenience sample.</li> </ul>	<ul style="list-style-type: none"> <li>• Private university.</li> <li>• Size not defined.</li> <li>• Northeast region.</li> </ul>	First year female undergraduate students.	483	<ul style="list-style-type: none"> <li>• 1 Baseline with 8 monthly follow-ups.</li> </ul>
Kilmer, 2007	<ul style="list-style-type: none"> <li>• Longitudinal.</li> <li>• Cross-sectional.</li> </ul>	<ul style="list-style-type: none"> <li>• Public/private not defined.</li> <li>• Size not defined.</li> <li>• Northwest region.</li> </ul>	First year freshmen.	725	<ul style="list-style-type: none"> <li>• Online baseline survey.</li> <li>• Items adapted from the Global Appraisal of Individual Needs – 1 survey and the Rutgers Marijuana Problem Index</li> </ul>
Palmer, 2012	<ul style="list-style-type: none"> <li>• Cross-sectional.</li> <li>• Convenience sample.</li> </ul>	<ul style="list-style-type: none"> <li>• Small private university.</li> <li>• Public/private not defined.</li> <li>• Northeast region.</li> </ul>	Undergraduate students.	262	<ul style="list-style-type: none"> <li>• Paper/pencil distribution of survey.</li> <li>• Items adapted from the Addiction Severity Index, Young Adult Alcohol Problem Screening test (<math>\alpha \geq 0.92</math>).</li> </ul>
Norms					
Buckner, 2012*	<ul style="list-style-type: none"> <li>• Convenience sample.</li> <li>• Ecological momentary assessment</li> </ul>	<ul style="list-style-type: none"> <li>• Large public university.</li> <li>• Southeast region.</li> </ul>	Undergraduate students.	49	<ul style="list-style-type: none"> <li>• Multiple daily ratings of marijuana cravings, anxiety, and peer marijuana</li> </ul>

	design.					use over 2 week period. <ul style="list-style-type: none"><li>The prompts to record ratings came at different times of the day.</li><li>Items adapted from Anxiety Disorders Interview Schedule-IV-L, Marijuana Use form, Subjective Units of Distress.</li></ul>
Buckner, 2013*	<ul style="list-style-type: none"><li>Cross-sectional design.</li><li>Convenience sample.</li></ul>	<ul style="list-style-type: none"><li>Large public university.</li><li>Southeast region.</li></ul>	Undergraduate students.	223		<ul style="list-style-type: none"><li>Online survey.</li><li>Items adapted from Core (<math>\alpha \geq 0.87</math>); Marijuana effects Expectancy Questionnaire (<math>\alpha = 0.86</math>); Marijuana Motives Measure (<math>\alpha \geq 0.81</math>); marijuana problem scale (<math>\alpha = 0.76</math>).</li></ul>
Comello, 2010	<ul style="list-style-type: none"><li>Cross-sectional.</li><li>Mixed-method.</li><li>Convenience sample.</li></ul>	<ul style="list-style-type: none"><li>Large public university.</li><li>Midwest region.</li></ul>	Undergraduate students.	139/12		<ul style="list-style-type: none"><li>Online survey (n=139).</li><li>Focus groups (n=12).</li><li><math>\alpha \geq 0.66</math> for measures of social attractiveness, sensation-seeking, social anxiety, and normative success.</li></ul>
Comello, 2013	<ul style="list-style-type: none"><li>Cross-sectional design.</li><li>Convenience sample.</li></ul>	<ul style="list-style-type: none"><li>Large public university.</li><li>Region not defined.</li></ul>	Undergraduate students.	139		<ul style="list-style-type: none"><li>Online survey.</li><li>Adapted items from Short Sensation Seeking Scale, <math>\alpha = 0.82</math>.</li><li>Attitudes scale <math>\alpha = 0.47</math>.</li><li>User attributes scale <math>\alpha = 0.87</math>.</li></ul>
Ecker, 2014*	<ul style="list-style-type: none"><li>Cross-sectional design.</li><li>Convenience sample.</li></ul>	<ul style="list-style-type: none"><li>Large public university.</li><li>Southeast region.</li></ul>	Undergraduate students.	158		<ul style="list-style-type: none"><li>Online survey.</li><li>Adapted items from Marijuana use form, Daily Drug Taking Questionnaire, Marijuana Problem Scale (<math>\alpha \geq 0.92</math>); Alcohol Injunctive norms scale (<math>\alpha = 0.89</math>), and social phobia scale (<math>\alpha = .092</math>).</li></ul>
Gaher, 2007*	<ul style="list-style-type: none"><li>Cross-sectional design.</li><li>Convenience sample.</li></ul>	<ul style="list-style-type: none"><li>Size not defined.</li><li>Public/private not defined.</li><li>Location not defined.</li></ul>	Undergraduate students.	804		<ul style="list-style-type: none"><li>Online survey.</li><li>Marijuana use intensity test-retest over a 6 month period, <math>r = .88</math>),</li><li>Marijuana problem index (<math>\alpha = 0.96</math>)</li><li>Marijuana effect expectancies Questionnaire, <math>\alpha \geq 0.68</math>.</li><li>Inventory of Drug Use Consequences adapted for marijuana use only (<math>\alpha = 0.98</math>).</li></ul>
Gold, 2009	<ul style="list-style-type: none"><li>Stratified-random sample for actual use survey.</li></ul>	<ul style="list-style-type: none"><li>Large public university.</li><li>West coast.</li></ul>	Undergraduate students.	1582		<ul style="list-style-type: none"><li>Actual use survey (n=1101)</li><li>Perceived use survey (n=481)</li></ul>



	<ul style="list-style-type: none"> <li>• Convenience sample for perceived use survey.</li> <li>• Both were cross-sectional.</li> </ul>					<ul style="list-style-type: none"> <li>• Paper/pencil survey.</li> <li>• National College Health Assessment.</li> <li>• Humboldt State University – Health and Health Risk Behaviors Survey was created using items from CA Healthy Kids Survey, CA Health Interview Survey, National College Health Risk Behavior Survey.</li> </ul>
Kaynak, 2013*	<ul style="list-style-type: none"> <li>• Longitudinal study design.</li> <li>• Population sample.</li> </ul>	<ul style="list-style-type: none"> <li>• Large public university.</li> <li>• East coast.</li> </ul>	First year freshmen.	1253		<ul style="list-style-type: none"> <li>• 2 hour baseline assessment included both interviews and surveys in a computer lab.</li> <li>• Questions adapted from the National Survey on Drug Use and Health; the Parental Monitoring Scale (<math>\alpha = 0.76</math>), Zuckerman-Kuhlman Personality Questionnaire-Short Form (<math>\alpha = 0.74</math>).</li> </ul>
Kilmer, 2006*	<ul style="list-style-type: none"> <li>• Cross-sectional.</li> <li>• Random selection.</li> </ul>	<ul style="list-style-type: none"> <li>• Three universities.</li> <li>• Public/private not defined.</li> <li>• Size not defined.</li> <li>• Northwest Region.</li> </ul>	Undergraduate students.	5990		<ul style="list-style-type: none"> <li>• Online survey.</li> <li>• Marijuana items were adapted from Core, the Customary Drinking and Drug Use Record (<math>\alpha \geq 0.72</math>).</li> </ul>
LaBrie, 2009*	<ul style="list-style-type: none"> <li>• Population sample.</li> <li>• Cross-sectional.</li> </ul>	<ul style="list-style-type: none"> <li>• 2 NCAA division 1 Private, 1 public.</li> <li>• Both are mid-sized universities.</li> <li>• 1 on the East coast, 1 on the West coast.</li> </ul>	Undergraduate athletes.	522		<ul style="list-style-type: none"> <li>• Online survey for consent and demographics.</li> <li>• Homogenous gendered group meetings at individual institutions, clickers were used to gather live assessment data of perceived and actual behavior.</li> </ul>
LaBrie, 2011*	<ul style="list-style-type: none"> <li>• Random selection.</li> <li>• Cross-sectional.</li> </ul>	<ul style="list-style-type: none"> <li>• Two universities.</li> <li>• 1 large public institution, 1 mid-sized private institution.</li> <li>• West coast.</li> </ul>	Undergraduate students.	3553		<ul style="list-style-type: none"> <li>• Online survey.</li> <li>• Alpha level for items measuring individual attitudes and injunctive norms was <math>\geq 0.69</math>.</li> </ul>
Lewis, 2008	<ul style="list-style-type: none"> <li>• Nonprobability convenience sample.</li> <li>• Cross-sectional.</li> </ul>	<ul style="list-style-type: none"> <li>• Medium-sized university.</li> <li>• Public/private not defined.</li> <li>• Southwest region.</li> </ul>	Undergraduate students.	235		<ul style="list-style-type: none"> <li>• Paper/pencil survey.</li> <li>• Items adapted from the Alcohol and Other Drug Survey with <math>\alpha</math> levels ranging from 0.70 to 0.78.</li> </ul>
Napper, 2014*	<ul style="list-style-type: none"> <li>• Cross-sectional.</li> <li>• Convenience sample.</li> </ul>	<ul style="list-style-type: none"> <li>• Private mid-sized university.</li> <li>• West coast.</li> </ul>	Undergraduate students.	414		<ul style="list-style-type: none"> <li>• Online survey.</li> <li>• Marijuana approval and injunctive norms and parental monitoring each had alpha levels above 0.75.</li> </ul>
Neighbors,	<ul style="list-style-type: none"> <li>• Longitudinal.</li> </ul>	<ul style="list-style-type: none"> <li>• Large public university.</li> </ul>	First year	308		<ul style="list-style-type: none"> <li>• Online screening survey revealed</li> </ul>

2008*	<ul style="list-style-type: none"> <li>Population sample.</li> </ul>	<ul style="list-style-type: none"> <li>Region not defined.</li> </ul>	freshmen.		<p>students who had used marijuana in the past 90 days.</p> <ul style="list-style-type: none"> <li>These students were invited to participate in the longitudinal study.</li> <li>Items adapted from Marijuana Effect Expectancy Questionnaire (<math>\alpha = 0.67</math>) and the Global Appraisal of Individual Needs -1 survey (<math>\alpha = 0.75</math>).</li> </ul>
Neighbors, 2013*	<ul style="list-style-type: none"> <li>Cross-sectional.</li> <li>Random selection.</li> </ul>	<ul style="list-style-type: none"> <li>2 public universities.</li> <li>Northwest region.</li> </ul>	Undergraduate students who used marijuana.	107	<ul style="list-style-type: none"> <li>Online survey.</li> <li>Items adapted from Daily Drug Questionnaire.</li> </ul>
Pinchevsky, 2011*	<ul style="list-style-type: none"> <li>Longitudinal, growth mixture modeling.</li> <li>Population sample for baseline.</li> <li>Stratified-random sampling for annual follow-up.</li> </ul>	<ul style="list-style-type: none"> <li>Large public university.</li> <li>East Coast.</li> </ul>	First year freshmen.	1253	<ul style="list-style-type: none"> <li>2 hour baseline assessment included both interviews and surveys in a computer lab.</li> <li>Annual follow-up for 7 years.</li> <li>Items for parental monitoring <math>\alpha = 0.75</math>.</li> <li>Adapted items from Zucherman-Kuhlman Personality Questionnaire-Short Form <math>\alpha = 0.72</math>.</li> </ul>
Simons, 2006*	<ul style="list-style-type: none"> <li>Cross-sectional.</li> <li>Convenience sample.</li> </ul>	<ul style="list-style-type: none"> <li>Small public university.</li> <li>Region not defined.</li> </ul>	Undergraduate students.	292	<ul style="list-style-type: none"> <li>Online survey in a computer lab.</li> <li>Measures created by researchers included Marijuana related problems scale <math>\alpha = 0.86</math>; social norms scale <math>\alpha = 0.90</math>; personal strivings; and perceived utility/conflict (<math>\alpha = 0.92</math>).</li> <li>Adapted Eysenck's Impulsivity Scale <math>\alpha \geq 0.78</math>.</li> </ul>
Stewart, 2014*	<ul style="list-style-type: none"> <li>Longitudinal.</li> <li>Random selection.</li> </ul>	<ul style="list-style-type: none"> <li>2 Large public universities.</li> <li>Multiple regions.</li> </ul>	First year freshmen.	275	<ul style="list-style-type: none"> <li>Phone interviews before and after their freshmen year.</li> </ul>
Suerken, 2014	<ul style="list-style-type: none"> <li>Population sample for baseline.</li> <li>Random sample for longitudinal study.</li> </ul>	<ul style="list-style-type: none"> <li>11 universities.</li> <li>10 are public, 1 is private.</li> <li>Size not defined.</li> <li>Southeast region.</li> </ul>	First year freshmen.	3146	<ul style="list-style-type: none"> <li>Online baseline survey.</li> <li>Survey each semester for 8 semesters.</li> <li>Items were adapted from Brief Sensation-Seeking Scale (<math>\alpha = 0.81</math>), Center for Epidemiological Studies</li> </ul>

Depression Iowa Short Form ( $\alpha = 0.84$ ), and the Perceived Stress Scale ( $\alpha = 0.84$ ).

Physical and Mental Health

Arterberry, 2013*	<ul style="list-style-type: none"> <li>• Cross-sectional design.</li> <li>• Population sample</li> </ul>	<ul style="list-style-type: none"> <li>• Size not defined.</li> <li>• Private/public not defined.</li> <li>• Midwest region.</li> </ul>	First year freshmen.	597	<ul style="list-style-type: none"> <li>• Online survey in a psychology course.</li> <li>• Adapted items from Drinking Styles Questionnaire for marijuana.</li> <li>• Marijuana effect expectancy Questionnaire short form <math>\alpha \geq 0.76</math>.</li> </ul>
Beck, 2009*	<ul style="list-style-type: none"> <li>• Longitudinal, mixed method.</li> <li>• Population sample for baseline.</li> <li>• Stratified-random sampling for annual follow-up.</li> </ul>	<ul style="list-style-type: none"> <li>• Large public university.</li> <li>• East coast.</li> </ul>	Undergraduate students who used marijuana.	322	<ul style="list-style-type: none"> <li>• 2 hour baseline assessment included both interviews and surveys in a computer lab.</li> <li>• Interview at 1 year.</li> <li>• Surveys adapted: Center for Epidemiological Studies Depression Scale; Beck Depression Inventory;</li> <li>• Social context of cannabis use scale included PCA with varimax rotation and eigen values <math>&lt;.5</math>, <math>\alpha = .762</math>.</li> </ul>
Caldeira, 2012*	<ul style="list-style-type: none"> <li>• Longitudinal, growth mixture modeling.</li> <li>• Population sample.</li> <li>• Population sample for baseline.</li> <li>• Stratified-random sampling for annual follow-up.</li> </ul>	<ul style="list-style-type: none"> <li>• Large public university.</li> <li>• East coast.</li> </ul>	First year freshmen.	1253	<ul style="list-style-type: none"> <li>• 2 hour baseline assessment included both interviews and surveys in a computer lab.</li> <li>• Annual follow-up for 7 years.</li> <li>• General health questionnaire, Beck depression Inventory scale, and beck anxiety scale, abbreviated WHO Quality of Life scale, had reliability of <math>\alpha \geq 0.75</math>.</li> </ul>
Najolia, 2012**	<ul style="list-style-type: none"> <li>• Cross-sectional design.</li> <li>• Convenience sample.</li> </ul>	<ul style="list-style-type: none"> <li>• Large public university.</li> <li>• Southwest region.</li> </ul>	Freshmen and sophomores.	2145	<ul style="list-style-type: none"> <li>• Online survey.</li> <li>• Adapted item from Core survey, no <math>\alpha</math> reported.</li> <li>• Marijuana problem scale <math>\alpha = 0.98</math></li> <li>• Social interaction anxiety scale <math>\alpha = 0.98</math></li> </ul>

Note. One \* and two \*\* denote federally and state funded grants respectively.

Table 2: Primary Outcomes, Results, and Limitations

Academics			
<u>Author, Year</u>	<u>Measured Outcomes</u>	<u>Main Results</u>	<u>Limitations</u>
Arria, 2013a	<ul style="list-style-type: none"> <li>• Prevalence.</li> <li>• Adverse consequences.</li> <li>• Neurobiological consequences.</li> <li>• Mental health problems.</li> </ul>	<ul style="list-style-type: none"> <li>• 22% used drugs in the last month, most common drug used was marijuana.</li> <li>• Students who use drugs, especially marijuana, spend less time studying, skip more classes, earn lower GPA's. This reduces their interaction with the classroom learning experience and faculty and other students.</li> <li>• Those who use drugs are more likely to have disruptions in obtaining their degree.</li> <li>• Those who use drugs experience less academic motivation because substances "hijack" the brains reward pathways.</li> <li>• Reducing drug use is a viable way to increase retention and academic performance.</li> </ul>	<ul style="list-style-type: none"> <li>• Self-reported data.</li> <li>• Not generalizable.</li> <li>• Only closed ended questions were used during interviews.</li> <li>• Reliability and validity were not reported.</li> </ul>
Arria, 2013b	<ul style="list-style-type: none"> <li>• Psychiatric diagnosis.</li> <li>• Substance use.</li> </ul>	<ul style="list-style-type: none"> <li>• Marijuana use led to late discontinuity in college (discontinuing enrollment in years 3 or 4).</li> </ul>	<ul style="list-style-type: none"> <li>• Self-reported data, including psychiatric diagnosis.</li> <li>• Not generalizable.</li> <li>• Not able to track whether students who discontinued enrollment at the study institution enrolled elsewhere.</li> <li>• Other non-measurable factors could have led to observed associations.</li> <li>• Only closed ended questions were used during interviews.</li> <li>• Reliability and validity were not reported.</li> </ul>
Arria, 2013c	<ul style="list-style-type: none"> <li>• Continuous enrollment.</li> <li>• Substance use.</li> <li>• Marijuana use disorder.</li> </ul>	<ul style="list-style-type: none"> <li>• Infrequent, increasing, and chronic/heavy marijuana use were all associated with discontinuous enrollment.</li> </ul>	<ul style="list-style-type: none"> <li>• Self-reported data.</li> <li>• Not generalizable.</li> <li>• Difficult to make inferences on temporal relationships between drug use and discontinued enrollment.</li> <li>• Measurement of drug use problems was challenging because they measured for 10 different drugs annually.</li> <li>• Only closed ended questions were used during interviews.</li> </ul>
Legal/safety			
Arria, 2011	<ul style="list-style-type: none"> <li>• Substance-related traffic-risk.</li> </ul>	<ul style="list-style-type: none"> <li>• Marijuana is the most commonly mentioned drug used during drugged driving episodes.</li> </ul>	<ul style="list-style-type: none"> <li>• Self-reported data.</li> <li>• Not generalizable.</li> </ul>

	<ul style="list-style-type: none"> <li>• Past-year drug use.</li> <li>• Alcohol and marijuana dependence.</li> <li>• Access to a car.</li> </ul>	<ul style="list-style-type: none"> <li>• One in six participants who had access to a car drove drugged in the past year, regardless of age.</li> <li>• More than 55% of drugged drivers drove drugged more than 3 times a year, regardless of age.</li> <li>• White males are the most common drugged drivers, regardless of age.</li> <li>• One in four college students rode with a drugged driver at least once in the past year. This number began to decline after the age of 22.</li> <li>• White males are the most likely to ride with a drugged driver, regardless of age.</li> <li>• Marijuana dependence is most likely among drugged drivers, regardless of age.</li> </ul>	<ul style="list-style-type: none"> <li>• Whites may have had more access to cars.</li> <li>• No definition was provided to explain what drugged driving was.</li> <li>• Only closed ended questions were used during interviews.</li> <li>• <math>\alpha</math> levels not reported for CLS in this manuscript.</li> </ul>
Falls, 2011	<ul style="list-style-type: none"> <li>• Early conduct problems.</li> <li>• Early marijuana use opportunity.</li> <li>• Early marijuana use.</li> </ul>	<ul style="list-style-type: none"> <li>• Early conduct issues are associated with marijuana use.</li> </ul>	<ul style="list-style-type: none"> <li>• Self-reported data.</li> <li>• Not generalizable.</li> <li>• Convenience sample.</li> <li>• Only closed ended questions were used during interviews.</li> </ul>
Glascoff, 2013	<ul style="list-style-type: none"> <li>• Driving while high or riding with a high driver.</li> <li>• Marijuana use.</li> <li>• Designated driving behaviors.</li> </ul>	<ul style="list-style-type: none"> <li>• It is more popular to be a designated driver for someone using alcohol than for someone smoking marijuana.</li> <li>• 65% of marijuana using participants said they thought it was ok to drive after smoking marijuana (88% of respondents had reported using marijuana).</li> </ul>	<ul style="list-style-type: none"> <li>• Self-reported data.</li> <li>• Not generalizable.</li> <li>• Convenience sample.</li> <li>• Reliability and validity not reported.</li> <li>• Online survey administration.</li> </ul>
Whitehall, 2014	<ul style="list-style-type: none"> <li>• Driving after using marijuana.</li> <li>• Riding with a driver who has been using marijuana.</li> </ul>	<ul style="list-style-type: none"> <li>• Among all students, 13% had ridden in a car with a drugged driver in the past year.</li> <li>• 43% of current marijuana using males had driven drugged in the past year.</li> <li>• Current marijuana users were more likely to ride with a drugged driver.</li> <li>• Later onset of marijuana use was decreased the likelihood that a participant would drive drugged.</li> </ul>	<ul style="list-style-type: none"> <li>• Not generalizable.</li> <li>• Self-reported data.</li> <li>• Small sample size.</li> <li>• Majority of respondents were white.</li> <li>• There was no assessment of time between substance use and driving, level of impairment, and the number of traffic related accidents.</li> <li>• Reliability and validity not reported.</li> </ul>
Negative Outcomes			
Buckman, 2011	<ul style="list-style-type: none"> <li>• Marijuana use.</li> <li>• Risk factors.</li> </ul>	<ul style="list-style-type: none"> <li>• Non-athletes were most likely to use marijuana than student athletes.</li> <li>• For both genders and status as student athlete or non-athlete, being white, smoking cigarettes in the past year, having a high sensation-seeking personality, and misperceiving student marijuana use norms were associated with marijuana use.</li> </ul>	<ul style="list-style-type: none"> <li>• Self-reported.</li> <li>• Not generalizable.</li> <li>• Online survey.</li> <li>• Cannot prove causality.</li> <li>• Multiple recruitment methods.</li> <li>• Reliability and validity not reported for all items.</li> </ul>
Caldeira,	<ul style="list-style-type: none"> <li>• Illicit drug use.</li> </ul>	<ul style="list-style-type: none"> <li>• Almost 1 in 10 students met the criteria for the DSM-IV CUD diagnosis.</li> </ul>	<ul style="list-style-type: none"> <li>• Students who used marijuana less than 5 days</li> </ul>

2008	<ul style="list-style-type: none"> <li>CUD and other marijuana related disorders</li> </ul>	<ul style="list-style-type: none"> <li>40% of marijuana users reported problems concentrating.</li> <li>14% of marijuana users reported missing class.</li> </ul>	<ul style="list-style-type: none"> <li>in the past year were not included.</li> <li>Not generalizable.</li> <li>Self-reported data.</li> <li>Only closed ended questions were used during interviews.</li> <li>Only closed ended questions were used during interviews.</li> <li>Validity and reliability measures were not reported.</li> </ul>
Fielder, 2013	<ul style="list-style-type: none"> <li>Substance use.</li> <li>Hook-up behavior.</li> </ul>	<ul style="list-style-type: none"> <li>Marijuana use predicted hook-up behavior. Female students who used marijuana were more likely to hook-up than female students who didn't use marijuana.</li> </ul>	<ul style="list-style-type: none"> <li>Self-reported.</li> <li>Not generalizable.</li> <li>Convenience sample.</li> <li>Only a sub-set of personality traits were included.</li> <li>Reliability and validity were not reported.</li> </ul>
Kilmer, 2007	<ul style="list-style-type: none"> <li>Marijuana use.</li> <li>Perceived risk of marijuana use.</li> <li>Consequences of marijuana use.</li> </ul>	<ul style="list-style-type: none"> <li>70% of students who had never used marijuana perceived there to be future academic consequences if they used marijuana. 55% perceived future social consequences if they smoked marijuana.</li> <li>20% of students who had used marijuana in the past perceived there to be future academic consequences if they keep using marijuana. 42% reporting experiencing academic consequences already.</li> <li>35% of students who had used marijuana in the past reported that they had experienced past year social consequences. 9% reported that they perceived risk of future social consequences.</li> </ul>	<ul style="list-style-type: none"> <li>Self-reported data.</li> <li>Online survey.</li> <li>Reliability and validity not reported for all.</li> </ul>
Palmer, 2012	<ul style="list-style-type: none"> <li>Illicit drug use.</li> <li>Negative consequences.</li> <li>Personal concerns.</li> <li>Interest in intervention.</li> </ul>	<ul style="list-style-type: none"> <li>Recent drug use was associated with greater negative consequences.</li> <li>Past month marijuana use was associated with medication misuse, concern about drug use, and experiencing drug-related negative consequences in the past year.</li> </ul>	<ul style="list-style-type: none"> <li>Self-reported.</li> <li>Not generalizable.</li> <li>Small sample size.</li> <li>Convenience sample.</li> <li>72% were white.</li> <li>Reliability and validity were not reported for all measures.</li> </ul>
Norms			
Buckner, 2012	<ul style="list-style-type: none"> <li>Self-marijuana use.</li> <li>Craving.</li> <li>Anxiety.</li> <li>Situation type.</li> <li>Other's marijuana use.</li> </ul>	<ul style="list-style-type: none"> <li>Marijuana use is most likely to occur between 6pm and midnight.</li> <li>Anxiety and marijuana cravings both led to marijuana use.</li> <li>Participants were significantly more likely to use marijuana when in social situations where others were using marijuana.</li> <li>Evidence for the mutual maintenance model existed in this study. The MMM of anxiety and substance use suggests that regardless of whether</li> </ul>	<ul style="list-style-type: none"> <li>Self-reported.</li> <li>Not generalizable.</li> <li>Small sample size.</li> <li>Convenience sample.</li> <li>There was no practice period for participants to ensure they understood how to properly record</li> </ul>

marijuana use or anxiety came first, a vicious cycle begins where marijuana is perceived to temporarily relieve anxiety, but a withdrawal symptom of marijuana is anxiety. This leads to a marijuana use cycle to attempt to control the anxiety.

Buckner, 2013	<ul style="list-style-type: none"> <li>• Descriptive norms and self-use.</li> <li>• Injunctive norms.</li> <li>• Cognitive risk-factors.</li> </ul>	<ul style="list-style-type: none"> <li>• Marijuana use frequency can be predicted by descriptive norms, injunctive norms, and coping and enhancement motives.</li> <li>• Descriptive and injunctive norms were strongest predictors of marijuana self-use.</li> <li>• Both infrequent and weekly marijuana users overestimated the number of students who smoked marijuana yearly.</li> </ul>	<p>for EMA.</p> <ul style="list-style-type: none"> <li>• Only anxiety was measured and no other negative affective states.</li> <li>• No <math>\alpha</math> reported for Anxiety Disorders Interview Schedule-IV-L, Marijuana Use form, Subjective Units of Distress.</li> <li>• Self-reported.</li> <li>• Not generalizable.</li> <li>• Online survey.</li> <li>• Small sample size.</li> <li>• Convenience sample.</li> <li>• Majority of the sample were female, non-Hispanic students who worked part- or full-time.</li> <li>• Cross-sectional design limits ability to test causal relationship.</li> <li>• <math>\alpha</math> not reported for infrequency scale.</li> <li>• Test-retest not run reported for the full instrument.</li> </ul>
Comello, 2010	<ul style="list-style-type: none"> <li>• Self-view.</li> <li>• User and non-user prototype views.</li> <li>• Intention to use.</li> </ul>	<ul style="list-style-type: none"> <li>• Most participants did not see the user prototype as more attractive or successful than non-user prototypes.</li> <li>• Non-white males reported higher-levels of social attractiveness, marijuana use acceptance, marijuana linkage to highly desirable traits (creative thinking, swagger in self-presentation,</li> </ul>	<ul style="list-style-type: none"> <li>• Self-reported.</li> <li>• Not generalizable.</li> <li>• Online survey.</li> <li>• Small sample size.</li> <li>• Convenience sample.</li> <li>• Only two focus groups were conducted and one had 4 participants. No saturation.</li> <li>• Design limits causality.</li> <li>• Lacked measures of self-prototype congruence.</li> <li>• Reliability and validity were not reported for each scale.</li> </ul>
Comello, 2013	<ul style="list-style-type: none"> <li>• Perceptions of user attributes.</li> <li>• Risk-oriented attitudes.</li> <li>• Risk-oriented future self.</li> <li>• Marijuana use.</li> </ul>	<ul style="list-style-type: none"> <li>• How participants envision themselves in the future (as risk-adverse or risk-seeking) shape attitudes toward marijuana now.</li> </ul>	<ul style="list-style-type: none"> <li>• Self-reported.</li> <li>• Not generalizable.</li> <li>• Online survey.</li> <li>• Small sample size.</li> <li>• Convenience sample.</li> <li>• Two latent variables had only two indicators each.</li> <li>• Claims and causality are limited.</li> </ul>

Ecker, 2014	<ul style="list-style-type: none"> <li>• Marijuana use.</li> <li>• Descriptive norms.</li> <li>• Marijuana problem scale.</li> <li>• Injunctive norms.</li> <li>• Social anxiety.</li> </ul>	<ul style="list-style-type: none"> <li>• Participants believed their friends experienced significantly fewer problems than that participant themselves experienced.</li> <li>• Social anxiety was positively correlated with marijuana-related problems, but not marijuana use frequency.</li> <li>• Descriptive and injunctive norms significantly predicted marijuana use frequency</li> </ul>	<ul style="list-style-type: none"> <li>• Only one model was tested, not alternatives were proposed.</li> <li>• Self-reported.</li> <li>• Not generalizable.</li> <li>• Online survey.</li> <li>• Small sample size.</li> <li>• Convenience sample.</li> <li>• Population was largely white, female, psychology students.</li> <li>• Reliability and validity were not reported for the Daily Drug Taking Questionnaire.</li> </ul>
Gaher, 2007	<ul style="list-style-type: none"> <li>• Marijuana use.</li> <li>• Marijuana use intensity.</li> <li>• Marijuana-related problems.</li> <li>• Marijuana effect expectancies.</li> </ul>	<ul style="list-style-type: none"> <li>• Marijuana users viewed marijuana-related problems as less problematic and less likely to occur.</li> <li>• Expectancies of problems were significantly related to use intensity.</li> <li>• Participants who perceived problems to be more likely to occur after use, were significantly less likely to use marijuana.</li> </ul>	<ul style="list-style-type: none"> <li>• Self-reported.</li> <li>• Not generalizable.</li> <li>• Online survey.</li> <li>• Convenience sample.</li> <li>• Cannot measure direction of observed effects.</li> </ul>
Gold, 2009	<ul style="list-style-type: none"> <li>• Reported and estimated substance use.</li> <li>• Comparison of estimates of alcohol use to estimates of marijuana use.</li> <li>• Campus social atmosphere impression of drug use.</li> </ul>	<ul style="list-style-type: none"> <li>• Participants perceived that 91% of students had used marijuana in their lifetime while actual use was 46%.</li> <li>• Students estimated that marijuana use would be significantly higher than alcohol use.</li> <li>• 16% of respondents indicated that alcohol use was promoted on campus while 40% said the same for marijuana.</li> </ul>	<ul style="list-style-type: none"> <li>• Not generalizable.</li> <li>• Self-reported data.</li> <li>• Convenience sample.</li> <li>• Rates for the second study may be underreported because more than 100 males chose not to answer the drug use questions.</li> <li>• Validity and reliability was not reported for the Humboldt State University – Health and Health Risk Behaviors Survey.</li> </ul>
Kaynak, 2013	<ul style="list-style-type: none"> <li>• Substance dependence.</li> <li>• Parental monitoring.</li> <li>• Sensation seeking.</li> </ul>	<ul style="list-style-type: none"> <li>• Marijuana dependence was significantly related to white males who were less religious, were high sensation seekers, used marijuana in high school, and had lower parental monitoring.</li> </ul>	<ul style="list-style-type: none"> <li>• Self-reported data.</li> <li>• Not generalizable.</li> <li>• Clinical diagnosis were used, instead DSM-IV was used to categorize dependence.</li> </ul>
Kilmer, 2006	<ul style="list-style-type: none"> <li>• Perceived norms.</li> <li>• Drug use problems.</li> </ul>	<ul style="list-style-type: none"> <li>• 98% of students reported that they thought students in general used marijuana at least once a year. 67% reported never using marijuana.</li> <li>• Number of marijuana related consequences experiences was related to own use, perceptions of friend use and general student use.</li> </ul>	<ul style="list-style-type: none"> <li>• Self-reported.</li> <li>• Not generalizable.</li> <li>• Online survey.</li> <li>• Females were overrepresented.</li> <li>• No actual data was collected about friend use or general student use.</li> <li>• No assessment of what “students in general” was defined as.</li> </ul>



LaBrie, 2009	<ul style="list-style-type: none"> <li>• Individual marijuana use.</li> <li>• Perceptions of use among athletes.</li> <li>• Association between normative perceptions and personal marijuana use.</li> </ul>	<ul style="list-style-type: none"> <li>• Males reported significantly more marijuana use.</li> <li>• Student athletes misperceived the frequency of marijuana use of their athlete peers. They reported that they thought 85% of their peers used marijuana at least once a year while the actual percentage was 37.</li> <li>• Individual perceived marijuana use norms significantly predicted personal marijuana use beyond the effects of sex and age.</li> <li>• Normative beliefs about marijuana use were significantly associated with personal use by male athletes.</li> </ul>	<ul style="list-style-type: none"> <li>• Lifetime measure of drug consequences did not measure marijuana consequences specifically.</li> <li>• Test-retest was not run on the survey created from adapted items.</li> <li>• Self-reported.</li> <li>• Not generalizable.</li> <li>• Caucasian athletes were overrepresented (70%).</li> <li>• Confidential not anonymous.</li> <li>• Hawthorne effect.</li> <li>• Reliability and validity not reported.</li> </ul>
LaBrie, 2011	<ul style="list-style-type: none"> <li>• Individual attitudes.</li> <li>• Injunctive norms.</li> <li>• Marijuana use.</li> </ul>	<ul style="list-style-type: none"> <li>• High levels of individual marijuana use approval, perceived close friend approval, and perceived parental approval all lead to higher levels of actual use.</li> <li>• Heaviest marijuana users reported their marijuana use approval was higher than that of the typical student or their friends. This could lead to challenges using norms based prevention for this group.</li> </ul>	<ul style="list-style-type: none"> <li>• Not generalizable.</li> <li>• Self-reported data.</li> <li>• Confidential not anonymous.</li> </ul>
Lewis, 2008	<ul style="list-style-type: none"> <li>• Frequency of Marijuana use.</li> <li>• Gender specific social norms variables.</li> </ul>	<ul style="list-style-type: none"> <li>• College students may be influenced by perceptions beyond those related to close friends. These perceptions may have a limiting effect on marijuana use.</li> <li>• Participants marijuana use was more influenced by same-gender close friend than by opposite gender close friend or boyfriend/girlfriend.</li> </ul>	<ul style="list-style-type: none"> <li>• Self-reported.</li> <li>• Not generalizable.</li> <li>• Small sample size.</li> <li>• Non-probability convenience sample.</li> <li>• 72% female</li> <li>• 74% Caucasian.</li> <li>• Cannot conclude causal effect.</li> </ul>
Napper, 2014	<ul style="list-style-type: none"> <li>• Marijuana approval.</li> <li>• Marijuana use.</li> <li>• Injunctive norms.</li> <li>• Descriptive norms.</li> <li>• Parental monitoring.</li> </ul>	<ul style="list-style-type: none"> <li>• Student's actual use per year was significantly higher than parental perception of use.</li> <li>• Students were more approving of marijuana use than their parents.</li> <li>• Parents and students significantly overestimated the typical student's use of marijuana.</li> <li>• Student marijuana use was related to their perception of typical student use and parental approval of use.</li> <li>• Parental monitoring led to lower approval of marijuana use by students as well as lower marijuana usage.</li> <li>• Parents influence marijuana use in college through parental monitoring and perceived parental approval.</li> <li>• Students held accurate perceptions of their parent's approval or disapproval of marijuana use.</li> </ul>	<ul style="list-style-type: none"> <li>• Self-reported.</li> <li>• Not generalizable.</li> <li>• Online survey.</li> <li>• Convenience sample.</li> <li>• 73% of the parents were female.</li> <li>• Study focused on college students who did not live with parents.</li> <li>• Most of the participants were freshmen.</li> <li>• Students selected parent of choice to fill out parent survey.</li> <li>• Reliability was not reported for marijuana use and descriptive norms.</li> </ul>

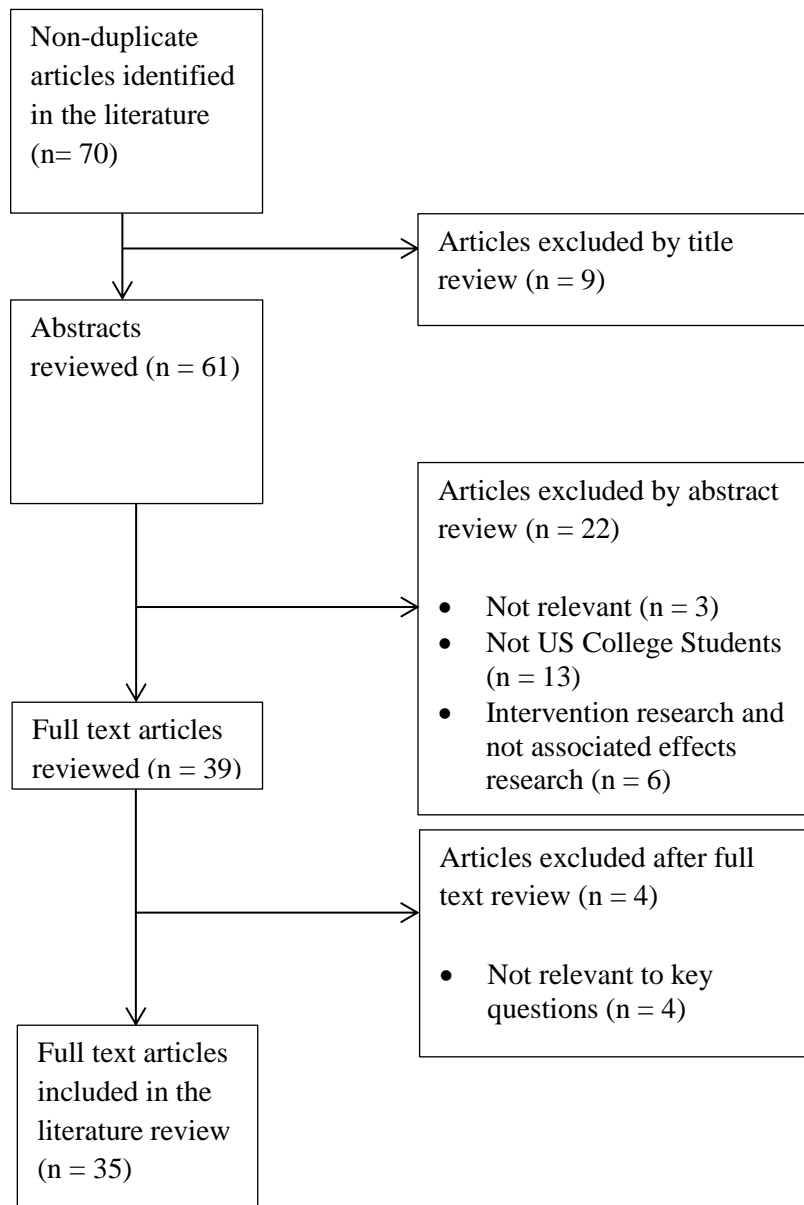
Neighbors, 2008	<ul style="list-style-type: none"> <li>• Social norms.</li> <li>• Social expectancies of marijuana use.</li> <li>• Marijuana use.</li> </ul>	<ul style="list-style-type: none"> <li>• Marijuana use was related to perceived descriptive and injunctive norms.</li> <li>• Greater perceptions of descriptive and injunctive norms led to more days of marijuana use in the past 90 days.</li> <li>• Descriptive norms and social expectancies were associated with consequences.</li> </ul>	<ul style="list-style-type: none"> <li>• Self-reported.</li> <li>• Not generalizable.</li> <li>• Online survey.</li> <li>• Small sample size.</li> <li>• Cannot infer causal direction.</li> <li>• Marijuana use was measured only in days of use, and not in amount used.</li> <li>• Confidential non anonymous.</li> <li>• Perceptions of marijuana use was limited to close friends.</li> <li>• Reliability and validity were not reported for some items but not all.</li> </ul>
Neighbors, 2013	<ul style="list-style-type: none"> <li>• Marijuana use.</li> <li>• Perceived norms.</li> <li>• Identification.</li> </ul>	<ul style="list-style-type: none"> <li>• The majority of participants identified with the typical student more than with the marijuana using student.</li> <li>• Those who identified with marijuana users were more likely to use marijuana themselves.</li> </ul>	<ul style="list-style-type: none"> <li>• Self-reported data.</li> <li>• Not generalizable.</li> <li>• Online survey.</li> <li>• Small sample size.</li> <li>• Only heavy marijuana users.</li> <li>• Measurement error (those who did not use joints as their administration method were asked to quantify their use in joints)</li> <li>• Single-item assessment of identification.</li> <li>• Reliability and validity were not reported.</li> </ul>
Pinchevsky, 2011	<ul style="list-style-type: none"> <li>• Marijuana exposure opportunity.</li> <li>• Marijuana initiation during college.</li> <li>• Peer marijuana use.</li> <li>• Parental monitoring.</li> <li>• Sensation-seeking.</li> <li>• Religiosity.</li> </ul>	<ul style="list-style-type: none"> <li>• 54% used marijuana at least once during the four years of college.</li> <li>• Marijuana exposure opportunity after starting college was correlated with white males with low religiosity, low parental monitoring, high sensation-seeking, and a higher percentage of marijuana-using peers.</li> <li>• Once a previous non-marijuana using student was exposed to marijuana in college, they were more likely to use marijuana if their proximal peers used.</li> </ul>	<ul style="list-style-type: none"> <li>• Self-reported.</li> <li>• Not generalizable.</li> <li>• White individuals were overrepresented.</li> <li>• Initiation of use was dichotomized as use or non-use. Does not tease out those who used only once.</li> <li>• Reliability and validity not reported for all scales.</li> </ul>
Simons, 2006	<ul style="list-style-type: none"> <li>• Marijuana use.</li> <li>• Marijuana problems.</li> <li>• Impulsivity.</li> <li>• Social norms.</li> <li>• Striving assessments.</li> </ul>	<ul style="list-style-type: none"> <li>• Social norms were related to use or nonuse.</li> <li>• Utility (cost and benefit) was related to number of marijuana-problems experienced among predicted users.</li> </ul>	<ul style="list-style-type: none"> <li>• Self-reported data.</li> <li>• Not generalizable.</li> <li>• Small sample size.</li> <li>• Convenience sample.</li> <li>• Women were overrepresented.</li> <li>• Marijuana use was low in the sample.</li> <li>• No causal interpretations.</li> <li>• Reliability and validity not reported for all</li> </ul>

Stewart, 2014	<ul style="list-style-type: none"> <li>• Attitudes.</li> <li>• Intentions.</li> <li>• Behaviors.</li> <li>• Marijuana initiation and use.</li> </ul>	<ul style="list-style-type: none"> <li>• Marijuana attitudes increased from time 1 to time 2.</li> <li>• Intention to use marijuana increased from time 1 to time 2.</li> <li>• 13.5% of users initiated during their freshmen year of college.</li> <li>• At time 1, 16% were marijuana users, at time 2, 22% were marijuana users.</li> <li>• Those who had initiated marijuana use in college reporting more positive attitudes toward marijuana and intention to use at Time 1.</li> <li>• Attitudes, intention, and behavior toward marijuana changed significantly towards favor during the students first year of college.</li> <li>• Attitudes toward tobacco at time 1 and time 2 were less positive than attitudes toward marijuana at times 1 and 2.</li> </ul>	<p>measures.</p> <ul style="list-style-type: none"> <li>• Self-reported data.</li> <li>• Not generalizable.</li> <li>• Small sample size.</li> <li>• Caucasian were overrepresented.</li> <li>• Telephone survey.</li> <li>• Reliability and validity not reported.</li> </ul>
Suerken, 2014	<ul style="list-style-type: none"> <li>• Marijuana use.</li> <li>• Social characteristics.</li> <li>• Other substance use.</li> <li>• Mental health and psychological factors.</li> </ul>	<ul style="list-style-type: none"> <li>• Females who were religious were least likely to use marijuana before freshmen year began.</li> <li>• Students with more disposable income, were members of a sorority or fraternity, or reported higher levels of sensation seeking, were more likely to have used marijuana before freshmen year began.</li> <li>• Current cigarette, alcohol, or other drug (besides marijuana) users were more likely to have used marijuana before freshmen year.</li> <li>• Hispanic students living on campus who reported recent use of cigarettes, alcohol, hookah, or other drug use (besides marijuana) were more likely to initiate marijuana use freshmen year.</li> <li>•</li> </ul>	<ul style="list-style-type: none"> <li>• Self-reported.</li> <li>• Not generalizable.</li> <li>• Online survey.</li> <li>• Students were classified as lifetime marijuana users if they had used marijuana just once.</li> <li>• 86% were Caucasian, 94% were non-Hispanic.</li> <li>• Relationship between clustering variables and model covariates leads to potential bias.</li> <li>• Smokeless tobacco users were oversampled.</li> <li>• Cohort survey was initiated 6 weeks after the beginning of the semester.</li> </ul>
<b>Physical and Mental Health</b>			
Arterberry, 2013	<ul style="list-style-type: none"> <li>• Marijuana use.</li> <li>• Driving while high.</li> <li>• Riding with a high driver.</li> <li>• Marijuana expectancies.</li> <li>• Driving cognitions.</li> </ul>	<ul style="list-style-type: none"> <li>• 35% reported driving within 2 hours of smoking in the past 3 months.</li> <li>• 64% reported riding with a high driver in the past 3 months.</li> <li>• Negative marijuana effects expectancies were most associated with not driving while high or not riding with someone who is high for those who did not smoke marijuana.</li> <li>• For those who did smoke marijuana, social and sexual facilitation were related with driving high while perceptual and cognitive enhancement expectancies were associated with riding with someone who is high.</li> <li>• Users with strong negative marijuana outcome expectancies and those who see DWH as more dangerous, were less likely to DWH.</li> <li>• Those who saw their peers as less accepting of DWH were also less likely to RWHD.</li> <li>• Global expectancies about the negative effects of marijuana serve as a protective factor against DWH or RWHD.</li> </ul>	<ul style="list-style-type: none"> <li>• Self-reported.</li> <li>• Not generalizable.</li> <li>• Online survey.</li> <li>• Cannot determine causal effects.</li> <li>• Asked about between smoking and driving, but not amount consumed.</li> <li>• Items were adapted from several scales; no test-retest was run on the new scale.</li> <li>• No <math>\alpha</math> reported for Driving cognitions, driving while high and riding with a high driver.</li> </ul>

Beck, 2009	<ul style="list-style-type: none"> <li>• Marijuana use.</li> <li>• Reasons for marijuana use.</li> </ul>	<ul style="list-style-type: none"> <li>• Social contexts of marijuana use included social facilitation, peer acceptance, emotional pain, and sex seeking.</li> </ul>	<ul style="list-style-type: none"> <li>• Self-reported.</li> <li>• Not generalizable.</li> <li>• Scales of driving under the influence did not load separately instead it loaded with facilitation. This could have led to the separation of problematic and non-problematic marijuana users.</li> <li>• Convenience sample.</li> <li>• No test-retest of items adapted from previously validated surveys.</li> </ul>
Caldeira, 2012	<ul style="list-style-type: none"> <li>• Marijuana use trajectories.</li> <li>• Health outcomes.</li> </ul>	<ul style="list-style-type: none"> <li>• Six marijuana use trajectories were observed: non-use; low-stable; college peak; late increase; early decline; and, chronic users.</li> <li>• Individuals who used marijuana, even at the low-stable trajectory, had more visits to the doctor for physical or mental health reasons, were sick more often, experienced higher levels of emotional impairment and physical injury. These same individuals also scored much lower on quality of physical and psychological health.</li> </ul>	<ul style="list-style-type: none"> <li>• Self-reported.</li> <li>• Not generalizable.</li> <li>• Convenience sample.</li> <li>• Conducted at only one institution.</li> <li>• The association between health outcomes and marijuana use is correlated and not causal.</li> <li>• Variables did not consider lifestyle or behaviors.</li> </ul>
Najolia, 2012	<ul style="list-style-type: none"> <li>• Marijuana use behaviors.</li> <li>• Anxiety and depression.</li> </ul>	<ul style="list-style-type: none"> <li>• schizotypy is a theory stating that there is a continuum of personality characteristics and experiences ranging from normal dissociative, imaginative states to more extreme states related to psychosis and in particular, schizophrenia (Wikipedia)</li> <li>• High-schizotypy individuals are more likely to use marijuana and to experience marijuana related problems.</li> <li>• Individuals in the schizotypy group who experienced high social anxiety were more likely to use marijuana.</li> <li>• Frequency of marijuana use was related to marijuana-related outcomes in both control and schizotypy groups.</li> <li>• Among the marijuana users, the high schizotypy group experienced three times more marijuana related outcomes than control group.</li> </ul>	<ul style="list-style-type: none"> <li>• Self-reported.</li> <li>• Not generalizable.</li> <li>• Online survey.</li> <li>• Convenience sample.</li> <li>• These are correlational data, and not causation.</li> <li>• Did not question about duration of use, only frequency.</li> <li>• Over-representation of females. Self-reported data.</li> </ul>

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Figure 1. Study selection results.



### **Chapter 3**

#### **The Outcomes on Medical Marijuana Policies on College Students.**

The purpose of this study was to evaluate the outcomes medical marijuana laws have on college students. An analysis was conducted between states with and without medical marijuana laws using the results of the Spring 2013 Core Alcohol and Drug Survey Long Form. More specifically, marijuana and other drug use, grade point average (GPA), location of use, negative outcomes, and normative influences were examined. The initial section of this chapter includes an abstract and overview of how marijuana use affects college students. The second section presents a detailed account of the methods utilized for this inquiry. Next, the results are discussed followed by the comment. The chapter concludes with a summary paragraph, references, and tables and figures. A copy of the Journal of American College Health publication guidelines can be found in Appendix B.

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## Abstract

**Objective:** The purpose of this study was to evaluate the outcomes medical marijuana laws have within the college student population. **Participants:** Participants (n=34,165) consisted of students in the United States attending institutions of higher education in Spring 2013 with representation from 37 states. **Methods:** A secondary data-analysis was conducted from a national data set. Descriptive statistics, odds-ratios, and logistic regression were performed to analyze the data. **Results:** Students in states with medical marijuana laws were more likely to use marijuana, perceive that their close friends would approve of their marijuana use, and experienced more negative consequences (e.g., experienced memory loss, contemplated suicide, were hurt or injured, performed poorly on an exam and had lower grade point averages) than students in states without laws. **Conclusions:** Medical marijuana laws adversely affect college students, both from an academic and health perspective. Findings such as these should be considered before passing additional marijuana legislation.

**Key words:** Medical marijuana, college students, negative outcomes, academics, policy



## Introduction

Next to alcohol, marijuana is the most widely used drug on college campuses. Results from the 2014 National College Health Assessment indicate that 39% of college students have used marijuana in the past year, with 18% using in the last 30 days (ACHA, 2014). These findings represent more than a two-fold increase in regular use since 2000 (ACHA, 2000). The results from the Monitoring the Future (Johnston et al., 2015) data indicate that marijuana use within the college student population has risen from 1 in 50 students using daily in the early 1990's to 1 in 20 using daily in 2013. There are several contributing factors to the increased use of marijuana on college campuses. Misperceived social norms, myths (Buckner, 2013; Comello, 2013; Ecker, Richter, & Buckner, 2014; Kaynak et al., 2013; LaBrie, Hummer, & Lac, 2011; Napper et al., 2014; Neighbors et al., 2013, Pinchevsky et al., 2011, Stewart & Moreno, 2014; Suerken et al., 2014) and increased access (because of the passage of medical marijuana laws) (Cerdeira et al., 2011) all influence use. Currently 20 states have enacted legislation that permits medical marijuana use (ProCon.org, 2015).

The negative outcomes associated with marijuana use are well documented. Marijuana use negatively affects the learning ability of college students as well as their physical and mental health (Arria, et al., 2013a; Arria et al., 2013c; Arria et al., 2013d; Arterberry et al., 2013; Beck et al., 2009; Caldeira et al., 2012; Najolia, Buckner, & Cohen, 2012). The 1983 ground breaking report, *Surgeon General Warning on Marijuana*, suggests that marijuana use impacts multiple aspects of mental functioning including performing skilled tasks such as driving a car or fine performing motor skills. The most commonly and consistently reported cognitive decline related to marijuana is response time (Shivastava, Johnston, & Tsuang, 2011). Arria and colleagues (2011) report marijuana as the most commonly mentioned drug used during drugged driving

episodes. More than 55% of drugged drivers drove intoxicated in excess of three times in a year with 25% of college students riding with an intoxicated driver at least once in the past year. Marijuana dependence was also more likely among drugged drivers than those who rode with a drugged driver. Further, Glascoff, Shrader, and Haddock (2013) report 65% of marijuana users perceive driving after getting high as acceptable.

In addition to affecting health and safety, marijuana use has deleterious effects on academics. Chronic use of marijuana has been linked to short-term memory impairment (Glascoff, Shrader, & Haddock, 2013; Solowij et al., 2011; Thoma et al., 2011) and adverse effects on academics (Arria, et al., 2013a; Arria et al., 2013c; Arria et al., 2013d; Caldeira et al., 2008) and behavior (Office of National Drug Control Policy, n.d.). Students who use drugs, especially marijuana, spend less time studying, attend fewer classes, and have lower GPAs (Arria et al., 2013d). Students were also more likely to experience disruptions in continuous enrollment (Arria, et al., 2013a; Arria et al., 2013c; Arria et al., 2013d) if they regularly used marijuana. Further, college students who use marijuana reported more unsafe sexual encounters (Fielder et al., 2013) and increased misuse of prescription drugs (Palmer et al., 2012).

While some college students may indicate concern for their own drug use (Palmer et al., 2012), exaggerated misperceptions regarding their peers marijuana use normalizes this behavior. Indeed, marijuana use frequency can be predicted by descriptive and injunctive norms (Buckner, 2013; Ecker, Richter, & Buckner, 2014; Kilmer et al, 2007; Kilmer et al., 2006; LaBrie, Grossbard, & Hummer, 2009; Lewis & Clemens, 2008, Napper et al., 2014; Neighbors, Geisner, & Lee, 2008; Simmons, Neal, & Gaher, 2006). Participants in several studies reported that they perceived themselves to experience significantly fewer problems related to marijuana (missing class, getting into an argument, etc.) than their peers who use marijuana (Ecker, Richter, &

Buckner, 2014; Gaher & Simmons, 2007; Neighbors, Geisner, & Lee, 2008; Simmons, Neal, & Gaher, 2006). College students also believed negative outcomes related to marijuana were less problematic than alcohol or other illicit drugs consequences (Ecker, Richter, & Buckner, 2014; Gaher & Simmons, 2007; Neighbors, Geisner, & Lee, 2008; Simmons, Neal, & Gaher, 2006). In a similar study, participants also felt that consequences from marijuana were less likely to occur when compared to alcohol or other illicit drugs (Ecker, Richter, & Buckner, 2014; Gaher & Simmons, 2007; Neighbors, Geisner, & Lee, 2008; Simmons, Neal, & Gaher, 2006). Kilmer and colleagues (2006) reported the number of marijuana related consequences experienced was related to individual use, and perceptions of friend and peer use. Further, in a related study, 40% of college students indicated that they thought marijuana use was promoted on campus (Gold & Nguyen, 2009).

The rates of marijuana use among college students may also be influenced by a permissive drug culture in varying states. California was the first state to legalize medical marijuana in 1996 with seven more states implementing this law since 2000 (ProCon.org, 2015). From 2001 to 2009 no legislation was passed, but in 2010 Arizona, DC, and New Jersey approved medical marijuana laws. Since 2011, eight states (Connecticut, Delaware, Illinois, Maryland, Massachusetts, Minnesota, New Hampshire, and New York) have passed medical marijuana laws and four states (Alaska, Colorado, Oregon, Washington) and DC have passed recreational marijuana laws (ProCon.org, 2015). While the federal government classifies marijuana as a Schedule I Drug (DEA, n.d.), they have done little to dissuade the passing of these laws. The U.S. Attorney General issued a memorandum indicating that the Department of Justice will not challenge state marijuana laws (Reilly, 2013), leading many to speculate that widespread legalization appears imminent.

The purpose of this study was twofold. First, to evaluate the outcomes medical marijuana laws have within the college student population. Specifically, the difference in marijuana use between states with and without medical marijuana laws as well as other drug use, grade point average (GPA), location of use, negative outcomes, and normative influences. Second, researchers sought to determine which variables (negative outcomes, normative influence, location of use, and substance use) predicted marijuana use to assist college officials and practitioners with prevention efforts and inform future policy initiatives.

### **Methods**

Participants consisted of students in the United States attending institutions of higher education that administered the Core Alcohol and Drug Survey Long Form during spring semester of 2013 (the ACHA NCHAA II survey was unable to provide state as a variable in their dataset therefore, the Core survey was selected). Campuses were comprised of public (53%) and private (47%) institutions with 56% in urban areas, 23% in suburban areas, and 22% in rural areas. Fifty-two percent of students attended campuses with less than 9,999 students (Carnegie M4)<sup>43</sup> and 48% went to campuses with 10,000 or more students (Carnegie L4) (The Carnegie Classification of Institutions of Higher Education, n.d.). Thirty-seven states were represented in the total sample. Thirty-one hundred students resided in states with medical marijuana (MM) laws (n=9 states) and 31,065 resided in states without medical marijuana (NMM) laws (n=28 states). Table 1 illustrates the majority of students were between the ages of 18 and 22 (94%), were white (73%), single (98%), and female (60%). Twenty-seven percent of students were freshmen, 24% sophomores, 25% juniors, and 24% seniors. Most students lived on campus (58%) and 47% worked part-time. Grade point averages were reported as follows: 39%, A; 48%, B; 12%, C; 0.7%, D; and 0.1%, F.

[Insert Table 3]

### *Procedures*

Data from the 2013 Core Alcohol and Drug Survey Long Form national data set were obtained after receiving IRB approval. Institutions of higher education self-select to administer the Core and each campus selects their own method of administration (online vs. in the classroom) and implementation (random sample vs. convenience sample). The survey consists of 39 items assessing college student demographics and experiences with alcohol and other drugs. It has been previously evaluated for validity and reliability among United States (US) college students (Martens, et al., 2005). No previous research evaluating the outcomes of medical marijuana laws have been conducted using this survey.

### *Measures*

**Demographic Variables** – Participants provided data about their grade classification (freshmen, sophomore, junior, and senior), age, ethnic origin (American Indian/Alaskan Native, Hispanic, Asian/Pacific Islander, White, Black, and other), living arrangements (on-campus versus off-campus), gender, marital status (single, married, separated, divorced, widowed), working status (not working, working part-time, and working full-time), and grade point average (A,B, C, D, F).

**Substance Use Variables** – The Core Alcohol and Drug Survey Long Form includes past-30 day and past-year frequency (never, once/year, six times/year, once/month, twice/month, once/week, three times/week, five times/week, and every day) of substances (tobacco, alcohol, marijuana, cocaine, amphetamines, sedatives, hallucinogens, opiates, inhalants, designer drugs, steroids, and other illegal drugs) used.

**Normative Influence Variables** – Questions included injunctive and descriptive normative influences. Descriptive norms were measured by asking participants how often (never, once/year, six times/year, once/month, twice/month, once/week, three times/week, five times/week, and every day) they thought the average student on campuses used marijuana and injunctive norms was assessed by how participant's close friends would feel (don't disapprove, disapprove, and strongly disapprove) about the frequency of their use of marijuana (trying marijuana once or twice, smoking marijuana occasionally, and smoking marijuana regularly).

**Negative Outcome Variables** – Self-reported negative outcomes were assessed by asking participants if they had experienced any of the following: performed poorly on a test or important project; been in trouble with police, residence hall, or other college authorities; damaged property, pulled fire alarm, etc.; got into an argument or fight; driven a car while under the influence; missed a class; thought I might have a drinking or other drug problem; had a memory loss; done something I later regretted; been arrested for driving while intoxicated/driving under the influence; tried unsuccessfully to stop using; seriously thought about suicide; seriously tried to commit suicide; and been hurt or injured. Response options included: once, twice, three to five times, six to nine times and 10 or more times.

**Location of Use Variables** – Participants reported location (on campus events, residence hall, fraternity/sorority, bar/restaurant, where you live, in a car, private parties, or other) and type of substance used (tobacco, alcohol, marijuana, cocaine, amphetamines, sedatives, hallucinogens, opiates, inhalants, designer drugs, steroids, and other illegal drugs).

#### *Data Analysis*

Analyses were conducted using Statistical Package for the Social Sciences (SPSS), version 22 and assumed a Type 1 error of 0.05. To describe the sample population frequencies,

percentages, means, and standard deviations were conducted. Two-by-two tables were generated and odds ratios were calculated to examine the impact medical marijuana laws had on location and the negative consequences users experienced. Logistic regression was used to predict past 30 day marijuana use, past year marijuana use, descriptive and injunctive norms, other drug use, and GPA among college students in states with and without medical marijuana laws.

## **Results**

Mean and standard deviation descriptive statistics were conducted to describe the sample. Overall 66% of students (n=34,165) reported past year marijuana use, with 20% reporting past 30 days. Participants also reported past year use of the following substances: alcohol (81%), tobacco (32%), amphetamines (6%), designer drugs (6%), hallucinogens (5%), cocaine (4%), sedatives (3%), other illegal drugs (2%), opiates (1%), inhalants (.9%), and steroids (.6%). Overall, students experienced a myriad of negative consequences including: hangover (59%), had a memory loss (34%), later regretted an action (34%), have been criticized for their use (27%), getting into an argument or fight (26%), missed class (25%), poor test score (20%), driving under the influence (16%), or were hurt or injured (15%), getting into trouble with police or campus authorities (11%), thought they had a problem (9%), tried or failed to stop using (4%), thought about suicide (4%), attempted suicide (1%), and arrested for a DWI/DUI (1%). Twenty-four percent of students reported they used marijuana at private parties, 20% where they live, 17% in a car, 13% in other locations, 10% in the residence halls, 5% in fraternity or sorority houses, 4% of students indicated they used marijuana on campus, and 3% in bars or restaurants. Injunctive and descriptive social norms were measured separately. Most participants (91%) reported that the average student uses marijuana. Regarding peer acceptance, 60%, 48%, and

26% of students reported their friends would approve of their using marijuana once or twice, occasionally, and regularly, respectively.

The odds ratios ratio results indicate the location of drug use differed in states with medical marijuana laws, see Table 4. Students who attended college in states with medical marijuana laws were 2.78 (95% CI, 2.40 to 3.21) times more likely to use marijuana on campus, 2.47 (95% CI, 2.24 to 2.72) times more likely to use in the residence halls, 2.36 (95% CI, 2.18 to 2.55) times more likely to use where they live, 2.21 (95% CI, 1.87 to 2.62) times more likely to use it in a bar/restaurant, 2 (95% CI, 1.83 to 2.17) times more likely to use in a car, 1.96 (95% CI, 1.81 to 2.12) times more likely to use at private parties, 1.89 (95% CI, 1.72 to 2.08) times more likely to use in other places, and 1.23 (95% CI, 1.05 to 1.43) times more likely to use in a sorority or fraternity house, than students who attended college in states without medical marijuana laws.

[Insert Table 4]

The results from the odds ratio analysis reveal that students who attended college in states with medical marijuana laws were more likely to experience negative consequences than students who did not. The odds of participants, who attend college in states with medical marijuana laws, being hurt or injured increased 1.35 (95% CI, 1.22 to 1.48) times, memory loss increased 1.09 (95% CI, .95 to 1.15) times, and doing something they later regretted increased 1.09 (95% CI, 1.01 to 1.18) times, doing poorly on an exam increased 1.04 times (95% CI, .95 to 1.16). The risk of participants driving while under the influence decreased 82% (95% CI, .73 to .91), being arrested for DWI/DUI decreased 45% (95% CI, .25 to .78), and the chances of getting into trouble with the police (1.08 times; 95% CI, .96 to 1.20) increased among students in states with medical marijuana laws. The odds of students in states with medical marijuana laws



thinking they have a problem increased 1.51 (95% CI, 1.35 to 1.70) while the odds of being unsuccessful in an attempt to quit using also increased 1.29 (95% CI, 1.09 to 1.54) times. The odds of thinking about suicide were 1.69 greater (95% CI, 1.45 to 1.97) and 1.36 times higher actual attempts among students in states with laws with medical marijuana laws. When compared to students in states without medical marijuana laws, students in states with medical marijuana laws were more likely to have lower grade point averages ( $\beta=.16$ ,  $p<.001$ ) after holding institution location, current residence, working status, descriptive and injunctive norms, and post year other drug use constant. Conversely, there were no increased chances of missing class or getting into fights or arguments with students in states with medical marijuana laws.

[Insert Table 5]

Student marijuana and other drug used also differed by state medical marijuana laws. After controlling for past year other drug use (tobacco, alcohol, marijuana, cocaine, amphetamines, sedatives, hallucinogens, opiates, inhalants, designer drugs, steroids, and other illegal drugs), social norms, grade classification, residential status, working status, and student status; students who attended school in states with medical marijuana laws were more likely to use marijuana in the past 30 days ( $\beta=.46$ ,  $p<.001$ ) and the past year than those in states without medical marijuana laws ( $\beta=.31$ ,  $p<.001$ ) with Pseudo  $R^2$  (Cox and Snell; Nagelkerke) values ranging between .29 and .46. In addition, after controlling for the same variables, students in states with medical marijuana laws were more likely to use hallucinogens ( $\beta=.75$ ,  $p<.001$ ), designer drugs ( $\beta=.19$ ,  $p<.05$ ), and other illegal drugs ( $\beta=.32$ ,  $p<.05$ ) than students in states without laws. However, students in states without medical marijuana laws were more likely to report using tobacco ( $\beta=.29$ ,  $p<.001$ ), alcohol ( $\beta=.25$ ,  $p<.005$ ), amphetamines ( $\beta=.35$ ,  $p<.001$ ), and steroids ( $\beta=1.14$ ,  $p<.05$ ) than those in states with medical marijuana laws after controlling

the aforementioned variables. There were no significant differences found among student drug use with cocaine, sedatives, opiates, or inhalants based on medical marijuana laws.

Descriptive and injunctive norms differed among students in states with medical marijuana laws when compared to students in states without medical marijuana laws. After holding past 30 day and past year marijuana use, grade classification, age, gender, residential status, working status, living arrangements, campus situation on alcohol and drugs (is there a policy?, is it enforced?, etc.), place of permanent residence (including enforcement and prevention) and injunctive norms constant, students in states with medical marijuana laws were more likely to perceive the average student used marijuana more often ( $\beta=.41$ ,  $p<.001$ ) than students in states without medical marijuana laws. Students perceptions of how their close friends would feel about their using marijuana once or twice ( $\beta=.32$ ,  $p<.001$ ), smoking marijuana occasionally ( $\beta=.28$ ,  $p<.001$ ), and smoking marijuana regularly ( $\beta=.22$ ,  $p<.001$ ) were more likely to be positive if the participant was from a state with medical marijuana laws after holding age, gender, residential status, working status, living arrangements, campus situation on alcohol and drugs, student status, permanent residence, and social norms constant. The logistic regression analyses elicited Psuedo  $R^2$  (Cox and Snell, Nagelkerke) values ranging between .53 to .72, .60 to .80, and .39 to .56 respectively.

### **Comment**

The addition of medical and recreational marijuana laws in some states, poses unique challenges for college officials and public health leaders. It is imperative to assess the impact these laws have on college students, as this information may help inform future state and federal policy decisions. The purpose of this inquiry was to examine how medical marijuana laws impact college student health. The decision to focus exclusively on medical marijuana was made

because at the time of this study (when the data were collected) recreational marijuana laws had not been implemented. Thus, comparisons for the current study were made between students who attended college in states with and without medical marijuana laws concerning health and academic outcomes as well as normative information.

Overall, students who attended college in states with medical marijuana laws were more likely to use marijuana and illicit drugs. Concerning marijuana use, students in states with medical marijuana laws were more than 50% likely to have used marijuana in the past 30 days. This may be due to increased access, normalization of marijuana use, and a reduction in the perception of risk associated with use (Johnston et al., 2015). These same students were also more likely to use hallucinogens, designer drugs, and other illegal drugs while students in states without medical marijuana laws demonstrated a higher incidence of tobacco, alcohol, amphetamine, and steroid use. Students in states without medical marijuana laws were more likely to use legal substances such as alcohol or tobacco. Concerning these trends, perhaps students who attended college in states with medical marijuana laws were more likely to use illicit drugs and engage in poly-drug use because their experiences using marijuana were not perceived as negative and/or dangerous. Thus, the lack of a negative experience (or positive experience) may have led to other drug experimentation/use; some refer to this as the “Gateway Theory” (Tullis, et al., 2003). Conversely, students in states without medical marijuana laws were less likely to use illicit drugs, possibly due to less drug exposure.

Students in states with medical marijuana laws experienced more negative consequences. These students reported increased instances of having a memory loss, being injured, later regretting an action, driving while intoxicated, being arrested for DWI, thinking about suicide, attempting suicide, thinking they have a problem, and unsuccessfully trying to quit using. These

consequences are particularly problematic for this population because of their impact with retention and enrollment rates. Beyond academic consequences, marijuana use can also negatively impact student mental health. With the rate of attempted suicide among college students tripling since the 1950's (ACHA, 2014) coupled with the connection between substance use and suicide attempts, the necessity for comprehensive substance abuse prevention and treatment programs is increasing.

Location of marijuana use differed between students in states with and without medical marijuana laws. Students in states with these laws were twice as likely to use marijuana on campus, in the residence halls, in sorority or fraternity houses, where they live, or in a car, than students who attended college in states without medical marijuana laws. There are several concerns with the increased use of any substance on a college campus. First, any substance use on university grounds can have damaging effects on overall campus atmosphere, which can lead to reduced enrollment and graduation rates. Second, recommendations for the use of medical marijuana are made based on strict rules set by the state. Most of the state's list covered medical conditions that are very uncommon among 18-24 year old students (cancer, chronic pain, and Alzheimer's disease) (ProCon.org, 2015). Therefore, issues of location of use should be addressed as medical marijuana is meant to be used in a patient's residence and not at parties, bars, restaurants, and in fraternity and sorority houses. Third, the issue of secondhand smoke and secondhand effects of marijuana become an issue when used in public.

Regarding perceptions, the findings from this study are consistent with previous research indicating that most college students grossly overestimate how much marijuana college students use (Buckner, 2013; Comello, 2013; Ecker, Richter, & Buckner, 2014; Kaynak et al., 2013; LaBrie, Hummer, & Lac, 2011; Napper et al., 2014; Neighbors et al., 2013; Pinchevsky et al.,

2011, Stewart & Moreno, 2014; Suerken et al., 2014). Descriptive and injunctive norms varied considerably among students in states with medical marijuana laws when compared to students in states without medical marijuana laws. Students in states with medical marijuana laws were more likely to think the average student used marijuana regularly and that their close friends would approve of their occasional or regular use. Social norm marketing campaigns can be used to correct these misperceptions (descriptive norms). This prevention strategy has been somewhat successful with high-risk drinking and college students, these same principles can be applied to marijuana with this population as well (Benton, et al., 2006; DeJong et al., 2006; Glassman & Braun, 2010; Neighbors, et al., 2006; Perkins, 2002).

Results from this study will assist college health educators and medical professionals in several ways. First, because of the increased odds of negative consequences among students in states with medical marijuana laws, dedicating funding toward developing prevention and treatment programs to address marijuana use and the related consequences on college campuses is warranted. Second, prevention information such as healthy decision making and alternative activities (student organizations, clubs, sports, etc.) could be shared with students and their parents as early as student orientation and existing campus resources such as campus counseling centers need to be promoted more rigorously. Third, with the increased risk of mental health issues related to marijuana use (thinking about or attempting suicide), medical providers need to screen students for marijuana abuse, treat, and refer as appropriate. Forth, because of the greater odds of using marijuana in states with medical marijuana laws, specific interventions designed to prevent and reduce marijuana abuse need to be implemented and rigorously evaluated. Finally, knowing the impact that marijuana has on students' mental, physical, and intellectual health and

addressing these issues is consistent with goals and objectives delineated in *Healthy Campuses 2020* (ACHA, 2012).

### **Limitations**

Several noteworthy limitations exist due to the inherent constraints associated with secondary data analyses. First, self-reported data were collected for this study, which, because of the sensitive nature of questions, may have led respondents to underreport, over-report, or experience imperfect recall of their substance use. Second, causal inferences cannot be gleaned from cross-sectional data analysis. For example, whether the findings from this study are the result of medical marijuana laws or differences in culture from state to state, is impossible to surmise, based on the methods employed for this study. Third, a set of questions asked how often students experienced negative outcomes in relation to all substances use, not just marijuana. This is problematic because it is impossible to determine if the negative outcomes experienced were due exclusively to marijuana and/or some other drug(s). Fourth, another item from the survey (how do you think your close friends feel – or would feel – about you...) utilized a double negative response option (don't disapprove) which may have confused some respondents. Finally, the use of only one item to measure perceived risk, descriptive norms, and injunctive norms, limits the assessment of these constructs (mono-method biases).

### **Conclusions**

Despite these limitations, this study provides information concerning the impact of medical marijuana on college campuses. Students in states with medical marijuana laws are more likely to have used marijuana in the past year, use on campus, suffer academic challenges and believe that their friends would approve of their use. The current study focused on medical marijuana, therefore, future research should also include the impact that recreational marijuana

laws have on college students. Further, a time-series analysis should be conducted to determine exactly when behavior change occurs to more accurately assess the impact of marijuana policies. Intervention research needs also needs to be conducted to evaluate and improve upon the impact of social norms marketing interventions (Buckner, 2013; Comello, 2013; Ecker, Richter, & Buckner, 2014; LaBrie, Hummer, & Lac, 2011; Napper et al., 2014; Neighbors et al., 2013) and programs such as BASICS (SAMHSA, n.d.), focusing exclusively on marijuana use.

Because of the discrepancies between state and federal law, campuses in states with medical marijuana laws face the challenge of meeting the federal standards of the safe and drug free schools act while still allowing their students to access their “medication.” So while the state may allow the medical use of marijuana, the federal government, who provides substantial funding to public institutions of higher education, view marijuana as a schedule one drug that is prohibited on federally funded college campuses (Adele, 2015). As the issue of medical marijuana laws continue to be in the media and most likely in the federal courts, college campuses are going to have to re-evaluate their policies on use of this substance in order to maintain healthy campuses whose policies are in agreement with federal law. Indeed, as medical and recreational marijuana laws continue to be part of state and federal legislative discussions, findings from this study and others can be used to help guide future law and policy.

Tables/figure

TABLE 3. Participant demographics

	Frequency	Percentage
<b>Age</b>		
17	99	0.3
18	5348	15.7
19	8127	23.8
20	7442	21.8
21	7443	21.8
22	3844	11.3
23	1216	3.6
24	646	1.9
<b>Gender</b>		
Female	20573	60.2
Male	12703	37.2
Unknown	889	2.6
<b>Ethnicity</b>		
White	25021	73
Black	3334	9.8
Hispanic	2025	5.9
Asian/Pacific Islander	1954	5.7
Other	1151	3.4
Missing	449	1.3
American Indian/Alaskan Native	231	0.7
<b>Living Arrangements</b>		
House or Apartment	16134	47.2
Residence Hall	16004	46.8
Fraternity or Sorority House	791	2.3
Other	526	1.5
Approved Housing	474	1.4
Missing	236	0.7
<b>Employment</b>		
Not employed	16409	48.0
Part-time	16107	47.1
Full-time	1439	1.2

N=



TABLE 4. Prevalence of marijuana use by location and consequences in the state with (MM) and without (NMM) marijuana laws and odds ratios when compared with NMM.

	All Students (N=34,165)	NMM (n=31,103)	MM (n=3,062)	
Location of use	%	%	%	OR (95%CI)
On campus	3.5	3.0	8.0	2.78 (2.40 – 3.21)**
Residence hall	9.8	8.8	19.2	2.47 (2.24 – 2.72)**
Where you live	20.0	18.5	34.8	2.36 (2.18 – 2.55)**
Restaurant or bar	2.9	2.6	5.6	2.21 (1.87 – 2.62)**
In a car	16.8	15.8	27.2	2.00 (1.83 – 2.17)**
Private parties	24.1	22.8	36.6	1.96 (1.81 – 2.12)**
Other locations	12.8	12.1	20.6	1.90 (1.72 – 2.08)**
Fraternity/sorority	5.4	5.3	6.4	1.23 (1.05 – 1.43)*
Negative Consequences				
Thought about suicide	4.3	4.1	6.7	1.70 (1.45 – 1.97)**
Thought I had a problem	8.9	8.5	12.4	1.52 (1.35 – 1.70)**
Tried to commit suicide	1.2	1.2	1.6	1.36 (1.01 – 1.83)
Been hurt or injured	14.5	14.1	18.1	1.35 (1.23 – 1.49)**
Tried/failed to stop	4.0	3.9	5.0	1.29 (1.09 – 1.54)*
Later regretted action	33.6	33.5	35.5	1.09 (1.01 – 1.18)*
Trouble with police or campus officials	11.3	11.2	12.0	1.08 (0.96 – 1.21)
Poor test score	19.6	19.5	20.2	1.04 (0.95 – 1.15)
Missed class	25.1	25.2	24.6	0.97 (0.89 – 1.06)
Been in an argument or fight	26.2	26.3	25.5	0.96 (0.88 – 1.04)
Driven under the influence	16.2	16.4	13.9	0.82 (0.73 – 0.91)
Arrested for DUI/DWI	0.9	0.9	0.4	0.45 (0.26 – 0.79)*

Notes: \*p<.01, \*\*p<.001

TABLE 5: Logistic regression predicting grade point average, past marijuana and other drug use, and social norms by medical marijuana (MM) state variable.

Predictor	$\beta$	S.E.	Wald $X^2$	$p$	Odds Ratio	95% CI for OR	
						Lower	Upper
Past 30 day marijuana use							
Grade classification: Freshmen (baseline)							
Grade classification: Sophomore	-.14	.05	7.27	.007	.87	.77	.96
Grade classification: Junior	-.47	.05	85.03	.000	.62	.57	.69
Grade classification: Senior	-.63	.05	149.58	.000	.53	.48	.59
Perception that the average student uses marijuana	1.26	.11	125.15	.000	3.55	2.84	4.43
Friends approval of using marijuana once or twice	.78	.09	73.80	.000	2.18	1.82	2.60
Friends approval of using marijuana occasionally	-1.31	.07	338.07	.000	.27	.23	.31
Friends approval of using marijuana regularly	.99	.04	621.25	.000	2.70	2.50	2.92
Past 30 day use: Tobacco	.90	.04	527.60	.000	2.47	2.28	2.66
Past 30 day use: Alcohol	1.64	.07	593.17	.000	5.12	4.50	5.85
Past 30 day use: Cocaine	1.26	.16	60.52	.000	3.51	2.56	4.81
Past 30 day use: Amphetamines	.73	.10	54.73	.000	2.08	1.71	2.53
Past 30 day use: Sedatives	.41	.17	5.68	.017	1.50	1.08	2.10
Past 30 day use: Hallucinogens	1.75	.22	66.42	.000	5.77	3.78	8.79
Past 30 day use: Opiates	.726	.28	6.75	.009	2.07	1.20	3.58
Past 30 day use: Designer drugs	1.46	.16	87.87	.000	4.31	3.18	5.85
Past 30 day use: Steroids	.91	.28	10.58	.001	2.47	1.43	4.27
Past year marijuana use							
Grade classification: Freshmen (baseline)							
Grade classification: Sophomore	-.14	.05	16.44	.000	.83	.76	.91
Grade classification: Junior	-.38	.05	70.94	.000	.68	.62	.75
Grade classification: Senior	-.52	.05	128.21	.000	.60	.54	.65
The average student uses marijuana	1.21	.08	213.47	.000	3.37	2.87	3.97
Friends approval of using marijuana once or twice	1.15	.06	411.09	.000	3.17	2.83	3.54
Friends approval of using marijuana occasionally	-1.10	.05	529.24	.000	.33	.30	.36
Friends approval of using marijuana regularly	.48	.04	152.33	.000	1.62	1.50	1.75

Past year use: Tobacco	1.08	.03	1018.20	.000	2.94	2.75	3.14
Past year use: Alcohol	202	.08	671.46	.000	9.03	7.59	10.74
Past year use: Cocaine	1.31	.16	68.37	.000	3.70	2.71	5.04
Past year use: Amphetamines	.87	.09	85.33	.000	2.38	1.98	2.86
Past year use: Sedatives	.32	.16	3.93	.047	1.37	1.00	1.87
Past year use: Hallucinogens	1.73	.16	117.09	.000	5.67	4.14	7.76
Past year use: Designer drugs	1.58	.12	166.61	.000	4.87	3.83	6.19
Past year use: Other illegal drugs	1.24	.23	29.42	.000	3.47	2.21	5.44

## **Chapter 4**

### **Conclusions**

This chapter provides context for the results of the current studies. The contents are divided into the following sections: Summary of the Study; Accepted Hypotheses; Rejected Hypothesis; Discussion; Recommendations; Synthesis of Articles; Future Research; and Summary.

#### **Summary of the Studies**

##### *Article 1*

Marijuana represents the most widely-used illicit drug on college campuses. Repeated use can impair students' physical and mental health, intelligence, memory, and academic performance (Arria et al., 2013a; Arria et al., 2013c; Beck et al., 2009; Buckner et al., 2012; Caldeira et al., 2013; Falls et al., 2013; Hall & Dagenhardt, 2008; Jacobus et al., 2013; Meier et al., 2012; Morbidity and Mortality Weekly Report, 1983; Office of National Drug Control Policy, 2004). Marijuana use has also been linked to deficits in complex attention, storing memory, planning sequencing abilities, and verbal and visual memory (Arria et al., 2013a; Arria et al., 2013b; Arria et al., 2013c; Falls et al., 2011; Hunt et al., 2010; Jacobus et al., 2013; Solowij et al., 2011). Further, marijuana use has been associated with reductions in college graduation, skipping class, early conduct problems, and lower grade point averages (Arria et al., 2013a; Arria et al., 2013b; Arria et al., 2013c).

Regardless of prevention efforts, past 30 day marijuana use prevalence rates have been stable for the last two decades ranging from 14% in 1993 to 20% in 2013 (Johnston et al., 2014). Results from the 2014 National College Health Assessment II (NCHA II) survey indicate that 40% of college students have used marijuana at some point in their lifetime, with 20% using in the last 30 days. Similarly, results from the 2013 Core Alcohol and Drug Survey reveal that 45% of students used marijuana in their lifetime, 33% in the past year, and 19% reported current use – during the past 30 days. Marijuana has been associated with high-risk activities such as riding with a high driver or driving while high (Arria et al., 2011; Glascoff, 2013; Whitehall, 2014). This level of use coupled

with the current political landscape and public opinion, reflect more permissive attitudes toward marijuana use in general. The shifting drug culture along with the U.S. Attorney General issuing a memorandum indicating that the Department of Justice will not challenge state marijuana laws (Reilly, 2013), leading many to speculate that widespread legalization appears imminent.

To date a dearth of research exists summarizing marijuana's associated effects on college students. These issues include college retention, reduced academic performance, health outcomes, and increased legal or conduct issues. The purpose of this systematic review was to assess the topics published on this subject, as well as the methods researchers employed, including: study design, location, target population, psychometrics, measured outcomes, and limitations.

The following research questions were investigated:

1. What impact does marijuana use have on college students?
2. What is the rigor of the current research on the outcomes of college student marijuana use?

The search technique for this systematic literature review included the use of specific inclusion/exclusion criteria, databases and key words. PubMed, Academic Search Complete, Electronic Journal Center, ProQuest, and Google Scholar were the five data bases used for this investigation. Search terms included: marijuana or cannabis and college students; marijuana or cannabis and college students and academics; marijuana or cannabis and college students and health; marijuana or cannabis and college students and law or legal; marijuana or cannabis and college students and conduct or judicial; marijuana or cannabis and college students and negative outcomes or consequences; marijuana or cannabis and college students and cognition; and marijuana or cannabis and college students and perceived norms. The reference section of each of the articles was also reviewed to identify additional studies to include for the systematic review. The database examination occurred in December 2014.

Studies were included if they were published after 2000 and specifically focused on 17-24 year old US undergraduate students who used marijuana and reported on the associated effects. Studies were excluded from the analysis if the sample population used did not include exclusively US college students, the article was published before 2000, or if the research was intervention based. An intervention was defined as any study in which researchers employed an experimental design attempting to reduce marijuana use. While findings from these studies are important, their inclusion goes beyond the scope of the current analysis, which focuses on associated outcomes of marijuana use.

Of the seventy articles identified in the literature search, nine were excluded by initial title review. After abstract review was complete, 22 articles were excluded because they were either not relevant (n=3), did not include US college students as study participants (n=13), or were intervention based research (n=6). Thirty-nine full article texts were reviewed with four being excluded because they were not relevant to this inquiry. Search parameters included all studies published after 2000; however, the eligible studies were each published after 2006. The final number of articles included for systematic analysis was 35.

Each of the 35 studies included marijuana use indicators. Nineteen examined normative influence, five assessed negative outcomes, four explored legal and safety issues, four examined physical and mental health, and three focused on academic influence. Common topics emerged from the primary measures. Risk factors for marijuana use were examined in 19 studies with measures including intention to use, campus social atmosphere, approval, age of first marijuana use, exposure opportunity, positive perception of users, low perceived risk, self-identification as a marijuana user, positive attitude toward use, and positive expectancies. Protective factors included 10 studies with measures of high perceived risk, interest in intervention, parental monitoring, religiosity, striving assessments, future self-orientation, negative perception of users, negative attitudes toward use, and negative expectancies. In 13 articles, the researchers examined the influence of social norms

including perceptions of use, and user and non-user status. Mental health problems included measures of cannabis use disorder, anxiety, depression, and schizotypy were addressed in nine of the articles. Negative consequences were discussed in seven studies and included measures of academic, legal/conduct, enrollment disruptions, and unsafe sexual practice. Four studies focused on substance related traffic risk including driving while high or riding with a high driver. Two studies each examined neurobiological consequences and reasons for marijuana use while only one focused on health outcomes.

## *Article 2*

Next to alcohol, marijuana is the most widely used drug on college campuses. Results from the 2014 National College Health Assessment indicate that 39% of college students have used marijuana in the past year, with 18% using in the last 30 days (ACHA, 2014). These findings represent more than a two-fold increase in regular use since 2000 (ACHA, 2000). Results from the Monitoring the Future (2015) data indicate that marijuana use within the college student population proliferated from 1 in 50 students using daily in the early 1990's to 1 in 20 using daily in 2013. There are several contributing factors to the increased use of marijuana on college campuses. Misperceived social norms, myths (Buckner, 2013; Comello, 2013; Ecker, Richter, & Buckner, 2014; Kaynak et al., 2013; LaBrie, Hummer, & Lac, 2011; Napper et al., 2014; Neighbors, et al., 2013, Pinchevsky et al., 2011; Stewart & Moreno, 2014; Suerken et al., 2014), and increased access (because of the passage of medical marijuana laws; Cerda et al., 2011) all influence use. Currently 20 states have enacted legislation that permits medical marijuana use (ProCon.org, 2015).

The negative outcomes associated with marijuana use are well documented. Marijuana use negatively affects the learning ability of college students as well as their physical and mental health (Arria et al., 2013d; Arria et al., 2013c; Arria et al., 2013a; Arterberry, et al., 2013; Beck et al., 2009; Caldeira et al., 2012; Najolia, Buckner, & Cohen, 2012). The 1983 ground breaking report, *Surgeon General Warning on Marijuana* (Surgeon General, 1983) suggests that marijuana use impacts

multiple aspects of mental functioning including performing skilled tasks such as driving a car or fine performing motor skills. Arria and colleagues (2011) report marijuana as the most commonly mentioned drug used during drugged driving episodes.

In addition to affecting health and safety, marijuana use has deleterious effects on academics. Chronic use of marijuana has been linked to short-term memory impairment (Glascoff, Shrader, & Haddock, 2013; Solowij et al., 2011, Thoma et al, 2011) and adverse effects on academics (Arria et al., 2013d; Arria et al., 2013c; Arria et al., 2013a; Caldeira et al., 2008) and behavior (Office of National Drug Control Policy, n.d.). Students who use drugs, especially marijuana, spend less time studying, attend fewer classes, and have lower GPAs (Arria et al., 2013d). Students were also more likely to experience disruptions in continuous enrollment (Arria et al., 2013d; Arria et al., 2013c; Arria et al., 2013a) if they regularly used marijuana.

While some college students may indicate concern for their own drug use (Palmer et al., 2012) exaggerated misperceptions regarding their peers marijuana use normalizes this behavior. Indeed, marijuana use frequency can be predicted by descriptive and injunctive norms (Buckner, 2013; Ecker, Richter, Buckner, 2014; Kilmer et al., 2007; Kilmer et al., 2006, LaBrie, Grossbard, & Hummer, 2009; Lewis & Clemens, 2008; Napper et al., 2014; Neighbors, Geisner, & Lee, 2008; Simmons, Neal, & Gaher, 2006). Participants in several studies reported that they perceived themselves to experience significantly fewer problems related to marijuana (missing class, getting into an argument, etc.) than their peers who use marijuana (Ecker, Richter, & Buckner, 2014; Neighbors, Geisner, & Lee, 2008; Simmons, Neal, & Gaher, 2006). College students also believed negative outcomes related to marijuana were less problematic than alcohol or other illicit drugs consequences (Ecker, Richter, & Buckner, 2014; Neighbors, Geisner, & Lee, 2008; Simmons, Neal, & Gaher, 2006).

The rates of marijuana use among college students may also be influenced by a permissive drug culture in varying states. California was the first state to legalize medical marijuana in 1996 with seven more states implementing this law since 2000 (ProCon.org, 2015). From 2001 to 2009 no



legislation was passed, but in 2010 Arizona, DC, and New Jersey approved medical marijuana laws. Since 2011, eight states (Connecticut, Delaware, Illinois, Maryland, Massachusetts, Minnesota, New Hampshire, and New York) have passed medical marijuana laws and four states (Alaska, Colorado, Oregon, Washington) and DC have passed recreational marijuana laws (ProCon.org, 2015). While the federal government classifies marijuana as a Schedule I Drug (DEA, n.d.) they have done little to dissuade the passing of these laws. The U.S. Attorney General issued a memorandum indicating that the Department of Justice will not challenge state marijuana laws (Reilly, 2013), leading many to speculate that widespread legalization appears imminent.

The purpose of this study was twofold. First, to evaluate the outcomes medical marijuana laws have within the college student population. Specifically, the difference in marijuana use between states with and without medical marijuana laws as well as other drug use, grade point average (GPA), location of use, negative outcomes, and normative influences. Second, researchers sought to determine which variables (negative outcomes, normative influence, location of use, and substance use) predicted marijuana use among college students. This information may assist college officials and practitioners with prevention efforts and inform future policy initiatives.

Research questions investigated include:

1. Do college students in states with medical marijuana laws and college students in states without medical marijuana laws use marijuana at equal rates after controlling for past year other drug use, social norms, grade classification, residential status, working status, and student status?
2. Do college students in states with medical marijuana and college students in states without medical marijuana laws perceive peer use of marijuana at equal rates after controlling for past 30 day and past year marijuana use, grade classification, age, gender, residential status, working status, living arrangements, campus situation on alcohol and drugs (is

- there a policy, is it enforced, etc.), place of permanent residence (including enforcement and prevention) and injunctive norms constant?
3. Do college students in states with medical marijuana laws and college students in states without medical marijuana laws use other substance in the past year at equal rates?
  4. Do college students in states with medical marijuana laws and college students in states without medical marijuana laws have equal GPA rates after controlling for institutional location, current residence, working status, social norms, and previous year other drug use.
  5. What is the difference between college students in states with medical marijuana laws and college students in states without medical marijuana laws on locations of marijuana use?
  6. What is the difference between college students in states with medical marijuana laws and college students in states without medical marijuana laws on negative consequences?
  7. Do college students in states with medical marijuana laws and college students in states without medical marijuana laws have equal perception rates on peer injunctive norms after controlling age, gender, residential status, working status, living arrangements, campus situation on alcohol and drugs, student status, permanent residence, and social norms?
  8. What is the path model that predicts marijuana usage among college students based on the Core Alcohol and Drug Survey, in states with and without medical marijuana laws?

Data from the 2013 Core Alcohol and Drug Survey national data set were obtained after receiving IRB approval. Institutions of higher education self-select to administer the Core and each campus determines their own method of administration (online vs. in the classroom) and implementation (random sample vs. convenience sample). The survey consists of 39 items assessing college student experiences with alcohol and other drugs as well as demographic information. Martens and colleagues (2005) assessed the psychometrics of the instrument and the results indicate the questionnaire is both reliable and valid. Previous research evaluating the outcomes of medical marijuana laws has not been conducted with this instrument.

Measures included demographic variables, substance use, normative influences, negative outcomes, and location of use. Analyses were conducted using Statistical Package for the Social Sciences (SPSS), version 22 and assumed a Type 1 error of 0.05. To describe the sample population frequencies, percentages, means, and standard deviations were conducted. Odds ratios were performed to examine the impact medical marijuana laws had on location and prevalence of marijuana use as well as the negative consequences users experienced. Binary logistic regression was used to predict past 30 day marijuana use, past year marijuana use, descriptive and injunctive norms, other drug use, and GPA among college students in states with and without medical marijuana laws.

The location of drug use differed in states with medical marijuana laws. Students who attended college in states with medical marijuana laws were 2.78 (95% CI, 2.40 to 3.21) times more likely to use marijuana on campus, 2.47 (95% CI, 2.24 to 2.723) times more likely to use in the residence halls, 2.36 (95% CI, 2.18 to 2.55) times more likely to use where they live, 2.21 (95% CI, 1.87 to 2.62) times more likely to use it in a bar/restaurant, 2 (95% CI, 1.83 to 2.17) times more likely to use in a car, 1.96 (95% CI, 1.81 to 2.12) times more likely to use at private parties, 1.89 (95% CI, 1.72 to 2.08) times more likely to use in other places, and 1.23 (95% CI, 1.05 to 1.43) times more likely to use in a sorority or fraternity house, than students who attended college in states without medical marijuana laws.

Students who attended college in states with medical marijuana laws experienced different rates of negative consequences. There were no increased chances of missing class or getting into fights or arguments in students in states with medical marijuana laws. The odds of participants reporting being hurt or injured increased 1.35 (95% CI, 1.22 to 1.48) times, memory loss increased 1.09 (95% CI, .95 to 1.15) times, and doing something they later regretted increased 1.09 (95% CI, 1.01 to 1.18) times, doing poorly on an exam increased 1.04 times (95% CI, .95 to 1.16). The risk of participants driving while under the influence decreased 82% (95% CI, .73 to .91), being arrested for DWI/DUI decreased 45% (95% CI, .25 to .78), and the chances of getting into trouble with the police

(1.08 times; 95% CI, .96 to 1.20) increased among students in states with medical marijuana laws. The odds of students in states with medical marijuana laws thinking they have a problem increased 1.51 (95% CI, 1.35 to 1.70) while the odds of being unsuccessful in an attempt to quit using also increased 1.29 (95% CI, 1.09 to 1.54) times. The odds of thinking about suicide are 1.69 greater (95% CI, 1.45 to 1.97) and 1.36 times higher actual attempts among students in states with laws with medical marijuana laws. When compared to students in states without medical marijuana laws, students in states with medical marijuana laws were more likely to have lower grade point averages ( $\beta=.16$ ,  $p<.001$ ) after holding institution location, current residence, working status, descriptive and injunctive norms, and post year other drug use constant.

Student marijuana and other drug used differed by state medical marijuana laws. After controlling for past year other drug use (tobacco, alcohol, marijuana, cocaine, amphetamines, sedatives, hallucinogens, opiates, inhalants, designer drugs, steroids, and other illegal drugs), social norms, grade classification, residential status, working status, and student status those residing in states with medical marijuana laws were more likely to use marijuana in the past 30 days ( $\beta=.46$ ,  $p<.001$ ) and the past year than those in states without laws ( $\beta=.31$ ,  $p<.001$ ). In addition, after controlling for the same variables, students in states with medical marijuana laws were more likely to use hallucinogens ( $\beta=.75$ ,  $p<.001$ ), designer drugs ( $\beta=.19$ ,  $p<.05$ ), and other illegal drugs ( $\beta=.32$ ,  $p<.05$ ) than students in states without laws. However, students in states without medical marijuana laws were more likely to report using tobacco ( $\beta=.29$ ,  $p<.001$ ), alcohol ( $\beta=.25$ ,  $p<.005$ ), amphetamines ( $\beta=.35$ ,  $p<.001$ ), and steroids ( $\beta=1.14$ ,  $p<.05$ ) than those in states with medical marijuana laws after controlling the aforementioned variables for past year other drug use (tobacco, alcohol, marijuana, cocaine, amphetamines, sedatives, hallucinogens, opiates, inhalants, designer drugs, steroids, and other illegal drugs), social norms, grade classification, residential status, working status, and student status. There were no significant differences found among student drug use with cocaine, sedatives, opiates, or inhalants based on medical marijuana laws.

Descriptive and injunctive norms differed among students in states with medical marijuana laws when compared to students in states without medical marijuana laws. After holding past 30 day and past year marijuana use, grade classification, age, gender, residential status, working status, living arrangements, campus situation on alcohol and drugs (is there a policy?, is it enforced?, etc.), place of permanent residence (including enforcement and prevention) and injunctive norms constant, students in states with medical marijuana laws were more likely to perceive the average student used marijuana more often ( $\beta=.41$ ,  $p<.001$ ) than students in states without medical marijuana laws. Students' perceptions of how their close friends would feel about their using marijuana once or twice ( $\beta=.32$ ,  $p<.001$ ), smoking marijuana occasionally ( $\beta=.28$ ,  $p<.001$ ), and smoking marijuana regularly ( $\beta=.22$ ,  $p<.001$ ) were more likely to be positive if the participant was from a state with medical marijuana laws after holding age, gender, residential status, working status, living arrangements, campus situation on alcohol and drugs, student status, permanent residence, and social norms constant.

### **Accepted Hypotheses**

#### *Article 1*

All hypotheses were rejected.

#### *Article 2*

The following 8 out of 51 (16%) null hypothesis were accepted:

- Hypothesis 3.3: College students in states with medical marijuana laws and college students in states without medical marijuana laws used cocaine at an equal.
- Hypothesis 3.5: There is not a significant difference between students in states with and students in states without medical marijuana laws on sedative use.
- Hypothesis 3.7: There is not a significant difference between students in states with and students in states without medical marijuana laws on opiate use.

- Hypothesis 3.8: There is not a significant difference between students in states with and students in states without medical marijuana laws on inhalant use.
- Hypothesis 6.3: There is no difference between college students in states with medical marijuana laws and college students in states without medical marijuana laws on getting into an argument or a fight.
- Hypothesis 6.5: There is no difference between college students in states with medical marijuana laws and college students in states without medical marijuana laws on missing a class.
- Hypothesis 8.1: The path model that predicts marijuana usage does not reach goodness of fit indicators for college students in states without medical marijuana laws.
- Hypothesis 8.2: The path model that predicts marijuana usage does not reach goodness of fit indicators for college students in states without medical marijuana laws.

## **Rejected Hypotheses**

### *Article 1*

The following 2 out of 2 (100%) null hypothesis were rejected:

- Marijuana has no impact on college students.
- There is no difference in rigor among the current research on the outcomes of college student marijuana use.

### *Article 2*

The following 43 out of 51 (84%) null hypothesis were rejected:

- Hypothesis 1.1: College students in states with medical marijuana laws and college students in states without medical marijuana laws used marijuana at the same rate in the past 30 days after controlling for past year other drug use, social norms, grade classification, residential status, working status, and student status.

- Hypothesis 1.2: College students in states with medical marijuana laws and college students in states without medical marijuana laws used marijuana at than equal rate in the last year after controlling for past year other drug use, social norms, grade classification, residential status, working status and student status.
- Hypothesis 2.1: College students in states with medical marijuana laws and college students in states without medical marijuana laws perceived peer use of marijuana at an equal rate after controlling for age, ethnic origin, gender, marital status, grade classification, residential station, and working status.
- Hypothesis 3.1: College students in states with medical marijuana laws and college students in states without medical marijuana laws used tobacco at an equal rate after controlling for past year other drug use (tobacco, alcohol, marijuana, cocaine, amphetamines, sedatives, hallucinogens, opiates, inhalants, designer drugs, steroids, and other illegal drugs), social norms, grade classification, residential status, working status, and student status.
- Hypothesis 3.2: College students in states with medical marijuana laws and college students in states without medical marijuana laws used alcohol at an equal rate after controlling for age, ethnic origin, gender, marital status, grade classification, residential station, and working status.
- Hypothesis 3.4: College students in states with medical marijuana laws and college students in states without medical marijuana laws used amphetamines at an equal rate after controlling for past year other drug use (tobacco, alcohol, marijuana, cocaine, amphetamines, sedatives, hallucinogens, opiates, inhalants, designer drugs, steroids, and other illegal drugs), social norms, grade classification, residential status, working status, and student status.

- Hypothesis 3.6: College students in states with medical marijuana laws and college students in states without medical marijuana laws used hallucinogens at an equal rate after controlling for past year other drug use, social norms, grade classification, residential status, working status, and student status.
- Hypothesis 3.8: College students in states with medical marijuana laws and college students in states without medical marijuana laws used inhalants at an equal rate.
- Hypothesis 3.9: College students in states with medical marijuana laws and college students in states without medical marijuana laws used designer drugs at an equal rate after controlling for past year other drug use, social norms, grade classification, residential status, working status, and student status.
- Hypothesis 3.10: College students in states with medical marijuana laws and college students in states without medical marijuana laws used steroids at an equal rate after controlling for past year other drug use (tobacco, alcohol, marijuana, cocaine, amphetamines, sedatives, hallucinogens, opiates, inhalants, designer drugs, steroids, and other illegal drugs), social norms, grade classification, residential status, working status, and student status.
- Hypothesis 3.11: College students in states with medical marijuana laws and college students in states without medical marijuana laws used other illegal drugs at an equal rate after controlling for past year other drug use, social norms, grade classification, residential status, working status, and student status.
- Hypothesis 4.1: College students in states with medical marijuana laws and college students in states without medical marijuana laws have equal GPA rates after controlling for age, ethnic origin, gender, marital status, grade classification, residential station, and working status.



- Hypothesis 5.1: There is no difference between college students in states with medical marijuana laws and college students in states without medicinal marijuana laws using marijuana on campus.
- Hypothesis 5.2: There is no difference between college students in states with medical marijuana laws and college students in states without medicinal marijuana laws using marijuana in a residence hall.
- Hypothesis 5.3: There is no difference between college students in states with medical marijuana laws and college students in states without medicinal marijuana laws using marijuana in a fraternity or sorority.
- Hypothesis 5.4: There is no difference between college students in states with medical marijuana laws and college students in states without medicinal marijuana laws using marijuana in a bar or restaurant.
- Hypothesis 5.5: There is no difference between college students in states with medical marijuana laws and college students in states without medicinal marijuana laws using marijuana where they live.
- Hypothesis 5.6: There is no difference between college students in states with medical marijuana laws and college students in states without medicinal marijuana laws using marijuana in a car.
- Hypothesis 5.7: There is no difference between college students in states with medicinal marijuana laws and college students in states without medicinal marijuana laws using marijuana at private parties.
- Hypothesis 5.8: There is no difference between college students in states with medicinal marijuana laws and college students in states without medicinal marijuana laws using marijuana in other locations.

- Hypothesis 6.1: There is no difference between college students in states with medical marijuana laws and college students in states without medical marijuana laws on performing poorly on a test or important project.
- Hypothesis 6.2: There is no difference between college students in states with medical marijuana laws and college students in states without medical marijuana laws on being in trouble with police, residence hall, or other college authorities..
- Hypothesis 6.4: There is no difference between college students in states with medical marijuana laws and college students in states without medical marijuana laws on driving a car while under the influence.
- Hypothesis 6.6: There is no difference between college students in states with medical marijuana laws and college students in states without medical marijuana laws on thinking they might have a drinking or other drug problem.
- Hypothesis 6.7: There is no difference between college students in states with medical marijuana laws and college students in states without medical marijuana laws on having memory loss.
- Hypothesis 6.8: There is no difference between college students in states with medical marijuana laws and college students in states without medical marijuana laws on doing something they later regretted.
- Hypothesis 6.9: There is no difference between college students in states with medical marijuana laws and college students in states without medical marijuana laws on being arrested for DWI/DUI.
- Hypothesis 6.10: There is no difference between college students in states with medical marijuana laws and college students in states without medical marijuana laws on trying unsuccessfully to stop using

- Hypothesis 6.11: There is no difference between college students in states with medical marijuana laws and college students in states without medical marijuana laws on seriously thinking about suicide.
- Hypothesis 6.12: There is no difference between college students in states with medical marijuana laws and college students in states without medical marijuana laws on seriously trying to commit suicide.
- Hypothesis 6.13: There is no difference between college students in states with medical marijuana laws and college students in states without medical marijuana laws on being hurt or injured.
- Hypothesis 7.1: College students in states with medical marijuana laws and college students in states without medical marijuana laws perceive how their close friends would think about them trying marijuana once or twice at equal rates after controlling age, gender, residential status, working status, living arrangements, campus situation on alcohol and drugs, student status, permanent residence, and social norms.
- Hypothesis 7.2: College students in states with medical marijuana laws and college students in states without medical marijuana laws perceive how their close friends would think about them smoking marijuana occasionally at equal rates after controlling age, gender, residential status, working status, living arrangements, campus situation on alcohol and drugs, student status, permanent residence, and social norms.
- Hypothesis 7.3: College students in states with medical marijuana laws and college students in states without medical marijuana laws perceive how their close friends would think about them smoking marijuana regularly at equal rates after controlling age, gender, residential status, working status, living arrangements, campus situation on alcohol and drugs, student status, permanent residence, and social norms.

## **Discussion**

## *Article 1*

The focus of this systematic review was to examine the existing literature concerning associated effects of marijuana use on college student academics, conduct and legal issues, negative outcomes, normative perceptions, and physical and mental health in the United States. After assessing four databases, 70 non-duplicate inquiries emerged. Upon evaluation of article titles, 61 abstracts were reviewed followed by a full text analysis of 39 studies. Thirty-five papers met the inclusion criteria. Data were obtained using a standardized extraction form including columns focused on study design, location, target population, sample size, study methods, measured outcomes, results, and limitations. Overall, articles were analyzed based on topical areas and scientific rigor.

As with any type of research, there are inherent limitations, this also is true of systematic reviews. First, it is possible that despite the systematic review search strategy, some relevant articles were not included. The chance of this occurring was minimized by using a diverse database search strategy. Second, focusing on a limited area of research methods may have left other areas under assessed or reported. For example, perhaps too much emphasis was placed on sample size and not enough on measuring effect size. Third, there was significant variation in study population, response rates, campus size, and reliability and validity measures. This could lead to varying interpretations of the literature. Fourth, because of the nature of this inquiry, the inclusion/exclusion criteria omitted marijuana prevention, intervention, or education programs. Fifth, undoubtedly unpublished studies exist, which is not related to the methods used for this study, but leaves in question what other research on this subject is being conducted.

## *Article 2*

The addition of medical and recreational marijuana laws in some states, poses unique challenges for college officials and public health leaders. It is imperative to assess the impact these laws have on college students, as this information may help inform future state and federal policy decisions. The purpose of this inquiry was to examine how medical marijuana laws impact college

student health. The decision to focus exclusively on medical marijuana was made because at the time of this study (when the data were collected) recreational marijuana laws had not been implemented. Thus, comparisons for the current study were made between students who attended college in states with and without medical marijuana laws concerning health and academic outcomes as well as normative information.

Overall, students who attended college in states with medical marijuana laws were more likely to use marijuana, experience negative consequences, and have misperceptions of other student use and approval of use. Concerning marijuana use, students in states with medical marijuana laws were more than 50% likely to have used marijuana in the past 30 days. This may be due to increased access, normalization of marijuana use, and a reduction in the perception of risk associated with use (Johnston et al., 2015). These students reported increased instances of having a memory loss, being injured, later regretting an action, driving while intoxicated, being arrested for DWI, thinking about suicide, attempting suicide, thinking they have a problem, and unsuccessfully trying to quit using. This is problematic for this population because of their direct relationships with reduced retention and enrollment rates, and increasing mental health issues on college campuses.

Regarding perceptions, the findings from this study are consistent with previous research indicating that most college students grossly overestimate how much marijuana college students use (Buckner, 2013; Comello, 2013; Ecker, Richter, & Buckner, 2014; Kaynak et al., 2013; LaBrie, Hummer, & Lac, 2011; Napper et al., 2014; Neighbors et al., 2013, Pinchevsky et al., 2011, Stewart & Moreno, 2014; Suerken et al., 2014). Descriptive and injunctive norms varied considerably among students in states with medical marijuana laws when compared to students in states without medical marijuana laws. Social norm marketing campaigns can be used to correct these misperceptions (descriptive norms). This prevention strategy has been somewhat successful with high-risk drinking and college students, these same principles can be applied to marijuana with this population as well

(Benton, et al., 2006; DeJong et al., 2006; Glassman & Braun, 2010; Neighbors, et al., 2006; Perkins, 2002).

Results from this study will assist college health educators and medical professionals in several ways. First, because of the increased odds of negative consequences among students in states with medical marijuana laws, dedicating funding toward developing prevention and treatment programs to address marijuana use and the related consequences on college campuses is warranted. Second, prevention information such as healthy decision making and alternative activities (student organizations, clubs, sports, etc.) could be shared with students and their parents as early as student orientation and existing campus resources such as campus counseling centers need to be promoted more thoroughly. Third, with the increased risk of mental health issues related to marijuana use (thinking about or attempting suicide), medical providers need to screen students for marijuana abuse, treat, and refer as appropriate. Fourth, because of the greater odds of using marijuana, hallucinogens, and other illicit drugs in states with medical marijuana laws, specific interventions designed to prevent and reduce substance abuse need to be implemented and rigorously evaluated. Finally, knowing the impact that marijuana has on students' mental, physical, and intellectual health and addressing these issues is consistent with goals and objectives delineated in *Healthy Campuses 2020* (ACHA, 2012).

Several noteworthy limitations exist due to the inherent constraints associated with secondary data analyses. First, self-reported data were collected for this study, which, because of the sensitive nature of questions, may have led respondents to underreport, over-report, or experience imperfect recall of their substance use. Second, causal inferences cannot be gleaned from cross-sectional data analysis. For example, whether the findings from this study are the result of medical marijuana laws or differences in culture from state to state, is impossible to surmise, based on the methods employed for this study. Third, a set of questions asked how often students experienced negative outcomes in relation to all substances use, not just marijuana. This is problematic because it is impossible to

determine if the negative outcomes experienced were due exclusively to marijuana and/or some other drug(s). Forth, another item from the survey (how do you think your close friends feel – or would feel – about you...) utilized a double negative response option (don't disapprove) which may have confused some respondents. Finally, the use of only one item to measure perceived risk, descriptive norms, and injunctive norms, limits the assessment of these constructs (mono-method biases).

#### Path analysis

To conduct the path analysis, EQS 6.1 and IBM® SPSS® Analysis of Momentum Structures (AMOS) were used to construct the path model (Figure 2). The model depicting marijuana use in states with medical marijuana laws had several indices that specified a good or moderate fit, for example the Bentler-Bonett Index (NFI) was .941 and Comparative Fit Index (CFI) was .942 (Kenny, 2004). The correlation matrix depicted in Table 6 illustrates that past year use of alcohol, tobacco, hallucinogens, and designer drugs were correlated with past year marijuana use as were perceptions of occasional marijuana use among close friends and drug availability. However, the Chi-Square results ( $\chi^2=858.653$ ,  $p<.001$ ), Root Mean-Square Error of Approximation (RMSEA) (.155), and Joreskog-Sorbom's Fit Index (AGFI) (.812) all indicated that the model was a poor fit (Kenny, 2004). Therefore, after 60 or more attempts, a model meeting the required fit indices was not reached (see Table 7). Thus, the path analysis was not included in the third article.

There were two issues that likely affected the model fit. First, the data were categorical which is problematic because the software systems are designed to best interpret models that use continuous variables. One way to address the issue was to employ a bootstrapping technique (Nevitt & Hancock, 2001). Bootstrapping assists researchers in evaluating the empirical sampling distribution of parameter estimates and allows for obtaining standard errors in the absence of a theoretical formula, standardized loadings, and indirect effects. Second, rather than using one theory, with related constructs, the items used in the survey came from various theories, and were assessed with only a few items, thus the poor predictive validity of these items was somewhat expected.

## **Recommendations**

The following recommendations are presented based on the systematic literature review and the secondary data analysis. The recommendations are subdivided at the college health practitioner, campus administration, research and grantor levels, state and federal levels.

### **College Health Practitioner Level**

- College health practitioners should expand prevention programming to include marijuana education and information.
  - Where specific programming already exists it should be enhance through rigorous evaluation.
- The current college student population is likely to read about marijuana on various Internet sites. It is crucial for college health practitioners to stay up-to-date on the latest research and share it with students as well as teaching them how to assess the Internet for accurate information.
- Social norms marketing campaigns have shown great promise in college substance abuse prevention intervention research (Benton, et al., 2006; DeJong et al., 2006; Glassman & Braun, 2010; Neighbors, et al., 2006; Perkins, 2002) and thus practitioners should tailor this approach to marijuana prevention.
- Health communication campaigns should be designed to educate students on the physical and mental health risks associated with marijuana use.
- Educational sessions focusing on marijuana and substance abuse should be conducted at student and parent orientation programs, faculty and staff orientations, first year experience courses, and other student affairs events as appropriate.

### **Campus Administration Level**

- College officials should create a campus taskforce that is inclusive of all the relevant university units and divisions to advise senior administrators on substance abuse issues.



- College campuses will need to re-evaluate their policies on use of marijuana in order to maintain healthy campuses whose policies are in agreement with federal law.
  - These policies are not necessarily exclusive to substance use. Policies related to grounds and facilities, campus visitors, and facility rental may need to be addressed as well.
- As budgets are created, additional funds will need to be added to current budgets in order to address marijuana use and abuse.
- A full-time position dedicated to addressing substance abuse prevention is warranted. In addition, this person should be trained in public health and prevention education or related field.

### **Researcher and Grantor Level**

- The field would benefit from a meta-analysis of the literature focusing on intervention-based research to ascertain best practices for marijuana prevention similar to the National Institutes on Alcohol Abuse and Alcoholism *Tiers of Effectiveness* for alcohol prevention on college campuses (NIAAA, 2002).
- Increase grant funding:
  - A nationally representative study assessing college students and marijuana use is needed to inform campus officials, and state and federal governments, of pertinent issues that may inform policies and laws.
  - Since marijuana is a Schedule I drug, intervention research in this area is sparse; specific *Requests for Proposals* in this area should be implemented.
- Rigor is lacking in the current literature. Editors and reviewers for college health and prevention journals are urged to hold authors to high standards in the peer review process.

- Future research should include states that have implemented recreational marijuana laws and should focus on student physical and mental health, nutrition, sexual activity, campus safety, academics, negative consequences, and social norms.

### **State and Federal Level**

- Discrepancies between state and federal laws will need to be discussed. Campuses in states with medical marijuana laws face the challenge of meeting the federal standards of the safe and drug free schools act while still allowing their students to access their “medication.” So while the state may allow the medical use of marijuana, the federal government, who provides substantial funding to public institutions of higher education, view marijuana as a schedule one drug that is prohibited on federally funded college campuses (Adele, 2015).
- With the current rate of states passing more permissive marijuana laws, legalization (medical or recreational) at the federal level appears to be imminent. The federal government is urged to review all the data supporting the negative outcomes of marijuana use on college students including retention and graduation rates.

### **Synthesis of Articles**

Fifty percent of states in the U.S. have passed more permissive marijuana laws that make the substance more accessible. Of these 25 states, 20 have enacted medical marijuana laws and four have legalized recreational marijuana. Seventeen additional states failed to pass medical marijuana laws in 2015. The trend in the passage and creation of legislative bills has coincided with changes in college student social norms related to this substance. The first medical marijuana law was passed in California in 1996 (ProCon.org, 2015). At that time, results the Monitoring the Future study (2014) indicated that 60% of 18 year old college students perceived regular use of marijuana as harmful, approximately 18 years later the rate dropped by a third (40%). This is just one example of the potential impact marijuana use has on college student marijuana use which affects their health, retention, and graduation rates.

Indeed, the impact that marijuana has on college students is well documented. The results from the systematic literature review in Chapter Two contribute to the body of knowledge by summarizing the research in this area. Several trends emerged in this analysis including consequences related to academics, physical and mental health, safety, and the impact social norms have on student choice to use or not use marijuana. However, the most noteworthy finding was the lack of research focused on the unintended effects that medical marijuana laws have on college students. Therefore, a secondary data analysis was conducted address these gaps. The results of this analysis revealed that these laws have a substantial effect on college student health and academics. However, other questions still remain that warrant future investigation.

### **Future Research**

More permissive state marijuana laws and the related college student outcomes represent an emerging area of research. With 20 states allowing the medical use of marijuana and four permitting recreational use (ProCon.org, 2015), it is imperative that college campuses begin to devise prevention plans and create policies that address this evolving issue. State and federal medical and recreational marijuana laws represent a fertile area of research, specifically as it relates to college students academic, physical, and emotional health. A myriad of research questions exist including the following:

1. What prevention strategies are most effective with college students in states where medical marijuana is legal?
2. What prevention strategies are most effective on college campuses in states that have recreational marijuana laws?
3. What campus policies and prevention strategies will be supported by university administration?
4. How do campus policies differ in states with medical or recreational marijuana laws?

5. How are campuses enforcing their marijuana policies in states with legalized medical or recreational marijuana?
6. Are students in states without recreational marijuana laws physically and/or mentally healthier than those in states with laws?
7. What are the long-term trends of marijuana use in states such as California who implemented medical marijuana laws almost 20 years ago?
8. What are the long term college retention and graduation rate trends in states that have more permissive marijuana laws?

These research questions merit consideration for a variety of reasons. For example, what campus policies and prevention strategies will be supported by university administration?

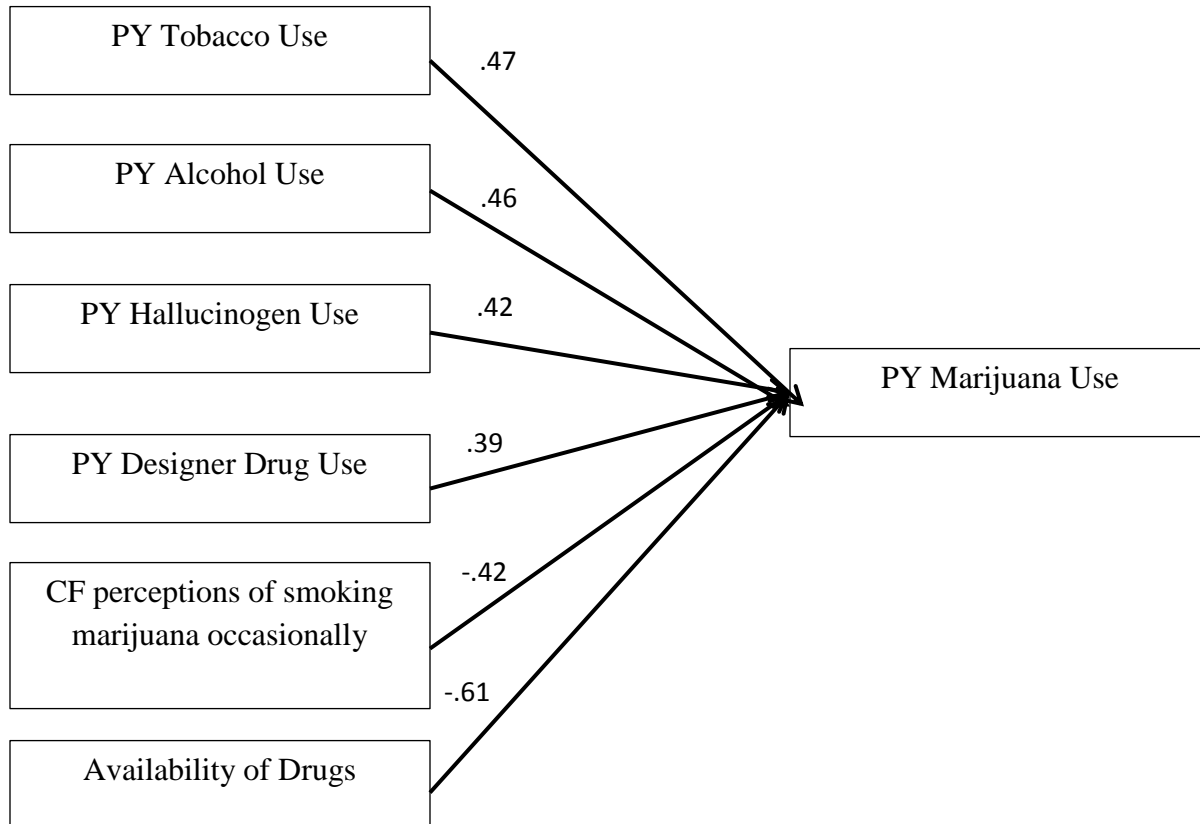
Determining how to best design and enforce a policy that balances civil liberties and a healthy campus environment is an important consideration. Therefore, defining how campuses are enforcing their marijuana policies in states with legalized medical or recreational marijuana is a logical next step. Next, what are the long-term effects of more permissive marijuana laws on college student marijuana use and retention and graduation rates? Are these rates declining in states with more permissive marijuana policies or are they consistent with findings in states without such laws? Finally, documentation of both the benefits (reduced student marijuana use) and outcomes (e.g., healthier campus) of campus marijuana prevention initiatives could inform future state, federal, and campus policy planning processes.

## **Summary**

This chapter provided a brief overview of the major findings reported in articles one and two. In addition, summaries of the accepted and rejected hypotheses were included. The discussion section examined the key results while placing these in the context of the current literature. Finally, recommendations for researchers and practitioners were offered followed by future potential research studies.



**Figure 2: Path Model**



*Notes:* All of the path coefficients are significant at the .05 level.  
PY=Past year. CF=Close friends.

TABLE 6: Spearman's Rho Correlation Coefficient Matrix

Variable	PY tobacco	PY alcohol	PY marijuana	PY hallucinogen	PY designer drug	CF perceptions of smoking marijuana occasionally	Drug availability
PY tobacco	1						
PY alcohol	<b>.411</b>	1					
PY marijuana	<b>.470</b>	<b>.466</b>	1				
PY hallucinogen	.330	.222	<b>.422</b>	1			
PY designer drug	.307	.262	<b>.391</b>	<b>.585</b>	1		
CF perceptions of smoking marijuana occasionally	-.247	<b>-.462</b>	<b>-.422</b>	-.159	-.162	1	
Drug availability	-.349	<b>-.398</b>	<b>-.605</b>	-.315	-.300	<b>.391</b>	1

Notes: Bold indicates  $p < .05$ . PY=Past year. CF=Close friends.

TABLE 7: Path Model Fit Indices

<b>Fit Indices</b>	<b>Marijuana Use</b>
Chi-square, df, p	858.653, 5, <.001
Bentler-Bonett Normed Fit Index (NFI)	.941
Bentler-Bonnet Non-Normed Fit Index (NNFI)	.756
Comparative Fit Index (CFI)	.942
Bollen's Fit Index (IFI)	.942
McDonald's Fit Index (MFI)	.942
Joreskog-Sorbom's Fit Index (GFI)	<b>.966</b>
Joreskog-Sorbom's Fit Index (AGFI)	.812
Root Mean-Square Residual (RMR)	.054
Root Mean-Square Error of Approximation (RMSEA)	.155

*Notes:* Bold indicates good fit.



## References

- Adele, G. (2015). Will colleges have to accommodate medical marijuana? *Student Affairs Today*, 17, 6.
- American College Health Association. (2012). Healthy Campus 2020. Retrieved July 2, 2014, from <http://www.acha.org/HealthyCampus/index.cfm>.
- American College Health Association. (2014). American College Health Association-National College Health Assessment II: Undergraduate students reference group executive summary spring 2014. Hanover, MD: American College Health Association.
- American College Health Association. (2000). American College Health Association-National College Health Assessment: Reference group executive summary spring 2000. Baltimore, MD: American College Health Association.
- Arbour-Nicitopoulos, K.P., Kwan, M.Y.W., Lowe, D., Taman, S. & Faulkner, G.E.J. (2010). Social norms of alcohol, smoking, and marijuana use within a Canadian University setting. *Journal of American College Health*, 59 (3), 191-196.
- Arria, A.M., Caldeira, K.M., Vincent, K.B., Garnier-Dykstra, L.M., & O'Grady, K.E. (2011). Substance-related traffic-risk behaviors among college students. *Drug and Alcohol Dependence*, 118 306-312.
- Arria, A.M., Garnier, Dykstra, L.M., Caldeira, K.M., Vincent, K.B., Winick, E.R., & O'Grady, K.E. (2013a). Drug use patterns and continuous enrollment in college: Results from a longitudinal study. *Journal of Studies on Alcohol and Drugs*, 74, 71-83.
- Arria, A.M., Wilcox, H.C., Caldeira, K.M., Vincent, K.B., Garnier-Dykstra, L.M., & O'Grady, K.E. (2013b). Dispelling the myth of "smart drugs": Cannabis and alcohol use problems predict nonmedical use of prescription stimulants for studying. *Addictive Behaviors*, 38, 1643-1650.
- Arria, A.M., Caldeira, K.M., Vincent, K.B., Winick, B.A., Baron, R.A., & O'Grady, K.E.

- (2013c). Discontinuous college enrollment: Associations with substance use and mental health. *Psychiatric Services*, 64(2), 165-172.
- Arria, A.M., Caldeira, B.A., Bugbee, B.A., Vincent, K.B., & O'Grady, K.E. (2013d). The academic opportunity costs of substance use during college, College Park, MD: Center on Young Adult Health and Development. Available at <http://www.cls.umd.edu/docs/AcadOppCosts.pdf>.
- Arterberry, B.J., Treloar, H.R., Smith, A.E., Martens, M.P., Pedersen, S., & McCarthy, D.M. (2013). Marijuana use, driving, and related cognition. *Psychology of Addictive Behaviors*, 27(3), 854-860.
- Beck, K.H., Caldeira, K.M., Vincent, K.B., O'Grady, K.E., Wish, E.D., & Arria, A.M. (2009). The social context of cannabis use: Relationship to cannabis use disorders and depressive symptoms among college students. *Addictive Behaviors*, 34, 764-768.
- Benton, S.L., Downey, R.G., Glider, P.S., Benton, S.A., Shin, K., Newton, D.W., Arck, W., & Price, A. (2006). Predicting negative drinking consequences: Examining descriptive norm perception. *Journal of Studies on Alcohol*, 67(3), 399-405.
- Blair, J., Czaja, R.F., & Blair, E.A. (2014). *Designing surveys: A guide to decisions and procedures* (3<sup>rd</sup> ed.). Thousand Oaks, CA; Sage Publications.
- Buckman, J.F., Yusko, D.A., Farris, S.G., White, H.R., & Pandina, R.J. (2011). Risk of marijuana use in male and female college student athletes and nonathletes. *Journal of Studies on Alcohol and Drugs*, 72, 586-591.
- Buckner, J.D. (2013). College cannabis use: The unique role of social norms, motives, and expectancies. *Journal on Studies of Alcohol and Drugs*, 74, 720-726.
- Buckner, J.D., Crosby, R.D., Silgado, J., Wonderlich, S.A., & Schmidt, N.B. (2012). Immediate antecedents of marijuana use: An analysis from ecological momentary assessment. *Journal of Behavior Therapy and Experimental Psychiatry*, 43, 647-655.
- Calderia, 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, 397-411.
- Caldeira, K.M., O'Grady, K.E., Vincent, K.B., & Arria, A.M. (2013). Marijuana use trajectories during the post-college transition: Health outcomes in young adulthood. *Drug and Alcohol Dependence*, 125, 267-275.
- Cannabis [Def. 2]. (n.d.). *Merriam-Webster Online*, Retrieved June 22, 2015, from <http://www.easybib.com/reference/guide/apa/dictionary>
- Cerda, M., Wall, M., Keyes, K.M., Galea, S., & Hasin, D. (2012). Medical marijuana laws in 50 states: Investigating the relationship between state legalization of medical marijuana and marijuana use, abuse and dependence. *Drug and Alcohol Dependence*, 120, 22-27.
- Comello, M.L.G. (2015). How does a risk-oriented “future-self” influence behavior?: A structural-equation-modeling approach with marijuana related outcomes. *Journal of Health Psychology*, 20, 37-47.
- Comello, M.L.G., & Slater, M.D. (2010). Examining marijuana user and non-user prototypes in formative research for prevention campaigns. *Journal of Drug Education*, 40(4), 315-330.
- Core Institute. (2013). Core Alcohol and Drug Survey Annual Results 2013. Retrieved on February 7, 2015 [http://core.siu.edu/\\_common/documents/2013.pdf](http://core.siu.edu/_common/documents/2013.pdf).
- DeJong, W., Schneider, S.K., Towvim, L.G., Murphy, M.J., Doerr, E.E., Simonsen, N.R., & Scribner, R.A. (2006). A multisite randomized trial of social norms marketing campaigns to reduce college student drinking. *Journal of Studies on Alcohol*, 67(6), 868-879.
- Drug Enforcement Administration. (n.d.). Drug schedules. Retrieved on July 7, 2015 from: <http://www.dea.gov/druginfo/ds.shtml>.
- Ecker, A.H., Richter, A.A., & Buckner, J.D. (2014). Cannabis-related impairment: The impacts

- of social anxiety and misconceptions of friends' cannabis-related problems. *Addictive Behaviors*, 39, 1746-1749.
- Elliott, J.C. & Carey, K.B. (2012). Correcting exaggerated marijuana use norms among college abstainers: A preliminary test of a prevention intervention. *Journal of Studies on Alcohol and Drugs*, 73, 976-980.
- Falls, B.J., Wish, E.D., Garnier, L.M., Caldeira, O'Grady, K.E., Vincent, K.B., & Arria, A.M. (2011). The association between early conduct problems and early marijuana use in college students. *Journal of Child and Adolescent Substance Abuse*, 20, 221-236.
- Ferner, M. (2015). Judge upholds federal government's classification that marijuana is dangerous. *Huffington Post*. Retrieved on May 5, 2015 from [http://www.huffingtonpost.com/2015/04/15/california-judge-upholds-marijuana-classification\\_n\\_7072930.html](http://www.huffingtonpost.com/2015/04/15/california-judge-upholds-marijuana-classification_n_7072930.html).
- Fielder, R.L., Walsh, J.L., Carey, K.B., & Carey, M.P. (2013). Predictors of sexual hookups: A theory-based, prospective study of first-year college women. *Archives of Sexual Behavior*, 42(8), 1425-1441.
- Gaher, R.M., & Simons, J.S. (2007). Evaluations and expectancies of alcohol and marijuana problems among college students. *Psychology of Addictive Behaviors*, 21(4), 545-554.
- Glascoff, M.A., Shrader, J.S., & Haddock, R.K. (2013). Friends don't let friends drive drunk, but do they let them drive high? *Journal of Alcohol and Drug Education*, 57, 66-84
- Glassman, T.J., & Braun, R.E. (2010). Confusion surrounding social marketing strategies and social norm theory: To prevent high-risk drinking among college students. *Social Market Quarterly*, 16, 94-103.
- Gold, G.J., & Nguyen, M.A. (2009). Comparing entering freshmen's perceptions of campus marijuana and alcohol use to reported use. *Journal of Drug Education*, 39(2), 133-148.
- Governing. (2015). State marijuana laws map. Retrieved on February 24, 2015 from

<http://www.governing.com/gov-data/safety-justice/state-marijuana-laws-map-medical-recreational.html>.

- Gruber, S.A., Dahlgren, M.K., Saqar, K.A., Gonec, A., & Lukas, S.E. (2014). Worth the wait: Effects of age on onset of marijuana use on white matter impulsivity. *Psychopharmacology*, 231(8), 1455-1465.
- Hall, W. & Degenhardt, L. (2008). Cannabis use and the risk of developing a psychotic disorder. *World Psychiatry*, 7, 68-71.
- Hunt, J., Eisenberg, D., & Kilbourne, A.M. (2010). Consequences of receipt of a Psychiatric diagnosis for completion of college. *Psychiatric Services*, 16(4), 399-404.
- Jacobus, J., Squeglia, L.M., Infante, M.A., Bava, S., & Tapert, S.F. (2013). White matter integrity pre- and post- marijuana and alcohol initiation in adolescence. *Brain Sciences*, 3, 396-414
- Johnston, L.D., O'Malley, P.M., Bachman, J.G., Schulenberg, J.E., & Miech, R.A. (2014). Monitoring the Future national survey results on drug use, 1975-2013: Volume 2, College Students and adults ages 19-55. Ann Arbor: Institute for Social Research, The University of Michigan.
- Johnston, L. D., O'Malley, P. M., Miech, R. A., Bachman, J. G., & Schulenberg, J. E. (2015). Monitoring the Future national survey results on drug use: 1975-2014: Overview, key findings on adolescent drug use. Ann Arbor: Institute for Social Research, The University of Michigan.
- Kaynak, O., Meyers, K., Vincent, K.B., Winters, K.C., & Arria, A.M. (2013). Relationships among parental monitoring and sensation seeking on the development of substance use disorder among college students. *Addictive Behaviors*, 38, 1457-1463.
- Kenny D. (2014). Measuring Model Fit (pdf document). Retrieved Structural Equation Modeling. Retrieved on July 28, 2015 from <http://davidakenny.net/cm/fit.htm>
- Kilmer, J.R., Hunt, S.B., Lee, C.M., & Neighbors, C. (2007). Marijuana use, risk perceptions,

- and consequences: Is perceived risk congruent with reality? *Addictive Behaviors*, 32, 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 and Drugs*, 67, 277-281.
- LaBrie, J.W., Grossbard, J.R., & Hummer, J.F. (2009). Normative misperceptions and marijuana use among male and female college athletes. *Journal of Applied Sport Psychology*, 21(1), S77-S85.
- LaBrie, J.W., Hummer, J.F., & Lac, A. (2011). Comparing injunctive marijuana use norms of salient reference groups among college student marijuana users and nonusers. *Addictive Behaviors*, 36, 717-720.
- Lewis, T.F., & Clemens, E. (2008). The influence of social norms on college student alcohol and marijuana use. *Journal of College Counseling*, 11, 19-31.
- Marijuana [Def. 2]. (n.d.). *Merriam-Webster Online*, Retrieved June 22, 2015, from <http://www.merriam-webster.com/dictionary/marijuana>
- Marijuana: Myths and Facts. Office of National Drug Control Policy. Retrieved on July 2, 2012. [https://www.ncjrs.gov/ondcppubs/publications/pdf/marijuana\\_myths\\_facts.pdf](https://www.ncjrs.gov/ondcppubs/publications/pdf/marijuana_myths_facts.pdf).
- Marijuana use among students at institutions of higher education, 2008. Higher Education Center. Retrieved on July 2, 2012. <http://www.higheredcenter.org/files/product/marijuana.pdf>.
- Martens, M.P., Brown, N.T., Donovan, B.M., & Dude, K. (2005). Measuring negative consequences of college student substance abuse: A psychometric evaluation of the Core Alcohol and Drug Survey. *Measurement & Evaluation in Counseling & Development*, 38, 164-175.
- Medical marijuana law and legal definition. (n.d.). USLegal, Retrieved June 22, 2015, from <http://www.easybib.com/reference/guide/apa/dictionary>.

- Medina, K.L., Hanson, K.L., Schweinsburg, A.D., Cohen-Zion, M., Nagel, B.J., & Tapert, S.F. (2007). Neuropsychological functioning in adolescent marijuana users: Subtle deficits detectable after a month of abstinence. *Journal of the International Neuropsychological Society*, 13, 807-820.
- Meier, M.H., Caspi, A., Ambler, A., Harrington, H, Houts, R., Keefe, R. S. E., McDonald, K., Ward, A., Poulton, R. & Moffitt, T. E. (2012). Persistent cannabis users show neuropsychological decline from childhood to midlife. *Proceedings of the National Academy of Science*, 109:40, E2657-2664.
- Najolia, G.M., Buckner, J.D., & Cohen, A.S. (2012). Cannabis use and schizotypy: The role of social anxiety and other negative states. *Psychiatry Research*, 200, 660-668.
- Napper, L.E., Hummer, J.F., Chithambo, T.P., & LaBrie, J.W. (2014). Perceived parent and peer marijuana norms: The moderating effect of parental monitoring during college. *Prevention Science*, 1, 1-10.
- National Institutes of Health, Task Force of the National Advisory Council on Alcohol Abuse and Alcoholism. (2005). A call to action: Changing the culture of drinking at U.S. colleges. Retrieved online on April 3, 2015 from <http://www.collegedrinkingprevention.gov/media/TaskForceReport.pdf>.
- Neighbors, C., Bergstrom, R.L., Lewis, M.A., & Larimer, M.E. (2006). Being controlled by normative influences: Self-determination as a moderator of a normative feedback alcohol intervention. *Health Psychology*, 25, 571-579.
- Neighbors, C.F, Foster, D.W., Walker, D.D., Kilmer, J.R., & Lee, C.M. (2013). Social identity as a moderator of the association between perceived norms and marijuana use. *Journal of Studies on Alcohol and Drugs*.74, 479-483.
- Neighbors, C.F., Geisner, I.M., & Lee, C.M. (2008). Perceived marijuana norms and social

- expectancies among entering college student marijuana users. *Psychology of Addictive Behaviors*, 27(3), 433-438.
- Nevitt, J., & Hancock, G.R. (2001). Performance of bootstrapping approaches to model test statistics and parameter standard error estimation in structural equation modeling. *Structural Equation Modeling*, 8(3), 353-377.
- Office of National Drug Control Policy. (2004). Marijuana: Myths and Facts. Retrieved on February 7, 2015  
[https://www.ncjrs.gov/ondcppubs/publications/pdf/marijuana\\_myths\\_facts.pdf](https://www.ncjrs.gov/ondcppubs/publications/pdf/marijuana_myths_facts.pdf).
- Palmer, R.S., McMahon, T.J., Moreggi, D.I., Rounsaville, B.J., & Ball, S.A. (2012). College student drug use: Patterns, concerns, consequences, and interest in intervention. *Journal of College Student Development*, 53, 1-10.
- Perkins, H.W. (2002). Social norms and the prevention of alcohol misuse in collegiate contexts. *Journal of Studies Alcohol and Drugs, Supplement*, 14, 164-172.
- Pinchevsky, G.M., Arria, A.M., Caldeira, K.M., Garnier-Dykstra, L.M., Vincent, K.B., & O'Grady, K.E. (2012). Marijuana exposure opportunity and initiation during college: Parent and peer influences. *Prevention Science*, 13, 43-54.
- ProCon.org (2015). Medical marijuana pros and cons: 23 legal medical marijuana states and DC; laws, fees, and possession limits. Retrieved on February 24, 2015 from  
<http://medicalmarijuana.procon.org/view.resource.php?resourceID=000881>.
- Recreational Drug [Def. 1]. (n.d.). *Merriam-Webster Online*, Retrieved June 22, 2015, from <http://www.merriam-webster.com/dictionary/marijuana>.
- Reilly, R. J., & Grim, R. (2013). Eric Holder says DOJ will let Washington, Colorado marijuana laws go into effect. Huffington Post. Retrieved on February 24, 2015 at  
[http://www.huffingtonpost.com/2013/08/29/eric-holder-marijuana-washington-colorado-doj\\_n\\_3837034.html](http://www.huffingtonpost.com/2013/08/29/eric-holder-marijuana-washington-colorado-doj_n_3837034.html).



- SAMHSA. NREPP. (n.d.) Brief alcohol screening and intervention for college students (BASICS). Retrieved on July 22, 2015 from <http://www.nrepp.samhsa.gov/ViewIntervention.aspx?id=124>
- Simmons, 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. *The American Journal of Drug and Alcohol Abuse*, 32, 41-53.
- Shrivastava, A., Johnston, M., & Tsuang, M. (2011). Cannabis use and cognitive dysfunction. *Indian Journal of Psychiatry*, 53, 187-191.
- Solowij, N., Jones, K.A., Rozman, M.E., Davis, S.M., Ciarrochi, J., Heaven, P.C.L., Lubman, D.I., & Yucel, M. (2011). Verbal learning and memory in adolescent cannabis users, alcohol users, and non-users. *Psychopharmacology*, 216, 131-144.
- Stewart, M.W., & Moreno, M.A. (2014). Changes in attitudes, intentions, and behaviors toward tobacco and marijuana during U.S. students' first year of college. *Tobacco Use Insights*, 6, 7-16.
- Suerken, C.K., Reboussin, B.A., Suftin, E.L., Wagoner, K.G., Spangler, J., & Wolfson, M. (2014). Prevalence of marijuana use at college entry and risk factors for initiation during freshmen year. *Addictive Behaviors*, 39, 302-307.
- Task Force of the National Advisory Council on Alcohol Abuse and Alcoholism. (2002). A call to action: Changing the culture of drinking at U.S. colleges. Retrieved on February 18, 2015 from <http://www.collegedrinkingprevention.gov/media/TaskForceReport.pdf>.
- Tetrahydrocannabinol (THC) [Def. 1]. (n.d.). *Merriam-Webster Online*, Retrieved July 27, 2015 from: <http://www.merriam-webster.com/dictionary/thc>
- The Carnegie Classification of Institutions of Higher Education. (2010). Classification description: Size and setting. Retrieved on April 2, 2015 from [http://carnegieclassifications.iu.edu/descriptions/size\\_setting.php](http://carnegieclassifications.iu.edu/descriptions/size_setting.php).

The Surgeon General's Warning on Marijuana, 1983. Retrieved on July 2, 2012.

<http://www.cdc.gov/mmwr/preview/mmwrhtml/00001143.htm>.

Thoma, R.J., Monnig, M.A., Lysne, P.A., Ruhl, D.A., Pommy, J.A., Bogenschutz, M.,

Tonigan, J.S., & Yeo, R.A. (2011). Adolescent substance abuse: The effects of alcohol and marijuana on neuropsychological performance. *Alcoholism: Clinical Experimental Research*, 35(1), 39-46.

Tullis, L.M., Dupont, R., Frost-Pineda, K., Gold, M.S. (2003). Marijuana and tobacco: A major connection? *Journal of Addictive Diseases*, 22(3), 399-405.

Upcraft, M.L. (2002). Today's first-year students and alcohol. Retrieved on February 24, 2015 at: <http://www.collegedrinkingprevention.gov/SupportingResearch/upcraft1.aspx>.

United States Department of Health, U.S. Food and Drug Administration. (2015). Controlled Substances Act. Retrieved on May 5, 2015 from

<http://www.fda.gov/regulatoryinformation/legislation/ucm148726.htm>.

Wadley J. (2014). College students' use of marijuana on the rise, some drugs declining.

*Michigan News*. Retrieved on April 18, 2015 from <http://ns.umich.edu/new/releases/22362-college-students-use-of-marijuana-on-the-rise-some-drugs-declining>.

Whitehill, J.M., Rivara, F.P., & Moreno, M.A. (2014). Marijuana-using drivers, alcohol-using drivers, and their passengers: Prevalence and risk factors among undergraduate college students. *Journal of the American Medical Association Pediatrics*, 168(7), 618-624.

Zhao, J., Stockwell, T., & MacDonald, S. (2009). Non-response bias in alcohol and drug population surveys. *Drug and Alcohol Review*, 28, 648-657.

## Appendix A

### Journal on Studies of Alcohol and Drugs Submission Guidelines

The average time from acceptance to online publication is 3.5 months. The average time from submission to acceptance is 4 months. The Journal of Studies on Alcohol and Drugs (JSAD), founded in 1940, publishes peer-reviewed manuscripts dealing with diverse aspects of alcohol and other substances of abuse. JSAD is a multidisciplinary journal, and the range of materials includes biological, medical, epidemiological, social, psychological, legal, and other aspects of alcohol and other drug use, abuse, and dependence. JSAD will publish the following types of manuscripts:

- **Reviews Articles:** JSAD welcomes submission of review articles, particularly those that represent a new synthesis of information. These articles should be no more than 5,000 words (from the Introduction through the Discussion, excluding the Title Page, Abstract, Acknowledgments, References, Tables, Figure Captions, and Figures).
- **Original Studies:** These are reports of original investigations that convey the discovery of new knowledge and whose main emphasis is not the development of methods. The recommended length for these reports is no more than 5,000 words (from the Introduction through the Discussion, excluding the Title Page, Abstract, Acknowledgments, References, Tables, Figure Captions, and Figures).
- **Brief Reports:** These are brief communications that describe new methods, techniques, or apparatus of general interest to the field of alcohol and other drug studies or that present the results of experiments that can be concisely reported with up to one table or figure. These papers are limited in length to 2,500 words (from the Introduction through the Discussion, excluding the Title Page, Abstract, Acknowledgments, References, Tables, Figure Captions, and Figures).
- **Correspondence:** The Editor encourages readers' letters, whether they respond to articles or editorial comments published in JSAD, concern important issues of general interest to the

field of alcohol and other drug studies, or describe upcoming meetings and events of interest to the JSAD's readership. Authors will be given the opportunity to reply to accepted letters critical of their work.

## **PAGE CHARGES**

JSAD does not assess page charges on its contributors except for the use of color in figures.

## **MANUSCRIPT SUBMISSION**

Authors should submit articles online. Most word processing languages are acceptable, but MS WORD is preferred.

Each manuscript must be accompanied by a cover letter indicating whether the paper is submitted as a review, an original study, a brief report, or a theoretical article. The cover letter should also contain (a) the name, address, email address, and telephone/fax numbers of the corresponding author; (b) a statement that the paper contains original material, not submitted, in press, or published elsewhere in any form; (c) a statement that each author has contributed significantly to the work and agrees to the submission; (d) a note describing any conflict of interest regarding the paper or a statement that no conflict exists; (e) an explanation of the contribution of the present manuscript to the literature; (f) if desired, suggestions for possible reviewers; and finally (g) the signatures of all authors. If all authors cannot sign the same letter, each author can submit a separate letter with his or her signature on it. Electronic signatures (i.e. scanned images of signatures that are imported into the word processing document) are acceptable. Cover pages that are not included with the electronic submission may be faxed to (858) 822-1002.

JSAD has adopted the guidelines of the International Committee of Medical Journal Editors regarding authorship. These state that "All persons designated as authors should qualify for authorship. The order of authorship should be a joint decision of the co-authors. Each author should have participated sufficiently in the work to take public responsibility for the content. Authorship credit should be based only on substantial contributions to (a) conception and design, or analysis and

interpretation of data; and to (b) drafting the article or revising it critically for important intellectual content; and on (c) final approval of the version to be published. Conditions (a), (b), and (c) must all be met ... [The editor] may require authors to justify the assignment of authorship" (Uniform Requirements for Manuscripts Submitted to Biomedical Journals, 1994).

If the manuscript is accepted for publication, it will be necessary for JSAD to receive a written Assignment of Copyright from all authors. Forms for the Assignment of Copyright will be mailed from the Editorial Office at Rutgers University. When a manuscript is accepted for publication in JSAD, it is understood that the authors are agreeable to other competent scientists having access to sufficient data to verify the study's results.

## **MANUSCRIPT FORMAT AND ORGANIZATION**

Each manuscript must be in English, in 12-point Times New Roman font, with everything double-spaced (including references) and 1" margins. The following sections should be included in the order listed: (a) Title Page, (b) Abstract, (c) Introduction, (d) Method, (e) Results, (f) Discussion, (g) Acknowledgments, (h) References, (i) Tables, (j) Captions for Figures, and (k) Figures.

- **Title Page:** This should contain the full manuscript title (which should concisely convey the article's major contents); the names, academic degrees, and affiliations, with complete addresses, of all authors; and the institution(s) of origin. Indications of grant support should appear in the bottom of this page and should include the name of the granting agency and the grant number. This page should also include the name, telephone and fax numbers, and email and street addresses of the corresponding author to whom galley proofs should be sent. The number of tables and the number of figures in the manuscript should be indicated in the top left-hand corner of the title page.
- **Abstract Page:** Abstracts should be 250 or fewer words and must include the following information under the these four headings: (a) Objective: the background and purpose of the study (in a complete, grammatical sentence); (b) Method: the study design, setting,

participants (including manner of sample selection, number and gender of participants) and interventions; (c) Results: details of major findings; and (d) Conclusions: main inferences drawn from results and potential application of findings.

- Introduction: This section, which should begin a new page, should acquaint the reader with the background of the study and should contain a clear statement of the goals of the investigation or the hypotheses that the study was designed to test.
- Method: For all research containing human subjects, the first paragraph of the method section should provide detail about human subjects review and institutional review board approval. The methods should be described in sufficient detail to allow the reader to judge their accuracy, reproducibility, and reliability. New methods or procedures and modifications of previously published methods should be described in sufficient detail to permit replication of the study. Commonly used methods require only a citation of the original source.
- Results: The experimental data should be described succinctly but completely in text without redundancy between figures and tables or discrepancy between text and tables. Graphic and tabular displays are preferred to discursive narrative. Sufficient data must be provided to allow readers to judge the variability and reliability of the results. Average values must be accompanied by standard errors or standard deviations (e.g.,  $M = 21.5$ ,  $SD = 0.95$ ). Statistical analysis of the data should be explained early so that the interested but non-expert reader can interpret the findings. The results of statistical tests should be accompanied by degrees of freedom, for example,  $t(27) = 2.12$ ,  $p = .05$ ,  $F(3, 27) = 6.51$ ,  $p = .0$ . For the presentation of statistics in the text, use American Psychological Association (APA) style (Publication Manual of the APA, Sixth Edition, Second Printing). For further guidance on the appropriate presentation of results, authors should consult Carpenter, J. A. (1996) Between acceptance and publication. A sampling of some common problems. *Journal of Studies on Alcohol and Drugs*, 57, 341-343.

- Discussion: The discussion of the experimental findings and their interpretation should be brief and focused. Alternative interpretations and/or limitations in the procedures should be explained. Avoid repetition of material in the introduction and detailed repetition of the experimental findings. Speculative discussion should be limited and directly relevant to the results obtained.
- Acknowledgments: Acknowledgments made to individuals should be as brief as possible.
- In-text citations: JSAD uses its own journal style for in-text citations. It is similar to APA style, but different in one important aspect: JSAD uses "et al." after the first author's surname on the first and all subsequent in-text citations for any reference with three or more authors. Authors should use the following format on the first appearance of a citation within the text and for all subsequent appearances.
- Authors' names in parentheses (first and all subsequent citations):
  - One author: ... (Washington, 1976) ...
  - Two authors: ... (Washington & Gates, 1987) ...
  - Three or more authors: ... (Jefferson et al., 1998) ...
- Authors' names in the text (first and all subsequent citations):
  - One authors: ... as surveyed by Washington (1976).
  - Two authors: Washington and Gates (1987) discovered ...
  - Three or more authors: Jefferson et al. (1998) wrote that ...
- **Multiple works by the same first author:** If two or more references in the list have the same first author, have three or more authors, and were published in the same year (e.g., an article by Arthur, Cleveland, and Harrison published in 1988 and a second article published by Arthur, McKinley, and Hayes also in 1988), the first article would become "1988a" and the second would become "1988b" in the reference list. On the first and all subsequent in-text

citations, Arthur, Cleveland, and Harrison should be cited "Arthur et al., 1988a," and Arthur, McKinley, and Hayes should be cited "Arthur et al., 1988b."

- **Reference list:** JSAD publishes all reference lists in APA style (Publication Manual of the APA, Sixth Edition, Second Printing). In the following, we present a brief sample of a reference list entry for a journal article and a book chapter. Please consult the Publication Manual of the APA for additional details about styling reference lists. More information and tutorials are also available at: [www.apastyle.org](http://www.apastyle.org). EndNote Users: Authors who use EndNote can download JSAD's reference style directly from EndNote's website via this link:<http://endnote.com/styles/J%20Studies%20Alcohol%20Drugs.ens>

### **Journal Articles**

Warner, L. A., White, H. R., & Johnson, V. (2007). Alcohol initiation experiences and family history of alcoholism as predictors of problem-drinking trajectories. *Journal of Studies on Alcohol and Drugs*, 70, 56-65.

### **Book Chapters**

McCord, J. (1991). Identifying developmental paradigms leading to alcoholism. In D. J. Pittman & H. R. White (Eds.), *Society, culture, and drinking patterns reexamined* (pp. 480-491). New Brunswick, NJ: Alcohol Research Documentation, Inc.

- **Tables:** Each table should be typewritten on a separate page and should be numbered consecutively with Arabic numerals. Each table must have a concise descriptive heading and should be constructed as simply as possible: Preferably use only tabs and text typed directly in the word processing document, or use Word's table function. Tables must be intelligible without reference to the text (e.g., in the footnotes, define all abbreviations used in the table). Footnotes to tables should be referred to by italicized lowercase superscript letters (a, b, c, etc.) and should appear beneath the table involved, not on a separate page of



the manuscript. Do not use any functions or tools that format footnotes, but instead set footnotes in plain type below the table.

- **Figures Captions:** These should be numbered consecutively in Arabic numerals and should appear on a separate page of the manuscript. Captions should explain the figures in sufficient detail so that repeated reference to the text is unnecessary. Abbreviations in the captions should conform to those in the text.
- **Figures:** Copies of all figures should be embedded within the word processing file at the end of the manuscript, if possible. However, authors may submit figures as separate files. Figures will be photo-reproduced and thus must be supplied fully camera-ready. Figures preferably should be black and white only, with black and white hatching or design used in the place of gray or color. (If a figure requires grayscale and cannot be altered to contain black and white only, create a file of the figure in .tif format with 300 dpi. If a file requires color, create a high-resolution CMYK .eps file with 300dpi.) Authors will be charged a fee for the use of color. Symbols, numbers, and letters should be supplied in 11-14 point boldface (2.5-3.5 mm); all borders, rules, and lines should also be printed in boldface. The title of each figure should appear in the caption rather than on the figure itself.
- **Abbreviations, Symbols, and Nomenclature:** Blood alcohol concentration (BAC) should be expressed in percent for whole blood and in mg/dl for plasma. Whether whole blood or plasma was used should be indicated. The forensic standard for BAC (e.g., driving while intoxicated = .08%) is measured in whole blood and is 85% of BAC measured in plasma (118 mg/dl).
  - Nonstandard abbreviations, symbols, or acronyms not easily understood by the general scientific reader should be avoided. In general, abbreviations should be avoided in text except for standard units of mass, concentration, time, length,

volume, and temperature; routes of drug administration; standard error; and standard deviation.

- **Drugs:** Generic names should be used in the text, tables, and figures. Trade names may be mentioned in parenthesis in the first text reference to the drug but should not appear in titles, figures, or tables. When a trade name is used, it should be capitalized; generic or chemical names are not capitalized. The form of drug used in calculations of doses (e.g., base or salt) should be indicated.
- **Ethical Assurances:** Studies involving human subjects should explicitly indicate that informed consent was given for participation in the research. Studies involving animals should indicate that care and maintenance were conducted in accordance with National Academy of Sciences-National Research Council (NAS-NRC) guidelines. The type and dose of anesthetic agent used in surgical procedures should be specified.
- **Pagination:** Each manuscript page should be numbered consecutively in the upper right-hand corner, and the last name of the first author should appear next to the page number in the header. Other than the Introduction, sections do not need to begin on a new page.

## **PROOFS AND REPRINTS**

Galley proofs will be sent to the corresponding author and should be returned within 72 hours.

A reprint order form and price list will accompany galley proofs.

## **Appendix B**

### **Journal of American College Health Guidelines for Manuscripts**

This journal uses ScholarOne Manuscripts (previously Manuscript Central) to peer review manuscript submissions. Please read the guide for ScholarOne authors before making a submission. Complete guidelines for preparing and submitting your manuscript to this journal are provided below.

Please note that The Journal of American College Health uses CrossCheck™ software to screen papers for unoriginal material. By submitting your paper to The Journal of American College Health, you are agreeing to any necessary originality checks your paper may have to undergo during the peer review and production processes.

The Journal of American College Health provides information related to health in institutions of higher education. The journal publishes articles encompassing many areas of this broad field, including clinical and preventive medicine, environmental and community health and safety, health promotion and education, management and administration, mental health, nursing, pharmacy, and sports medicine.

The Journal of American College Health is intended for college health professionals: administrators, health educators, nurses, nurse practitioners, physicians, physician assistants, professors, psychologists, student affairs personnel, and students as peer educators, consumers, and pre-professionals.

The journal publishes (1) scientific or research articles presenting significant new data, insights, or analyses; (2) state-of-the-art reviews; (3) clinical and program notes that describe successful and innovative procedures; and (4) viewpoints, book reviews, and letters to the editor. All content must go through a rigorous peer-review process before being selected for publication.

#### **Types of Articles**

##### **Major Articles**

Theoretical, scientific, and research manuscripts and reviews will be considered as major articles. The preferred length is 15 to 20 double-spaced pages (4,000–6,000 words), including tables, figures, and references.

### **Case Reports**

The Journal of American College Health seeks to publish cases with clinically valuable lessons for college health professionals. Therefore, we encourage submissions that outline cases which present a diagnostic, ethical or management challenge, or that highlight aspects of mechanisms of injury, pharmacology or histopathology that are deemed of particular educational value for college health professional. These papers are limited in length to 2,000 words (excluding the title page, abstract, acknowledgments, references, tables, and figures). Case Reports may address, but are not limited to: important clinical lessons learned from practice, emerging pathogenesis pertinent to college health, lessons learned from practice, rare conditions, and novel diagnostic criteria or measurement practices.

### **Brief Reports**

Brief Reports may fall into one of two categories: (1) describe new methods, techniques, or topics of general interest to the field of college health or (2) present the results of experiments/investigations that can be concisely reported with up to one table or figure. These papers are limited in length to 2,000 words (excluding the title page, abstract, acknowledgments, references, tables, and figures). Overall, Brief Reports are intended to highlight interesting findings that do not warrant the space required of an original article.

### **Viewpoint**

Viewpoint is a forum for opinions. Topics may be ethical, organizational, social, professional, or economic. Debate on controversial subjects is welcome. Manuscripts vary from 4 to 10 pages (1,000–2,500 words), but we prefer concise presentations. Tables and figures are **unnecessary**.

**References should follow the same format as that used in major articles.**

## **Letters to the Editors**

Letters to the Editors in response to published articles are also welcome. they should be brief (500–1,000 words), and they may be edited.

## **Manuscript Preparation**

1. Submit your manuscript, including tables, as double-spaced Word files with minimal formatting in Times. Save it as a .doc, .rtf, or .ps file. Please use simple filenames and avoid special characters. Do not use word-processing styles, forced section or page breaks, or automatic footnotes or references. Number every five lines in the document.
2. Follow the American Medical Association Manual of Style (AMA), 10th edition, in medical and scientific usage. Please consult our guidance on keywords [here](#).
3. Abstract must be no longer than 150 words, be written in AMA format, and include these words as subheadings: Objective, Participants, Methods, Results, and Conclusions.
4. The Participants section must include the month and year in which research was conducted.
5. Text in research articles must be divided into these headings: Methods, Results, and Comment (which must include the subheadings Limitations and Conclusions).
6. Proofread carefully, double-checking all statistics, numbers, symbols, references, and tables. Authors are responsible for the accuracy of all material submitted.
7. Indicate approval of the appropriate institutional review board (IRB) for all studies involving human participants and describe how participants provided informed consent.
8. Provide written permission from publishers and authors to reprint or adapt previously published tables or figures.

## **Submitting Your Manuscript in Manuscript Central**

When your files are ready, visit the online submission Web site:

<http://mc.manuscriptcentral.com/jach>

1. First, log into the system. Register, if you have not done so before, by clicking on the Create Account button on the log-in screen and following the on-screen instructions.
2. To submit a new manuscript, go to Author Center, then click on Submit a Manuscript and follow the on-screen instructions.
3. Enter your manuscript data into the relevant fields.
4. When you upload your manuscript files via the File Upload screen, Manuscript Central will automatically create a PDF and HTML document of your main text and any figures and tables that you submit. This document will be used when your manuscript undergoes peer review.
5. Attach 1 blinded manuscript file for review, with all identifying information included in a title page that is identified as "TITLE PAGE" and submitted separately.

### **Editorial Procedures**

All submissions are blind reviewed by at least 1 consulting editor or ad hoc reviewer, a statistical reviewer (when appropriate), and an executive editor. The process may take up to 4 months. The managing editor will notify authors of the decision—accept, revise, or reject. Review comments will be returned to the author.

Taylor & Francis Group, LLC reserves the right to edit accepted manuscripts for clarity, coherence, and felicity of style. Authors receive an edited draft to proof, answer queries, and correct errors that may have been introduced in the editing process. Extensive changes and rewriting are not permitted at this stage.

Accepted manuscripts are usually published within 1 year of acceptance.

As an author you are required to secure permission if you want to reproduce any figure, table or extract text from any other source. This applies to direct reproduction as well as "derivative reproduction" (where you have created a new figure or table which derives substantially from a copyrighted source).

### **References**

Authors should cite references consecutively in the text, using a superscript to indicate source. References are listed by number at the end of the text, with titles of journals abbreviated in the form listed in Index Medicus. Titles of unlisted journals should be written out in full. The following are examples of reference style.

#### *Journals*

1. Engwal D, Hunter R, Steinberg M. Gambling and other risk behaviors on university campuses. *J Am Coll Health*. 2004;52:245–255.

#### *Books*

2. Bernstein TM. *The Careful Writer: A Modern Guide to English Usage*. New York: Atheneum; 1965.

#### *Other*

- Citations for data on a Web site should take this form: Health Care Financing Administration. 1996 statistics at a glance. Available at: <http://www.hcfa.gov/stats/stathili.htm>. Accessed December 2, 1996.
- References to unpublished material should be noted parenthetically in the text (eg, James Jones, personal communication, (September 2002)).
- Quoted material must include an indication of the page on which the quoted words appeared (eg, 7(p26)).
- Please use current references and use hard-copy, rather than Web, references whenever possible.

### **Illustrations**

Illustrations submitted (line drawings, halftones, photos, photomicrographs, etc.) should be clean originals or digital files. Digital files are recommended for highest quality reproduction and should follow these guidelines:

- 300 dpi or higher

- Sized to fit on journal page
- EPS, TIFF, or PSD format only
- Submitted as separate files, not embedded in text files

### **Color Illustrations**

Color art will be reproduced in the online production at no additional cost to the author. Color illustrations will also be considered for the print publication; however, the author will bear the full cost involved in color art reproduction. Please note that color reprints can only be ordered if the print reproduction costs are paid. Print Rates: \$900 for the first page of color; \$450 for the next 3 pages of color. A custom quote will be provided for authors with more than 4 pages of color. Art not supplied at a minimum of 300 dpi will not be considered for print.

### **Tables and Figures**

Tables and figures (illustrations) should not be embedded in the text, but should be included as separate sheets or files. A short descriptive title should appear above each table with a clear legend and any footnotes suitably identified below. All units must be included. Figures should be completely labeled, taking into account necessary size reduction. Captions should be typed, double-spaced, on a separate sheet.

### **Proofs**

Page proofs are sent to the designated author using Taylor & Francis' Central Article Tracking System (CATS). They must be carefully checked and returned within 48 hours of receipt.

### **Reprints and Issues**

Authors from whom we receive a valid email address will be given an opportunity to purchase reprints of individual articles, or copies of the complete print issue. These authors will also be given complimentary access to their final article on Taylor & Francis Online.

### **Open Access**



Taylor & Francis Open Select provides authors or their research sponsors and funders with the option of paying a publishing fee and thereby making an article fully and permanently available for free online access – open access – immediately on publication to anyone, anywhere, at any time. This option is made available once an article has been accepted in peer review. Full details of our Open Access program.

<http://www.tandfonline.com/action/authorSubmission?journalCode=vach&page=instructions#.VPXavWctHIU>



## Appendix C

### The University of Toledo Department for Human Research Protections

Social, Behavioral & Educational IRB  
Phone: 419-530-2844 Fax: 419-530-2841  
Biomedical Institutional Review Board  
Phone: 419-383-6796 Fax: 419-383-3248  
(FWA 00010686)

## Claim of Exempt Research & Instructions

*Request for designation as Exempt for a research project involving no risk to human subjects.*

### **Instructions:**

ALL UT research using living human subjects, or samples or data, obtained from them, directly or indirectly, with or without their consent, must either be approved in advance by a University of Toledo Institutional Review Board (IRB), or be found to meet narrow criteria for exemption from IRB oversight by the IRB office. This Form will help the PI to determine if the project is likely to meet the criteria for exemption, to present the case for exemption and to document the decision on the request.

NOTE: A determination of Exempt status does not release the researcher from exercise of prudent practice in protecting the interests of research subjects. Exempt or not, the project must be conducted in a manner consistent with the Ethical Principles and Guidelines for the Protection of Human Subjects (The Belmont Report: <http://ohrp.osophs.dhhs.gov/humansubjects/guidance/belmont.htm>)

IRB applications for research protocols that fall into the appropriate exempt categories will be reviewed by the IRB Chair, or the Chair's Designee when appropriate. Exempt IRB applications are reviewed as they are submitted and usually take only 5-10 days for feedback from the IRB. Turn-around time largely depends on the investigator's response time to the IRB's request for clarification or revision.

Review the **Exempt Category Claimed** (page 2) and **Screening Questions** (page 3). If your research project appears to qualify for exemption, submit a completed **Claim of Exemption** form with pages 2 & 3 of the Instructions to the IRB Office.

If at any time in this reading process it becomes clear to you that your human subjects research protocol does not meet the requirements for exemption, **STOP** and use the **Expedited or Full IRB Application** form appropriate to the risk level of your research.

### **Please Remember:**

**You may not start your research until you receive a written communication from the UT IRB confirming that the research meets exemption criteria.**

## EXEMPT CATEGORY CLAIMED

(According to OPRR Reports, Title 45, CFR 46, rev. June 18, 1991) Please identify all that apply to your research by checking applicable boxes.

<input type="checkbox"/> 1.	Research conducted in established or commonly accepted educational settings, involving normal educational practices, such as (i) research on regular and special education instructional strategies, or (ii) research on the effectiveness of or the comparison among instructional techniques, curricular or classroom management methods. This category may include children
2.	Research involving the use of educational tests (cognitive, diagnostic, aptitude, achievement), survey procedures, interview procedures or observation of public behavior, unless: (i) information obtained is recorded in such a manner that human subjects can be identified, directly or through identifiers linked to the subjects; and (ii) any disclosure of the human subjects' responses outside the research could reasonably place the subjects at risk of criminal or civil liability or be damaging to the subjects' financial standing, employment or reputation. Research which deals with sensitive aspects of the subject's own behavior such as illegal conduct, drug use, sexual behavior, or use of alcohol, cannot be exempt from review.
<input type="checkbox"/> 2a	Research involving the use of <u>educational tests</u> (cognitive, diagnostic, aptitude, achievement) for which subjects <u>can not</u> be identified, or release of the information would not be harmful to the subject. This category may include children.
<input type="checkbox"/> 2b	Research involving the use of <u>survey procedures</u> or interview procedures or <u>observation of public behavior</u> for which subjects <u>can not</u> be identified, or release of the information would not be harmful to the subject. <b>This category <u>may not</u> include children.</b>
<input type="checkbox"/> 3.	Research involving the use of educational tests (cognitive, diagnostic, aptitude, achievement), survey procedures, interview procedures, or observation of public behavior that is not exempt under paragraph (b) (2) of this section if (i) the human subjects are elected or appointed public officials or candidates for public office; or (ii) federal statute(s) require(s) without exception that the confidentiality of the personally identifiable information will be maintained throughout the research and thereafter. Research which deals with sensitive aspects of the subject's own behavior such as illegal conduct, drug use, sexual behavior, or use of alcohol, cannot be exempt from review.
<input checked="" type="checkbox"/> 4.	<b>Research involving the collection or study of <u>existing data</u><sup>2</sup>, documents, records, pathological specimens, or diagnostic specimens, if these sources are publicly available or if the information is recorded by the investigator in such a manner that subjects cannot be identified, directly or through identifiers linked to the subjects. This category may include children.</b>
<input type="checkbox"/> 5.	Research and demonstration projects which are conducted by or subject to the approval of <b>federal</b> department or agency heads and which are designed to study, evaluate, or otherwise examine: (i) public benefit or service programs; (ii) procedures for obtaining benefits or services under those programs; (iii) possible changes in or alternatives to those programs or procedures; or (iv) possible changes in methods or levels of payment for benefits or services under those programs. This category may include children.
<input type="checkbox"/> 6.	Taste and food quality evaluation and consumer acceptance studies, (i) if wholesome foods without additives are consumed or (ii) if a food is consumed that contains a food ingredient at or below the level and for a use found to be safe, or agricultural chemical or environmental contaminant at or below the level found to be safe, by the U.S. Food and Drug Administration or approved by the Environmental Protection Agency or the Food and Safety and Inspection Service of the U.S. Department of Agriculture. This category may include children.

<sup>1</sup>Harm to subjects means that any disclosure of the human subjects' responses outside the research could reasonably place the subjects at risk of criminal or civil liability or can be damaging to subjects' financial

## EXEMPT SCREENING QUESTIONS

Please complete the following sections. If you answer **YES** to any of the questions A through C below, then **STOP** and use the Expedited or Full Application Form appropriate to the risk level of your research project.

If you answer **NO** to all questions A through C below, continue to complete this claim of exemption packet.

<b>A. For research involving special populations, interventions or manipulations</b>	
<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No	1. Does your research involve pregnant women, fetuses, prisoners or the mentally ill or incapacitated?
<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No	2. Does your research involve using survey or interview procedures with children, minors < 18 years old?
<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No	3. Does your research involve the observation of children in settings where the investigator(s) will participate in the activities being observed?

<b>B. For research using survey procedures, interview procedures, observational procedures and questionnaires</b> (Note: Exemption is not allowed in surveys or interviews with children.)	
<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No	1. If data are to be recorded by audiotape or videotape is there potential harm <sup>1</sup> to subjects if the information is revealed or disclosed?
<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No	2. If the subjects are to be identifiable either by name or through demographic data, is there potential harm to participants if the information is revealed?
<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No	3. Will collection include sensitive data (e.g. illegal activities, or sensitive themes such as sexual orientation, sexual behavior, undesirable work behavior, or other data that may be painful or very embarrassing to reveal, such as death of a family member, memories of physical abuse?

<b>C. For research using existing or archived data<sup>2</sup>, documents, records, or specimens only</b>	
<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No	1. Will any data, documents, records or specimens be collected from subjects after the submission of this application?
<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No	If the data, documents, records, or specimens are originally labeled in such a manner that subjects can be identified, directly or indirectly through identifying links, is the investigator recording the data in such a manner that subjects can be identified, directly or indirectly through identifying links (i.e., demographic information that might reasonably lead to the identification of individual subjects – name, phone number; <b>or</b> any code number that can be used to link the investigator's data to the source record – medical record number or hospital admission number?

<sup>1</sup>Harm to subjects means that any disclosure of the human subjects' responses outside the research could reasonably place the subjects at risk of criminal or civil liability or can be damaging to the subjects' financial standing, employability, or reputation.

<sup>2</sup>Existing data means the items exist before the research was proposed or was collected prior to the research for a purpose other than the proposed research.



**The University of Toledo**  
**Department for Human Research Protections**

Social, Behavioral & Educational IRB  
 Phone: 419-530-2844 Fax: 419-530-2841  
 Biomedical Institutional Review Board  
 Phone: 419-383-6796 Fax: 419-383-3248  
 (FWA 00010686)

**Claim of Exemption Form**

*Request for designation as Exempt for a research project involving no risk to human subjects.*

A. STUDY INFORMATION			
Date:	December 16, 2015	IRB Number: (Assigned by IRB office)	
Study Title:	The Impact of Medical Marijuana on College Students		
Principal Investigator or Faculty Advisor:	Faculty Advisor – Tavis Glassman		
Department:	Health and Recreation Professions	Rocket ID#:	R00237753
Address:	2801 W. Bancroft Street, MS 119	Pager:	
Phone:	419.530.2770	Email:	Tavis.glassman@utoledo.edu
Fax:			
Student Name:	Alexis Blavos – R00923082		
Student's Phone:	330.607.5101	Email:	Alexis.blavos@rockets.utoledo.edu
Fax:		Pager:	

B. STUDY FUNDING			
Funding:	<input checked="" type="checkbox"/> Unfunded		
	<input type="checkbox"/> Departmental	Institutional Account #	
	<input type="checkbox"/> Extramural:	Agency/ Company Name:	
		UT Account Number:	
Funding Status:	<input type="checkbox"/> Pending	<input type="checkbox"/> Funded	<input type="checkbox"/> Planned
Grant title if different than protocol title:			

### C. PERFORMANCE SITE(S)

List all performance sites for this study. Attach permission letters and/or **current** IRB approval memos for off-campus sites if applicable. **Check box if site is “engaged in research.”** A site becomes "engaged" in human subjects research when its employees or agents: (i) intervene or interact with living individuals for research purposes; or (ii) obtain individually identifiable private information for research purposes [45 CFR 46.102(d),(f)].

Performance site(s)  Location Name	Address	Engaged in research  Yes      No
N/A	Secondary Data Analysis	<input type="checkbox"/> <input type="checkbox"/>

### D. STUDY PERSONNEL

Please list all study personnel involved in the conduct of this study. All study personnel must complete required training in human subject research and provide to the IRB office certification verifying completion of the requirement. **The IRB will not review a study without such forms on file for all research personnel.** Only UT faculty, staff, students, or registered volunteers are considered “UT-affiliated” and thus covered by the UT IRB review. All non-affiliated study personnel must have their participation reviewed by the appropriate IRB. (Attach separate sheet if more space is needed).

Name	Rocket I.D. #	Department	Role on Project
Tavis Glassman	R00237753	Health and Rec Professions	Faculty Advisor
Alexis Blavos	R00923082	Health and Rec Professions	Principle Investigator

### E. METHODS AND PROCEDURES (Please read carefully)

This section must be written in lay terms so that it can be understood by the non-scientific members of the IRB.

1. Describe briefly the background and significance of the study.

**Estimates of Marijuana Use.** Marijuana represents the most widely-used illicit drug on college campuses and when used repeatedly can impair students' physical and mental health, intelligence, memory, and academic performance (Arria, et al., 2013; Beck et al., 2009; Buckner, et al., 2012; Caldeira et al, 2013; Falls et al., 2013; Jacobus et al., 2013; Hall & Dagenhardt, 2008; Higher Education Center, 2008; Meier. et al., 2012; Morbidity and Mortality Weekly Report, 1983; Office of National Drug Control Policy, 2004).. Results from the 2013 National College Health Assessment II (NCHA) survey indicate that 38% of college students have used marijuana at some point in their lifetime, with 16% using in the last 30 days. Similarly, the 2012 CORE Alcohol and Drug Survey report that 45% of students used marijuana, 33% used marijuana in the past year with 20% reporting current use in the past 30 days.

**Impact of Marijuana Use.** When used habitually, marijuana can impair students' physical and mental health, intelligence, and memory (Arria, et al., 2013; Beck et al., 2009; Buckner et al., 2012; Caldeira et al, 2013; Falls et al., 2013; Jacobus et al., 2013; Hall & Dagenhardt, 2008; Higher Education Center, 2008; Meier et al., 2012; Morbidity and Mortality Weekly Report, 1983; Office of National Drug Control Policy, 2004). Marijuana use has proven to increase the risk of schizophrenia (Hall & Dagenhardt, 2008). Buckner and colleagues (2012) report a close relation between anxiety and marijuana craving, specifically, craving marijuana and having anxiety leads to marijuana use. Beck and colleagues (2009) reported similar findings with consistent cannabis users reporting marijuana use in the context of emotional pain and depression.

Beyond emotional pain, marijuana use has been linked to reductions in college graduation, skipping class, early conduct problems, and lower GPA (Falls et al., 2011; Hunt, Eisenberg, & Kilbourne, 2010; Arria, et al., 2013a; Arria, et al., 2013b; Arria, et al., 2013c). While grades and retention may be impacted, it is more concerning that marijuana impairs mental functioning (Jacobus, et al., 2013; Medina et al., 2007; Solowij, et al., 2011; Thoma et al., 2011). Jacobus and colleagues (2013) indicate heavy marijuana users experience shortfalls in complex attention, storing memory, and planning and sequencing abilities, even after a month of abstinence, as well as deficits on tests of verbal and visual memory when compared to non-users. Further, research suggests that after one month of abstinence from marijuana, subtle deficits remain in complex attention, planning and sequencing, and verbal story memory when compared to nonusers (Medina, et al., 2007; Thoma, et al., 2011). Memory impairment has also been linked specifically to cannabis use and was not attributable to co-use of cannabis and alcohol or cannabis and other drugs (Solowij et al., 2011).

**Marijuana use and the Law.** At the time this dissertation was written, 2 states

passed legislation allowing medicinal marijuana and two states have legalized recreational marijuana (procon.org, 2014). Three more states attempted to pass ballot initiatives and 13 states experienced legislative failure in 2014 (procon.org, 2014). While there are no studies examining medicinal marijuana and college campuses at this time, Cerda and colleagues (2012) reported that the passage of state medicinal marijuana laws leads to higher levels of dependence and abuse in those states. Further, societal normative influences are significantly more permissive of recreational marijuana use in states with medicinal marijuana laws (Cerda, et al., 2012). A related public health issue involves the increase in drugged driving on college campuses among white males engaging in this behavior at disproportionately high rates (Arria et al., 2011).

## **2. What is the objective of the study?**

Second to alcohol, marijuana is the most widely used substance on college campuses. Currently 21 states have passed medicinal marijuana laws with several more anticipating ballot initiatives in the next few years (procon.org, 2014). The aim of this investigation involves exploring the impact of medical marijuana use on college campuses. The purpose of this research is to determine the marijuana usage habits and related consequences among students who reside in states, which permit medical marijuana compared to those who do not. More specifically, do differences exist between states who permit medical marijuana versus those who do not in the following areas: (a) college student marijuana use; (b) perceived college student marijuana use; (c) negative consequences related to substance use (e.g. performing poorly on exams, driving a car under the influence, or missing a class); (d) grade point average; (e) rates of other drug use (e.g. tobacco, alcohol, or cocaine); (f ) peer injunctive norms; (g) location of use; (h) permissive social atmosphere; (i) level of concern by the student for problems associated with AOD use; and (j) perceived risk associated with use.

## **3. Describe the study design, the subject population to be studied and all procedures (sequentially) to which human subjects will be subjected.**

**Study Design:** This study includes only secondary data obtained from the Core Institute (<http://core.siu.edu/>) Alcohol and Drug Survey long form.

I will be conducting Mann-Whitney U tests on ordinal data, Odds-Ratio tests on categorical data, path analysis, and descriptive/frequency tests. Research questions include:

- *Research Question 1:* Do college students in states with medical marijuana laws and college students in states without medical marijuana laws use marijuana at equal rates?
- *Research Question 2:* Do college students in states with medical marijuana and college students in states without medical marijuana laws perceive peer use of marijuana at equal rates?
- *Research Question 3:* Do college students in states with medical marijuana laws and college students in states without medical marijuana laws use other substance in the past year at equal rates?
- *Research Question 4:* Do college students in states with medical marijuana laws and college students in states without medical marijuana laws have equal GPA rates?
- *Research Question 5:* What is the difference between college students in states with medical marijuana laws and college students in states without medical marijuana laws on locations of marijuana use?
- *Research Question 6:* What is the difference between college students in states with medical marijuana laws and college students in states without medical marijuana laws on negative consequences?
- *Research Question 7:* Do college students in states with medical marijuana laws and college students in states without medical marijuana laws have equal perception rates on peer injunctive norms?
- *Research Question 8:* What is the path model that predicts marijuana usage among college students based on the Core Alcohol and Drug Survey, in states with and without medical marijuana laws?

**Study population and participants:** Data reviewed is from Jan 2013 – May 2013. The dataset does not include any individual or institutional identifiers. The Core Alcohol and Drug Survey population are US college students aged 18-25. Institution is not a variable that I will be receiving. States included in the Core data set are: AL, CA, CO, CT, DC, FL, GA, IA, IL, IN, KY, LA, MA, MD, MI, MN, MO, MT, NC, NE, NJ, NV, NY, OH, OK, PA, RI, SC, SD, TN, TX, VA, VT, WA, WI. There is no risk to participants or institutions as I have no way of identifying which institutions/participants are included in data for each state. Confidentiality is maintained through the Core Institute as they do not share any participant or institutional data set variable information, therefore no consent needs to be obtained for the secondary data analysis.

## F. SURVEYS AND QUESTIONNAIRES

**Please attach a copy of each survey, questionnaire or other instrument that you intend to use in this study.**

☐ Survey/Questionnaire (go to A)      ☒ Record, Database, Registry Review (go to B)      ☐ Other, Briefly explain:

### A. Surveys and Questionnaires. Attach a copy of each instrument.

1. What type of instrument(s) will be used?

N/A

2. Describe the setting and mode of administering the instrument (e.g., by phone, one-on-one, group) and the provisions for maintaining privacy and confidentiality (e.g. anonymous). Include duration, intervals of administration, and overall length of participation.

N/A



**B. Records Review.**

1. Will you have ongoing contact with the subjects?

**No.**

2. Will you be recording identifiers (information items that could potentially identify human subjects)?

**No.**

3. What is the timeframe of charts that you plan to review (ex. – 2/1/2007 – 2/1/2008)

**January 2013 - May 2013**

**Principal Investigator's Assurance Statement:**

As Principal Investigator I verify that the information provided in this application is complete and correct

AND I agree to:

- accept responsibility for the scientific and ethical conduct of this research study,
- assure the training of study personnel in the proper conduct of research,
- comply with all IRB and Institutional policies and procedures,
- protect of the rights and welfare of human subjects,
- obtain prior review from the Institutional Review Board before amending or altering the project or research protocol to ensure the designation of Exempt remains appropriate,
- immediately report to the IRB any serious adverse events.

\_\_\_\_\_  
Signature of Principal Investigator\*

**Tavis Glassman – Faculty Advisor**  
**Alexis Blavos – Principle Investigator**

\_\_\_\_\_  
12/18/14

Date