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Education About the Adverse Health Effects of Recreational Marijuana: The Role of Type of Persuasion and Source

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Education About the Adverse Health Effects of Recreational Marijuana:
The Role of Type of Persuasion and Source

by

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Bachelor of Arts, Siena College, 2014

A Thesis Submitted in Partial Fulfillment of the Requirements for the
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Neuroscience

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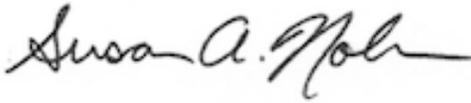
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SETON HALL UNIVERSITY
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APPROVAL FOR SUCCESSFUL DEFENSE

Masters Candidate, Dina Mattern, has successfully defended and made the required modifications to the text of the master's thesis for the M.S. during this spring Semester 2016.

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Abstract

In recent years, efforts have been made to legalize cannabis based on increasing research supporting medical benefits and the assumption, albeit questionable, that this is a safe drug. Statistics from the National Institute on Drug Abuse (NIDA) demonstrate a sharp increase in users, especially among the youth population (2014). This is problematic because smoking marijuana during the teenage years has been shown to have possible adverse effects, such as despondency and potential complications in cognitive development. (Crane et al., 2012) This current study aims to explore effective ways to educate the public on the adverse health effects of recreational marijuana through print advertisements. By comparing three types of persuasion (factual claims, evaluative claims, and unrelated claims) and two sources of information (Food and Drug Administration versus a branding agency), we evaluate factors that might increase overall knowledge, believability, and induce attitude change toward cannabis. Results suggest that participants who read factual claims had higher mean levels of knowledge about the effects of marijuana than those who read unrelated claims. In addition, information sponsored by the FDA was significantly more believable, on average, compared to a branding agency, with factual claims being significantly more believable than evaluative claims. Policy makers may wish to consider these findings when developing ways to educate the public on the potential consequences of smoking marijuana as it becomes legal.

Keywords: marijuana, cannabis, education, persuasion, source, believability, attitude change

Introduction

Due to the 1937 Marijuana Tax act, marijuana (cannabis) has been prohibited throughout the United States under federal law. Classified as an illegal Schedule 1 drug, the Drug Enforcement Administration (DEA) of the United States defines marijuana as having a high potential for abuse and no legally accepted medical properties (Office of National Drug Control Policy, 2011). Within recent years, however, several movements have made efforts to legalize this drug based on increasing research supporting medical benefits and the questionable implication that marijuana is a 'safe' drug (Pacula, Kilmer, Wagenaar, Chaloupka, & Caulkins, 2014). In November 2012, voters in the states of Colorado and Washington passed initiatives legalizing the possession of up to one ounce of marijuana for recreational purposes for adults 21 and older, as well as for-profit firms to supply the market under state law (ONDCP, 2011; Pacula et al., 2014). As of January 1, 2014, the state of Colorado became the first to legalize the sale of recreational marijuana (Ghosh, Van Dyke, Maffey, Whitley, Erpelding, & Wolk, 2015). Several bills pushing for legalization are being introduced in various states across the country and it is highly likely that there will be more ballot initiatives in future elections (Pacula, et al., 2014). As of 2015, twenty-three states and the District of Columbia have enacted laws legalizing marijuana in some form, and several other states have eliminated criminal penalties for a small amount of possession (Governing, 2015). Although marijuana remains illegal under Federal Law, there is much debate about its aversive health effects and about how to regulate and distribute the product among the populations for whom it is legal.

What is Marijuana/Cannabis?

Marijuana, scientifically known as *Cannabis Sativa*, is a mixture of the dry, shredded leaves and flowers of a cannabis plant that is typically smoked as a marijuana cigarette referred to as a 'joint' or consumed orally through various infused foods. The *C. Sativa* plant is known to contain over 60 naturally occurring compounds called cannabinoids and as many as 400 other chemicals, including a known carcinogen, Benzopyrene (Greydanus, Hawver, Greydanus, & Merrick, 2013). The psychoactive chemical, delta-9-tetrahydrocannabinol (THC) creates an intense euphoria that many people seek for recreational purposes. THC exhibits a structure similar to the brain chemical anandamide, becoming easily recognized by the body and altering normal brain communication (Greydanus et al., 2013). This component of marijuana acts on specific molecular targets on brain cells called cannabinoid receptors. These receptors are a crucial part of a neural communication network known as the Endocannabinoid System (ONDCP, 2011). A high density of cannabinoid receptors are prevalent in the mesocortical and limbic systems along with the striatum and lateral prefrontal cortex, all areas of the brain that influence pleasure, memory, thinking, concentration, sensory, time perception, and coordinated movement (Greydanus et al., 2013).

Troubling Statistics Call for Concern

Marijuana is the most prevalently used illicit drug in the United States. In 2012, 18.9 million people in the U.S. reported using the drug within the past 30 days. This represented a 5.8% increase in users since 2007 (ONDCP, 2011). Statistics from the National Institute on Drug Abuse (NIDA) indicate a sharp rise in the average amount and strength of THC in marijuana. In 1992, the average THC potency of marijuana

confiscated by the government was at 3 percent, indicating a low level of drug strength. By 2009, the average THC content had increased to 11 percent, more than triple the potency and strength of the drug only 17 years prior (ONDCP, 2011).

Recent surveys by the Substance Abuse and Mental Health Services Administration (SAMHSA) point to troubling increases in the rate of cannabis use among youths. Approximately 2.6 million Americans aged 12 or older had experimented with marijuana for the first time in 2011 with more than half of them under the age of 18. The percentage of users between 12 and 17 years old increased from 6.7% in 2008 to 7.9% in 2011 (ONDCP, 2011). Results from a study conducted at the University of Michigan in 2011 point toward a significant upward trend in the use of marijuana among the 10th and 12th graders in their study. The number of 10th and 12th grade students who had used marijuana within the past month had increased 3.8% and 4.3% respectively, between 2006 and 2011 (ONDCP, 2011).

Marijuana is a Safe Drug: Fact or Myth?

There is a growing body of literature that supports the medical benefits of cannabis. Current medical research works to isolate specific components and synthetic compounds of the marijuana plant. Studies are examining the potential benefits of several cannabinoids that could aid in the management of neuropathic pain, inhibit cancer growth, and serve as a remedy for various symptoms of illness and as a treatment for numerous diseases (Greydanus et al., 2013). Cannabidiol (CBD) is just one of the several highly researched cannabinoids that has been found to exhibit numerous medicinal benefits and provide a therapeutic effect (ONDCP, 2010). Based on results like these, medical marijuana is legal in 23 states and counting (Governing, 2015).

With the newfound medical benefits of various components of marijuana and the overall magnitude of health harms debated, many people are under the questionable impression that marijuana is a ‘safe’ drug. Evidence for adverse effects has been demonstrated through both acute and nonacute consequences especially for chronic (one who smokes habitually) and/or long-term users (one who does not necessarily smoke habitually but has been engaging in the processing of smoking over a long period of time) (Pascual et al., 2014) Acute refers to the actual period of intoxication whereas nonacute refers to the following hours and days after intoxication has subsided (Pascual et al., 2014). Identifying adverse health effects has proven difficult due to both the ethics of studying an illicit drug and its possible concurrent use with other substances. However, current research on the neurocognitive effects of cannabis has consistently demonstrated harmful health effects and long-lasting detrimental effects on the brain in the critical period of adolescence (Greydanus et al., 2013).

The extent to which adolescents believe that marijuana or other illicit drugs can cause them harm is a crucial factor influencing their actions toward initiation and use. The popular media often portray cannabis use in a way that misconstrues scientific evidence while highlighting findings promoting beneficial aspects and recreational appeal (Moffat, Jenkins & Johnson, 2013). In reality, cannabis is a complex substance in which the psychopharmacology has been predominantly under-researched and the majority of the literature supports contradictory evidence of health effects (Moffat et al., 2013). Data from the National Survey of Drug Use and Health (NSDUH) indicate troubling trends in recent years, demonstrating that Americans 12-17 years of age perceive the risks of marijuana to be much lower than the risks perceived by previous generations. With the

recent debate about the legalization of marijuana and the increased controversy about whether there are aversive effects, it is likely that the perception of risk will continue to decrease, as marijuana use increases among youths (ONCPD, 2011).

Marijuana and Addiction

Contrary to popular belief, marijuana can be an addictive drug (Greydanus et al., 2013). Endogenous Cannabinoids, specifically the activation of the Cannabinoid 1 Receptor (CB1R), have been shown to stimulate neural mechanisms within the central nervous system, mimicking other reward-enhancing drugs that motivate drug addiction (Greydanus et al., 2013). Current evidence indicates that long-term marijuana use can lead to increased rates of addiction and dependency (Volkow, Baler, Compton, & Weiss, 2014). It is possible for chronic marijuana smokers to develop a psychological addiction and/or cannabis withdrawal syndrome (CWS). Symptoms of cannabis withdrawal include anxiety, restlessness, irritability, aggression, and difficulties with sleep (NIDA, 2015; Volkow, Baler, Compton, & Weiss, 2014). These symptoms are likely to develop within the first 48 hours after cessation of the drug and tend to subside between 2 and 12 weeks after abstinence (Greydanus et al., 2013). Diagnostic criteria for an explicit CWS were included in the fifth edition of the Diagnostic and Statistical Manual of Mental Disorders (DSM-5) (American Psychiatric Association, 2013).

Age also seems to be a factor. Several studies demonstrate positive correlations between the age of onset and the likelihood of becoming dependent or addicted. Overall, about 9%, or 1 in 11 cannabis users becomes dependent on the drug. In contrast, approximately 17% or 1 in 6 individuals who begin smoking marijuana in their teenage years will show signs of addiction (Volkow, Baler, Compton, & Weiss, 2014). Statistics

from the 2012 National Survey on Drug Use and Health suggested an estimated 2.7 million people over the age of 12 had met DSM-IV criteria for marijuana dependency (Volkow, Baler, Compton, & Weiss, 2014). In addition, treatment admissions for cannabis have significantly increased throughout the last decade. For example, approximately 872,000 individuals over the age of 12 had reported receiving treatment for cannabis use in 2011 (ONDCP, 2011). However, it is important to keep in mind that addiction is a complex social, cultural, and biological phenomenon in which explanations of the mechanisms of addiction have yet to achieve consensus among social scientists and neuroscientists (Hammer et al., 2016). Because drug use, abuse, and dependency is not well understood, it is important to take a conservative approach and make people aware of the potential consequences and negative effects of marijuana suggested by current research.

Short and Long Term Effects of Cannabis

In recent years, significant advances in research have been directed toward understanding the endogenous cannabinoid system and its functioning in reaction to marijuana (Crane, Schuster, Fusar-Poli, & Gonzalez, 2012). With a large number of cannabinoid receptors in the hippocampus, amygdala, basal ganglia, and prefrontal cortex, it is suggested that the intrusion of exogenous cannabinoids such as THC potentially disrupts the cannabinergic system, affecting various neurobehavioral processes (Crane et al., 2012). Current research has focused on mood and anxiety regulation, learning, memory, motivation, motor control, reward processing, and executive functioning, but has often yielded contradictory results, adding to the overall confusion and controversy towards the drug (Crane et al., 2012). However, recent studies

have demonstrated that cannabis influences neurocognition and behavioral effects both during intoxication, and after acute effects subside (Crane et al., 2012).

When marijuana is actively inhaled or consumed, users experience euphoria followed by relaxation or drowsiness; sensory distortion; altered perception of time; poor muscle coordination; increased heart rate; poor memory and ability to learn; impaired short term memory, attention and judgment; and increased appetite. Smokers often experience a dry or ‘cotton’ mouth and bloodshot eyes. In larger doses, marijuana can produce effects such as hallucinations, depression, paranoia, and anxiety attacks (NIDA, 2015). Consumption of marijuana can lead to a heightened risk of automobile accidents while intoxicated. These short-term effects usually subside within two to three hours after the drug is inhaled, but can last several hours after being orally consumed. Although there is no direct evidence of a hangover or lasting effects after acute intoxication, THC is stored within fat cells and slowly expelled from the body over time, taking several days and even weeks to clear the system (NIDA, 2015).

Several scientific literature reviews agree that the use of cannabis has a negative impact on various aspects of neurocognition, particularly those regulated by the frontal-limbic system (Crane et al., 2012). Studies from the past five years consistently demonstrate adverse effects on learning and memory along with deficits in attention, concentration and abstract reasoning during intoxication and after cessation of the drug. Most aversive consequences occur during acute intoxication, with active deficits in working and episodic memory (Abush & Akirav, 2014). Because the hippocampus exhibits a high expression of Cannabinoid 1 Receptors (CB1R), activation heavily influences short-term memory, spatial learning, and attention while inhibiting long-term

potentiation (LTP) in the ventral subiculum nucleus accumbens pathway (Abush & Akirav, 2014). In a study conducted by Montgomery and colleagues (2012), chronic users who have smoked marijuana at least four times within the last month demonstrated noticeable impairments in executive functioning along with deficits in prospective memory even after five days of abstinence (Montgomery, Seddon, Fisk, Murphy, & Jansari, 2012). Another study executed by Cuttler, McLaughlin, and Graf (2012) observed lasting impairments in encoding, storage, manipulation, and memory retrieval in long-term chronic users after acute intoxication.

Complications with episodic memory have been the most persistent finding reported. However, other neurocognitive brain areas appear to be adversely compromised by varying doses and frequency of marijuana consumption. Marijuana-related effects in other neurocognitive regions have been less consistent, with several studies producing mixed and controversial results on the extent and length of negative effects in both adults and adolescents (Crane et al., 2012).

Currently, inconclusive evidence on the underlying pathophysiology associated with marijuana use hinders the treatment and prognosis of disorders associated with cannabis use. Because most of the existing literature provides an inconsistent picture of long-term effects of marijuana on the brain, Fibley and colleagues (2014) aimed to develop a clearer picture on the presence and absence of structural changes of chronic users. These scientists were the first to utilize three different Magnetic Resonance Imaging (MRI) techniques to analyze a large cohort of chronic marijuana users alongside age- and gender-matched healthy controls. In regard to long-term chronic exposure to cannabis, the researchers found significant structural differences in the brains of long-

term users. Experimental subjects displayed reduced occipital-frontal cortex (OFC) gray matter volume and expansion in structural and functioning connectivity within the brain, on average, as compared to control subjects who had never been exposed to marijuana (Fibley et al., 2014). Although these results remained consistent among both adolescents and adults, these neural alterations were highly correlated with the age of initiation, frequency, and duration of use. For example, significant brain-behavior correlations suggest that an earlier age of onset may lead to an increase in functional connectivity of the bilateral orbitofrontal cortex (OFC). An inverse correlation between functional connectivity and the left temporal lobe was also associated with problems pertinent to marijuana use. Through this research it is evident that chronic use of marijuana holds severe implications in regard to neuroadaptive processes and structural alterations within the brain (Fibley et al., 2014).

Some research also suggests that deficits in prospective memory and executive functioning due to cannabis consumption last beyond intoxication and could be highly damaging in chronic smokers (Montgomery et al., 2012). On the other hand, some studies produced results suggesting that all neurocognitive performance deficits related to use disappear after 25 days of abstinence (Schreiner & Dunn, 2012).

Aside from the detrimental neurocognitive effects of chronic cannabis use, researchers often point out the dangers of physically smoking marijuana. Exposure to smoking not only leads to contact with many harmful chemicals and carcinogens, but can also lead to increased dental problems, as well as pulmonary and cardiovascular effects. Specifically, the toxic combinations of gases and carcinogenic substances have demonstrated an increased risk for dental cavities and oral infections in chronic marijuana

smokers (Greydanus et al., 2013). The inhaled smoke also can result in airway inflammation leading to irritated lungs, chronic bronchitis, and pulmonary infection (Greydanus et al., 2013). In fact, it has been estimated that a single cannabis cigarette is equivalent to 2.5-5 tobacco cigarettes in regards to pulmonary dysfunction. However, a specific link between cannabis inhalation and lung cancer currently remains unproven (Greydanus et al., 2013). In addition, cannabis smokers often experience an escalation in heart rate along with a mild increase in blood pressure, substantially increasing the chances of a heart attack and other various cardiovascular diseases (NIDA, 2015).

With a dramatic increase in the usage of marijuana among both the general and youth populations, Calvigioni and colleagues (2014) researched the implications of prenatal cannabis exposure. The psychoactive compound THC easily crosses the placental barrier and has been correlated with explicit physiological effects on the human fetus, including growth retardation and distress. Infants exposed in utero have demonstrated deficits in growth, impaired verbal and memory functioning, and damage in higher-order functioning (Calvigioni, Hurd, Harkany, & Keimpema, 2014). Similar studies demonstrate that in utero cannabis exposure increases susceptibility to neuropathic disorders such as schizophrenia (Chadwick, Miller, & Hurd, 2013). On the other hand, clinical evidence points to the marijuana-induced complications on the male reproductive system. Cannabinoids have been demonstrated to exert negative effects on human sperm, altering quantity, activity, and motility (Rossato, Popa, Gergio, Clari, & Foresta, 2005).

Lastly, some studies have focused on possible ties between the administration of cannabis and susceptibility to psychiatric illness (Chadwick et al., 2013). Current studies

are examining a potential underlying mechanism within the Endocannabinoid system that could explain why cannabis use during early adolescence has been affiliated with an increased potential of developing psychiatric and abuse disorders further on in life, especially to individuals who exhibit a vulnerability to a psychiatric syndrome (Caballero & Tseng, 2012). Scientists hypothesize that cannabis use during early adolescence could lead to alterations in CB1R signaling within the brain. Administering a CB1R agonist has demonstrated behavioral abnormalities that mirror the positive symptoms of schizophrenia such as fragmented thinking, paranoia, alterations in perception and disrupted thinking (Caballero & Tseng, 2012). Although there is a general concern that cannabis use during adolescence may increase the risk of psychiatric illness the mechanisms underlying this association are currently unclear. Most active cannabis users do not go on to develop psychosis and the possible link appears to be an intricate environmental-genetic-molecular interaction that most likely involves anandamide dysfunction along with several other biological factors (Greydanus et al., 2013).

Problem Among the Youth Population

The use of marijuana becoming increasingly pervasive among adolescents is a problem for several reasons. Many people use marijuana for the first time when they are teenagers (ONDCP, 2011). Adolescence is a vulnerable time for subsequent adverse brain effects. During adolescence, the brain is consistently undergoing multiple changes, including neuroplastic modifications, an increased loss of synapses present in neocortical regions, and the reconstruction of the still-developing prefrontal cortex (Abush & Akirav, 2014). Cannabinoids have been shown to disrupt the development and remodeling of young brains, leading to lasting aversive consequences on both the brain and behavior.

The receptors to which endogenous cannabinoids bind are at their highest levels in the hippocampus during adolescence (Rodriguez de Fonseca, Ramos, Bonnín, & Fernández-Ruiz, 1993). Both human and rat studies suggest that the most vulnerable period of a developing brain exists during the first 16 years of age (Ehrenreich et al., 1999; Schneider & Koch, 2003; Stiglick & Kalant, 1985). During this critical period, frequent exposure to cannabis increases the probability of lasting implications on the overall development of brain structure, function, and cognition.

The exposure to exogenous cannabinoids in a developing brain with high neuronal plasticity drastically increases the risk for cognitive dysfunction, changes in the central nervous system, neuropsychiatric disorders, dependence, and possible consumption of other illicit drugs (Greydanus et al., 2013). For instance, the central nervous system has an abundance of cannabinoid receptors and long-term use during this vulnerable period of life, specifically within the first sixteen years, can lead to impaired axonal fiber connectivity with detrimental negative effects on the white matter of the brain such as an overall decrease in volume (Zalesky, Solowij, Yucel, Lubman, Takagi, Harding, et al., 2012). Earlier initiation in cannabis use has also been shown to lead to an increase in addiction and dependence. Consistent or problematic use can act as a major interference with daily life activities and even lead to a decrease in overall quality of life including mental and physical health, social life, and career status (ONCDP, 2011).

Policy and Regulation

Assuming a decision to officially legalize marijuana has already been made, it is crucial to consider how one might regulate recreational marijuana to promote public health objectives. Policy makers are currently developing policies and public health

regulations in regards to the commercial production, distribution, and sale of cannabis and related products (Pacula, et al., 2014.) With insight from alcohol and tobacco laws, policy makers are interested in developing regulations that target major topics of public concern. These objectives include minimizing access, availability, and use of the drug by youths; eliminating drugged driving; reducing dependence and addiction; decreasing consumption of cannabis products with uncertain potency or unwanted contaminants; and improving regulation of the substance in public settings (Pacula et al., 2014).

With a dramatic increase in use among youths, it becomes clear that a controlled approach in advertising recreational marijuana to the public is crucial. For example, advertisements and billboards supporting the sales of recreational marijuana may have restrictions in place to limit marketing to the youth population. Policy makers juggle the idea of placing a comprehensive ban on all forms of promotional marketing for cannabis products including advertisements, promotions, sponsorships and other varying forms of marketing by branding agencies or cannabis sellers. These comprehensive restrictions could be justified to maintain antismoking norms and keep risk perception high in efforts to reduce youth initiation and use (Pacula et al., 2014). Contradictory evidence in regard to the aversive effects of marijuana highlights the blurred boundaries between marijuana's negative health harms, its medicinal properties, and its recreational appeal, decreasing overall risk perception among youth (Moffat et al., 2013). With recent statistics demonstrating an increase in use of marijuana among the adolescent population and the several initiatives being made to legalize for recreational purposes, there is a need to effectively educate the public on exactly what is involved when smoking marijuana.

Although advertisements often promote the purchase of a product, this form of marketing has also been shown as an effective way to educate the public on the adverse health effects of potent substances – educating as opposed to promotional marketing (Rucker & Petty, 2006). A common challenge for policy makers is to successfully present technical and scientific facts in a way that consumers perceive as believable. In order for warnings to be effective, the audience must believe that their risk is real as conveyed in the warning label information (Beltramini, 1988). Several studies have focused on effective ways to create advertisements for a product while informing the public of the consequences that are associated with it. For example, health warnings are often used to raise awareness of the risky nature of cigarettes, alcohol, and even soft drinks. However, warnings are not guaranteed to elicit the desired response among consumers. Research has shown that health risk communication, especially in regard to cigarette use can lead consumers to be more critical of the provided information, leading to a boomerang effect (Meyers-Levy & Malaviya, 1999).

Theories of Persuasion

Public Service Announcements (PSAs) and warning labels are methods of persuasive communication with the intention of informing consumers of the risks associated with using a specific substance or participating in a certain behavior (Rucker & Petty, 2006). The use of health communications in advertising has been shown to significantly influence the overall awareness and attitudes about health-related warnings. The end goal of risk communication messages is to produce either immediate or enduring changes in attitude (Rucker & Petty, 2006). For example, the health warnings associated with the dangers of smoking marijuana will be directed toward adolescents and young

adults, with the goal of delaying initiation or ceasing the use of the drug and ultimately creating enduring changes in attitude toward this behavior.

The Dual Process Theory of Persuasion or Elaboration Likelihood Model (ELM) is an organizing framework for assessing and understanding persuasion and attitude change. The power of persuasion does not lie within a warning message, but in the specific mental processes a consumer invokes. The ELM emphasizes a thinking/elaboration continuum in which persuasion operates by focusing on one of two routes: the central route or the peripheral route of processing (Petty, 1994). Other factors such as message construct and content along with source credibility and expertise play a crucial role on influencing persuasion through both elaboration conditions (Zuckerman & Chaiken, 1998).

The central route of processing occurs when consumers examine all of the information that is presented along with information generated internally in order to decipher the merits of a product. These consumers exhibit the motivation to indulge in thinking allowing them to greatly elaborate on the health risks being presented while actively scrutinizing all available information. After being exposed to health warnings, most people's attitudes are shaped by their cognitive responses to the message and information presented. The recipient of the message focuses on the overall content of the message as well as on the credibility and expertise of the source (Jones, Sinclair, Rhodes, & Courneya, 2004). People then generate either positive or negative issue-relevant thoughts, which shape their overall attitude toward the product. Additionally, the greater confidence individuals have in their thoughts, the greater the chance of these thoughts influencing their attitudes.

The central route of processing is highly efficient if a lasting attitude change is desired (Brinol, Petty, & Tormala, 2004). For example, a PSA directed toward pregnant mothers about the dangers of drinking alcohol comes in the form of a printed brochure and outlines the risks associated with alcohol consumption during pregnancy. In this scenario, the topic is highly relevant to the audience, the brochure contains a substantial amount of factual information, and long-term attitude change is desired. Because this information is relatable, contains strong arguments, and is aimed at changing attitudes, it is likely for elaboration to be relatively high. An assessment on attitude, attitude certainty, and thoughts can help determine whether or not this information was processed through the central route under high elaboration, and if attitudes had indeed changed (Rucker & Petty, 2006).

The peripheral route of processing often occurs when people lack the motivation or ability to successfully process all information presented. Instead, attitudes are formed through the use of heuristics or simple cues. Elaboration likelihood is relatively low, and certain variables are used to induce persuasion by one of the many peripheral processes, such as heuristic reasoning, self-perception, or classical conditioning (Petty, 1994). Very basic inferences are often generated, representing generalized rules of thumb that have been acquired from previous experiences (Meyers-Levy & Malaviya, 1999). Consumers may agree with a message on the basis of whether a source appears to be credible, or on the basis of number of arguments presented (Rucker & Petty, 2006).

The peripheral route of processing is valuable if an immediate but not long-lasting attitude change is required, such as deciding against stopping for fast food at the moment. Regardless, it is crucial to present a strong argument or powerful peripheral

cues in order to successfully implicate attitude change. An example where this route of processing may occur is through the development of an antismoking commercial that is designed to encourage parents to discuss drug use with their children. The message might showcase various celebrities stressing the importance for parents to advise their children against the use of drugs, but it might not disclose the specific benefits of initiating this conversation (Rucker & Petty, 2006). Elaboration is expected to be low because the specific commercial occurs within a crowd of other messages and has an overall lack of general relevance. If the goal of this commercial is to have parents engage their children in a brief talk about not using drugs, it can be inferred that a short-term attitude change may not be sufficient. Due to low elaboration, the audience of the commercial is expected to have few message-relevant thoughts and a weak association toward their attitudes (Rucker & Petty, 2006).

When trying to successfully communicate the health risks of a product, it is important to consider the recipients of the message and their probability of processing the information either centrally (i.e., systemically) or peripherally (i.e., heuristically). The motivation of consumers is heavily influenced by the perceived personal relevance of the product to their lives, level of anticipated knowledge, and overall enjoyment of thinking (Rucker & Petty, 2006). One of the goals of persuasive communication is to induce long-lasting changes in attitudes. Attitude certainty, or the confidence in which people believe their attitudes are correct, is an important factor in influencing behavior.

Development of a strong attitude is often influenced by the perceived strength of the argument, and whether or not the source is believed to be credible, regardless of elaboration. For example, an advertisement sourced by a well-known company of high

credibility will elicit greater perceived believability and trustworthiness than if it were sourced by a lesser known branding agency, inducing a positive attitude change (Rucker & Petty, 2006). Previous studies demonstrate that the majority of people are more open-minded to a message that comes from an expert, but highly critical if the same message is presented by a non-expert (Nan, 2009). After consumers have analyzed a message, providing information about the level of expertise of the source has shown to increase overall confidence in the thoughts generated and greater certainty in attitude (Nan, 2009). Attitudes held with a greater level of certainty are more likely to impact behavior, prevail over time and combat attempts to be altered (Rucker & Petty, 2006).

Several studies have analyzed various ways to effectively create and communicate health risk information while incorporating the ELM to determine levels of processing. For example, Effertz and colleagues (2014) analyzed various ways of creating effective health warnings for soft drinks directed toward children and adolescents. For warnings to be effective, the facts need to be attended to, understood, recalled, and taken into account when consumption decisions are made (Effertz, Franke, & Teichert, 2013). However, warning labels often interact with and compete with other ad features such as pictorial framing, graphic images, and other sources of distraction. The authors found that participants were more receptive to the warnings when they included pictures that grabbed attention and elicited emotions. Graphic images such as blackened lungs filled with tar from cigarette smoke were easily recalled with high accuracy weeks after exposure (Effertz et al., 2013). Another significant finding includes the fact that the effectiveness of warnings are heavily dependent on the recipients' characteristics, previous background, knowledge, and exposure to the product (Effertz et al., 2013).

Therefore, the cognitions of the consumer play a role in how he or she perceives the warnings.

A study conducted by Krugman and colleagues (1999) adopted a cognitive learning-oriented goal to make the public more aware of adverse health effects of smoking, aiming to enable people to make informed decisions about smoking. The authors hoped to create messages that would enhance the elaboration process, ultimately changing attitude perception. Although consumers are aware of the existence of warning labels, most individuals do not pay attention to, fully comprehend, or remember the specific dangers (Krugman, Fox & Fischer, 1999). Individuals encounter warnings in at least three different settings: when viewing an advertisement or other form of promotion, on the package or carton during product purchase, and on the product packaging prior to use (Krugman et al., 1999).

In order for warnings to successfully communicate meaningful risk information at reasonably high levels of cognition, the authors had created three distinct criteria: cognitive, affective, and conative. Cognitive criteria include a wide range of concepts, including visibility and detailed knowledge. Although warnings are visually expressed on an advertisement or packaging, most consumers only pay limited attention and spend a short amount of time reading the warnings. Consumer attitudes, beliefs, preferences, convictions and desire are included in affective criteria. Changing the perception of hazard and communicating believable risk is the most reasonable affective goal. However, consumers must be willing to read and comply with the reduction strategies presented by a warning label. Lastly, conative criteria focuses on actions such as not

initiating, reducing, or discontinuing the use of the product in which warnings are being advocated toward (Krugman et al., 1999).

Following these criteria, the authors aimed to create mandated warnings that not only attracted the audience, but held their attention long enough to be considered and then later remembered well enough to possibly influence behavior (Krugman et al., 1999). Significant results of this study demonstrated that individuals who were exposed to newly designed warnings in comparison to a typical Surgeon General black-and-white text box, were much more likely to remember the concept of those warnings. If a warning label were designed in such a way that it is appealing to the audience, the facts would be more persuasive and influential (Krugman et al., 1999).

In 2003, Harrington and colleagues used an ELM framework to investigate the influence of message design on lasting changes in attitudes, behavioral intentions, and overall behavior in relation to marijuana consumption. Previous research has demonstrated that message content such as quality, the order of arguments, and the source can be manipulated to produce various persuasive effects. These factors have been shown to interact with individual characteristics, including a varying need for cognition or enjoyment of thinking in order to influence attitude and behavior change (Harrington et al., 2003).

In order to evaluate the two routes of persuasion associated with the ELM, the researchers of this investigation created a 'message cognition value' (MCV) construct. Messages that contain a strong rational argument and complex presentation of facts are considered to have high cognitive value (HCV). On the other hand, messages that include a limited argument, simplistic presentation of basic information and pictorial content are

considered to have low cognitive value (LCV) (Harrington et al., 2003). Depending on an individual's need for cognition, each type of message had been hypothesized to influence attitudes in a different way. According to traditional ELM research, HCV messages are more likely to be processed under the central route, creating stronger attitude certainty and lasting behavioral changes. The results from this study were synonymous with previous research, concluding that HCV messages were much more effective, on average, than LCV messages in encouraging central processing and creating lasting attitude change (Harrington et al., 2003).

In another example, Blanton and fellow researchers conducted a study on the effect of graphic cigarette warnings on smoking intentions in adolescents (2014). Previous research suggests that graphic warnings can increase the overall perception of harm of smoking, and decrease the desirability of the smoking social image ultimately declining the intention to purchase cigarettes (Blanton, Snyder, Strauts, & Larson, 2014). The researchers adopted a systemic/heuristic dual process theory in order to account for how the graphic warnings were attended to and processed. Specifically, they presented participants with nine FDA graphic images representing the consequences of smoking, such as decaying teeth and laryngectomies. Afterwards, the researchers administered questionnaires assessing smoking-related history, and willingness and intention to smoke. However, the authors realized that changes in attitudes toward a product did not always translate into a change in behavioral intention, regardless of the elaboration process. Two hypotheses were developed primarily based on consumers' characteristics in an effort to explain the various reactions toward the graphic warnings. Recipients were classified as either adaptive-responsive or defensive-responsive. Dependent upon their past

experiences, adaptive-responsive consumers were generally very open and responsive to the warnings presented throughout the ad. On the contrary, defensive-responsive recipients included individuals who had engaged in similar risky behaviors in the past that led them to react more defensively to the risk prevention messages (Blanton et al., 2014). For instance, previous research suggests that current cigarette smokers often disengage from anti-smoking messages and are more critical of message content. In detailed interviews with heavy cigarette smokers, Wolburg (2006) found that smokers tended to regard anti-smoking advertisements as annoying, insulting, and ineffective, reacting to messages in an angry, defensive, and defiant fashion (Wolburg, 2006). These defensive reactions in response to prevention messages could be so strong as to challenge smokers' self esteem and psychological reactance, resulting in a boomerang effect (Blanton et al., 2014). Although the researchers did not find any significant evidence to suggest this type of effect on smokers with an extensive history of cigarette use, it is crucial to keep in mind the possibility of this phenomenon among highly defensive cigarette smokers. This may also be true of marijuana smokers.

A study conducted by Nan (2009) examined the influence of source credibility on attitude certainty. Source credibility is a crucial factor in communication persuasion. Previous research supports that attitudes that are based on a high cognitive elaboration are often held with greater certainty. Stronger attitudes are more likely to persist over time, resist attempts to change, and are more predictive of behaviors. The results of this study demonstrate that stronger attitudes with greater certainty are developed when the information presented is processed centrally and sponsored by a trustworthy source (Nan, 2009).

The Current Study

The present study aims to explore the most effective ways to educate and warn the public about the aversive health effects of cannabis through printed advertisements selling recreational marijuana. Using the ELM as a framework, participants will assess warning information presented through either a cognitively based central route, or a less effort-inducing peripheral route of processing. Factual claims elaborating on the details of the aversive health effects present a strong argument to be perceived through the central route of processing. On the contrary, general evaluative claims present a weaker argument than factual claims, and should serve as peripheral cues to induce a peripheral route of processing. Participants will be randomly assigned to view one of six advertisements with manipulations in the sources of information (Food & Drug Administration versus a branding agency) and type of facts presented (factual claims, evaluative claims, unrelated claims). Source credibility, expertise, and the types of warnings presented have been previously demonstrated to evoke different mean levels of processing and influence overall perception and attitude change.

This study differs from existing research by focusing on how to successfully educate the public on recreational marijuana, as it increasingly is legalized across the U.S. Additional states are beginning the process of legalization for recreational purposes and statistics demonstrate a relative increase in marijuana use among the population of the U.S., especially among young people. However, a lack of accurate and consistent messages along with harm-reduction strategies related to cannabis consumption has particular implications for adolescents as they encounter controversial evidence and make decisions regarding its use.

The goal of this study is to learn how best to educate and warn the public about the real harms of marijuana that are often not presented through the media, but have been demonstrated through scientific research in both humans and rodents. A set of five factual claims about the short- and long-term effects of marijuana were matched with a second set of five matching evaluative claims.

Based on research on persuasive communication and advertising, there are two main hypotheses. The first hypothesis is that related factual claims will increase overall mean knowledge about the negative health effects of marijuana, as well as higher mean negative attitudes about smoking marijuana, as compared to related evaluative claims. In turn, related evaluative claims are expected to increase overall mean knowledge and create higher average negative attitudes toward marijuana, on average, than the unrelated claims. Compared to the evaluative claims, factual claims present a stronger, more complex argument that is more likely to elicit central route processing and create lasting attitude change (Rucker & Petty, 2006).

The second hypothesis is that the advertisements said to have been sponsored by the Food and Drug Administration (FDA) will elicit greater believability and higher attitude certainty, on average, than advertisements sponsored by a fictional branding agency, KingCannabis. Previous research demonstrates that a credible or well-known source yields greater mean levels of believability and more confidence, on average, in attitudes formed about a product (Nan, 2009). Because the branding agency is for-profit, we expect that its ad will be perceived as less believable, on average, than that from the FDA.

Based on previous literature, we do not anticipate a statistically significant interaction of the source of information and the type of claim.

Methods

Participants

An a priori power analysis was conducted using G*Power (Buchner, Erdfelder, Faul, & Lang, 2007). Based on this analysis, 158 participants were needed to achieve a power level of 0.80 to detect a medium effect with and an alpha of 0.05. The 219 students in the study were recruited using SONA, an internet-based departmental research participant pool. Due to inconsistent cell sizes, data collection was resumed after a month hiatus to incorporate 25 more students, totaling 244 participants. Of the 244 participants, 6 were dropped due to computer malfunctions or because the participant took less than five minutes to complete the study, totaling 238 participants for analyses.

The age range of participants was 18-30 ($M=19.55$, $SD=2.48$). The study consisted mostly of women (67.1%). The sample was 53.8% white, 13.3% African American, 7.6% Hispanic, 10.8% Asian and the remaining 10% listed multiple ethnicities. Nearly half of the participants were in their sophomore year (49%), with 20.5% freshman, 17.3% juniors, and 8.8% seniors. All students received class credit for their participation. Participants had to be fluent in English to ensure the ability to read the advertisement and appropriate measures. All participants gave informed consent in accordance with the Institutional Review Board approval. In addition, each participant was debriefed at the end of the study.

Materials

Advertisement. Participants were randomly assigned to view one of six advertisements providing health risk information about either recreational cannabis or indoor tanning (see Appendix A). The advertisements were printed in color with the

appropriate warnings on the bottom half of the page. The facts in the experimental ads were developed based on previous research that examined the short- and long-term effects of marijuana consumption (NIDA, 2015; Greydanus et al., 2013; Calvigioni et al., 2014; Fibley et al., 2014). Although there were two different types of facts (factual claims or evaluative claims) presented, the information is parallel to ensure that everyone is receiving the same information (See Appendix B). For example, one factual claim is, “Marijuana leads to poor muscle coordination and impaired judgment, which can increase the risk of automobile accidents.” A parallel evaluative claim is, “It’s dangerous to toke and drive.” Both statements are reinforcing the fact that marijuana use is hazardous in regard to driving an automobile. On the contrary, the unrelated claims on the control advertisements do not provide any information about the effects of marijuana consumption.

For the four experimental conditions, participants viewed an ad with either factual or evaluative claims, funded by one of two sources—the Food and Drug Administration (FDA) or KingCannabis. The FDA is part of the United States Department of Health and Human Services and aims to promote and protect health. KingCannabis is a fabricated cannabis-marketing agency. The four ads viewed by participants assigned to one of the experimental conditions included; factual claims sponsored by the FDA, evaluative claims sponsored by the FDA, factual claims sponsored by KingCannabis or evaluative claims sponsored by KingCannabis. The remaining two ads served as controls promoting unrelated facts on indoor tanning, funded by either the FDA or KingTan. The five facts are from the FDA website and pertain to the risks of ultraviolet rays associated with indoor tanning (FDA, 2015; See Appendix B).

Marijuana Decisional Balance Scale. The Marijuana Decisional Balance Scale (MDB) for young adult use was developed to assess the costs and benefits of marijuana consumption (Elliot, Carey, & Scott-Sheldon, 2011). The MDB is divided into two categories containing pros and cons of marijuana consumption. Assessing both pros and cons not only offers information about positive and negative attitudes associated with marijuana use, but also demonstrates readiness to change. Endorsement of pro-cannabis items has been associated with more positive expectations and attitudes, higher frequency of use, and greater intentions to use in the future. Endorsement of con items has been associated with lower intention to use, less frequency of use, and a negative correlation between perceived risk and frequency of use. People interested in committing to a process of change in attitude are more likely to report more cons and fewer pros of the target problem behavior. Analyses of reliability indicate a robust internal consistency with Cronbach's coefficient alpha levels of .91 and .95 for pros and cons, respectively (Elliot et al., 2011). Coefficient alpha for the current study was $\alpha = .93$ and $\alpha = .91$ for pros and cons, respectively.

Marijuana Effect Expectancy Questionnaire (MEEQ) Subscale: Cognitive and Behavioral Impairment. The Marijuana Effect Expectancy Questionnaire (MEEQ) is frequently used to assess the degree to which an individual expects physical and cognitive effects to occur as a result of using marijuana. This measure can be completed by people who report varying levels of marijuana use – from no experience to daily use. The MEEQ consists of six subscales and a total of 48 questions. However, for this study only the Cognitive/Behavioral Impairment subscale with 10 items was used. Both this subscale and the MDB were administered together to evaluate participants' knowledge

and perceptions of the effects of marijuana. Primary users have been shown to endorse less cognitive/behavioral impairment, with expectancies negatively related to use. This particular scale demonstrated adequate internal consistency, $\alpha = .84$ (Buckner, Ecker, & Welch, 2013). Coefficient alpha for the current study was $\alpha = .74$.

Advertising Believability Scale. The Advertising Believability Scale (ABS) developed by Beltramini (1982) consists of ten items that evaluate the extent to which an advertisement evokes satisfactory confidence in its credibility. The scale is considered relevant to various types of ad claims promoting assorted products. The ten items are anchored as opposites using a 5-place scale response format. Each participant's score is his or her mean of the ten items. Lower scores indicate greater believability or confidence that the ad is accurate (Beltramini, 1982). Calculations of Cronbach's coefficient alpha among each item averaged .90 indicating an acceptable level of reliability (Beltramini, 1988). Coefficient alpha for the current study was $\alpha = .93$. This scale was used to assess the participant's perception of the believability of the advertisement and facts presented.

Attitude Scale. The attitude scale has been adopted from a study conducted by Tormala and Petty, (2004). The objective of administering this measure is to determine if recipients resisted or were persuaded by the information presented in the advertisement. Participants report their attitudes toward the advertisement on a sequence of scales ranging from 1 to 9 with subsequent anchors: *bad-good*, *negative-positive*, *unfavorable-favorable*, *harmful-beneficial*, and *foolish-wise*. Higher numbers indicate more favorable attitudes. Analysis of reliability indicate high internal consistency, $\alpha = .94$ (Tormala & Petty, 2004). Coefficient alpha for the current study was $\alpha = .96$.

Attitude Certainty. After reporting their attitudes toward the advertisement, participants were asked to complete a few questions on how certain they are of these attitudes. In several previous studies, attitude certainty is evaluated by two questions on a nine-point scale; “How certain are you of your attitude toward this product?” and “How convinced are you that your attitude is correct?” (Rucker & Petty, 2006). Coefficient alpha for the current study was $\alpha = .88$.

Behavioral Intention. Future behavioral intention was evaluated by a single question. “Assuming recreational marijuana is legal in your state for someone your age, would you be interested in buying this product?” (Lancaster, 2004). This question will assess two important details about the participant. The first is the probability that the individual would buy this product and smoke marijuana. The second is the potential for attitude change. A participant who is not likely to buy this product is likely someone who exhibits a more negative attitude towards marijuana consumption and chooses to abstain from the drug.

Manipulation Check. A brief manipulation check will be administered by a single question. “What source sponsored this advertisement?” By asking this question, we can ensure that each participant understood the appropriate source and took this information into consideration when perceiving the advertisement and making their overall decision.

Demographics Form. Each participant will be asked to complete a demographics form. This form will provide information about gender, ethnicity and year in school. These data will assist in providing a better understanding of the sample population while analyzing results. Participants will also have the opportunity to write additional

commentary at the end of this form. This section can be constructive in establishing any possible issues in the study or any reasons for omitting an individual's data from analyses.

Design and Procedure

The experiment lasted approximately fewer than thirty minutes. Participants were randomly assigned into one of the six conditions. After providing informed consent, participants were asked to read the appropriate advertisement.

After the participants read the advertisement they completed the seven measures with the advertisement still available to them if needed. To counterbalance, half of the sample completed the measures regarding marijuana knowledge and perception first, and the measures regarding attitude and believability second, and vice versa. The demographics form was completed last by all participants. All measures were administered on a computer screen using Survey Monkey and each question was presented individually. After the participant had completed all of the measures, he or she was debriefed.

Results

Six participants were excluded from the subsequent data analyses based on criteria developed prior to data collection leaving $N=238$ for the analyses. Two participants were removed due to a computer malfunction. The remaining four were removed because they completed the experiment in less than five minutes.

A multivariate analysis of variance (MANOVA) was used to examine both hypotheses. Important assumptions of a MANOVA include multivariate normality, or assuming that residuals are normally distributed; independence; random sampling; and homogeneity of covariance matrices (Field, 2013). Because all participants were required to take the study for class credit, the sample of this experiment was not randomly selected. However, it is worth mentioning that all participants came from the population of interest, college students. The college population is often exposed to illicit drugs, and providing educational information may help in assisting in one's decision in choosing to abstain from a drug. In accordance with the Central Limit Theorem, normal distribution can be assumed because the sample size is larger than 30. Homogeneity of covariance matrices was examined using Levene's test of equality of error variances to determine if the variance-covariance matrices of the different groups within in the analysis were equal. All values were greater than 0.05, indicating that the variability between conditions is similar.

Knowledge, Perception and Attitudes about Marijuana

The first hypothesis was that related factual claims will lead to higher overall mean knowledge about the negative health effects of marijuana as well as higher average negative attitudes about smoking marijuana compared with evaluative claims. And in

turn, related evaluative claims are expected to lead to higher levels of mean knowledge and higher average negative attitudes toward marijuana than unrelated claims. The second hypothesis was that advertisements sponsored by the FDA would induce greater believability and higher overall mean attitude certainty compared with advertisements sponsored by a branding agency such as the fictional KingCannabis. Both hypotheses are examined in the first set of MANOVAs examining the effects of persuasion type and type of source with respect to some dependent variables such as MEEQ and MDB scores.

A 3 x 2 multivariate analysis of variance (MANOVA) was conducted to examine the effects of persuasion type (factual claims, evaluative claims, or unrelated claims) and type of source (FDA or a branding agency) on MEEQ scores and MDB scores. The MDB scale was divided into two subscales either endorsing the pros or cons of smoking marijuana. This analysis was run to provide insight on the overall perception and knowledge of the effects of marijuana. An overall main effect of type of persuasion was found ($\Lambda=.94$, $F(6,460) = 2.413$, $p=.026$, partial $\eta^2 = .031$), a small effect size (see Table 1). A Tests of Between-Subjects Effects of the 3 x 2 MANOVA revealed statistically significant univariate effects of MEEQ ($F(2, 232)=4.808$, $p=.009$, partial $\eta^2 = .40$, a small-to-medium effect) and MDB pro scores ($F(2,232)=4.667$, $p=.01$, partial $\eta^2 = .39$, a small-to-medium effect). A univariate effect of MBD con scores was not statistically significant, ($F(2,232)=1.187$, $p=.307$, partial $\eta^2 = .01$), a very small effect, so we will not discuss this univariate main effect further. We examine the significant univariate effects through follow-up analyses, described below.

There was no significant main effect for type of source ($\Lambda=.978$, $F(3,230) = 1.713$, $p=.165$, partial $\eta^2 = .022$), and there was no significant interaction of persuasion

and source ($\Lambda=.961$, $F(6,460) = 1.531$, $p=.166$, partial $\eta^2=.02$), both small effects.

Therefore, these effects will not be discussed further in the follow-up analyses.

Table 1.

Means and Standard Deviations of MEEQ and MDB scores by Type of Persuasion

Type of Persuasion	MEEQ			MDB PRO		MDB CON	
	<i>N</i>	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>
Evaluative Claims	80	3.61	.59	2.94	1.19	4.0	.733
Factual Claims	82	3.78	.52	2.61	1.12	4.12	.828
Unrelated Claims	76	3.51	.52	3.12	.91	3.94	.597

A follow up between-groups analysis of variance (ANOVA) was conducted to examine the main effect of type of persuasion (factual claims, evaluative claims, and unrelated claims) on MEEQ scores. As the MEEQ is aimed to measure the endorsement of the cognitive and behavioral impairment caused by marijuana, higher scores indicated greater endorsement. The type of fact (persuasion) significantly affected MEEQ scores ($F(2,237) = 4.928$, $p=.008$, partial $\eta^2 = .40$), a small-to-medium effect. A Tukey *HSD* post-hoc test revealed that, on average, participants who read the factual claims had statistically significantly higher MEEQ scores ($M=3.7833$, $SD=.525$), than those who read unrelated claims ($M=3.515$, $SD=.516$, $p=.006$, $d=.52$, a large effect) but not than those who read the evaluative claims ($M=3.61$, $SD=.594$, $p=.111$, $d=.30$, a medium effect; see Table 1). The average scores on the MEEQ of those who read the evaluative claims and unrelated claims did not statistically significantly differ ($p=.277$, $d=0.17$, a small effect).

The results from the follow-up ANOVA examining MEEQ scores indicated that, on average, participants who read factual claims rated the effects of marijuana as leading to more impairment compared to participants who received unrelated information. These

results suggest that factual claims, providing concrete and clear information about the aversive effects of marijuana, led to higher mean levels of knowledge about the effects of marijuana than did evaluative and unrelated claims.

A follow up between-groups analysis of variance (ANOVA) was conducted to examine the effects of type of persuasion (factual claims, evaluative claims, and unrelated claims) on endorsement of the pros of smoking marijuana of the MDB scale. The type of persuasion significantly affected pro endorsement of marijuana use ($F(2,237) = 4.496$, $p=.012$, partial $\eta^2 = .37$), a small-to-medium effect. A Tukey *HSD* post-hoc test revealed that, on average, participants who read factual claims endorsed the pros of smoking marijuana significantly less ($M=2.613$, $SD=1.12$) than did participants who read unrelated claims ($M=3.12$, $SD=1.1$, $p<.01$, $d=.46$, a medium-to-large effect) but not than participants who read evaluative claims ($M=2.94$, $SD=1.19$, $p<.141$, $d=.28$, a small-to-medium effect; refer to Table 1). The average scores on the pro-endorsement MDB subscale of those who read the evaluative claims and unrelated claims did not significantly differ, ($p=.533$, $d=0.16$), a small-to-medium effect.

A follow-up between-groups ANOVA was conducted to examine the effects of persuasion (factual claims, evaluative claims, and unrelated claims) on endorsement of the cons of smoking marijuana of the MDB scale. There was no statistically significant effect for type of persuasion ($F(2,237)=1.251$, $p=.288$, partial $\eta^2 = .011$), a very small effect. These effects will not be discussed further.

Participants who received factual claims about the aversive effects of marijuana rated the pros of smoking marijuana as less appealing, on average, than did participants who received unrelated claims. These results suggest that participants who received

factual claims were less likely to endorse the pros of smoking marijuana, indicating fewer expectations of positive effects from smoking the drug, than participants who read unrelated claims.

In the interest of examining only the advertisements providing information about marijuana on differences in perception and knowledge, a separate multivariate analysis of variance (MANOVA) was conducted excluding the control advertisements. A 2x2 MANOVA was conducted to examine the effects of persuasion type providing factual information about marijuana (factual claims or evaluative claims) and type of source (FDA or King Cannabis, a branding agency) on MEEQ scores and the scores of the pro and con subscales of the MDB.

There was no significant effect for type of source ($\Lambda=.963$, $F(6,156) = 1.973$, $p=.120$, partial $\eta^2 = .037$) or type of persuasion ($\Lambda=.962$, $F(3,156) = 2.034$, $p=.111$, partial $\eta^2 = .038$), a small-to-medium effect. However, there was a trend toward a significant interaction of type of source and type of persuasion ($\Lambda=.958$, $F(3,156) = 2.256$, $p=.084$, partial $\eta^2 = .042$), a small-to-medium effect. Although there were no statistically significant main effects for either factual or evaluative claims and type of sponsor, it is possible that there was not sufficient statistical power to detect the interaction between a specific type of source and type of fact. Based on the results of the 2x2 MANOVA there were no statistically significant differences with respect to overall mean perception and knowledge, regardless of type of persuasion or source.

A 3 x 2 multivariate analysis (MANOVA) was conducted to examine the effects of type of source (FDA or a branding agency) and persuasion type (factual claims, evaluative claims, or unrelated claims) on overall attitude scores and certainty about

one's attitude toward marijuana. There was no significant main effect of type of source ($\Lambda=.999$, $F(2,231) = .084$, $p=.920$, partial $\eta^2 = .001$) or type of persuasion ($\Lambda=.991$, $F(4,462) = .531$, $p=.711$, partial $\eta^2 = .005$), not even small effects according to Cohen's conventions, on overall mean attitude score or mean attitude certainty. There also was no significant interaction of type of source and type of fact ($\Lambda=.993$, $F(4,462) = .408$, $p=.803$, partial $\eta^2 = .004$).

These results suggest that reading an advertisement providing factual, evaluative, or unrelated claims about the aversive health effects of marijuana may not be influential enough to induce direct attitude change. It is possible that people exhibit pre-existing attitudes toward marijuana that may not be significantly altered by one session of exposure to a set of facts. Failure to provide evidence in support of an effect of the advertisement manipulation on attitude change in the present experiment does not necessarily mean that advertisements with claims about the aversive health effects cannot affect attitude change. It is possible that additional exposure to the informational material is required to induce a significant attitude change. However, based on the previous analyses examining the first hypothesis, it is likely that providing related factual evidence about the aversive health effects of recreational marijuana may increase overall knowledge and perception about using the drug.

Believability and Attitude Certainty

Both hypotheses were examined in the following ANOVAs with respect to the dependent variables of believability and attitude certainty. A 2x2 analysis of variance (ANOVA) was conducted to examine the effect of source (FDA vs. King Cannabis, a branding agency) and type of persuasion (factual or evaluative claims) on believability.

Lower scores indicate more believability. The control ads or unrelated facts were excluded from this analysis because we were interested in examining how believable the information about the aversive effects of marijuana appeared to participants. We were not interested in seeing if participants believed the tanning-related facts in the control advertisements.

The 2x2 ANOVA revealed a significant main effect for type of sponsor ($F(1,162)=15.697, p<.0001, \text{partial } \eta^2=.09$), a medium-to-large effect. Participants reported that information in advertisements sponsored by the FDA was statistically significantly more believable ($M=3.6275, SD=1.511$) than that from a branding agency, ($M=4.7211, SD=1.811, d=0.65$, a very large effect; see Figure 1).

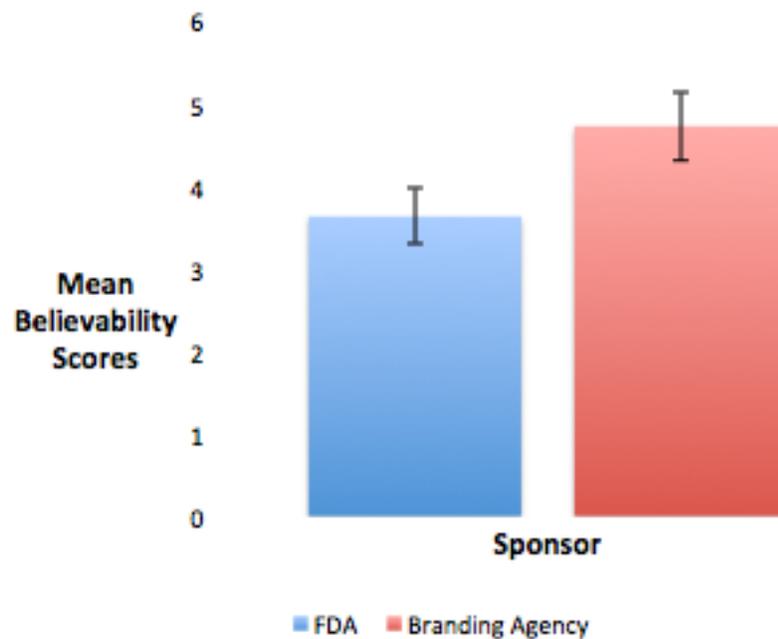


Figure 1. The effect of sponsor on mean believability scores. Error bars show 95% confidence intervals.

There was a significant main effect for the two types of persuasion ($F(1,162)=17.956, p<.0001, \text{partial } \eta^2=.102$), a large effect. Participants were

statistically significantly more likely to believe an advertisement that contained factual claims ($M=3.615$, $SD=1.67$) compared to evaluative claims ($M=4.76$, $SD=1.77$, $d=0.67$, a very large effect; see Figure 2).

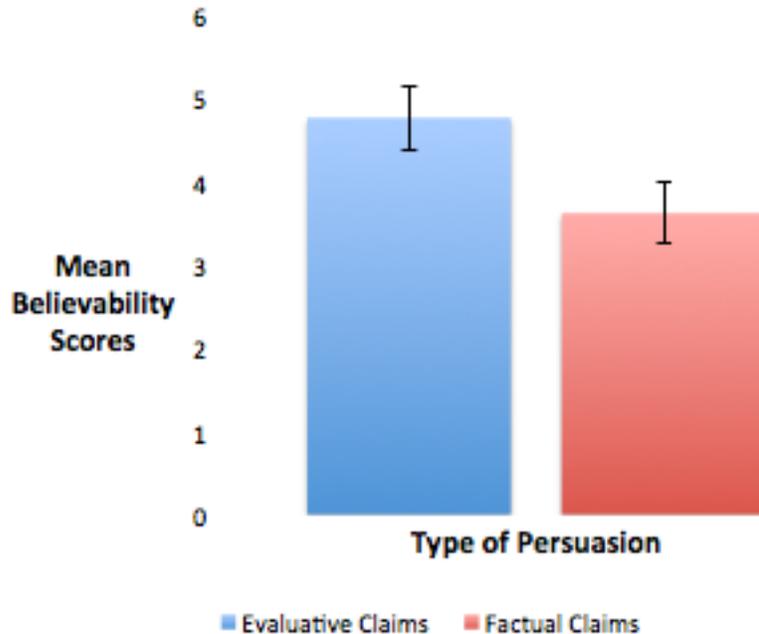


Figure 2. The effect of type of persuasion on mean believability scores. Error bars show 95% confidence intervals.

There was a trend for a significant interaction effect between type of sponsor and two types of persuasion ($F(1,162)=3.789$, $p=.053$, partial $\eta^2=.023$), a small effect. Based on these results, it appears that believability may be dependent upon an interaction between the type of persuasion and source with a specific set of facts and source increasing mean believability. It is possible that the type of persuasion (such as factual claims) has a different type of effect depending on which source (such as the FDA) sponsors it. A pattern of interaction is described through the results of an independent sample t -test mentioned below.

These results suggest that people are more likely to believe clear and concise information about a product compared with general health claims. People are also more likely to believe information when it is supported by a well-known government funded agency such as the FDA compared with a branding agency. Policy makers may require individual companies to provide information on harmful effects, but that information may not be believed by the population unless provided by a well-known and reliable source.

Two independent samples *t*-tests were conducted to compare mean believability scores between the type of persuasion (factual claims or evaluative claims) and type of source (FDA or King Cannabis). There was a statistically significant difference in believability scores for factual claims sponsored by the FDA ($M=2.0465$, $SD=2.65$) as compared with evaluative claims sponsored by the FDA ($M=3.54$, $SD=2.07$); $t(78)=3.854$, $p=.002$, $d=0.63$, a large effect (see Figure 3). These results indicate that when the FDA sponsors the advertisement, factual claims are statistically significantly more believable than evaluative claims. There was not a significant difference in mean believability scores for factual claims sponsored by King Cannabis, ($M=3.69$, $SD=2.79$) as compared with evaluative claims sponsored by King Cannabis, ($M=4.488$, $SD=2.649$); $t(80)=1.324$, $p=.502$, $d=0.29$, a small-to-medium effect (see Figure 3). These results indicate that when the advertisement is sponsored by a branding agency, the information presented, regardless of the type of claim, is less believable, on average.

The overall results from the independent samples *t*-test results suggest that when advertisements are sponsored by the FDA, it matters what kinds of facts are being presented in order for the information to be believable. However, a branding agency like King Cannabis is considered to be much less believable regardless of the types of facts

being presented.

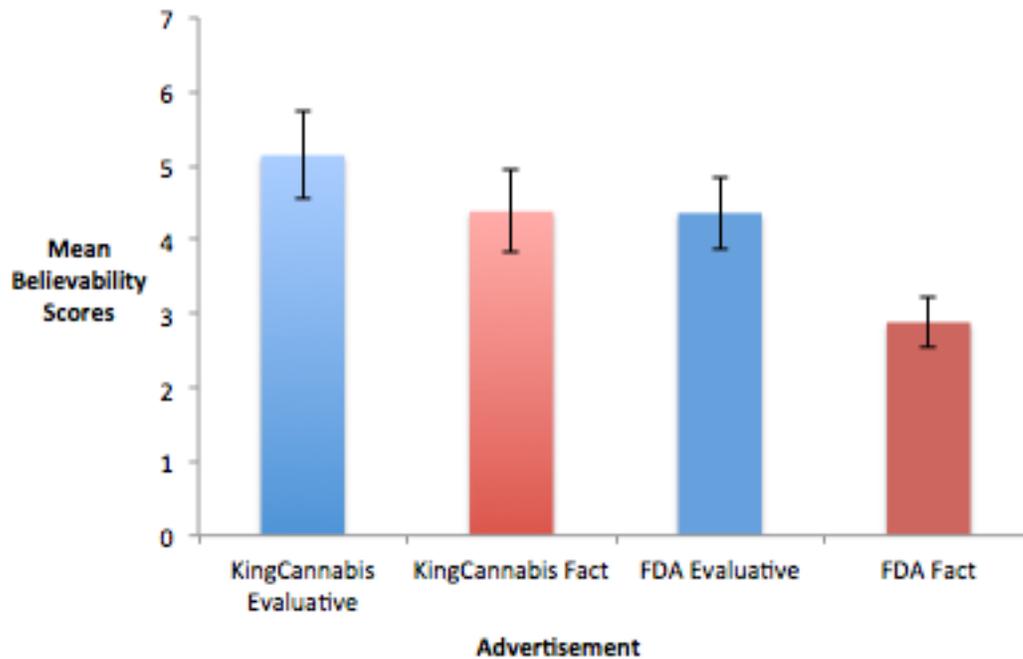


Figure 3. The effect of persuasion type and source on mean believability scores. Error bars show 95% confidence interval.

An analysis of variance was conducted to examine the effect of advertisements containing only information about marijuana on mean certainty of one's attitude toward marijuana. A 2x2 ANOVA was conducted analyzing the effect of type of persuasion (factual or evaluative claims) and source (FDA or King Cannabis, a branding agency) on confidence that attitudes toward marijuana were correct. There was no statistical effect for either type of source, ($F(1,162)=.071, p=.790$, partial $\eta^2 = 0$) or type of persuasion ($F(1,162)=.0, p=.99$, partial $\eta^2 = 0$) not even a small effect. There was no interaction of type of source and persuasion on certainty of one's attitude, ($F(1,162)=1.157, p=.284$, partial $\eta^2 =.007$), not even a small effect.

Behavioral Intention

After providing factual information about the aversive health effects of marijuana, we were interested in how many participants would be inclined to purchase recreational marijuana if it were legal in their state for someone their age based on the type of information they received. The type of sponsor was not evaluated in this analysis since there was no statistically significant effect shown in the previous 2x3 MANOVA.

A frequency analysis revealed that of the participants who read evaluative claims, 26.3% would purchase marijuana, 61.3% would not, and 11.3% were unsure. Of the participants who read factual claims, 15.9% would make the purchase, 68.3% would not, and 11% were unsure. Of the participants who read unrelated claims that provided no information about marijuana at all, 32.9% would buy, 50% would not, and 17.1% were unsure (see Figure 4). These results suggest that participants who read either evaluative or unrelated claims were almost twice as likely to purchase recreational marijuana compared to participants who read factual claims. These results suggest a possible social desirability bias that will be later discussed as a limitation.

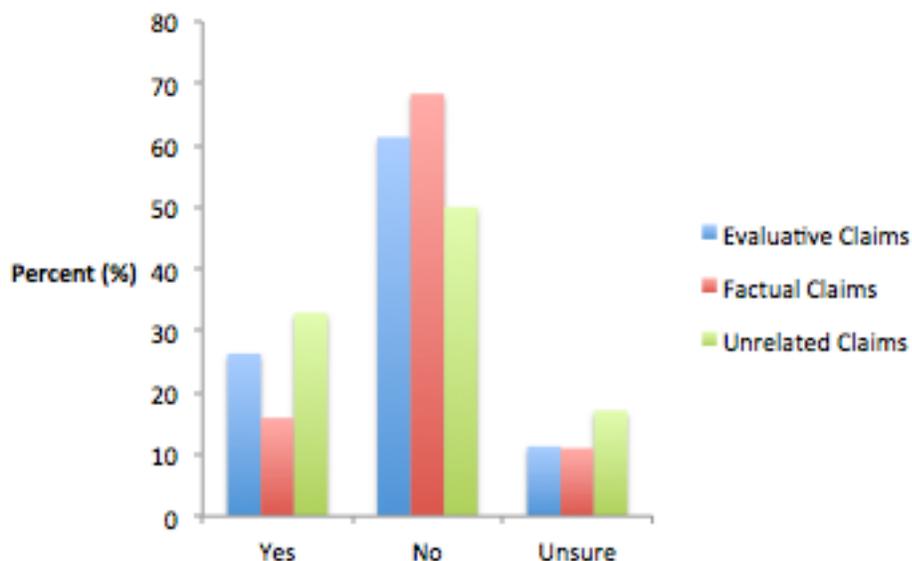


Figure 4. Distribution of decisions to purchase legal marijuana based on type of persuasion.

A chi-square test of independence was performed to examine the relation between type of persuasion and participants who would be interested in purchasing recreational marijuana if it were legal for someone their age in their state. The relationship between these variables was trending significance $\chi^2(4, N=233)=8.291, p=.081$, Cramer's $V=.133$, a small effect. Participants who received factual claims were trending toward deciding not to buy recreational marijuana. A second chi-square test of independence was performed to examine the relationship between the type of source (FDA or a branding agency) and participants who would be interested in purchasing marijuana if it were legal in their state for someone their age. The relationship between these variables was not statistically significant, $\chi^2(3, N=238)=1.389, p=.708$, Cramer's $V=.076$, a very small effect.

In the experiment, participants were asked about their close group of friends and how many of those friends had used marijuana within the last month. From this information, an overall percentage was calculated. A 3x2 analysis of variance (ANOVA) was conducted to determine the effect of persuasion type and type of source on the reported number of friends that used marijuana in the last month. Surprisingly, a 3x2 ANOVA revealed a significant main effect for type of fact ($F(2,230)=3.082, p=.048$, partial $\eta^2=.027$) a small effect. There was a significant interaction effect of type of fact and sponsor, ($F(2,230)=4.293, p=.015$, partial $\eta^2=.037$), a small-to-medium effect. We examine these effects through follow-up analyses below. There was not a significant

effect for type of sponsor ($F(2,230)=4.293, p=.786, \text{partial } \eta^2 = 0$), not even a small effect, therefore this effect will not be discussed further in the follow-up analyses.

A Tukey *HSD* post-hoc test revealed that, on average, participants who read factual claims reported a lower percentage of friends who have smoked marijuana in the past month ($M=24\%, SD=25.265$) than participants who read unrelated claims ($M=35.03\%, SD=29.568, p=.051, d=.40$, a medium-to-large effect) but not than participants who read evaluative claims ($M=33.45\%, SD=32.796, p=.106, d=.32$, a medium effect). The number of friends reported by participants who read evaluative claims and unrelated claims did not statistically significantly differ, ($p=.941$).

To examine the pattern of interaction, an independent samples *t*-test was conducted to compare the reported mean percentage of friends who have used marijuana between participants who read advertisements sponsored by the FDA and the type of persuasion (factual claims or evaluative claims). There was a statistically significant difference in the mean percentage of friends reported for factual claims sponsored by the FDA ($M=17.50\%, SD=18.488$) as compared with evaluative claims sponsored by the FDA ($M=37.23\%, SD=33.117$); $t(77)=3.280, p=.002, d=0.74$, a very large effect (see Figure 5). Participants who read factual claims sponsored by the FDA reported significantly fewer friends who have used marijuana within the last month compared to participants who read evaluative claims sponsored by the FDA.

These results were surprising because the percentage of friends who smoked marijuana within the past month should not have been affected by the type of information their friend received to read. Because participants who read the factual claims reported the lowest percentage of friends who have used marijuana, it is possible that a social

desirability bias is occurring. Participants who read factual claims about the harms of smoking marijuana may be less likely to report knowing people who smoke because the descriptive information (compared to more general evaluative claims) adds to the negative connotation of the effects.

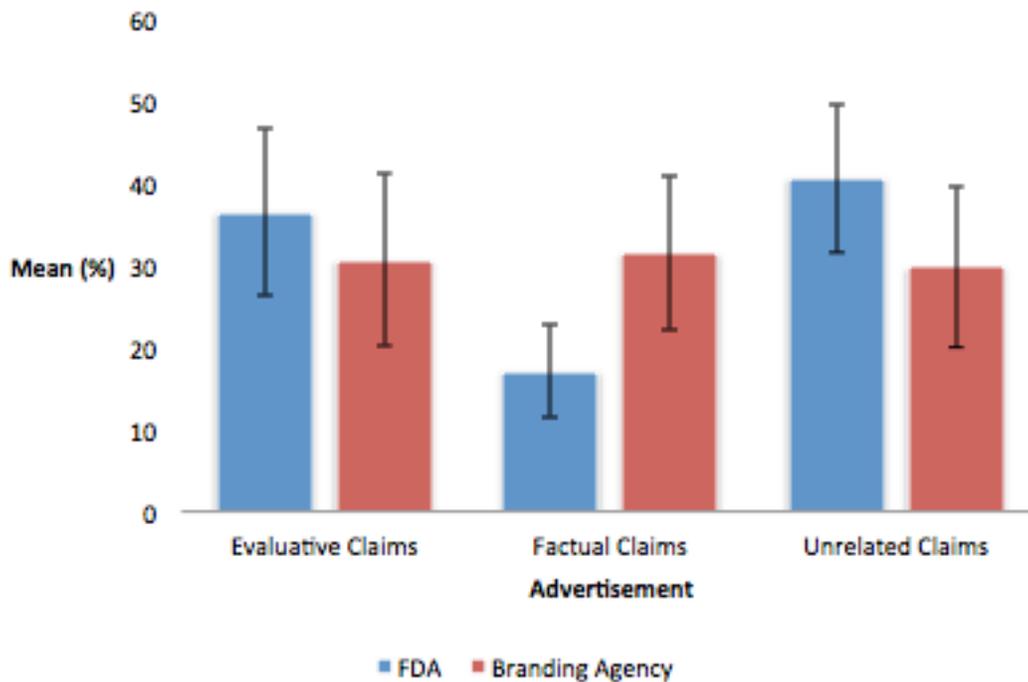


Figure 5. Reported friend use of marijuana within the last 30 days. Error bars show 95% confidence interval.

Manipulation Check

As a manipulation check, all participants were asked, “What source sponsored the advertisement that you read?” toward the end of the experiment. It is important to determine whether or not all participants were aware of the source sponsoring the advertisement when answering the questionnaires. When examining the match up between reported sponsor and advertisement, 3 out of 238 participants got the answer

wrong. This suggests that with the exception of three cases, all participants were paying attention and aware of the source sponsoring the information on the advertisement.

General Discussion

With the current and impending legalization of recreational marijuana throughout the United States, it is crucial for states to consider how to achieve their public health objectives. A challenge for policy makers is to successfully present technical and scientific facts in a way that consumers perceive as believable. The current study investigated effective ways to educate the public on the adverse health effects of recreational marijuana through advertisements. The results suggest that the way information is presented based on source and type of persuasion plays a role in how that information is perceived.

The findings of the present study support the first hypothesis that factual claims will lead to higher overall mean knowledge about the aversive health effects of marijuana. Participants who read factual claims were less likely to endorse the pros of smoking marijuana and rated the effects of the drug as leading to more impairment, on average, than participants who read evaluative or unrelated claims. Therefore, participants who read the factual claims demonstrated higher mean levels of knowledge compared to those who read either evaluative or unrelated claims. These results suggest that individuals who read factual claims were more likely to induce a central route of processing when reading the advertisement. Because the factual claims contain strong arguments, participants may have been more likely to absorb and apply the new information to their pre-existing thoughts about marijuana (Rucker & Petty, 2006).

The current results also support the second hypothesis that advertisements sponsored by the FDA would induce greater believability compared with advertisements sponsored by a branding agency such as King Cannabis. Participants were more likely to

believe information when it is supported by a well-known government funded agency such as the FDA as compared to a branding agency. However, when it comes to believability, the type of facts being presented is a crucial factor even when the advertisement is sponsored by a well-known agency such as the FDA. The results suggest that when the FDA sponsors the advertisement, factual claims are statistically significantly more believable than evaluative claims, a pattern that does not occur when a branding agency sponsors the advertisement.

The findings of the present study did not support the second part of the first hypothesis that factual claims would induce higher mean negative attitudes about smoking marijuana compared with evaluative and unrelated claims. The results also did not support the second part of the second hypothesis that advertisements sponsored by the FDA would induce higher overall mean attitude certainty compared with advertisements sponsored by a branding agency. It is possible that a single exposure to a list of five facts (either descriptive as in the factual claims or general as in the evaluative claims) is not sufficient to induce significant changes in pre-existing attitudes toward marijuana. Although all of the college students who received recreational marijuana ads were presented with accurate information, it is unclear how closely they paid attention to the material contained within them.

It is also possible that the actual information presented on the advertisements was not sufficient enough to influence previous attitudes about smoking marijuana. In line with the Dual Process Theory of Persuasion or Elaboration Likelihood Model (ELM), it is possible that participants did not process the information with high elaboration through a central route. High elaboration through a central route of processing is desirable for

lasting attitude change (Rucker & Petty, 2006). It is possible that most participants processed the presented information through a more peripheral route, lacking the motivation to successfully process and incorporate the new material into their existing thoughts and attitudes about marijuana (Rucker & Petty, 2006). Other forms of education may also be necessary, such as an information session led by a professional, where an individual can take advantage of educational and informative resources to make informed decisions about using marijuana.

Strengths and Limitations

One strength of the present study was that it appears to be the first study in literature to examine the role of source and type of persuasion in print advertisements providing information about the adverse health effects of recreational marijuana. With the current change in policy regarding the legalization of both medical and recreational cannabis, it is crucial for the public to become educated about the consequences of the adverse effects before choosing to consume the drug. These findings are particularly important in the light of public policy changes in the United States. It is important to consider these findings when developing ways to educate the public on the potential consequences of smoking marijuana as it becomes legal.

A second strength of the study was its experimental design. Participants were randomly assigned to each condition to ensure equality among the groups, address individual differences, and minimize bias. Through the design, factors like the type of information and associated source were controlled along with the environmental setting and procedure. In addition, all measures were counterbalanced across participants. Lastly,

because this is a between-groups design, each participant was placed in a single condition, eliminating any possible order effects.

The limitations of this study should be taken into account when considering the implications of these results. One issue is the sample of students used for this study. All participants were undergraduate students at a small Catholic university fulfilling a requirement for an introductory psychology course. Although college students are a primary target population for this particular study because many people use marijuana for the first time when they are teenagers, such a restricted sample may limit the external validity of these results.

Another limitation is the use of self-report measures. All questionnaires were administered on a computer and were self-report. Self-report measures containing sensitive questions asking about a socially undesirable behavior such as drug use may produce increased measurement error in response and higher nonresponse rates (Tourangeau & Yan, 2007). A reporting bias with respect to recreational drug use is likely to be heavily influenced by perceptions of social desirability. Deliberate or biased misreporting is a main source of error for sensitive topics in self-report measures with respondents under-reporting socially unacceptable behaviors (Macleod, Hickman, & Smith, 2005).

Although the use of cannabis is undergoing a normalization process indicated by an increase in general use, social tolerance, broader cultural acceptance and legalization laws, there are still negative stereotypes and stigma associated with use (Hathaway, Comeau, & Erickson, 2011). People are often guarded when reporting recreational drug use to avoid loss of status, offending non-users who may criticize, use demeaning labels

such as “pothead,” and make unbecoming attributions. It also may lead to penalization from law authorities. Negative stereotypes persist and marijuana has been associated with deviant behavior or criminality; there is a presumption that recreational use is incompatible with traditional responsibilities and roles (Hathaway, Comeau, & Erickson, 2011). Due to the negative connotations and undesirable attributes of smoking marijuana, it is possible that participants were inclined to play down or deny their own use and their friends’ use (Macleod, Hickman, & Smith, 2005).

Future Directions

Future research may seek to examine the effects of the current study on a different target population, such as youth and adolescents under the age of 18. Smoking marijuana has been shown to lead to lasting aversive consequences involving the brain and behavior for individuals whose brains are still developing (Abush & Akirav, 2014). Because many people use marijuana for the first time when they are teenagers, educational materials may be more effective by targeting a younger population who may lack general knowledge about marijuana and have yet to develop a pre-existing attitude about the drug.

In addition to targeting a different population, future research should seek to examine different education modalities. Because it is possible that five facts posted on an advertisement were not sufficient to induce a significant attitude change, the use of brochures or fact sheets may optimize education efforts. Research may also examine factors contributing to whether or not a member of the general public will take time to read and process such short-term education materials such as an advertisement posted on a wall or found in a magazine outside of the context of the lab.

Conclusions

Within the last few years, efforts have been made to legalize marijuana both medically and recreationally. Policy makers are currently developing public health regulations that promote objectives regulating drug use among the general population (Pacula, et al., 2014). The present study investigated effective ways to educate the public on the adverse health effects of recreational marijuana through print advertisements. The current findings support that the type of source and type of persuasion presented on the advertisements play a significant role in overall knowledge and perception of marijuana, along with believability of presented information. However, the current findings do not support a significant difference in attitude change toward marijuana from the advertisements alone. Future research is needed to explore different educational modalities and the current effects on a different population to provide a better understanding of effective education.

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Appendix A

DID YOU KNOW?



Marijuana can impair decision-making, short-term memory, and attention, along with creating sensory distortion, altered perception of time and hallucinations.

Smoking elevates heart rate and blood pressure, increasing the chance of a heart attack.

Marijuana leads to poor muscle coordination and impaired judgment, which can increase the risk of automobile accidents.

Smoking marijuana while pregnant can lead children to experience growth retardation and cognitive deficits.

Long-term use can lead to memory problems and decreased gray matter volume in the brain.



U.S. Food and Drug Administration

DID YOU KNOW?



Marijuana can impair decision-making, short-term memory, and attention, along with creating sensory distortion, altered perception of time and hallucinations.

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Marijuana leads to poor muscle coordination and impaired judgment, which can increase the risk of automobile accidents.

Smoking marijuana while pregnant can lead children to experience growth retardation and cognitive deficits.

Long-term use can lead to memory problems and decreased gray matter volume in the brain.



DID YOU KNOW?



Marijuana can alter perception in harmful ways.

Smoking marijuana is dangerous for your heart.

It is dangerous to toké and drive.

Smoking while pregnant can be harmful to the baby.

Marijuana can damage your brain long-term.



U.S. Food and Drug Administration



Marijuana can alter perception in harmful ways.

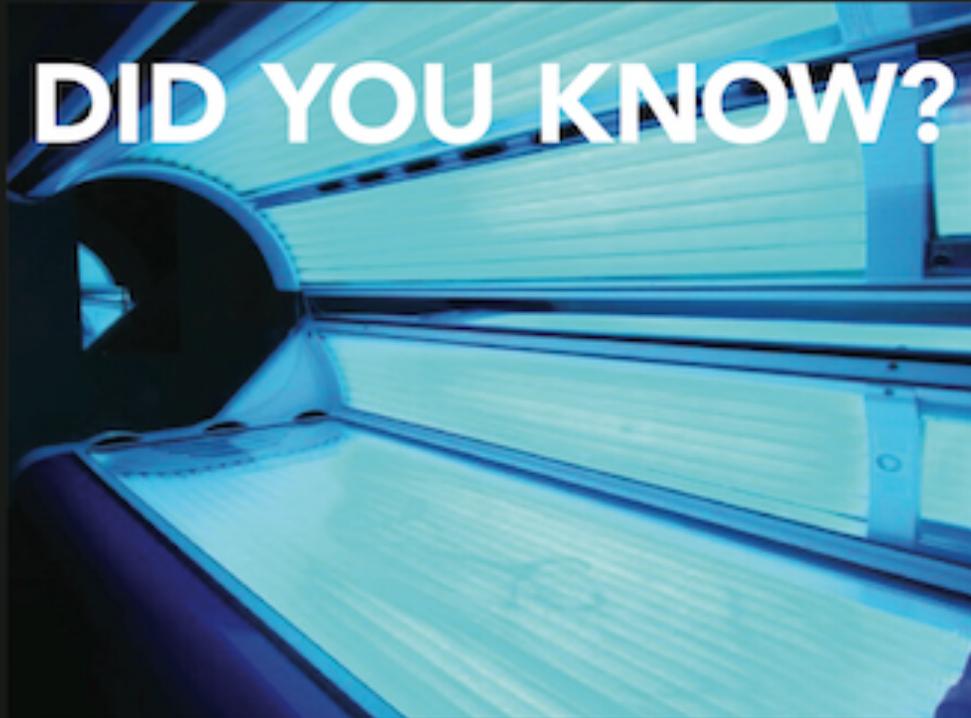
Smoking while pregnant can be harmful to the baby.

Smoking marijuana is dangerous for your heart.

Marijuana can damage your brain long-term.

It is dangerous to toké and drive.





Exposure to UV radiation increases the risk of developing skin cancer, especially squamous cell carcinoma and melanoma.

Tanning can cause the skin to lose elasticity and wrinkle prematurely.

UV-B radiation can suppress proper functioning of the body's immune system, leaving you more vulnerable to diseases and skin cancer.

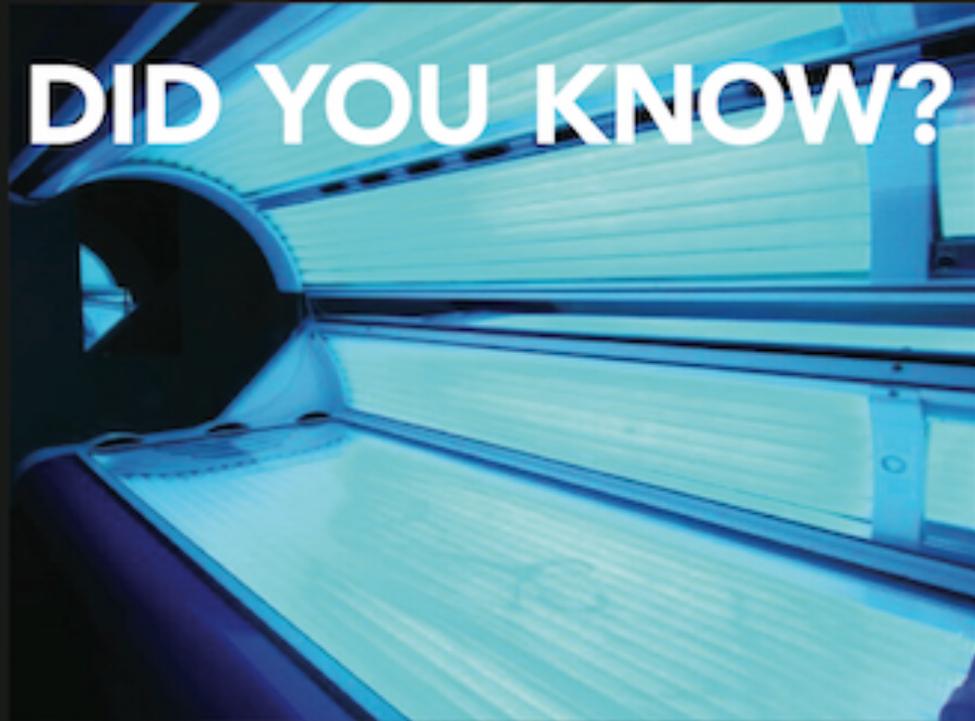
Exposure to UV radiation can cause irreversible damage to the eyes.

Some people who are sensitive to UV radiation can develop an itchy red rash or other aversive effects.



U.S. Food and Drug Administration

DID YOU KNOW?



Exposure to UV radiation increases the risk of developing skin cancer, especially squamous cell carcinoma and melanoma.

Tanning can cause the skin to lose elasticity and wrinkle prematurely.

UV-B radiation can suppress proper functioning of the body's immune system, leaving you more vulnerable to diseases and skin cancer.

Exposure to UV radiation can cause irreversible damage to the eyes.

Some people who are sensitive to UV radiation can develop an itchy red rash or other aversive effects.



Appendix B

Related Factual Claims*

1. Marijuana can impair decision-making, short-term memory, and attention, along with creating sensory distortion, altered perception of time and hallucinations (NIDA, 2015).
2. Smoking elevates heart rate and blood pressure, increasing the chance of a heart attack (Greydanus et al., 2013).
3. Marijuana leads to poor muscle coordination and impaired judgment, which can increase the risk of automobile accidents. (Greydanus et al., 2013).
4. Smoking marijuana while pregnant can lead children to experience growth retardation and cognitive deficits. (Calvigioni et al., 2014).
5. Long-term use can lead to memory problems and decreased gray matter volume in the brain. (Fibley et al., 2014).

Related Evaluative Claims

1. Marijuana can alter perception in harmful ways.
2. Smoking marijuana is dangerous for your heart.
3. It is dangerous to toké and drive.
4. Smoking while pregnant can be harmful to the baby.
5. Marijuana can damage your brain long-term.

Unrelated Indoor Tanning Claims

1. Exposure to UV radiation increases the risk of developing skin cancer, especially squamous cell carcinoma and melanoma (FDA, 2015)
2. Tanning can cause the skin to lose elasticity and wrinkle prematurely (FDA, 2015).
3. UV-B radiation can suppress proper functioning of the body's immune system, leaving you more vulnerable to diseases and skin cancer (FDA, 2015)
4. Exposure to UV radiation can cause irreversible damage to the eyes (FDA, 2015).
5. Some people who are sensitive to UV radiation can develop an itchy red rash or other aversive effects (FDA, 2015).

* Citations are not included in the advertisement viewed by the participant.