THE STATE OF MARIJUANA USE IN GEORGIA:
A SECONDARY NEEDS ASSESSMENT

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To: The Council on Alcohol and Drugs

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EXECUTIVE SUMMARY

Since the 1970s, prevalence of marijuana use and its potency have been on the rise in the United States. It is America’s most popular illicit drug, with 43% of Americans having tried marijuana at least once in their lifetime (1). Marijuana legalization is a widely debated issue: while marijuana is illegal under federal law and is considered a Schedule 1 controlled substance, as of November 2014, now four states have legalized marijuana for recreational use (2), and 23 states plus the District of Columbia, have comprehensive laws permitting medical use (3, 4).

Marijuana health risks are controversial. Potential health risks of marijuana use include substance dependence and abuse, cognitive impairment, changes in brain function, and certain mental health conditions(5). Additionally, users commonly report the use of other drugs, especially alcohol(6); evidence is needed that examines the effects on concurrent users. This report addresses each of the major health concerns relating to marijuana use, including areas where research is inconclusive and further research is needed.

Common limitations in marijuana research include lack of standardized measures of exposure (frequency, duration, and method of use), and failure to rule out alternative explanations or factors that may influence negative health outcomes other than marijuana itself. Finally, surveys of
marijuana use are inherently biased: it is likely that marijuana use is broadly underreported given its status as an illicit drug.

According to the National Survey on Drug Use and Health (2012), 18-25 year olds have used marijuana in the past month (18.7%) and in their lifetime (52.2%) more frequently than any other age group(1). American Indian/Alaskan Natives as an ethnic group have the highest prevalence of lifetime and past month use of marijuana(1). By level of educational attainment, the highest rates of past year use were seen among individuals without a high school degree and among individuals with some college education(1).

Georgia has relatively low marijuana use prevalence compared to the nation. Again, 18-25 year olds have the highest prevalence of past year and past month use(1), and American Indian/Alaska Natives have the highest prevalence of lifetime use(7). Over one-third of Georgia high school students have used marijuana at least once in their lifetime, and 18.2% of Georgia high school seniors reported smoking marijuana in the last 30 days(8). Marijuana is the most commonly used drug among 14-15 year old Georgians(1). In addition, marijuana use increases with age among Georgia youth, while perceptions of harm relating to marijuana use decrease. Perceptions of risk are associated with lower use. Finally, behind alcohol and tobacco, marijuana is the most commonly treated type of drug dependence in
the US(9). In 17.5% of substance abuse program admissions in Georgia, marijuana was reported as the primary substance used(10).

Legalization of marijuana, particularly for recreational use, will likely increase the prevalence of marijuana use, stemming from social normativity, greater access, and decreased perceptions of risk relating to marijuana use. Should marijuana be legalized in the state of Georgia, it will be necessary that some of the revenue generated from taxes on marijuana is used to fund campaigns that raise awareness about risks of using the drug, again, because greater perceived risk of harm is associated with lower rates of use.

Although some states have legalized marijuana for recreational and medical use, Federal law under the Controlled Substance Act deems marijuana a Schedule 1 illicit drug(11). The state of Georgia has recently passed House Bill 1, which is a limited access medical marijuana law. It allows for the possession and use of “low-THC”-containing oil for research and medical purposes. THC is the psychoactive ingredient in marijuana. The oil described in HB 1 has not been approved by the U.S. Food and Drug Administration. The oil may be used by persons experiencing one or more of eight qualifying medical conditions or the end stage of some of these conditions provided they are currently being treated by a physician for that condition. Should one’s physician recommend the THC oil for their patient or his/her caretaker, that person or caretaker would then seek to be included in
a Low THC Oil Patient Registry and issued a registration card from the Georgia Department of Public Health. The bill allows for a maximum THC content of 5% (3, 12). However, as the average THC percentage of marijuana in the 1980s was around 3%, when it was being taken for its psychoactive effects (13), the use of the word “low” to describe the THC percentage allowed should be taken in context. The THC oil must contain a percentage of CBD (cannabidiol) which is equal to or greater than the percentage of THC. However, the possession, use, and distribution of marijuana (other than the “low-THC” oil) still remains illegal in Georgia (12). There are sanctions for possession, sale, delivery, and cultivation and many of these carry strong sentences (12). In addition, Georgia is one of many states with per se, or zero tolerance, drugged driving laws for illicit substances. If marijuana were to be legalized in Georgia, there would be significant implications for workplace policy, education and training, regulation, law enforcement, and prevention in general.

Existing state laws legalizing marijuana use currently have problematic implications for the workplace. Regardless of state legalization, employers retain the right to establish and maintain their own drug free policies in accordance with the Controlled Substances Act. This inconsistency between state and federal law creates unclear legal consequences for both employers and employees. It makes employers particularly vulnerable as they attempt to comply with state and federal law while ensuring workplace
safety (e.g., safety-sensitive regulations). The cost to defend a single lawsuit could cripple a small business. Also, businesses that operate in multiple states have more complex issues with which to deal. This fact reiterates the increasing need for training, education and more comprehensive workplace policy development in states with marijuana legalization laws.

Employers must ensure that their drug policies are clearly articulated and communicated to all employees. This presents a unique challenge for companies who have zero tolerance drug policies in states where marijuana is legal, or where employees are legally allowed to use for medical reasons, particularly in states where no workplace protections have been included in their medical marijuana laws. Georgia’s House Bill 1 contains workplace protection language (12).

Driving under the influence of cannabis (DUIC) is an increasing concern. A recent National Roadside Survey of Alcohol and Drug Use found cannabis as the most common illicit drug with 8.6% of nighttime drivers testing positive for THC(14). Marijuana intoxication produces impairment in cognitive and psychomotor functioning in a dose related manner, and can also promote risk-taking behavior(15). These factors impair reaction time, perception, short-term memory, attention, motor skills, and tracking and skilled activities, which are all important in driving(14, 16). Legalization would likely result in increased rates of DUIC and motor vehicle accidents.
More education to increase awareness of marijuana effects on driving is needed to strengthen marijuana prevention efforts.

Research is inconclusive about at what level of THC (the psychoactive component of marijuana) constitutes actual impairment (17). Current testing methods (blood, oral fluid, and urine) are incapable of determining impairment; rather, they can only determine recent use (17). Furthermore, limits set by states which have legalized marijuana are arbitrary due to the inaccuracy of current testing methods. This presents challenges for measuring impairment in drivers and in the workplace. For example, a person with a medical marijuana registration card could be charged with impairment even though they were not impaired at the time of driving, since marijuana derivatives would definitively be detected upon testing via current methods. It should be noted that recent research may indicate that, for chronic users, an individual’s critical tracking and divided attention tasks may be impaired for up to 3 weeks after ceasing marijuana use. However, the authors of this research study warn that these findings must be interpreted with caution, as the control group was not matched on education levels, socioeconomic status, lifestyle, or race/ethnicity (18).

A public health approach may be used to prevent and control harms stemming from marijuana use. Education and training initiatives are a large component of this. The Let’s be Clear Georgia: A Collaborative to Prevent Marijuana Abuse aims to 1) educate parents, youth, and other Georgia
residents about marijuana abuse and its inherent consequences, and 2) educate employers on the risks of marijuana use and the risks employers carry when employees are using, selling or distributing marijuana in the workplace (19). Similar strategies that have been employed to prevent tobacco and alcohol use can be applied to marijuana with the advantage that marijuana has not yet been legalized. Since availability of marijuana is associated with increased use (20, 21), the first goal of many prevention providers is to prevent legalization of marijuana. Where this is not possible, control measures such as prohibiting commercialization, can be implemented from the time of legalization rather than later. Careful consideration should occur if there is a decision to broaden current marijuana legalization in Georgia. Failure to act cautiously and be proactive in prevention efforts could have grave consequences for public health and safety resulting from increased use and its associated harms.

**KEY RECOMMENDATIONS**

Research on Marijuana Effects

Existing research has suggested long term effects of marijuana use, including cognitive impairment, changes to brain structure, respiratory problems, and mental health problems. Long-term, heavy use may have an especially large impact on health outcomes, and any use during pregnancy may be dangerous
for developing fetuses. For these issues in particular, further research should be done to answer these questions. Broadly,

- More prospective, longitudinal research is needed, that is, research that examines the consequences of use forward in time rather than exploring associations by looking at past records.
- Research should examine the impact of marijuana use in combination with other drugs, particularly alcohol.
- Studies must assess and report marijuana use accurately, comprehensively using measures of frequency, duration, and intensity.
- Research must adequately control for confounding variables, which are alternative explanations for the outcome of interest. It is very important that research funds are used to support high quality, well-designed studies of marijuana effects on health and other societal outcomes.

In general, there is so much we still do not know about marijuana and the extent of costs to human health and society. While the application of the precautionary principle is encouraged, other forces at play may result in legalization and a shift toward prevention and risk reduction.

**Prevention and Risk Reduction**

Given the possibility that marijuana may be legalized for broad medical purposes, which may, in turn, lead to de facto recreational legalization as it
has in other states, in the state of Georgia, there are many recommendations that can be gleaned from the alcohol and tobacco literature (17).

Key objectives for preventing and minimizing harms of marijuana through a public health lens include:

- Preventing broad medical legalization and/or recreational legalization
- Improving, codifying, and operationalizing decriminalization efforts regarding offenses such as possession of less than an ounce of marijuana
- Minimizing access, availability, and use by youth,
- Minimizing drugged driving,
- Minimizing dependence and addiction,
- Minimizing consumption of marijuana with unwanted contaminants or uncertain potency, and
- Minimizing concurrent use of marijuana and alcohol, particularly in public.

Reducing use, particularly among youth, can also be achieved by keeping prices artificially high. Research on tobacco and alcohol have shown that higher excise taxes decrease initiation, amount of smoking, drunk driving, and potentially the health detriments, in the case of alcohol. A state monopoly may also reduce consumption, particularly among young people, via:
• Less competition and limited access,

• Lower convenience for consumers,

• Control of messaging, (i.e. buying from other places will not guarantee quality; warnings can be made),

• Lower density of retailers, and Monitoring licenses and licensees.

The following examples may reduce potential harms of widespread use if they were operationalized at the same time as legalization measures:

• A strong system of licensing for any part of market (i.e., growing, production, processing, wholesale, distribution, or retail) would allow for careful regulation of the market, product monitoring, and compliance.

• Fewer licenses would allow greater oversight.

• A strict regulatory structure around tax collection and enforcement would also de-incentivize black market sales.

• Colorado allows home growing, but this is completely unregulated; citizens do not need a license for it. If marijuana were legalized, we recommend against home growing.

Restricting public consumption may reduce harms associated with use by decreasing normative effect and social acceptability, particularly among youth.
• Concerns about marketing marijuana to youth must therefore be met with strict oversight of marijuana producers as has been done in the tobacco industry. Furthermore, indoor air laws to reduce second hand smoke are associated with lower initiation among youth and therefore may be beneficial.

Finally, reducing public use of marijuana and alcohol together would be a beneficial preventive measure both for reducing social acceptability and motor vehicle crashes.

• Research shows that concurrent use among drivers is associated with increased crash risk. Furthermore public education campaigns, as described elsewhere, can increase public perception about harms of driving either under the influence of marijuana, or of both marijuana and alcohol.

Prevention Messaging

Research shows that earlier initiation of marijuana use is more likely to cause harm; as noted above, dependence and abuse were reported at a much higher rate for persons who began using marijuana before the age of 18. Preventing initiation of marijuana, particularly for youth, should be a point of emphasis. Messaging that targets marijuana in addition to other substance use should be explored.

Increasing perceptions of harm may reduce use:
There is a lower perceived risk of frequent marijuana use among youth as compared to other substances.

An increase in risk perception is associated with lower use: young people who perceive marijuana to be more dangerous to their health are less likely to use it than those who consider it to be less dangerous.

Legalization of marijuana will further contribute to lower perceptions of risk relating to marijuana use.

- Risk perception can be managed by controlling and repealing legalization of the drug.
- Should that not occur, however, legalization must be balanced with adequate prevention and safety campaigns to ensure the public’s understanding of the risks people take when using marijuana.
- We recommend a participatory approach that engages youth or the at-risk population in design of prevention advertising campaigns.

**Threshold for Impairment**

Current evidence shows that it is unclear what level of THC (the main psychoactive ingredient in marijuana) constitutes actual impairment. In fact, current marijuana testing methods are incapable of determining impairment or current drug-use; they are only able to determine that a certain amount of
THC metabolites are present in the specimen being tested. This creates a dilemma for policymakers in states which have implemented THC limits for driving under the influence of THC.

- We recommend that policymakers identify a chemical test with a high sensitivity for detecting levels of delta-9 THC (the psychoactive ingredient) in a person’s system.

- Evidence shows that being able to detect this specific metabolite of marijuana will provide a more accurate determination of whether or not a marijuana user is impaired.

- Given the lack of sensitivity to delta-9 THC of current testing methods that are available, policymakers may want to consider developing behavioral testing as a means of determining marijuana impairment.
  - Behavioral testing is currently being implemented through the use of Drug Recognition Experts (DRE), however, more are needed. These are individuals who are trained extensively to be able to systematically identify people who are under the influence of drugs, using observable signs and symptoms that are reliable indicators of drug impairment.

- Should behavioral testing be used, there will need to be more widespread education and training programs on recognizing
impairment behaviors, especially for law enforcement officials and workplaces.

**Workplace Policy**

Employers have the right establish their own drug policies, and are entitled to maintain drug-free policies and test employees for marijuana, in accordance with the Controlled Substances Act, regardless of whether marijuana use is legalized within the state. Given the challenges of complying with state and federal law, and ensuring workplace safety, the Society for Human Resources Management recommends the following (22):

- Ensure workplace policies are consistent with your state’s laws on discrimination against marijuana users.
- Maintain compliance with federal regulations.
- Confirm that drug-use and drug-testing policies clearly articulate your expectations regarding drug testing, marijuana impairment, and marijuana use outside of work hours.
- Be prepared to consistently enforce your policies.
- Clearly communicate your policies and expectations to all employees.
- Train managers about maintaining confidentiality regarding drug-test results and accommodations for those who have obtained medical marijuana recommendations.
- Companies must consider potential increased cost associated with legal counsel or other professionals making sure they have a legally sound
policy for each state in which they operate. They must clearly define marijuana especially if a person may live in one state but work in a neighboring state.

• Employers choosing to enforce a zero-tolerance drug policy must also address the following:
  
  o Legal recreational marijuana use by employees,
  o Whether to refer to federal law to justify a drug-free workplace policy, or whether your organization is required to comply with federal regulations

Additionally, we recommend the following for workplaces who are trying to navigate marijuana policy:

• Marijuana training should be provided to HR and personnel that includes medical and recreational coverage along with policy awareness.

• Employee education should also be implemented, including information about mixing marijuana with other drugs, driving under influence, operating equipment, as well as explanation of company drug policies.

• A helpline should also be established that employers can use to find information about workplace drug policies, and training employees about these policies.
Education and Training Needs

As marijuana use is legalized in a growing number of states, there is a significant need for education and training to inform various stakeholders about the consequences of legalization.

• Education is needed to inform parents, youth, educators, health care workers and the general population of Georgia about the problems associated with marijuana abuse.

• Employers also need to be educated about how marijuana use among employees may have a detrimental effect on workplace safety, as well as the legal ramifications of workplace drug policies.

• Policymakers need to be aware of current research evidence related to marijuana use and abuse in order to make informed decisions about the development and implementation of marijuana regulations. Additionally, they will need to be able to determine how state marijuana policies should be interpreted in conjunction with federal marijuana policies.

• Medical professionals will need to be trained on whether it is appropriate to recommend medical marijuana (including information on the health risks associated with marijuana use, the risks recommending a substance that has not been approved by the FDA, and whether it is sound medical practice to do so),
as well as how to monitor use of medical marijuana among patients.

- Law enforcement officials will need training on the intricacies of marijuana regulations, as well as how to accurately identify those who violate the law using the best evidence available through current and/or newly developed marijuana testing methods. It should be noted that, at the present time, the state of Georgia has no capacity to measure THC percentages within the THC oil. Also Georgia currently does not measure THC concentration in urine, oral fluids, or breath, only in a person’s blood.

- Those who cultivate, deliver and sell marijuana in states where it is legalized will require training in responsible marijuana sales and service practices. At present, cultivation and dispensaries are illegal in Georgia.
INTRODUCTION

“Marijuana,” “cannabis,” “pot,” “weed”, “reefer”, and “Mary Jane”: these are just some of the many names that refer to America’s most popular illicit drug. Approximately 43% of Americans have used marijuana at least once in their lifetime. That is more than twice the number of the next most popular illicit drug (the non-medical use of psychotherapeutics, including prescription stimulants, sedatives, tranquilizers, and analgesics)(23). Marijuana is popular among all age groups and is present in every state in the U.S. (23). There are currently four states that have legalized marijuana for recreational use: Colorado, Washington, Alaska and Oregon (24). Twenty-three states and the District of Columbia have laws permitting the use of medical marijuana (24). Despite the growing number of states that have been legalizing marijuana use, either medically or recreationally, the federal government has determined that marijuana is a dangerous drug and it remains on the schedule 1 controlled substance list. Furthermore, the sale and distribution of marijuana remains a serious crime at the federal level (24).

Marijuana use has some significant public health consequences (5). In 2012, approximately 4.3 million people either abused or were dependent upon marijuana (10), and marijuana use has been correlated with cognitive impairment, and respiratory illnesses, as well as temporal associations between smoking marijuana and adverse cardiac events (5, 9, 25). In 2010,
marijuana was a major contributor to emergency department visits, with a rate of 149 emergency department visits out of every 100,000 in the population (5, 10). This may be related to the fact that habitual marijuana use has been associated with injuries obtained in car crashes, above and beyond the effects of age, sex, race/ethnicity, education, time of day, and drinking alcohol while using marijuana (6). Additionally, marijuana is the second leading drug for which people are admitted into substance abuse treatment programs (5, 10).

Marijuana is a highly-used drug that does have serious impact on population health (5). This needs assessment will describe, in detail, the prevalence of marijuana use for various ages, ethnicities, and income levels at both the national level and the state of Georgia. Additionally, it will present marijuana dependence rates at the state and national level. We will compare and contrast state and national policies surrounding marijuana as well as enforcement of those policies. Finally, we will discuss business policies related to marijuana use and Georgia public education efforts and make recommendations based on our findings.
BACKGROUND RESEARCH ON MARIJUANA

Potency: Recent Trends

Numerous studies from 1970 to the present document a worldwide increase in cannabis (tetrahydrocannabinol – THC) potency and a coinciding decrease in other phytocannabinoids, a plant-derived natural product that directly interacts with cannabinoid receptors (26), particularly cannabidiol (CBD) in marijuana samples (27-35). The results are highly variable since they involve analyses of police-confiscated samples with no ability to control factors which affect cannabis potency such as plant variety, geographical origin, genetic modifications, plant part used (buds have the most THC followed by leaves, stems and seeds), freshness of sample, and analytical and cultivation methods (30). This increase in potency from the 1990s is primarily due to the appearance of ‘sinsemilla’ (an un-pollinated female cannabis plant) which is hydroponically (growing plants using mineral nutrient solutions in water without soil) cultivated and may have THC levels over 20% (29). Cannabis fungal, pesticide and heavy metal contamination are each common quality concerns in these products. In the U.S., cannabis potency of confiscated samples has increased from 2% to 4.5 % to 8.5% between 1980 and 1997, and 1980 and 2006, respectively. It had reached almost 12% by 2008 (28, 31).

Marijuana as a drug does differ from other products of the hemp plant, which has been clarified by the United States Drug Enforcement
Administration (36). Marijuana is the psychoactive component derived from the buds, leaves, and resin of a cannabis plant, whereas hemp, a legal substance in some states for industrial and research purposes, is typically used to describe the stalks and sterilized seeds. Hemp is used to make many things, including rope, clothing products, as well as food products.

High-potency cannabis is of concern because of increased health risks. Daily use, especially of high-potency cannabis, has been reported to drive the earlier onset of psychosis or schizophrenia in cannabis users (37). Observed subjective cannabis effects were more pronounced with high potency cannabis use, and these effects lasted for a longer time period (38, 39). Total consumption levels of THC in high potency cannabis smokers may be determined by examining smoking habits such as amount used per cigarette/joint, sharing with others, the number of cigarettes/joints consumed per session, the number of sessions in any given time period, and individual smoking technique including puff frequency, volume and retention (39).

Adverse Risks of Marijuana Use

Key health issues concerning marijuana use include dependence and abuse, respiratory problems, cognitive impairment and changes in brain function (5). Additionally, association with other drug use and effects on mental health including depression, psychosis (including schizophrenia), and other psychiatric disorders are areas of concern (24). The following addresses
each of the major concerns relating to marijuana use, including research limitations and the need for further study.

**Dependence and Abuse**

Dependence on marijuana is a condition that is similar to other substance abuse or dependence disorders (40). People experiencing dependence do not have control over their use and have difficulty stopping despite harms, including social, financial, health, and life satisfaction consequences (41). Users who seek treatment perceive themselves as being unable to stop, report withdrawal symptoms, and have been unsuccessful in quit attempts (98).

Lab studies show the development of tolerance to many of the effects of THC over time, supporting marijuana dependence s being a likely consequence of frequent use as is the case with other drugs (42). The adverse health and social consequences of marijuana use may be less severe than those reported by individuals grappling with alcohol or opioid dependence (43). Nonetheless, marijuana dependence motivates users to seek treatment due to the negative effects on peoples’ lives.

Notably, marijuana is considered by some to be a gateway drug to other drug use, a point of emphasis in prevention messaging and campaigns. Marijuana users frequently also use tobacco, alcohol, and other illicit drugs.
To that end, marijuana use or dependence may predispose people to use other drugs, particularly when they initiate such use at earlier ages.

**Marijuana Use Disorders in the DSM-5**

In the current release of the Diagnostic and Statistical Manual of Mental Disorders (DSM-5) by the American Psychiatric Association, marijuana use and dependence are now diagnosed as a single cannabis use disorder – distinct from other substance use disorders. Withdrawal is defined as its own diagnosis for the first time in the history of the manual’s publication. Furthermore, symptoms are delineated and the number present are used to differentiate mild, moderate, and severe disorder. This has strengthened the reliability of a diagnosis by requiring multiple criteria for diagnosis, and has separated physical dependence from mental and behavioral aspects of the disorders. In addition to cannabis use disorder and withdrawal, cannabis intoxication and cannabis-induced psychotic disorder, anxiety disorder, and sleep disorder are also defined.

Cannabis use disorder is described in the DSM-5 as a problematic pattern of use leading to clinically significant impairment or distress, as manifested by at least two of the following symptoms in the period of one year:

1. Cannabis is often taken in larger amounts or over a longer period than was intended.
2. There is a persistent desire or unsuccessful efforts to cut down or control cannabis use.

3. A great deal of time is spent in activities necessary to obtain cannabis, use cannabis, or recover from its effects.

4. Craving, or a strong desire or urge to use cannabis.

5. Recurrent cannabis use resulting in a failure to fulfill major role obligations at work, school, or home.

6. Continued cannabis use despite having persistent or recurrent social or interpersonal problems caused or exacerbated by the effects of cannabis.

7. Important social, occupational, or recreational activities are given up or reduced because of cannabis use.

8. Recurrent cannabis use in situations in which it is physically hazardous.

9. Cannabis use is continued despite knowledge of having a persistent or recurrent physical or psychological problem that is likely to have been caused or exacerbated by cannabis.

10. Tolerance, as defined by either of the following:

    1. A need for markedly increased amounts of cannabis to achieve intoxication or desired effect.

    2. Markedly diminished effect with continued use of the same amount of cannabis.
11. Withdrawal, as manifested by either of the following:

1. The characteristic withdrawal syndrome for cannabis

2. Cannabis (or a closely related substance) is taken to relieve or avoid withdrawal symptoms (44) (p. 517).

As noted previously, withdrawal syndrome was recently added to the manual, and is experienced by the marijuana user who abruptly stops using marijuana when he/she previously used regularly, either daily or almost daily, and as a result experiences substantial problems with social or occupational functioning or in other areas. Symptoms used to determine cannabis withdrawal include: anger, irritability, or feelings of aggression; depressed mood; feelings of restlessness; a loss of appetite or weight loss; trouble sleeping; feelings of anxiety or nervousness; and common physical symptoms of withdrawal including headache, stomach pains, increased sweating, fever, chills, or shakiness that cause significant discomfort for the individual.

Additionally, discomfort from symptoms contributes to difficulty quitting and/or relapse among marijuana users. Withdrawal symptoms are commonly reported among heavy users and those seeking treatment, with reports of 50-95% in different studies. (45-47) Furthermore, among those who regularly report using marijuana at some point in their life, up to one-third also reported withdrawal
symptoms. (45, 48) As a result the DSM-5 now explicitly recognizes marijuana withdrawal as a diagnosis.

**Marijuana and the Developing Brain**

Numerous studies suggest a link between cannabis exposure—particularly at an early age—and changes in brain structure, activation and connectivity. These changes may be linked to adverse behaviors, cognitive problems, loss of executive function, and addiction and psychiatric disorders later in life.

- Numerous studies correlate white matter deficits with early cannabis exposure and are linked to greater probability of future risk taking behaviors in heavy substance use individuals (49-52). Adolescent marijuana users demonstrated significantly larger inferior posterior (lobules VIII–X) vermis (a section of the brain that sits between the two hemispheres, the vermis is the rounded and elongated central part of the cerebellum) volume than controls, and this is associated with poorer executive functioning (53).

- Cannabis-abusing adolescents had decreased right moPFC (medial orbital prefrontal cortex) volume and also reported increased impulsivity. (54).

- Adolescents engaging in heavy cannabis use had significantly smaller and right hippocampus volumes and poor performance on verbal
memory and learning scores as compared to their matched controls after 6.7 months of abstinence (55).

- Adolescent marijuana users have reduced cortical thickness in the prefrontal cortex and insula (56).
- Gender differences should be considered when examining the effects of marijuana on brain structure. Female marijuana users exhibited larger right amygdala volumes and reported more intense depression and anxiety symptoms (57).

Evidence exists that some abnormalities in brain structure may precede cannabis use and increase risk for the development of Substance Use Disorders (SUDs) rather than being entirely a consequence of substance use. Smaller orbitofrontal cortex volumes at age 12 years predicted initiation of cannabis use by age 16 years. The volumes of amygdala, hippocampus, and anterior cingulate cortex did not predict later cannabis use (58). Most of these studies, however, do not demonstrate causality as they do not take into account pre-existing genetic factors and vulnerabilities or environmental conditions (59). Longitudinal and follow-up studies are necessary to clarify these issues (60).

The US National Institute on Drug Abuse (NIDA) will fund a $300 million program to study how marijuana affects the developing adolescent brain when used alone and with alcohol and other drugs (61). There is extensive re-organization of grey (GM) and white matter (WM) during
adolescence, and the endocannabinoid (eCB) system through which cannabis acts is still developing at that age (62). This study, which is still in the planning stages, will follow 10,000 US adolescents for ten years and hopefully clarify the current incomplete and conflicting information on these drugs and developmental factors.

**Marijuana and Cognitive Functioning**

Research has examined whether chronic cannabis use impairs cognitive functioning. It has been shown, for example, that heavy users perform worse on several measures of cognitive performance relative to healthy non-smoking control subjects, specifically on executive function tasks. Furthermore, earlier-initiating smokers (before 16 years) were more severely impaired and smoked more marijuana than late-start smokers (after 16) (63). Additionally:

- Frequent use of marijuana was associated with poorer memory performance and adolescents with Substance Use Disorders (SUDs) had lower scores on attention, memory, and processing speed. (64).
- Early-onset chronic cannabis users exhibited poorer cognitive performance than controls and late-onset users in executive functioning (65).
- In the Dunedin Study of 1,037 individuals followed for 20 years (49, 57, 61, 66) persistent cannabis use was associated with neuropsychological decline and cognitive problems including
significant IQ decline. Cessation of cannabis use did not fully restore neuropsychological function (67, 68). However, examination of this same data set suggested that socioeconomic factors may be a confounding factor and that the true effect of cannabis in IQ may not be known (69, 70).

- Adolescent Cannabis users performed normally on tests of working memory (WM) and associative memory (AM). However, in adolescent cannabis users, excessive activity in prefrontal regions was observed, and the WM system was overactive during a novel task, suggesting functional compensation for the effects of impairment (71).

- In studies comparing cannabis users and controls on the Go/No-Go task that probed inhibitory control, adolescent cannabis users performed more poorly, showed no differences in brain activation but showed hyperactivity in the parietal-cerebellar network. The authors suggest that in other studies where users perform as well as controls this may be due to the fact that they activate more neural circuits to perform and non-users don’t need to do this (72).

- Deficits in verbal learning, memory and attention were worse for long-term marijuana users (24 years of use) than short term (10 years or less) users and nonusers in a study of individuals seeking treatment for substance use. In this study, researchers accounted for
chronic use as well as recent use that could impact the study outcomes (73).

- Subjects who received oral CBD prior to intravenous THC were less likely to exhibit psychotic symptoms and had improved episodic memory scores. This supports the hypothesis that high THC/CBD products have increased adverse risks (74). Similar studies with herbal cannabis support this conclusion (75, 76).

**Behavioral Science**

There are also behavioral effects of marijuana use that may relate to cognitive functioning:

- Marijuana smokers have more difficulty than controls in their ability to inhibit inappropriate responses, “Gerber” and non-planning impulsivity, suggesting a possible source of impaired decision making (54).
- Furthermore, use of marijuana, tobacco, and alcohol are all inversely related to the ability to delay gratification (77).

**Marijuana and Psychiatric Disorders**

The relationship between marijuana use and psychiatric disorders has been explored. At best, a causal relationship between cannabis use in adolescence and later psychiatric disorders is controversial. Several studies suggest a relationship, while others do not (74, 78-80). Further, no convincing data exist to support one “common cause” that exclusively predicts
which individuals using cannabis as teens will progress to addiction and psychiatric disorders later in life versus those who do not. Whether the early onset of cannabis use relates to pre-existing pathology that is then exacerbated by the drug is still debated (81).

Prolonged exposure to cannabis is associated with impairments in sensory gating (the neurological process of filtering redundant or unnecessary stimuli in the brain from all possible stimuli), and similar deficits may be associated with schizophrenia (82). A 15-year follow up of Swedish men who had tried cannabis by age 18 found that they were 2.4 times more likely to develop schizophrenia than those who had not (37, 83). Further follow up of the same cohort of individuals found a dose-response relationship: those who used marijuana more frequently were more likely to later develop schizophrenia (84). Research with animals supports these findings: cannabis-exposed adolescent rodents have impaired social behaviors, cognitive and sensorimotor gating deficits and adult rodents show psychotic-like signs (79, 85, 86). Weaker associations have been found between marijuana use and other mental disorders including depression (87).

**Marijuana and Respiratory Illness**

An article in Journal of American Medical Association explored the association between marijuana use (current or lifetime) and lung function and found a dose-dependent response. Heavy, long-term use was associated with adverse lung function, where occasional and low cumulative use was
not. The study followed over 5,000 individuals for 20 years, measured force expiratory volume (FEV1) as an outcome, and accounted for marijuana as well as tobacco use (88). A systematic review of published studies on respiratory complications relating to marijuana use found that in general, marijuana smokers reported more symptoms of chronic bronchitis (wheezing, sputum production, chronic coughing, and respiratory infections) than non-users (89). In general, evidence implies significantly fewer and less significant risks of marijuana smoking on lung function compared with tobacco smoking (90).

Concerns about secondhand smoke also exist, particularly because much is known about adverse effects of tobacco secondhand smoke and its contribution to heart disease, lower respiratory infections, and lung cancer (91). There is little research that shows, however, the impact of second hand marijuana smoke on health outcomes; future research should examine this. Similarly, there is limited evidence for impact of marijuana use on development during pregnancy. With regard to substance abuse during pregnancy, a meta-analysis of studies revealed that marijuana users tended to have babies with lower birth-weight than non-users, likely due to effects of carbon monoxide exposure. The effects, however, were less pronounced than tobacco use (92).
Marijuana and Cancer Risk

Marijuana smoke contains several of the same carcinogens, or cancer-causing agents, as tobacco tar and smoke. These include vinyl chlorides, phenols, nitrosamines, reactive oxygen species, and various polycyclic aromatic hydrocarbons (PAHs) (93). There have been mixed results in a review of studies assessing the association of marijuana use and cancer risk. Two studies of a single population of Kaiser Permanente subscribers in northern California assessed marijuana smoking as a possible risk factor for cancer and had conflicting results.

- In the first study, current and lifetime use of marijuana was not associated with risks of cancer, including tobacco-related cancers (lung cancer), after adjusting for age, race, education, alcohol use, and cigarette smoking (94).
- In the second study, researchers found a moderately increased risk of malignant glioma (a type of brain cancer) for individuals who had smoked marijuana at least once in their lifetime after adjusting for sex, race, education, smoking status, alcohol and coffee consumption. A limitation of this study was that other risk factors for glioma were not included in analyses.
Marijuana and Cardiovascular Health

There is evidence that cannabis use, especially long-term, heavy cannabis use, may lead to adverse cardiovascular events. Cannabis and THC both increase the heart rate, immediately after smoking, in a dose-dependent way (25, 95). While this may not cause heart problems in young, healthy adults (95), it is problematic for people with pre-existing heart conditions. Additionally, there may be temporal associates with marijuana smoking and adverse cardiac events (25). In a landmark study, Mittleman and colleagues (96) interviewed 3,882 patients who had already had a heart attack. Of those patients, 124 (3.2%), reported smoking marijuana in the year prior. Of the patients who had reports smoking marijuana in the year prior, 37 had smoked within the last 24 hours, and 9 had smoked with then 1 hour preceding the heart attack. They found that, of those who smoked marijuana and who had a heart attack, the odds of having a heart attack were 4.8 times greater in the first hour after smoking than they would have been in non-marijuana-use periods. In the second hour after smoking, the odds dropped to 1.2, indicating a short term, but elevated, risk for having a heart attack immediately after smoking marijuana (96).

Marijuana smoking is especially dangerous for patients who already have heart disease. In a follow up study of the participants in the Mittleman study who had had heart attacks, it was found that smoking marijuana increased the risk of mortality by 4.2 for those participants who smoked more
than once a week and by 2.5 for those who smoked less than once a week (95). This supports findings that indicate that smoking marijuana may exacerbate angina in patients with heart disease (97).

**Marijuana and Fetal Development**

Current evidence indicates that marijuana use during pregnancy or while a woman is breastfeeding may be dangerous to the child, especially during periods of critical brain development (98). Additionally, cannabis smoking during pregnancy may result in lower fetal birth weights, which can lead to health complications for the infant. In infancy and childhood, there may be subtle cognitive or behavioral impacts of prenatal marijuana exposure that have implications for adolescent development including problems with executive functioning (99).

**Research Limitations**

These studies have certain limitations that should be considered when evaluating evidence in scientific publications.

- Many studies – particularly older ones – are retrospective, meaning a measure of risk is estimated by looking back in time and comparing levels of risk factors among people who developed a health problem with those who did not. In any retrospective study, it is impossible to establish causation.
• Additionally, in any epidemiologic study, the research must also determine the presence of other factors that may contribute to the outcome of interest to be able to rule out alternative explanations. For example, studies of mental health disorders should examine the presence of pre-existing illness as well as other factors.

• Another variable that should always be addressed in studies assessing marijuana health risks is use of other substances, particularly tobacco and perhaps even alcohol use. Marijuana users are more likely to use alcohol, smoke or use tobacco products, and use other illicit drugs. (83) Research must account for this factor and separate out effects of marijuana from other substances to determine marijuana's effects. At the same time, research that explores the negative effects of using multiple substances, including tobacco, alcohol, illicit drugs, or non-medical use of prescription drugs including Adderall and other psychostimulants should be explored given the frequency of concurrent use.

• Studies of marijuana users should thoroughly assess and describe marijuana exposure among the study population. Frequency of use (times per day or times per week), duration (years), amount of personal use, as well as mode of use (pipe, cigarette, bong, eaten) are needed. Currently, the definition of chronic use varies between studies, making it difficult to draw conclusions from different studies.
• Finally, because marijuana is illegal under federal law, it is likely that research and survey participants underreport their use. This makes it more difficult to get accurate information about marijuana and its effects.

There remain many questions about the effects of marijuana on human health, and as highlighted above, much research is still needed to better inform public health and policy decision-making. Nonetheless, one public health principle may be considered despite definite and complete evidence of risks and benefits: the precautionary principle.

The precautionary principle states that “in the case of serious or irreversible threats to the health of humans or the ecosystem, acknowledged scientific uncertainty should not be used as a reason to postpone preventive measures” (100). In the case of marijuana, prevention and risk reduction should be applied to minimize the potential harms (e.g., dependence, psychotic symptoms and schizophrenia) for which we do not yet have conclusive evidence (101). Furthermore, the potency of marijuana products has increased in recent years, and it is not known if people will actually titrate their dose to deliver an equal dose of THC. The association of high-potency cannabis with psychiatric problems could be detrimental to public health by putting more people at risk of developing these and other problems. Legalization of marijuana, particularly for recreational use, will likely increase the prevalence of use and its negative consequences should they
exist. Precaution in the absence of complete evidence is therefore highly recommended.
Patterns of Use and Risk

Patterns and trends in marijuana use can be seen at both the national level and the state levels. These patterns can be examined to identify especially vulnerable populations for marijuana use and targets for prevention interventions. Within the following sections, current patterns and trend in use and risk for use are identified at both the national level and the state level for Georgia.

Marijuana Use Prevalence: United States

The following sections will examine marijuana use within the United States by various demographic groups, such as age categories, racial/ethnic groups, and levels of educational attainment.

Marijuana Use by Age Category

According to the National Survey on Drug Use and Health, in 2012, 42.8% of individuals aged 12 and older used marijuana at least one time in their life, 12.1% used marijuana in the past year, and 7.3% used marijuana in the past month (1). The table below illustrates lifetime use, past year use, and past month use of marijuana broken down by age. The table indicates that 18-25 year olds have the highest rates of use in all three categories. Individuals 25 years and older had the second highest rates of lifetime use, but the lowest rates of past year and past month use. Individuals in the 18-25 year old group had the highest rates of current use, both past year and
past month, but that number decreases sharply in both categories for individuals 26 and older (1).

<table>
<thead>
<tr>
<th>Age Group</th>
<th>2012 Lifetime Use</th>
<th>2012 Past Year Use</th>
<th>2012 Past Month Use</th>
</tr>
</thead>
<tbody>
<tr>
<td>12-17</td>
<td>17.0%</td>
<td>13.5%</td>
<td>7.2%</td>
</tr>
<tr>
<td>18-25</td>
<td>52.2%</td>
<td>31.5%</td>
<td>18.7%</td>
</tr>
<tr>
<td>25+</td>
<td>44.4%</td>
<td>8.6%</td>
<td>5.3%</td>
</tr>
</tbody>
</table>

Marijuana Use by Race/Ethnicity

When looking at marijuana use prevalence by different racial and ethnic groups, one can see that American Indians and/or Alaskan Natives have the highest per capita use in all three categories: lifetime, past year, and past month use (1). The second highest per capita rate of lifetime use was seen among whites (47.1%), followed by black/African American (40.9%), Hispanics (33.3%), and Asians (17.6%). In past year use and past month use, black/African-American had the second highest percentages, followed by whites and Hispanics, with Asians reporting the lowest percentage use. While Native Americans/Alaskan Natives had the highest rates of use for all time categories, whites reported the second highest rate of lifetime use, and black/African Americans reported the second highest rates for both past year and past month use (1).
Table 2. Percent marijuana use by race/ethnicity (69).

<table>
<thead>
<tr>
<th>Race/Ethnicity</th>
<th>2012 Lifetime Use</th>
<th>2012 Past Year Use</th>
<th>2012 Past Month Use</th>
</tr>
</thead>
<tbody>
<tr>
<td>White</td>
<td>47.1%</td>
<td>12.3%</td>
<td>7.4%</td>
</tr>
<tr>
<td>Black or African American</td>
<td>40.9%</td>
<td>14.4%</td>
<td>9.1%</td>
</tr>
<tr>
<td>American Indian or Alaskan Native</td>
<td>49.2%</td>
<td>16.3%</td>
<td>9.4%</td>
</tr>
<tr>
<td>Asian</td>
<td>17.6%</td>
<td>5.0%</td>
<td>2.5%</td>
</tr>
<tr>
<td>Hispanic</td>
<td>33.3%</td>
<td>11.1%</td>
<td>6.2%</td>
</tr>
</tbody>
</table>

Marijuana Use and Education

Lifetime marijuana use is similar across all levels of education, with the highest percentage of use being in the “some college” category (54%) and the lowest were high school graduates (50.5%) (1). The highest percentage of past year use was in the “less than high school” category (33.7%), and the lowest percentage of past year use was in the “college graduate” category. Finally, the highest percent of past month use was “less than high school"(22.4%), and the lowest percent of past month use were college graduates (13.5%). The highest rates of lifetime marijuana use were seen in individuals with some college or with a college degree. The highest rates of
past year use were seen in individuals without a high school degree and in individuals with some college education (1).

Table 3. Percent marijuana use by education (69).

<table>
<thead>
<tr>
<th>Education Level</th>
<th>2012 Lifetime Use</th>
<th>2012 Past Year Use</th>
<th>2012 Past Month Use</th>
</tr>
</thead>
<tbody>
<tr>
<td>Less than High School</td>
<td>51.7%</td>
<td>33.7%</td>
<td>22.4%</td>
</tr>
<tr>
<td>High School Graduate</td>
<td>50.5%</td>
<td>30.3%</td>
<td>19.1%</td>
</tr>
<tr>
<td>Some College</td>
<td>54.0%</td>
<td>33.2%</td>
<td>19.0%</td>
</tr>
<tr>
<td>College Graduate</td>
<td>52.2%</td>
<td>27.6%</td>
<td>13.5%</td>
</tr>
</tbody>
</table>

Geographic Area and Marijuana Use Among People Aged 12 and Older

The map below shows the geographic distribution of marijuana use among persons 12 and older in the United States (1). The states with the greatest prevalence are Alaska, Colorado, Massachusetts, Montana, New Hampshire, Oregon, Rhode Island, Vermont, Washington D.C., and Washington State. The states in the lowest group are Alabama, Arkansas, Idaho, Kansas, Kentucky, Mississippi, Nebraska, Tennessee, Texas, and Utah. Georgia falls into the second lowest category for marijuana use (1).
Differences in Marijuana Use Compared with Other Drugs

In 2012, more individuals had used marijuana at least once in their lifetime than any other illicit drug, with 42.8% of individuals reporting lifetime use (1). The next most prevalently used drug was the non-medical use of psychotherapeutics (i.e., prescription pain medication such as oxycontin), with 20.9% of individuals over the age of 12 reporting lifetime use. The percent of individuals over 12 who had used hallucinogens (e.g., LSD, PCP, and Ecstasy) and cocaine (including crack) were roughly the same, with 14.5% and 14.6% reporting lifetime use, respectively. Inhalants (8.1%) and heroin (1.8%), had the lowest rates of lifetime use. By examining the percent use at different age groups (Figure 2), we can see that for very young...
adolescents (12-13 year olds), there is a higher percentage of inhalant use and non-medical use of psychotherapeutics than there is of marijuana use. However, in the 14-15 year old age group, marijuana becomes the most commonly used drug, and stays the most commonly used drug throughout all the remaining age groups (1).

Figure 2. Percent Drug Use by Substance and Age Group (69).
Marijuana Use Prevalence: Georgia

The following sections will examine marijuana use within Georgia by various demographic groups, such as age categories, racial/ethnic groups, and levels of educational attainment.

Marijuana Use by Age Category: Georgia

In the State of Georgia, as of 2011, the prevalence for both “past year” and “past month” was comparatively low for all age groups. When compared to all other states plus the District of Columbia, Georgia ranked 12th (9.74%) out of 51 for percent of the population 12 years and older who had smoked marijuana in the past year (1). For this ranking, the lowest ranking corresponds with the lowest rate of marijuana use. In comparison, Utah ranked the lowest: 7.68% of individuals 12 years and older reported having smoked marijuana in the past year, and the District of Columbia ranked the highest (19.75%). Out of adolescents aged 12-17, Georgia ranked 16th, with 12.5% reporting past year use. Of young adults ages 18-25, Georgia ranked 13th, with 26.1% reporting past year use. Finally, for individuals older than 26 years, Georgia is ranked 12th with 6.4% reporting past year use. In general, the state of Georgia has relatively low rates of marijuana use when compared to the rest of the nation (1).

The age categories in this comparison come from the National Survey on Drug Use and Health, which is an annual survey that is nationally representative and validated for between-state comparisons. However, the
Georgia Department of Education conducts the Georgia Student Health Survey 2.0, a survey with students in Georgia public schools, and in 2013 it was found that 18.2% of high school seniors had smoked marijuana in the past 30 days.

Table 4. Percent past year and past month marijuana use in Georgia (1).

<table>
<thead>
<tr>
<th>Age Group</th>
<th>2012 Past Year Use</th>
<th>2012 Past Month Use</th>
</tr>
</thead>
<tbody>
<tr>
<td>Under 12</td>
<td>9.74%</td>
<td>6.0%</td>
</tr>
<tr>
<td>12 – 17</td>
<td>12.5%</td>
<td>7.2%</td>
</tr>
<tr>
<td>18 – 25</td>
<td>26.1%</td>
<td>16.7%</td>
</tr>
<tr>
<td>Over 25</td>
<td>6.4%</td>
<td>3.9%</td>
</tr>
</tbody>
</table>
### Figure 3. State Rankings on Past Year Marijuana Use (102).

<table>
<thead>
<tr>
<th>State</th>
<th>Rank 12+</th>
<th>Rank 12-17</th>
<th>Rank 18-25</th>
<th>Rank 26+</th>
<th>State</th>
<th>Rank 12+</th>
<th>Rank 12-17</th>
<th>Rank 18-25</th>
<th>Rank 26+</th>
</tr>
</thead>
<tbody>
<tr>
<td>Utah</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>Pennsylvania</td>
<td>27</td>
<td>19</td>
<td>29</td>
<td>24</td>
</tr>
<tr>
<td>Kansas</td>
<td>2</td>
<td>7</td>
<td>3</td>
<td>2</td>
<td>Illinois</td>
<td>28</td>
<td>18</td>
<td>31</td>
<td>26</td>
</tr>
<tr>
<td>Tennessee</td>
<td>3</td>
<td>5</td>
<td>7</td>
<td>6</td>
<td>South Carolina</td>
<td>29</td>
<td>29</td>
<td>24</td>
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<tr>
<td>Alabama</td>
<td>4</td>
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<td>2</td>
<td>8</td>
<td>Arizona</td>
<td>30</td>
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<td>Nebraska</td>
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<td>12</td>
<td>4</td>
<td>Minnesota</td>
<td>31</td>
<td>26</td>
<td>35</td>
<td>30</td>
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<td>Mississippi</td>
<td>6</td>
<td>4</td>
<td>8</td>
<td>7</td>
<td>Ohio</td>
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<tr>
<td>Texas</td>
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<td>Hawaii</td>
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<td>Arkansas</td>
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<td>9</td>
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<td>New York</td>
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<tr>
<td>Kentucky</td>
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<td>9</td>
<td>14</td>
<td>11</td>
<td>Connecticut</td>
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<tr>
<td>Idaho</td>
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<td>20</td>
<td>4</td>
<td>15</td>
<td>Michigan</td>
<td>36</td>
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<td>39</td>
</tr>
<tr>
<td>North Dakota</td>
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<td>6</td>
<td>15</td>
<td>3</td>
<td>California</td>
<td>37</td>
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<tr>
<td>Georgia</td>
<td><strong>12</strong></td>
<td><strong>16</strong></td>
<td><strong>13</strong></td>
<td><strong>12</strong></td>
<td>Delaware</td>
<td>38</td>
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<td>33</td>
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<td>Vermont</td>
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<tr>
<td>Wyoming</td>
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<td>23</td>
<td>16</td>
<td>27</td>
<td>District of Columbia</td>
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<td>28</td>
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<td></td>
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<td></td>
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</tr>
</tbody>
</table>

Source: Rankings computed from National Survey on Drug Use and Health data 2012.
Marijuana Use by Race/Ethnicity: Georgia

Reflecting the national trend, American Indian/Alaskan Natives had the highest per capita percent of lifetime marijuana use in Georgia (49.8%), followed by Whites (39.8%) and Black/African American (36.5%) (7). The Asian and Hispanic populations had the lowest rate of lifetime marijuana use, with 24.4% and 22.4% respectively. Unfortunately, due to small sample sizes and confidentiality concerns, we are unable to report past year and past month use from the state of Georgia. However, we might expect the percentages to mirror the national trends, with American Indian/Alaskan Natives, Whites, and Blacks/African Americans marijuana use remaining high throughout past year and past month use (7).

**Table 5. Percent lifetime marijuana use by race/ethnicity (7)**

<table>
<thead>
<tr>
<th>Race/Ethnicity</th>
<th>2010-11 Lifetime Use</th>
</tr>
</thead>
<tbody>
<tr>
<td>White</td>
<td>39.8%</td>
</tr>
<tr>
<td>Black or African American</td>
<td>36.5%</td>
</tr>
<tr>
<td>American Indian or Alaskan Native</td>
<td>49.8%</td>
</tr>
<tr>
<td>Asian</td>
<td>24.4%</td>
</tr>
<tr>
<td>Hispanic</td>
<td>22.4%</td>
</tr>
</tbody>
</table>

Marijuana Use by Income and Employment Status: Georgia

In Georgia, the wealthiest population has the highest rate of lifetime marijuana use, with 45.3% of those making $75,000 or above having used marijuana at least once in their lifetime (1). In contrast, only 33.7% of people
making less than $20,000 per year reported using marijuana at least once in their lifetime. A similar pattern is seen with education. The highest rates of lifetime marijuana use are with those who have at least some college, and the second highest rates are seen in college graduates. When looking at these two categories, it appears that it is wealthier, more educated people who at least try marijuana. Again, due to small sample sizes and confidentiality concerns, we are unable to report past year and past month use from the state of Georgia (7).

**Table 6. Percent lifetime marijuana use by income and education in Georgia**

<table>
<thead>
<tr>
<th>Income</th>
<th>2010-11 Lifetime Use</th>
</tr>
</thead>
<tbody>
<tr>
<td>Less than $20,000/year</td>
<td>33.7%</td>
</tr>
<tr>
<td>$20,000-$49,999/year</td>
<td>38.1%</td>
</tr>
<tr>
<td>$50,000-$74,999</td>
<td>44.3%</td>
</tr>
<tr>
<td>$75,000 and above</td>
<td>45.3%</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Education</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Less than High School</td>
<td>35.2%</td>
</tr>
<tr>
<td>High School Graduate</td>
<td>39.6%</td>
</tr>
<tr>
<td>Some College</td>
<td>51.2%</td>
</tr>
<tr>
<td>College Graduate</td>
<td>45.6%</td>
</tr>
</tbody>
</table>

**Marijuana Use Among Youth: Georgia**

The Youth Risk Behavioral Surveillance System (YRBSS) is a bi-annual survey that assesses health risk factors for high school students across the country (103). According to the 2013 YRBSS, the percent of high
school students in Georgia who reported ever smoking marijuana was 35.9%. When broken down by sex, 33.7% of high school females had used marijuana, compared with 38.0% of high school males.

YRBSS defines current marijuana use as individuals who reported using marijuana one or more times during the 30 days before the survey. Of all Georgian high school students, 20.3% reported current marijuana use. When analyzed by sex, 21.3% of high school males and 19.1% of high school females reported current marijuana use (103). A total of 9% of Georgian youths (12.3% males and 5.3% females) had tried marijuana before the age of 12. Additionally, many high school students reported getting their illegal drugs at school. Nearly 27 percent (31% males and 22% females) of all high school students reported that they were offered, sold, or given an illegal drug on school property (103). Not counting alcohol, marijuana was the most prevalently used illicit drug among Georgian high school students.

Table 7. Percent of high school students reporting lifetime use of illicit drugs (103).

<table>
<thead>
<tr>
<th>Drug</th>
<th>Lifetime Use</th>
</tr>
</thead>
<tbody>
<tr>
<td>Marijuana</td>
<td>35.9%</td>
</tr>
<tr>
<td>Cocaine</td>
<td>7.0%</td>
</tr>
<tr>
<td>Inhalants</td>
<td>9.9%</td>
</tr>
<tr>
<td>Ecstasy</td>
<td>7.1%</td>
</tr>
<tr>
<td>Non-medical use of prescription drugs</td>
<td>17.7%</td>
</tr>
</tbody>
</table>

Marijuana use among youth can also be broken down by race/ethnicity. Among Georgian adolescents, black/African-Americans had the highest rates of lifetime use and the second highest rates of past month use (103).
Hispanics had the second highest rates of lifetime use and the highest rates of past month use. White adolescents in Georgia had the lowest rates of both lifetime and past month use. Additionally, we can see differences by race/ethnicity in the age of marijuana initiation. Only 5.9% of white adolescents reported using marijuana before the age of 13. In contrast, 10.4% of black/African-American and 14% of Hispanic adolescents reported trying marijuana before the age of 12. Hispanic children were also offered, sold, or given illegal drugs at school more often; 30.7% of Hispanic youth had experienced this compared to 25.8% of black/African-American youths and 24.8% of white youths (103).

Table 8. Lifetime and past month use by race for youth in Georgia (103).

<table>
<thead>
<tr>
<th>Race/Ethnicity*</th>
<th>Lifetime Use</th>
<th>Past Month Use</th>
</tr>
</thead>
<tbody>
<tr>
<td>White</td>
<td>31.3%</td>
<td>16.9%</td>
</tr>
<tr>
<td>Black/African-American</td>
<td>41.2%</td>
<td>23.1%</td>
</tr>
<tr>
<td>Hispanic</td>
<td>40.0%</td>
<td>23.9%</td>
</tr>
</tbody>
</table>

Note: Sample sizes were too small to compute percentages for American Indians/Alaskan Natives, Asians, and Native Hawaiians and Other Pacific Islanders.

Finally, marijuana use increases with age. Only 23.8% of students in the 9th grade had ever used marijuana. By 10th grade, this number increased to 37.3%. In the 11th and 12th grades, 41.1% and 44.5% of students reported having tried marijuana, respectively. Current marijuana use (within the past 30 days) is lowest among 9th graders (13.7%), but relatively similar amongst 10th (22.9%), 11th (23.8%) and 12th (21.4%) graders (103).
An additional source of data for youth in Georgia is the Georgia Student Health Survey (GSHS II) (104). According to the GSHS 2.0, in 2014 10.2% of 9th graders, 13.4% of 10th graders, 15.7% of 11th graders, and 18.2% of 12th graders had used marijuana in the past 30 days. Additionally, the average age of marijuana initiation is sometime between 13 and 14 years old (13.43). By the time a student is in the 9th grade, 45% somewhat or strongly agree that marijuana is easy to get, and 67% of 12th grade students feel that marijuana is easy to get.

Table 9 Use among Youths: Georgia Student Health Survey (GSHS II) Data (104)

<table>
<thead>
<tr>
<th></th>
<th>2008</th>
<th>2009</th>
<th>2010</th>
<th>2011</th>
<th>2012</th>
<th>2013</th>
<th>2014</th>
</tr>
</thead>
<tbody>
<tr>
<td>Marijuana use past 30 days (%)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Female use</td>
<td>5.33%</td>
<td>5.40%</td>
<td>5.53%</td>
<td>6.18%</td>
<td>6.49%</td>
<td>6.55%</td>
<td>7.61%</td>
</tr>
<tr>
<td>Male use</td>
<td>8.19%</td>
<td>8.84%</td>
<td>8.95%</td>
<td>9.87%</td>
<td>9.73%</td>
<td>9.50%</td>
<td>10.15%</td>
</tr>
<tr>
<td>Marijuana use by gender (%)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6th Grade</td>
<td>0.82%</td>
<td>0.87%</td>
<td>0.76%</td>
<td>0.78%</td>
<td>1.04%</td>
<td>1.03%</td>
<td>1.32%</td>
</tr>
<tr>
<td>7th Grade</td>
<td>2.63%</td>
<td>2.65%</td>
<td>2.81%</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>8th Grade</td>
<td>5.01%</td>
<td>5.19%</td>
<td>5.08%</td>
<td>4.82%</td>
<td>5.35%</td>
<td>5.31%</td>
<td>5.80%</td>
</tr>
<tr>
<td>9th Grade</td>
<td>8.51%</td>
<td>9.24%</td>
<td>9.47%</td>
<td>10.24%</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>10th Grade</td>
<td>10.75%</td>
<td>11.61%</td>
<td>11.97%</td>
<td>11.86%</td>
<td>12.96%</td>
<td>12.16%</td>
<td>13.44%</td>
</tr>
<tr>
<td>11th Grade</td>
<td>14.22%</td>
<td>15.39%</td>
<td>14.70%</td>
<td>15.74%</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>12th Grade</td>
<td>14.33%</td>
<td>15.02%</td>
<td>15.53%</td>
<td>16.11%</td>
<td>16.91%</td>
<td>16.32%</td>
<td>18.18%</td>
</tr>
</tbody>
</table>
The majority of both 9th graders (83%) and 12th graders (76%) feel that adults would disapprove of the use of marijuana, and 66% of 9th graders and 52% of 12th graders felt that their friends would disapprove of marijuana use. Additionally, 35% of 9th graders and 58% of 12th graders reported that their friends used marijuana (104).
Figure 5 Student Agreement with the Statement that Peers Disapprove of Marijuana Use (104).

![Bar chart showing student agreement with peers disapproving of marijuana use]

Figure 6 Student Agreement with the Statement that Adults Disapprove of Marijuana Use (104).

![Bar chart showing student agreement with adults disapproving of marijuana use]

When asked to describe the places their friends used marijuana, 20% of 9th graders and 34% of 12th graders reported home use; 8% of 9th graders and 12% of 12th graders reported friends who used at school; 10% of 9th
graders and 24% of 12th graders reported friends who used in the car; and 20% of 9th graders and 37% of 12th graders reported that a friend’s house was where marijuana was used.

**Figure 7. Places Georgia students report their friends use marijuana (104).**

Further information from the GSHSII data can be seen in the table below (104). Notably, perception of harm and negative social perception relating to marijuana use consistently decrease as grade level increases, highlighting the relationship between harm perception and marijuana use.
Table 10 Use among Youths: Georgia Student Health Survey (GSHSii) Data (104)

<table>
<thead>
<tr>
<th>Year</th>
<th>Total Number</th>
<th>Mean onset age</th>
<th>Perception of harm (%)</th>
<th>Social Perception (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>6th Grade</td>
<td>7th Grade</td>
</tr>
<tr>
<td>2008</td>
<td>231910</td>
<td>13.60</td>
<td>83.73% 84.19% 83.40%</td>
<td>83.47% 83.18% 84.15%</td>
</tr>
<tr>
<td>2009</td>
<td>219603</td>
<td>13.60</td>
<td>84.30% 83.19% 82.80%</td>
<td></td>
</tr>
<tr>
<td>2010</td>
<td>230438</td>
<td>13.60</td>
<td>82.49% 79.86% 78.72%</td>
<td>79.31% 76.15% 73.44%</td>
</tr>
<tr>
<td>2011</td>
<td>290500</td>
<td>13.58</td>
<td>73.88% 69.78% 67.70%</td>
<td>75.91% 73.88% 69.78%</td>
</tr>
<tr>
<td>2012</td>
<td>561268</td>
<td>13.57</td>
<td>67.70% 67.70% 67.70%</td>
<td>77.57% 75.91% 73.88%</td>
</tr>
<tr>
<td>2013</td>
<td>513909</td>
<td>13.47</td>
<td>82.71% 82.71% 82.71%</td>
<td>81.52% 81.52% 81.52%</td>
</tr>
<tr>
<td>2014</td>
<td>587043</td>
<td>13.43</td>
<td>81.86% 81.86% 81.86%</td>
<td>82.86% 82.86% 82.86%</td>
</tr>
</tbody>
</table>

Note: Empty box indicates that data do not exist. Question was not asked for that grade in that particular year.

Marijuana Dependence: U.S.

Although it has been disputed, dependence on marijuana is a condition that has become more and more accepted in the empirical and clinical literature (105). Many users who seek treatment for abuse and dependence are long-time users, with an average of 10 years of heavy use and six serious attempts to quit (105). Users seeking treatment for abuse or dependences have reported continuing use despite reporting negative social, financial, health, and life satisfaction consequences. The majority of marijuana users who seek treatment perceive themselves as being unable to stop, and many experience withdrawal symptoms (105). The evidence indicates that
marijuana dependence exists, and that, in clinical populations, it appears to be very similar to other substance abuse and dependence disorders (105).

**Marijuana Dependence and Abuse**

There are currently approximately 4.3 million people who either abuse or are dependent upon marijuana (7). It is estimated that nine percent of all marijuana users will become dependent or abuse marijuana (106). For individuals who began using marijuana in their early teenage years, this number increases to around 17%. Individuals who use marijuana on a daily basis are even more likely to become addicted, and it has been estimated that between 25% and 50% of these users develop an addiction (106).

Behind alcohol and tobacco, it is the most commonly treated type of drug dependence in the US, Canada, and Australia (9). According to the National Survey of Substance Abuse Treatment Services, marijuana was reported as the primary substance of abuse for admission into a treatment program in 17.5% of admissions for individuals 12 and older (10). Seventy-three (73%) percent of individuals admitted for treatment in the 2012 national sample were male, and 27% were female. People admitted for marijuana abuse were typically younger, with 39% individuals admitted for marijuana under 20 years of age, compared to 10% for all admission types. Whites had the highest rates of admission for marijuana use (51.1%), blacks/African-Americans accounted for 32.4% of marijuana admissions, and
individuals with Hispanic origins accounted for 18.6% of marijuana admissions (10).

**Marijuana Dependence: Georgia**

According to the Treatment Episode Data Set (TEDS), there are 46,102 individuals admitted into substance abuse treatment programs annually in the state of Georgia. This equates to approximately 0.5% of the population (10). In 20% of substance abuse treatment admissions, marijuana was reported as the primary substance used/abused. Sixty-four (64%) percent of individuals admitted for marijuana use were male and 36% were female. Nearly 28% of individuals admitted for marijuana use were under the age of 20, compared to 9.7% for all admission types. Black/African-Americans had the highest rates of marijuana admissions, comprising 52.6% of admissions for marijuana as the primary substance. This was followed by whites, comprising 41.6% of marijuana admissions. Hispanic individuals accounted for 3.6% of marijuana admissions. (10)

Table 9 ranks 48 U.S. states and the District of Columbia by both the percent of total substance abuse admissions (total number of admissions/state population), and by the percent of marijuana admissions (marijuana as primary substance/total admissions). All of the numbers were derived from the 2012 TEDS reports (10). Unfortunately, there was no 2012 data listed for Pennsylvania or West Virginia, so they are not included in the ranking. This table allows us to compare both the percent of the population...
that was admitted into substance abuse treatment programs in 2012 and the amount of these admissions that were primarily due to marijuana. A ranking of number 1 indicates the lowest percentages.

Texas, Alabama, Tennessee, Mississippi, and Illinois had the lowest total substance abuse admissions. Vermont, New York, Colorado, Connecticut, and South Dakota had the highest rates of total substance abuse admissions. Nebraska, Maine, Colorado, and New Mexico were the lowest ranked for marijuana admissions, indicating that the percent of admissions that were for marijuana only were lower than in other states. North Dakota, South Carolina, Iowa, Hawaii, and Kansas had the highest rankings for marijuana admissions, indicating that the percent of admissions that were for marijuana only were higher than in other states (10).

Georgia falls in the middle of both categories. As can be seen in the following table, Georgia was ranked 22nd for total treatment admissions with 0.46% of the population entering treatment programs in 2012. Georgia was ranked 28th for marijuana admissions, with 20% of all substance abuse admissions reporting marijuana as the primary substance of use/abuse (10). The rank for total admissions and marijuana only admissions were significantly, negatively, moderately correlated ($r = -0.43$, $p=0.002$). This indicates that, as the number of admissions per population increases, the percentage of those admissions attributed to marijuana decreases.
Table 11. Rank of percent total admissions and percent marijuana admissions(10).

<table>
<thead>
<tr>
<th>State</th>
<th>Rank All Substance Abuse Admissions**</th>
<th>Rank Marijuana Primary Admissions***</th>
<th>State</th>
<th>Rank All Substance Abuse Admissions</th>
<th>Rank Marijuana Primary Admissions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Alabama</td>
<td>2</td>
<td>42</td>
<td>Missouri</td>
<td>30</td>
<td>36</td>
</tr>
<tr>
<td>Alaska</td>
<td>32</td>
<td>6</td>
<td>Montana</td>
<td>34</td>
<td>23</td>
</tr>
<tr>
<td>Arizona</td>
<td>13</td>
<td>31</td>
<td>Nebraska</td>
<td>38</td>
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<tr>
<td>Arkansas</td>
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<td>23</td>
<td>Nevada</td>
<td>10</td>
<td>25</td>
</tr>
<tr>
<td>California</td>
<td>20</td>
<td>32</td>
<td>New Hampshire</td>
<td>9</td>
<td>8</td>
</tr>
<tr>
<td>Colorado</td>
<td>47</td>
<td>4</td>
<td>New Jersey</td>
<td>31</td>
<td>19</td>
</tr>
<tr>
<td>Connecticut</td>
<td>48</td>
<td>10</td>
<td>New Mexico</td>
<td>7</td>
<td>5</td>
</tr>
<tr>
<td>Delaware</td>
<td>33</td>
<td>33</td>
<td>New York</td>
<td>46</td>
<td>16</td>
</tr>
<tr>
<td>District of Columbia</td>
<td>36</td>
<td>14</td>
<td>North Carolina</td>
<td>29</td>
<td>42</td>
</tr>
<tr>
<td>Florida</td>
<td>6</td>
<td>38</td>
<td>North Dakota</td>
<td>14</td>
<td>45</td>
</tr>
<tr>
<td>**Georgia</td>
<td>**22</td>
<td>**28</td>
<td>Ohio</td>
<td>27</td>
<td>39</td>
</tr>
<tr>
<td>Hawaii</td>
<td>24</td>
<td>48</td>
<td>Oklahoma</td>
<td>12</td>
<td>30</td>
</tr>
<tr>
<td>Idaho</td>
<td>17</td>
<td>44</td>
<td>Oregon</td>
<td>43</td>
<td>21</td>
</tr>
<tr>
<td>Illinois</td>
<td>5</td>
<td>41</td>
<td>Rhode Island</td>
<td>40</td>
<td>8</td>
</tr>
<tr>
<td>Indiana</td>
<td>16</td>
<td>29</td>
<td>South Carolina</td>
<td>18</td>
<td>46</td>
</tr>
<tr>
<td>Iowa</td>
<td>37</td>
<td>47</td>
<td>South Dakota</td>
<td>49</td>
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*Pennsylvania and West Virginia not included due to lack of data  
** Rank based on total substance abuse admissions divided by the State population  
*** Rank based on the percent of marijuana abuse admissions out of total admissions
Prevention Approaches

Should legislation to legalize marijuana become operational in the state of Georgia, it will be necessary that some of the revenue generated from taxes on marijuana is used to fund campaigns that raise awareness about risks associated with marijuana use as well as to pay for associated social and health care costs. Youth should particularly be targeted because initiating use before the age of 18 increases risk for impacted brain development, dependence, continued use, and other abuse of other substances. Discourse in Washington State has centered on de-emphasizing scare tactics for youth marijuana prevention, and rather implementing a peer engagement approach. Washington State Secretary of Health John Wiesman hopes to develop a prevention campaign with youth in his state. Although a community-engaged approach will require more resources and time to develop, it is likely to be more relevant and have greater impact (107).

Other community based programming using federal funding involves community based approaches for marijuana prevention and intervention (108).

- The Drug Free Communities (DFC) program is charged with strengthening collaborative efforts among prevention-focused organizations to develop evidence-based community prevention strategies (98).
• The National Youth Anti-Drug Media Campaign increases adolescent exposure to anti-drug messaging via the national Above the Influence program(109).

• Strategic Prevention Framework State Incentive Grants provide funds to State, local, and tribal organizations to build capacity for prevention efforts that use evidence based public health research and strategies(104).
POLICIES, LAWS AND REGULATION: COMPARISON OF STATE AND NATIONAL POLICIES

In order to understand marijuana policy, one must understand that there are several different types of marijuana policies that exist: laws that decriminalize marijuana, laws legalizing marijuana or ingredients in marijuana for medical purposes (medical marijuana), and laws that legalize marijuana for recreational use (110).

Decriminalization Laws

The decriminalization laws for marijuana are laws or policies which reduce the penalties for the possession or use of small amounts of marijuana, particularly for a first offense (from criminal sanctions to fines or civil penalties such as drug court). This means that, for small amounts of marijuana, criminal sanctions, fines, and/or civil penalties may not apply at the state or local level (110). The following states have taken steps to decriminalize marijuana: Alaska, California, Colorado, Connecticut, District of Columbia, Maine, Maryland, Massachusetts, Minnesota, Mississippi, Nebraska, Nevada, New York, North Carolina, Ohio, Oregon, Rhode Island, and Vermont.

Comprehensive Medical Marijuana Laws

According to the National Conference of State Legislatures, currently 23 states and the District of Columbia (DC) have comprehensive medical marijuana programs (3). They define “comprehensive” as follows: 1)
protection from criminal penalties; 2) access to marijuana through home cultivation or dispensaries; 3) allows a variety of strains; and 4) allows smoking or vaporization of some kind (3).

- In 22 of the 24 states (plus DC) these laws stipulate a form of patient registry or identification cards, with Washington being the only state that does not specifically require a patient registry or identification cards (3).
- 17 of the 23 states (plus DC) allow dispensaries. Alaska, Hawaii, Michigan, Montana, Nevada, Oregon, and Washington do not.
- 22 states specify which conditions qualify for medical marijuana. California does not, and the District of Columbia is still in the process of determining whether they will or will not.
- Finally, only 5 states and DC formally recognize medical marijuana patients from other states (Arizona, District of Columbia, Maine, Michigan, New Hampshire, and Rhode Island). Two (2) states expressly do not (Illinois and Montana). The other states do not specify whether they will or will not recognize patients from other states (3).

**Limited Access Marijuana Laws**

Limited access marijuana laws specify that legal marijuana and its derivatives must not contain more than a certain maximum percentage of THC, and often restrict dispensaries and/or the medical conditions for which
medical marijuana can be recommended (3). For example, among limited access states only Georgia and Florida include conditions other than epileptic seizure disorders. Only Florida and Missouri allow dispensaries; all other limited access states specify that universities must manage the program. In Florida, there are 5 regional dispensaries across the state, and specified physicians can recommend low-THC marijuana products for various chronic conditions. It should be noted, however, that implementation of the Florida law is currently tied up in court proceedings. Alternatively, in Iowa, there is no specified marijuana distributor, but only persons with intractable epilepsy can be recommended to receive medical marijuana. The majority of the limited access marijuana states define “low” THC content as less than 3%. Kentucky is the only state which has a limited access marijuana law that does not define the amount of THC that is considered low. There are currently fourteen states that have limited access marijuana laws on the books: Alabama, Florida, Georgia, Iowa, Kentucky, Mississippi, Missouri, North Carolina, Oklahoma, South Carolina, Tennessee, Utah, Virginia, and Wisconsin (3).

**Recreational Marijuana Laws**

In 2012, Washington State and Colorado passed laws that legalized recreational use of marijuana for individuals over the age of 21 (24), and in 2014 Oregon, Alaska, and Washington DC followed suit. For Washington DC, however, Congress effectively negated the bill by making it illegal to use
any state or local funds to implement the bill (2, 26). Additionally, Florida nearly passed an extremely broad medical marijuana constitutional amendment that would have been very similar to a recreational marijuana law. However, the amendment fell short of achieving the 60% vote needed for passage by 2.4%. All states that have legalized marijuana have unique justifications written into the laws. However, as is noted previously, marijuana possession, use, cultivation, and distribution are still illegal under Federal Law, and the Federal Government does not officially recognize State legalization laws. In order to demonstrate the potential difference that can exist between recreational marijuana legislation, below is a case comparison of the two states that first passed recreational marijuana laws.

In Colorado, according to the language of the amendment, Amendment 64 was intended to make law enforcement efforts more efficient and to improve the health of the public by allowing for regulation of marijuana sales (111). Washington’s laws, according to the language of the law, were passed with the intent that 1) legalizing recreational marijuana would allow law enforcement to focus on violent crimes and property crimes; 2) that it would generate new tax revenue at the state and local levels that would be used for education, healthcare, research, and substance abuse prevention; and 3) it takes marijuana out of the hands of drug dealers and into a regulated, legal environment (112). However, it should be noted that there was heavy
lobbying both Colorado and Washington by the marijuana industry, which stood to gain financially from the passage of recreational marijuana laws.

While both laws legalize marijuana for adults over the age of 21, there are some notable differences between the two laws (111-113). The Colorado law is an amendment to the state constitution. This means that any means of legal change can only be accomplished by another constitutional amendment. Conversely, Washington passed a state law, which can be legally changed by normal legislative action (113). Colorado permits individuals to grow up to six marijuana plants, with three flowering at any time, in the home. In Washington, home-growing of marijuana plants is prohibited (113). It should be noted that a substantial majority municipalities have chosen not to allow medical or recreational marijuana businesses or dispensaries (4).

The tax structure on marijuana sales is also different between the two states. Additionally, the intended use of the generated taxes is also different. In Colorado, marijuana taxes were supposed to have gone into the Marijuana Tax Cash Fund, which has clear funding streams that go to medical schools, marijuana-related education and prevention efforts, law enforcement agencies, and local governments that allow marijuana sales. Washington’s funding stream is more complicated, but after administration and research, money goes to marijuana specific programs, general healthcare spending, and the state’s general pool of money (113). However, what is actually occurring
with Colorado taxes is quite different due to a conflict with existing tax laws. Since total state tax revenues exceeded projections (although taxes from marijuana alone were less than projected) the state may have to refund all marijuana tax revenue to voters unless the legislature can convince voters to allow the state to keep the marijuana tax money (114).

Georgia Marijuana Laws

In 2015, Georgia passed House Bill 1, its first operational limited access medical marijuana law. In 1980, Georgia was one of the first states to consider medical marijuana. The state legislature passed a bill (in compliance with federal laws) that established a research program to study the effects of medical marijuana on cancer and glaucoma patients (115). The law would allow for the Composite State Board of Medical Examiners to appoint a Patient Qualification Review Board which could approve patients, physicians, and pharmacies for participation in the research program (116). However, due to the lack of federally approved marijuana vendors combined with the fact that the Patient Qualification Review Board was never appointed, this bill has never been operational (115, 116). House Bill 1 (HB1), which was signed into effect on the 16th of April, 2015, allows for the limited distribution and possession of “low-THC” containing, marijuana-derived oil for research and treatment related purposes. HB1 defines “low-THC” as not more than 5% and states that the Board of Regents of the University System of Georgia will designate a supplier of the “low-THC” oil.
Additionally, HB1 defines certain conditions for which “low-THC” containing oil can be recommended: end stage cancer, amyotrophic lateral sclerosis, multiple sclerosis, seizure disorders, Chron’s mitochondrial disease, Parkinson’s, and Sickle Cell disease (3).

While HB1 has legalized THC oil for certain uses and research, Georgia's criminal laws regarding marijuana remain in place. The personal possession of 1 ounce of marijuana or less is a misdemeanor, which carries a penalty of up to one year incarceration and a maximum fine of $1,000. However, the frequency with which this penalty is currently enforced is a matter in which further research may be necessary. The personal possession of more than 1oz is a felony charge which carries a 1-10 year incarceration sentence and no fine (12). Possession with intent to distribute is considered a felony charge. Ten pounds or less comes with a 1-10 year sentence and no fines. If the charge is for over 10 pounds of marijuana, the minimum and maximum sentence increases, as well as the amount of the fine (12).

Sales, delivery, and cultivation of marijuana are also considered felony offenses. All convictions for sales, delivery, and cultivation carry jail time, and most carry fines as well. If a person is found guilty of possession with intent to distribute, of sale or delivery, or of cultivation within 1,000 feet of school grounds, a park, or a low-income housing project, it carries a 20-40
year sentence and a max fine of $40,000, regardless of the amount of marijuana involved (12).

With respect to sentencing in Georgia, a person who is convicted of or pleads guilty to a marijuana possession charge on their first offense may have the proceedings deferred and be put on probation for 5 years. If the person successfully completes the terms of probation, their proceedings are dismissed. Additionally, the judge may sentence the person at a lesser sentence at her or his discretion (12).

**Georgia Drugged Driving Laws**

Georgia has a *per se*, or zero tolerance, drugged driving law in place. A person is guilty of a driving under the influence (DUI) charge if any illicit drug or its metabolites are detected in body fluids. Because metabolites can be present for up to a month after actual use, the law allows the DUI penalty even in the absence of actual driving impairment. Impaired driving and measures of impairment are discussed further in another section. It should be noted that recent research may indicate that, for chronic users, an individual’s critical tracking and divided attention tasks (skills that are important for driving) may be impaired for up to 3 weeks after ceasing marijuana use. However, the authors of this research study warn that these findings must be interpreted with caution, as the control group was not
matched on education levels, socioeconomic status, lifestyle, or race/ethnicity (18).

**Georgia Marijuana Education Efforts**

Certain private and public agencies in Georgia are currently making a concerted effort to change the public perspective that marijuana is harmless and has no impact on individual or public health (117). In February of 2014, the Council on Alcohol and Drugs launched a statewide initiative titled *The Georgia Marijuana Abuse Prevention Initiative (GMAPI)*. The GMAPI is a multi-year effort which is utilizing the U.S. Substance Use and Mental Health Services Administration’s (SAMHSA) Strategic Prevention Framework (SFP) to educate youth and adults about the consequences of marijuana use and to maintain or create safe, drug-free workplaces (117).

An effort with goals similar to those of GMAPI is “Let’s Be Clear Georgia: A Collaborative to Prevent Marijuana Abuse,” a non-profit coalition with more than 160 member agencies, companies, and individuals. The Collaborative is an active partnership of members from the private and public sectors who are engaging in prevention education and policy education to reduce marijuana abuse (117). The Collaborative has two main goals. The first is to prevent and reduce the abuse of marijuana among Georgia’s youth. To achieve this goal, the Collaborative has been working to educate parents, youth, and other Georgia residents about marijuana abuse and the inherent
consequences that follow. This effort includes a social media campaign as well as policy and other types of education for state and local legislators (118).

The second goal of the collaborative is to prevent and reduce marijuana abuse in the workforce. To achieve this goal, the Collaborative is educating employers on the risks of both short term and long term marijuana use, and on the risk the employers expose themselves to when employees are using, selling or distributing marijuana in the workplace (118). The following display is an example of the “Drugs Don’t Work in Georgia” Campaign, which is associated with the second goal.

Figure 8. Drugs Don’t Work In Georgia Educational Materials (119)
National Marijuana Laws

According to the Controlled Substances Act (CSA), which was enacted in 1970, marijuana is a Schedule I controlled substance (11). This means that according to the federal government, marijuana is considered to be a dangerous drug and that the use, sale, and distribution of marijuana is a federal crime (110, 120). However, the current US Department of Justice policy is that it will not be specifically focusing on individual marijuana users who are using marijuana according to their state guidelines (120). Rather, the Department of Justice has announced they will be prioritizing and enforcing the following measures (however, to date very little is known about whether actual enforcement has occurred):

- Preventing the distribution of marijuana to minors;
- Preventing cartels, gangs, and criminal enterprises from profiting from the sale of marijuana;
- Preventing the trafficking of marijuana from a state where it is legal to other states;
- Preventing state-authorized marijuana activity from being used as a cover for other illegal drugs or activities;
- Preventing violence and the use of firearms in the marijuana trade;
- Preventing driving under the influence and other adverse public health concerns associated with marijuana;
- Preventing the growing of marijuana on public lands; and
• Preventing marijuana possession on federal lands. (121)

Furthermore, the Department of Justice specifies that it typically relies on state and local authorities to address marijuana activities that fall outside of these priority areas (120). To put it simply, the possession, use, sale, and/or distribution of marijuana is still a federal crime. However, for the moment, the Department of Justice is not attempting to supersede state marijuana laws.

The Department of Transportation (DOT), however, holds a different stance than the Department of Justice. The US DOT has a zero-tolerance policy in place for the use of both recreational and medical marijuana use by safety-sensitive transportation employees, regardless of whether or not it is authorized under state law or physician recommendation (122, 123). These employees include pilots, school bus drivers, truck drivers, train engineers, subway operators, aircraft maintenance personnel, transit fire-armed security personnel, ship captains, and pipeline emergency response personnel, among others who are responsible for creating a safe environment for their colleagues and the travelling public. The DOT has issued the following statement (122, 123):

*We want to make it perfectly clear that the DOJ guidelines will have no bearing on the Department of Transportation’s regulated drug testing program. The Department of Transportation’s Drug and Alcohol Testing Regulation – 49 CFR Part 40 – does not authorize the use of Schedule I drugs, including marijuana, for any reason...We will not*
change our regulated drug testing program based upon these guidelines to Federal prosecutors.

In summary, the DOJ regulations do not apply to the DOT, and the DOT will continue regulated drug testing.

Private Company Drug Policies

As can be seen, the differences between state, national, and potentially even local policies regarding marijuana can make it difficult for some companies to create comprehensive marijuana policies that adhere to all levels of regulation. However, there are no state or local laws that require a company to permit drug use in the workplace or that sanction an employee reporting to work under the influence of marijuana (124). One main challenge for companies is that states that have decriminalized marijuana or that have allowed medical marijuana may have anti-discrimination language built into those laws (124). For example, Connecticut has a law that prohibits organizations from discriminating against workers based solely on their status as medical marijuana patients. Delaware has a law that prohibits organizations from discriminating against registered medical marijuana users who have tested positive for marijuana (124).

These state laws are in direct odds with both the Controlled Substances Act mentioned above and the Drug-Free Workplace Act. The Drug-Free Workplace Act was enacted in 1988 and prohibits marijuana use,
in or outside of the workplace, for any company that has a contract with the federal government (125).

As of 2013, 12% of employers had policies that recognized medical marijuana, 10% had plans to recognize medical marijuana in the future, and 79% did not recognize medical marijuana, nor did they intend to in the future (126). This supports a statement made by the New York Times which suggested that most businesses plan to keep drug-free policies in place (127). In our own research, 60 of the Forbes top 100 companies had publicly available drug-free workplace policies, which include marijuana as a Class I schedule substance. The remaining 40 did not have that information publicly available.

The maintenance of drug-free policies in states where medical and/or recreational use of marijuana has been legalized places employers in murky legal territory. A poignant example of this is the case of Brandon Coats vs. Dish Network currently being tried in the Colorado State Supreme Court. Coats is a former Colorado-based Dish Network employee who was fired in 2010 after his results for a random drug screen at work came back positive for marijuana (127). Coats is a quadriplegic who was fired despite being licensed to use medical marijuana to treat his muscle spasms, due to Dish Network’s drug-free workplace policies (128).
Coats claims that he only used marijuana outside of work and that he had never been impaired at work (128). He argues that his termination was a violation of another state law, the Lawful Activities Statute, which prohibits employers from firing employees for participating in lawful activities outside of work (129). However, Dish Network argues that employers have the right to maintain their drug-free policies, which are consistent with federal law (128). The company claims that if they are unable to maintain these policies, they, as well as other companies across the state, risk losing federal contracts due to the inability to comply with federal drug-free workplace laws (127).

The Coats case highlights the need for the clear articulation of how state vs. federal law should be interpreted in terms of marijuana legalization regulations, to prevent potential negative impacts on both businesses and employees.

Because the State of Georgia has a limited access medical marijuana law and has not decriminalized marijuana, it is an ideal state to target improving drug-free workforce policies within private companies. Unless a business is a contractor with the federal government, they are not legally required to specifically prohibit the use of marijuana (125). Grassroots efforts, such as the GMAPI and coalitions, such as the Let’s Be Clear Georgia collaborative, may be able to influence businesses to strengthen their drug-free workplace policies and to make substance abuse prevention among their employees a priority.
In Favor of a Public Health Approach

Public health researchers point to the history of alcohol and tobacco as a way to reduce the harmful effects of marijuana legalization (17). Opponents of legalization are commonly concerned with several issues in order to protect public health and safety, which are addressed by the authors:

- Minimizing access, availability, and use by young people;
- Minimizing drugged driving;
- Minimizing dependence and abuse;
- Minimizing consumption of unsafe marijuana products (highly potent or contaminated); and,
- Minimizing use of alcohol and marijuana.

Looking at the history of tobacco and alcohol may provide insights into reducing the harmful effects of marijuana in the wake of legalization. They include keeping taxes high, adopting a state monopoly, restricting and monitoring licenses for marijuana, limiting the types of products sold, limiting commercialization (e.g. promotions and marketing), restricting public consumption (e.g. smoke free policies), and measuring and preventing impaired driving.

Advocates of legalization are ramping up efforts to promote the financial gains to be made with cultivation and sales. A recent article on Marijuana.com cited that the current industry was valued at anywhere from
$1.5 billion to more than $50 billion, and that the legal industry will be worth $35 billion, notably “bigger than the [National Football League] NFL” by 2020 (130, 131).

It has been touted that in Denver there are more dispensaries than there are Starbucks coffee shops (132). While this may be true, it is also true that certain municipalities have been more restrictive (4). At any rate, legalization would present enormous regulatory challenges and potential conflicts between laws at different levels of government.

Researchers from the RAND Corporation were commissioned by the state of Vermont to study issues related to potential legalization, including distribution, possession, taxation and regulation. Public safety and public health are also addressed. The report was published as a RAND research report for Vermont legislators, and was completed in early 2015. Insights can be drawn from the comprehensive analysis, the first of its kind (133), by other states.

**Marijuana and Driving**

With changing public attitudes, legalization of medical marijuana in 23 states, and of recreational marijuana in four states, driving under the influence of cannabis (DUIC) is a growing national public health concern. Acute cannabis intoxication produces impairment in cognitive and psychomotor functioning in a dose-related manner, and can also promote
risk-taking behavior. Affected factors include reaction time, perception, short-term memory, attention, motor skills, and tracking skills, all important in driving (14). Legalization would likely increase the prevalence of drivers under the influence of marijuana and motor vehicle accidents (MVA).

**Marijuana Prevalence among Drivers**

The most recent (2007) National Roadside Survey of Alcohol and Drug Use found cannabis as the most common illicit drug with 8.6% of night time drivers testing positive for THC (14). Additionally, Driving and riding in a vehicle as a passenger after marijuana use is a common practice among college aged students (134). One in six 19-year-old college students drove drugged and 28% reported riding with someone under the influence. Approximately half of the drugged drivers also reported driving drunk (135). However, Driving after marijuana use is a bigger problem in younger populations than adults (136).

Colorado and Washington, and more recently Oregon and Alaska, are states of particular interest due to the fact that they have legalized marijuana for private use. In Colorado, the percentage of positive cannabinoid screens (THC at or above 2ng/ml) increased significantly from 28% in 2011 to 65% in 2013 (137). In Washington, the prevalence of THC detected pre-legalization was compared with the prevalence post-legalization. In 2009-2012, the average yearly percentages of cases positive for THC were
19.1 and 27.9%, respectively. In 2013, the percentages had significantly increased to 24.9 and 40%, respectively. The prevalence of alcohol and the majority of other drugs in this same population of suspected impaired drivers submitted for testing did not change during this same 5-year period. As of December, 2014, studies had not been done to determine whether the observed increase has had any effect on the incidence of crashes, serious injuries and/or traffic fatalities (138).

### Marijuana and Risk of Motor Vehicle Accidents

A meta-analysis of published studies suggests that marijuana use by drivers is associated with a significantly increased risk of being involved in motor vehicle crashes (139). The risk of crash involvement increased in a dose-response fashion with the concentration of THC detected in the urine and the frequency of self-reported marijuana use (139). More frequent cannabis exposure (more than once a week, four days per week) was associated with a significantly increased accident risk (14). Additionally, in driving under the influence of cannabis (DUIC) cases, smoking during the previous hour almost doubled crash risk. These risks were higher than driving within two hours (14).

Increased blood THC concentrations were associated with increased crash culpability for drivers with any measurable blood THC relative to drug-free drivers. When the blood THC concentration was greater than 5
nanograms per milliliter (ng/mL) accident culpability was comparable to a 0.15% blood alcohol concentration (BAC) (14). In culpability studies in France, the effect of cannabis on fatal crash responsibility is significant after adjustment for age, sex and alcohol. A multiplicative effect between cannabis and alcohol was noted. In other words, the effect of cannabis and alcohol combined might be greater than expected when looking at the effects of cannabis and alcohol individually (140).

**Drivers in Fatal Accidents**

Data from the Fatality Analysis Reporting System for 1999–2010 was used to assess trends in alcohol and other drugs detected in drivers who were killed within one hour of a motor vehicle crash in 6 US states. The results indicate that non-alcohol drugs, particularly marijuana, are increasingly detected in fatally injured drivers:

- During the study period, the prevalence of positive results for non-alcohol drugs rose from 16.6% in 1999 to 28.3%.
- The most commonly detected non-alcohol drug was cannabis prevalence of which increased from 4.2% in 1999 to 12.2% in 2010 (141).

**Marijuana in Combination with Other Drugs**

Multiple substance use may be even more harmful to public safety: alcohol and marijuana are the most commonly detected drugs in motor
vehicle accidents (15). Furthermore, they may present unique harms. Evidence shows that when cannabis and alcohol are detected together, there is a greater risk to road safety than when either drug is used alone (17, 142, 143). This has implications for impairment thresholds, particularly if drivers use each substance below the legal limit (17, 144, 145). In fact, driving after drinking has declined in recent years, but driving after use of marijuana has increased.

According to an analysis of the National Highway Traffic Safety Administration’s (NHTSA’s) Fatality Analysis Reporting System (FARS) between 1993-2010 in 2010 (146):

- 54.9% of drivers testing positive for cannabis were also using alcohol at the time of the accident.
- The percentage of drivers detected with more than three drugs in their system nearly doubled from 11.5% to 21.5%.
- Detection of cannabis in drugged drivers increased from 28.8% in 1993 to 36.9% in 2010.
- Drivers 50 years and older account for an increasing share of drugged drivers and for the highest proportion of prescription drug users.
- Prescription drugs accounted for the highest fraction of drugs used by drugged drivers in fatal crashes in 2010 (46.5%) with much of the increase since the mid-2000s.
Since DUIC individuals seem to have a general reckless driving style which puts them at risk for traffic incidents, this dangerous behavior may be a factor in accidents rather than cannabis use alone (147). Impaired individuals report willingness to drive if they have a good reason to do so, or they believe they have developed tolerance (15). These facts suggest that education and public awareness efforts would be best to focus on educating individuals about the harms of impaired driving.

**Medical Marijuana and Motor Vehicle Accidents**

The relationship between medical marijuana use and MVA is contradictory.

- In 2014, researcher Neavyn and colleagues reported that no research linked medical use of marijuana with driving impairment (148).
- Increased marijuana involvement was found in only three of the 12 states that had implemented medical marijuana laws (149).
- Contradictory evidence could stem from the variation in medical marijuana laws. Some medical marijuana laws, such as those found in California, do not restrict by disease (3) and may therefore make it easy for healthy individuals to use medical marijuana recreationally, while other states are more restrictive. The differences in the restrictiveness of the laws could impact these findings.
In Colorado, the proportion of drivers in a fatal motor vehicle crash who were marijuana-positive increased while no significant changes were seen in non-medical marijuana states (NMMS). For both Colorado and NMMS, no significant changes were seen in the proportion of drivers in a fatal motor vehicle crash who were alcohol-impaired (137).

Driving Impairment

Investigations of actual driving performance have demonstrated dose dependent THC impairment in road tracking at low to moderate THC levels (14). The position of the National Safety Council (NSC) Committee on Alcohol and Other Drugs (CAOD) is that it is unsafe to operate a vehicle or other complex equipment while under the influence of cannabis (marijuana), its primary psychoactive component, delta-9-tetrahydrocannabinol (THC) or synthetic cannabinoids with comparable cognitive and psychomotor effects, due to the increased risk of death or injury to the driver and the public (15).

Research on Driving Impairment

Current advanced driving simulators are very valuable in research because of the ability to control the environment and study the effects of high levels of THC under safe conditions. Simulator studies demonstrate:

• Divided Attention Tasks (DATs) and executive-function tasks as the most sensitive to marijuana’s effects (97).
• A significant THC impairment of reaction time (RT) and the standard deviation of lateral position (SDLP), such as weaving. THC smoking inhibited expected practice effects on divided attention tasks. In this study, no sex differences were observed (97).

• Percent of time in lane and straddled line demonstrated significant THC-induced impairment (15).

Simulation research testing both marijuana and alcohol found:

• In a study of three doses of cannabis and three doses of alcohol in simulator studies, high levels of cannabis induced greater impairment than lower levels (16).

• Both cannabis and alcohol were associated with increases in speed and lateral position variability, high dose cannabis was associated with decreased mean speed, increased mean and variability in headways, and longer reaction times (16).

• When regular and non-regular cannabis users consuming different levels of alcohol in driving simulator performance were compared, performance was more impaired in the THC and alcohol combined conditions. Participants had higher levels of blood THC when THC was consumed with alcohol, and regular cannabis users returned higher levels of THC in plasma than non-regular users (150).
Marijuana has been shown to increase driving reaction times, impair time and distance estimation, and decrease motor coordination for up to three hours after dosage in a dose related pattern (14). In addition, these simulator studies show that depending on the THC dose, driving speed may be reduced particularly while multitasking and headway may be increased. These results suggest impairment awareness and compensation for the effects of impairment (16).

Methods to Evaluate Driver Impairment

In the following sections, the current methods to evaluate driver impairment are describe and evaluated.

Standard Field Sobriety Testing (SFST)

The Standardized Field Sobriety Tests (SFST) and breathalyzer tests are suitable for roadside testing for alcohol and blood alcohol levels are an accurate measure of impairment. Testing for marijuana impairment is not so straight-forward. The Standardized Field Sobriety Tests (SFST) is only mildly sensitive to impairment in heavy cannabis users possibly due to increased tolerance and time of testing (151) and has limited ability to identify drug consumption in the absence of any evidence of driving impairment (150).

Testing for Marijuana and Impairment
Unlike alcohol, testing for marijuana and driving impairment is difficult. The problem is that the relationships between performance impairment and the amount of TCH in the blood are not consistent (14). Part of the problem is the way THC is metabolized. The acute psychoactive effects often last only a few hours, but THC remains detectable in blood for several hours and, for some chronic users, up to seven days after use and in urine even longer. Therefore, detection of use can occur well outside the window of impairment (17). Drivers claiming regular cannabis consumption were significantly less often judged to be impaired than occasional smokers, with no difference in the median blood THC concentration (14). Major difficulties include characteristics of the ways marijuana is metabolized, individual differences in metabolism, and problems with chemical tests for marijuana in roadside situations.

Some considerations regarding individual metabolism include the following.

- Among infrequent smokers peak plasma concentrations of THC occur within 2-15 minutes of inhalation and then dissipate rapidly. The initial high occurs after 20-40 minutes and largely disappears after 2.5 hours (11). For this reason there is no clear relationship between blood THC concentrations and impairment, as the time of maximum blood THC concentration proceeds the time of maximum impairment of driving-related abilities (143).
• In heavy users, THC sequesters into human fat and then it slowly seeps out over the course of a week or a month. For this reason there is no correlation between blood THC concentration and marijuana effects. They achieve a steady-state condition (rate of administration and rate of elimination reach an equilibrium) where blood THC concentrations are maintained by the continual release of THC from fat into the general circulation (143).

• Multiple cutoffs for different THC metabolites have been recommended to distinguish between these various types of smokers (152).

• Unlike alcohol there is no way to determine the potency of the initial marijuana consumed, and the state of Georgia currently has no capacity to measure THC percentage in THC oil, only its presence.

Chemical Tests

Tests for marijuana and its metabolites can be run on blood, oral fluids, urine and exhaled breath, but there are limitations of each of these approaches. Furthermore, the state of Georgia only tests for THC concentration in blood, but not in oral fluids, urine, or exhaled breath.

Blood Testing

- Blood concentration was thought to correlate most closely with impairment, but drawing blood is invasive and requires transporting the individual to a place where blood can be safely drawn (153).
However, the improvements in the safety and convenience of testing may make it a promising testing method.

- It may be useful to develop tests based on detection of a metabolite of cannabis [11-nor-9-carboxy-9-tetrahydrocannabinol (THCCOOH)] concentration in whole blood to distinguish habitual from casual cannabis users (154).

**Oral Fluid testing**

- Using data from the National Roadside Survey (2007), it was determined that oral fluids and blood samples provided very similar information regarding recent drug intake and randomly tested. Oral fluid (OF) can be considered a reliable alternative to blood for drug testing (155).

- The Drager Drug Test 5000 on oral fluids was sensitive for THC and may be suitable for roadside testing (156-158).

- Scheidweiler has developed a sensitive method to test for oral fluid 11-nor-9-carboxy-Δ9-tetrahydrocannabinol (THCCOOH). He proposes this as an assay applicable for the workplace, driving under the influence of drugs, drug treatment, and pain management testing. THCCOOH is not found in cannabis smoke, so this avoids false positives from passive exposure to cannabis smoke (159).

- In controlled THC administration experiments on oral fluid, THC tested positive for up to 13.5 hours after smoking without significant
differences between frequent and occasional smokers over 30 hours. THC was detected in 25 and 212 occasional and frequent smokers respectively. THCCOH has a longer detection window in frequent smokers, is useful in minimizing false positives from passive smoke exposure and can identify oral THC in oral ingestion which oral fluid THC cannot (160).

- Oral fluid cannabinoid concentrations cannot predict concurrent plasma concentrations according to Milman (153).
- Some drivers may be switching to synthetic cannabinoids (“Spice”) which have similar driving impairments to cannabis due to their non-detectability in standard tests (143).

**Urine Testing**

- Urine samples are easier to collect but a bit invasive. Testing has an extended cannabis-detection window and cannot establish a valid temporal association with crash risk (14).
- Many studies using urine do not find culpability (14).

**Breathalyzer Testing**

A breathalyzer test for marijuana is of interest but is still in the developmental stage (161, 162). In September 2014, the Colorado Office of Economic Development and International Trade (OEDIT) awarded a grant to Lifeloc Technologies to develop a breathalyzer tool, similar to breathalyzers
used to detect blood alcohol levels, to detect THC impairment (163). Lifeloc aims to create a tool that only detects delta 9 THC, because it is the psychoactive ingredient in marijuana (164), however, there is evidence to suggest that the examination of marijuana in exhaled breath may be limited to a short detection window (0.5 hours) (165). Additionally, Washington State University has announced that they are working to develop a portable breathalyzer to detect the presence of active THC (166).

**Laws for Driving Under the Influence of Cannabis (DUIC)**

There is considerable debate about the laws for DUIC. It is not clear what level of THC in blood concentrations constitutes impairment and patterns of use (frequent vs. habitual users) are important in interpreting blood concentration levels (143).

- Drug per se (zero tolerance) laws are in effect in several states, including Georgia.
- The Obama administration has strongly endorsed the implementation of drug per se laws (zero tolerance) which specify that the presence of THC or marijuana metabolites (as well as other drugs) in a driver’s system is itself (i.e. “per se”) a criminal violation (167).
- A few states, like Washington and Colorado, have established a legal limit of marijuana in the blood: five nanograms (ng) of THC per milliliter.
The policy question is whether the legal level should identify significant impairment for drivers (as the current case for alcohol, allowing driving at modest impairment levels below 0.08) or whether the legally allowable level for THC should be set at a very low level approximating zero impairment (currently in place for alcohol in the United States for drivers younger than 21 years) (17).

Interventions

The following interventions are promising practices to reduce DUIC:

- A high likelihood of getting caught via random roadside tests and arrests is suggested as the best deterrent (14).
- Most cannabis smokers feel they are minimally impaired and that advertising campaigns on hazards would have little effect (14).
- Screening, Brief Interventions, and Referral to Treatment (SBIRT) Core Training Program for primary care physicians may be useful in delivering brief interventions by technology to young people in a clinical setting (168).
- Adolescents reporting cannabis use in a primary care facility were given a brief intervention by computer (CBI) or a therapist (TBI) on cannabis consequences. There were short-term effects on cannabis related problems but less over the long term (12 month effects) (169).
- Frabitus proposed that traffic offenders be directed toward medical assessment of their fitness to drive if the whole blood THCCOOH
concentration is higher than 40ng/L. This evaluation is not recommended if the THCCOOH concentration is lower than 3ng/L and if the self-rated frequency of cannabis use is less than 1 time/week (170).

**Workplace Laws Related to Marijuana**

Marijuana use is not only a problem when behind the wheel, but has also been identified as a major risk factor in the workplace (171). Concerns include:

- Accidents and injuries, absenteeism, productivity, turnover, disciplinary actions;
- Public trust, image, and role modeling (important in military, police and athletes) (172); and Economic costs—The economic cost of drug abuse in the United States was estimated at $193 billion in 2007, the last available estimate. This value includes (173): $120 billion in lost productivity, mainly due to labor participation costs, participation in drug-abuse treatment, incarceration, and premature death; $11 billion in healthcare costs — for drug treatment and drug-related medical consequences; and $61 billion in criminal justice costs, primarily due to criminal investigation, prosecution and incarceration, and victim costs.

**Magnitude of the Problem**

The 2013 National Survey on Drug Use and Health (NSDUH) is the primary source of statistical information on the use of illegal drugs, alcohol,
and tobacco by the U.S. civilian, population aged 12 or older (174). According to the 2013 survey:

- Most illicit drug users were employed. Of the 22.4 million current illicit drug users aged 18 or older in 2013, 15.4 million (68.9 percent) were employed either full or part time.
- Among unemployed adults aged 18 or older in 2013, 18.2 percent were current illicit drug users, which was higher than the rates of 9.1 percent (similar to 8.9% in 2012) for those who were employed full time or part-time (13.7%).
- Commonly reported reasons for not receiving illicit drug or alcohol use treatment among persons aged 12 or older who needed and perceived a need included possible negative effects on the job.
- In 2011, 9.8 million adults who were employed full time had a substance use problem (175).

According to the Treatment Episode Data Set (TEDS), in 2011, employment status was reported for more than 1.6 million substance abuse treatment admissions aged 18 or older (10).

- Of these, 15.4 percent (about 256,000 admissions) were employed full time
- Among full-time employed admissions, 2.4 percent were referred to treatment by employers or Employee Assistance Programs (EAPs).
• This low percent is a concern and there should be ways to encourage more employees to take advantage of these programs.

**Turnover and Absenteeism**

Substance abuse has been shown to have a negative impact on employee retention and attendance. From 2002 to 2004, full-time workers aged 18-64 who reported current illicit drug use were more than twice as likely as those reporting no current illicit drug use to report they had worked for three or more employers in the past year (12.3% versus 5.1%)(173). In the same period, full-time workers who were current drug users were more likely to report missing two or more work days in the past month due to illness or injury, when compared with workers who were not current users (16.4% vs. 11.0%)(173). Full-time workers who were current drug users also were about twice as likely as non-users to skip one or more days of work in the past month (16.3% vs. 8.2%) (173).

**The Role of Drugs in Aviation Accidents**

Aviation employees were tested between 1995-2003 under random, and post-accident testing programs in a 2011 study of the role of drugs in aviation accidents (176). The study results indicated that the prevalence of all drug violation was 0.64% in random drug testing and 1.82% in post-accident tests (176). The odds of accident involvement of drug positive employees was three times that of drug negative employees with an estimated attributable risk of
1.2% (176). Marijuana accounted for 67.3% of illicit drugs detected (176). It is evident that drug violations are associated with an increased risk of accident involvement, but due to low prevalence of drug use in this population it contributes to only a small fraction of aviation accidents.

**Laws and Regulations**

Multiple federal laws have been passed to increase workplace safety, through prevention of substance abuse in the workplace. Congress passed the Drug-Free Workplace Act in April 1988, which resulted in the Mandatory Guidelines for Federal Workplace Drug Testing (177). The intent of this legislation was to establish a substance-free work environment for all federal workers and organizations that contract or receive money from the federal government.

The Substance Abuse and Mental Health Services Administration’s (SAMHSA) Division of Workplace Programs has a Drug Free Workplace Program with oversight of the Health and Human Services (HHS)-certified laboratories which operate under the mandatory guidelines for Federal Workplace Drug Testing. The Federal Drug Free Workplace Program has the following components (171, 177):

- Written policy describing the employer’s expectations about drug use and consequences of policy violations;
• An employee assistance program of confidential problem assessment, counseling, referral to treatment and follow-up support after treatment;

• Supervisor training to orient supervisors to the employer’s drug abuse policy and to define the supervisor’s responsibility to refer employees when job performance deficits are noted and to recognize and respond to employees with problems;

• Employee education to describe the signs and symptom of drug abuse and its effects on performance and to explain the program;

• Requiring that action be taken against employees who fail to comply with this prohibition in the workplace; and

• Drug testing on a controlled and carefully monitored basis.

These guidelines specifically, and exclusively, focus on testing urine specimens for metabolites of marijuana, cocaine, phencyclidine, opiates (focusing on heroin metabolites), and amphetamines (including Ecstasy) (178). Urine sampling is viewed as the “gold standard” because it is noninvasive and fast, and samples are easy to collect and test.

There have been many scientific, technical, and legal challenges to the validity of urine drug testing. In response, the Substance Abuse and Mental Health Services Administration, a branch of the Department of Health and Human Services, made several revisions, strict procedural guidelines and
specimen validity-testing criteria to manage suspicious or adulterated samples during and after urine collection (178).

One such change is the Synthetic Drug Abuse Prevention Act of 2012. President Obama signed the Synthetic Drug Abuse Prevention Act of 2012 into law on July 9, 2012, as part of S. 3187, the Food and Drug Administration Safety and Innovation Act. The legislation bans synthetic compounds commonly found in synthetic marijuana ("K2" or "Spice"), synthetic stimulants ("Bath Salts"), and hallucinogens by placing them under Schedule I of the Controlled Substances Act (179).

Additionally, Reisfield and colleagues (180) points out multiple problems with the Federal Drug Testing Programs set up in the 1980s:

- They focused on the most prevalent illegal drugs of the time amphetamines, cocaine, heroin marijuana and PCP with MDMA recently added, and did not consider other illegal drugs and prescription-controlled substances. The problems employers face today are very different. Today impairment due to prescription medication, cannabis and other psychotropic drug use and abuse is an important workplace issue due to diminished safety, productivity, morale and competitiveness.
- The Americans with Disabilities Act (ADA) places limitations on employers who are required to demonstrate impairment. Also a lot of the prescription drugs are not being tested for and also many of psychotropic
drugs. The situation is frustrating to employers who have reported poor performance and impairment and observed accidents and incidents increase and workers’ compensation costs grow as a result of misuse or abuse of prescription controlled substances. Current performance problems must suggest that an employee poses a direct threat to conduce disability-related inquiries or medical examinations according to the U.S. Equal Employment and Opportunity Commission (EEOC).

Additional Laws that Deal with Marijuana

The Americans with Disabilities Act (ADA) requires that employers first make a conditional offer of employment before an employee is subjected to a urine drug test(181). The ADA law protects qualified individuals with a disability from being discriminated against on the basis of past drug-related problems, but the law does allow employers to require that the prospective employee enter a drug rehabilitation program as a condition of employment(181). If the employer suspects the prospective employee of returning to substance abuse, the employer may refuse to extend a job offer(181).

The United States Department of Transportation (DOT) allows for random drug testing for all employees in transportation safety–sensitive positions such as aviation, trucking, railroads, school bus drivers, mass transit, pipelines and others(123). Following the issuance of the Department of Justice (DOJ) guidelines for Federal prosecutors in states that have
enacted laws authorizing the use of “medical marijuana” the DOT issued the following clarification (122):

- *We want to make it perfectly clear that the DOJ guidelines will have no bearing on the Department of Transportation’s regulated drug testing program. We will not change our regulated drug testing program based upon these guidelines to Federal prosecutors.*

- *The Department of Transportation’s Drug and Alcohol Testing Regulation – 49 CFR Part 40, at 40.151€ – does not authorize “medical marijuana” under a state law to be a valid medical explanation for a transportation employee’s positive drug test result.*

A similar clarification was issued following the legalization of marijuana for “recreational” purposes in several states (123).

The Negligence Law creates a legal duty for employers to intervene in situations where safety is an issue. “Legal Use” of a medication does not excuse impairment on the job. An example of this can be found in Arizona, where it is illegal to discriminate, discipline, or refuse to hire an employee because he/she is a medical marijuana user. However, employers can discipline employees who test positive for marijuana, regardless of their medical marijuana status, as long as there is objective evidence that the employee was impaired or possessed marijuana while at work (182).

Private Employers and Public Sector agencies implemented work place substance abuse programs patterned somewhat after the federal programs. In 2002, one-half to two thirds of major businesses had implemented such programs. These programs are variable with concern for the constitutional rights of individuals and include (172):
• Testing of all job applicants,
• Probable cause testing,
• Random testing of all employees,
• Aggressive policy of drug testing, dismissal or prosecution of drug positive workers, and
• Post-accident drug testing(183), which:
  o Sends a strong message to employee,
  o Reduces employer’s liability for drug-related workplace accidents,
  o Reduces an employer’s claims experience and exposure,
  o In some states a positive post/accident drug or alcohol test can lead to denial or reduction of workers’ compensation benefits, and
  o Return to duty and follow up drug testing after previous positive drug test or admission to a substance abuse program.

**Participation in Employee Assistance Programs (EAPs)**

EAP services are available to the majority of employees in the Unites States. 75% of U.S. employers provide EAP services to employees and their families (184). This includes:
- 66% of small companies (1-99 employees)
- 75% of medium-sized companies (100-499)
- 88% of large companies (500 or more)

Furthermore, average utilization rates are as follows:
- 3.5%-5% for face to face counseling
- 1.5%-2.5% for alcohol and other drug (AOD) problems

Data from the National Epidemiologic Survey of Alcohol and Related Conditions (NESARC) on 43,000 adults who sought help for AOD during their lifetime and were asked about their utilization of EAP services. The findings were as follows:
- 7.58% reported using EAP services during their lifetime.
- Among lifetime EAP service users only, 81% sought help for alcohol-related problems and 40% of these individuals sought help for drug related problems.
- EAP services use for both alcohol and drugs was 26% of lifetime EAP service users.
- Between 2001 and 2002 fewer than 2% of help seekers used EAP services for AOD problems.

Despite the wide availability of EAP programs, there are many reasons AOD employees do not use them: lack awareness of the program; stigma of substance abuse; perceived or real costs of substance abuse programs; and zero tolerance programs at the workplace are some examples.
Characteristics of EAP services users include: higher household incomes; slightly older individuals; higher percentage of blacks; and they were more likely to be married. Finally, persons with major mental disorders and drug use disorders were more likely to be help seekers (184).

**Effectiveness of EAP programs**

Data from the Washington State Department of Labor and Industries (1994-2000) based on workers’ compensation claims was used to evaluate the effect of a publicly sponsored drug-free workplace program on reducing the risk of occupational injuries (171). Results included:

- A net reduction in all injuries was observed for three industries, construction, manufacturing, and services with construction showing the strongest evidence of an intervention effect.
- A preventive effect on serious injuries involving lost work time was documented for two industries, construction and service
- The annual risk of any injury was reduced by about three cases per 100 person-years, while the risk of more serious (time loss) injuries was reduced by about one injury per 100 person-years

Factors which influence the potential of drug-free workplace programs to reduce injury risk are the background level of injury risk and the prevalence of substance abuse in the workforce. Additional benefits may include reduced absenteeism and employee turnover and change in workplace culture to promote safety (171).
KEY RECOMMENDATIONS

Research on Marijuana Effects

Existing research has suggested long term effects of marijuana use, including cognitive impairment, changes to brain structure, respiratory problems, and mental health problems. Long-term, heavy use may have an especially large impact on health outcomes, and any use during pregnancy may be dangerous for developing fetuses. For these issues in particular, further research should be done to answer these questions. Broadly,

1) More prospective, longitudinal research is needed, that is, research that examines the consequences of use forward in time rather than exploring associations by looking at past records.

2) Research should examine the impact of marijuana use in combination with other drugs, particularly alcohol.

The above two points of emphasis are highlighted by the NIDA study described above, which will follow 10,000 adolescents for 10 years to examine how marijuana affects the developing brain when used alone or with alcohol and other drugs, as well as the impact of occasional use versus regular use of marijuana, when used alone or in combination with alcohol and/or other drugs.
3) Studies must assess and report marijuana use accurately, comprehensively using measures of frequency, duration, and intensity.

4) Research must adequately control for confounding variables, which are alternative explanations for the outcome of interest. Older research tends to have more of these flaws, while recent studies have become more sophisticated in their design. It is very important that research funds are used to support high quality, well-designed studies of marijuana effects on health and other societal outcomes.

In general, there is so much we still do not know about marijuana and the extent of costs to human health and society. While the application of the precautionary principle is encouraged, other forces at play may result in legalization and a shift toward prevention and risk reduction.

Prevention and Risk Reduction

Given the possibility that marijuana may be legalized for broad medical purposes, which may lead to de facto recreational legalization as it has in other states, in the state of Georgia, there are many recommendations that can be gleaned from the alcohol and tobacco literature (17).

Key objectives for minimizing harms of marijuana through a public health lens include:

(1) Minimizing access, availability, and use by youth,

(2) Minimizing drugged driving,
(3) Minimizing dependence and addiction,

(4) Minimizing consumption of marijuana with unwanted contaminants or uncertain potency, and

(5) Minimizing concurrent use of marijuana and alcohol, particularly in public.

Reducing use, particularly among youth, can be achieved by keeping prices artificially high. Research on tobacco and alcohol have shown that higher excise taxes decrease initiation, amount of smoking, drunk driving, and potentially the health detriments, in the case of alcohol. A state monopoly may be the best way to reduce the potential harms of widespread use, as well as potentially reduce consumption, particularly among young people, via:

- Less competition and limited access,
- Lower convenience for consumers,
- Control of messaging, (i.e. buying from other places will not guarantee quality; warnings can be made),
- Lower density of marijuana retailers and marijuana retail licensees.

The following examples may reduce potential harms of widespread use if they were operationalized at the same time as legalization measures:

- A strong system of licensing for any part of market (i.e., growing, production, processing, wholesale, distribution, or retail) would allow
for careful regulation of the market, product monitoring, and compliance

- Fewer licenses would allow greater oversight.
- A strict regulatory structure around tax collection and enforcement would also de-incentivize black market sales.
- Colorado allows home growing, but this is completely unregulated; citizens do not need a license for it. If marijuana were legalized, we recommend against home growing, due to the potential for bypassing marijuana regulations. Home growing has the potential to increase accessibility to marijuana outside of legal channels, which is especially problematic for youth.

Restricting public consumption may reduce harms associated with use by decreasing normative effect and social acceptability, particularly among youth. Concerns about marketing marijuana to youth must therefore be met with strict oversight of marijuana producers as has been done in the tobacco industry. Furthermore, despite research which suggests that second hand smoke effects for marijuana are less detrimental than for tobacco, indoor air laws to reduce second hand smoke are associated with lower initiation among youth and therefore may be beneficial.

Finally, reducing public use of marijuana and alcohol together would be a beneficial preventive measure both for reducing social acceptability and motor vehicle crashes. Research shows that concurrent use among drivers is
associated with increased crash risk. Concurrent use may be minimized by prohibiting concurrent use of alcohol and marijuana in the same establishment. Furthermore public education campaigns, as described elsewhere, can increase public perception about harms of driving either under the influence of marijuana, or of both marijuana and alcohol.

**Prevention Messaging**

Research shows that earlier initiation of marijuana use is more likely to cause harm; as noted above, dependence and abuse were reported at a much higher rate for persons who began using marijuana before the age of 18. Preventing initiation of marijuana, particularly for youth, should be a point of emphasis. Messaging that targets marijuana in addition to other substance use should be explored.

Increasing perceptions of harm may reduce use:

- There is a lower perceived risk of frequent marijuana use among youth as compared to other substances.
- An increase in risk perception is associated with lower use: young people who perceive marijuana to be more dangerous to their health are less likely to use it than those who consider it to be less dangerous.

Legalization of marijuana will further contribute to lower perceptions of risk relating to marijuana use. Risk perception can be managed by controlling and repealing legalization of the drug. Should that not occur, however,
legalization must be balanced with adequate prevention and safety campaigns to ensure the public’s understanding of the risks people take when using marijuana. We recommend a participatory approach that engages youth or the at-risk population in design of prevention advertising campaigns.

**Threshold for Impairment**

Current evidence shows that it is unclear what level of THC (the main psychoactive ingredient in marijuana) constitutes actual impairment. In fact, current marijuana testing methods are incapable of determining impairment or current drug-use; they are only able to determine that a certain amount of THC metabolites are present in the specimen being tested. In addition, evidence shows that the period of time in which a marijuana user experiences acute psychoactive effects varies depending on individual factors such as smoking frequency. However, THC may remain in a smoker’s system for several weeks after use. This creates a dilemma for policymakers in states which have implemented THC limits for driving under the influence of THC. The problem lies in the fact that setting a legal limit implies that those above the limit are impaired, when this may not be the case. This puts legal frequent marijuana users in particular, at risk for possible wrongful accusations of impairment, as they are likely to have a sustained, elevated level of THC metabolites in their systems regardless of actual impairment.
We recommend that policymakers identify a chemical test with a high sensitivity for detecting levels of delta-9 THC (the psychoactive ingredient) in a person’s system. Evidence shows that being able to detect this specific metabolite of marijuana will provide a more accurate determination of whether or not a marijuana user is impaired. This type of test may also be helpful in distinguishing between habitual and casual users.

Given the lack of sensitivity to delta-9 THC of current testing methods that are available, policymakers may want to consider developing behavioral testing as a means of determining marijuana impairment. Behavioral testing may be useful as a means of identifying marijuana impairment, until a more accurate chemical test is developed, because:

1) It would help identify those who are impaired regardless of frequency of marijuana use (regular vs. infrequent users). Zero tolerance laws may negatively impact legal/medical marijuana users. A further complicating factor is that the state of Georgia currently only measures the THC concentration in blood, and not in urine, oral fluids, or breath. Furthermore Georgia does not have the capacity to measure the percentage of THC content or CBD content in the recently legalized THC oil. CBD in equal or greater proportion to THC, a ratio mandated by HB 1, is assumed by some Georgia policy makers to negate or at least largely mitigate the psychoactive effects of THC, but this has not been proven by medical research.
2) Behavioral testing may be helpful in focusing on the identification of behaviors that are indicative of impairment and, create an unsafe environment for driving or the workplace, rather than solely focusing on levels of THC in the body.

Behavioral testing is currently being implemented through the use of Drug Recognition Experts (DRE), however, more are needed. These are individuals who are trained extensively to be able to systematically identify people who are under the influence of drugs, using observable signs and symptoms that are reliable indicators of drug impairment. Should behavioral testing be used, there will need to be more widespread education and training programs on recognizing impairment behaviors, especially for law enforcement officials and workplaces.

Due to the inability of current marijuana tests to accurately identify impairment, the limits set by marijuana-legal states for driving under the influence are quite arbitrary. Unfortunately, states that legalize marijuana in the future are likely to implement policies which are similar to those of states which legalized marijuana before them, even if there is no true basis for the limits which have been set. If a limit is set with no scientific basis behind it, it could, in essence, legalize impaired driving due to marijuana intoxication because the limit is set too high. Furthermore, as stated earlier, in Georgia there is the added complication of law enforcement only measuring the percentage of marijuana content in blood. When considering
marijuana legalization, policymakers must proceed with caution, and be careful to consider the ramifications of the legislation that is put in place.

**Workplace Policy**

Employers have the right establish their own drug policies, and are entitled to maintain drug-free policies and test employees for marijuana, in accordance with the Controlled Substances Act, regardless of whether marijuana use is legalized within the state. This has created inconsistencies between federal and state law that could create legal complications for both employers and employees, as shown in the example of the Coats vs. Dish Network Colorado Supreme Court Case. Given the challenges of complying with state and federal law, and ensuring workplace safety, the Society for Human Resources Management recommends the following (22):

- Ensure workplace policies are consistent with your state’s laws on discrimination against marijuana users.
- Maintain compliance with federal regulations.
- Confirm that drug-use and drug-testing policies clearly articulate your expectations regarding drug testing, marijuana impairment, and marijuana use outside of work hours.
- Be prepared to consistently enforce your policies.
- Clearly communicate your policies and expectations to all employees.
• Train managers about maintaining confidentiality regarding drug-test results and accommodations for those who have obtained medical marijuana recommendations.

• Companies must consider potential increased cost associated with legal counsel or other professionals making sure they have a legally sound policy for each state in which they operate. They must clearly define marijuana especially if a person may live in one state but work in a neighboring state.

• Employers choosing to enforce a zero-tolerance drug policy must also address the following:
  o Legal recreational marijuana use by employees,
  o Whether to refer to federal law to justify a drug-free workplace policy, or whether your organization is required to comply with federal regulations

Ideally, marijuana training should be provided to both HR and personnel which includes medical and recreational coverage along with policy awareness. Employee education should also be implemented, including information about mixing marijuana with other drugs, driving under influence, operating equipment, as well as explanation of company drug policies. This should be mandatory for all employers in the state of Georgia if marijuana is legalized, and should be in addition to existing workplace drug policies. A helpline for Georgia employers should also be established that
employers can use to find information about workplace drug policies, and training employees about these policies.

**Education and Training Needs**

As marijuana use is legalized in a growing number of states, there is a significant need for education and training to inform various stakeholders about the consequences of legalization. Education is needed to inform parents, youth, educators, health care workers and the general population of Georgia about the problems associated with marijuana abuse. Employers also need to be educated about how marijuana use among employees may have a detrimental effect on workplace safety, as well as the legal ramifications of workplace drug policies. It is important for policymakers to be aware of current research evidence related to marijuana use and abuse in order to make informed decisions about the development and implementation of marijuana regulations. Additionally, they will need to be able to determine how state marijuana policies should be interpreted in conjunction with federal marijuana policies.

Another important consideration is the education of clinicians, who will need to be trained on whether it is appropriate to recommend medical marijuana (including information on the health risks associated with marijuana use, the risks of recommending a substance that has not been approved by the FDA, and whether it is sound medical practice to do so), as
well as how to monitor use of medical marijuana among patients. Law enforcement officials will need training on the intricacies of marijuana regulations, as well as how to accurately identify those who violate the law using the best evidence available through current marijuana testing methods. Finally, those who cultivate, deliver and sell marijuana in states where it is legalized will require training in responsible marijuana sales and service practices.

Conclusions

Currently, research and current knowledge about the impacts of marijuana on individual and public health is incomplete. Although we ascribe to a public health precautionary approach, the current landscape suggests recreational legalization is likely to occur in many other states than Colorado and Washington, Alaska, and Oregon. Such legalization would present considerable challenges for regulation. From a legal standpoint, differences between federal and state law will continue to be problematic. Where legalization does occur, we advise that careful consideration is made prior to medical or recreational legalization, rather than after, to operationalize any associated aspects of marijuana regulation. Furthermore, prevention and risk reduction should be considered equally with regulation of the marijuana market. Failure to appropriately regulate marijuana use could cause a large increase in misuse and consequent health and social harms.
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