

Review of the public health risks of widespread cannabis use

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ABSTRACT

This article is a review of the public health risks of widespread cannabis use based on a recent review of the literature. The purpose of this article is to help physicians better educate the public about the dangers of widespread cannabis products.

INTRODUCTION

Whatever your opinion is about the legalization of cannabis and practices of medical marijuana providers, there is no disputing that cannabis is not a harmless substance for everyone, and can lead to severe health consequences. The purpose of this article is to help doctors better educate the public about the dangers of widespread, untargeted cannabis products.

Doctors are trained to think in terms of health risks and benefits. The following is a review of the public health risks of widespread cannabis use:

1. Legalizing cannabis has been shown to increase the rates of motor vehicle accidents.

It is difficult to determine exactly how large of an impact drivers under the influence of cannabis have on the rate of motor vehicle accidents. There is no routine test that can be administered on the roadside for cannabis, such as the breathalyzer test for alcohol. However, one study showed that the rate of fatally injured drivers in the U.S. who tested positive for cannabis tripled from 1999 to 2010.¹ The study was based on six states, none of which are the two states that legalized cannabis.

A recent Canadian study found 11-12% of drivers admitted to emergency rooms in various provinces had used cannabis prior to driving based on blood samples.² The authors of this study derived a relative risk of greater than four based on these findings (95 % CI: 1.98–8.52).² Canadian data collected in 2004 indicated that 4% of Canadian adults have driven automobiles within one hour of consuming cannabis, an increase from 1.9% in 1996–1997.³ This study was a meta-analysis of observational studies investigating the association of cannabis consumption and motor vehicle accidents. The authors of this study note that surveys of young drivers in some jurisdictions show the rates of

driving under the influence of cannabis surpasses the rate of driving under the influence of alcohol. When alcohol is combined with cannabis, the effect is stronger than either drug alone.¹

Cannabis was legalized in Washington state in 2012.⁴ A study that looked at the percentage of drivers who tested positive for cannabis in Washington before legalization compared to after legalization found that an average of 19.1% of drivers tested positive for active THC from 2009–2012 (before legalization) compared to 24.9% of drivers who tested positive for active THC in 2013 (after legalization).⁴ The inclusion criteria for case selection of this study was blood toxicology results from all suspected impaired driving cases submitted by law enforcement officers in Washington state between the four years leading up to legalization (2009–2012) and 2013 (the year following legalization).⁴

The proportion of drivers in Colorado in a fatal motor vehicle crash who were marijuana-positive was 4.5% in the first six months of 1994, 5.9% in the first six months of 2009, and 10% at the end of 2011.⁵ There was a positive trend during the post-commercial marijuana period, after adjusting for the proportion of male drivers, the proportion of drivers 21–24 years old, and the proportion of drivers tested for drugs.⁵ In comparison, the proportion of drivers in the 34 non-medical marijuana states involved in a fatal motor vehicle crash who were marijuana-positive was 1.1% in the first six months of 1994, 4.2% in the first six months of 2009, and 4.1% at the end of 2011.⁵

Although Colorado passed medical marijuana laws in 2000, the medical marijuana industry became commercialized and began to grow rapidly in 2009 after the U.S. Department of Justice announced that it would not prosecute “individuals whose actions are in clear and unambiguous compliance with existing state laws providing for the medical use of marijuana.”⁶ The number of medical marijuana cardholders in Colorado increased from 4,800 in 2008 to 41,000 in 2009. By 2012, there were 532 licensed dispensaries in Colorado and over 108,000 registered patients.⁷

2. Cannabis use is a risk factor for mental illness.

Although most people who smoke cannabis don't become psychotic, there is evidence of a genetic link for those individuals who do become psychotic from smoking cannabis. For example, people with specific genotype polymorphisms

of the COMT gene (encoding one of the enzymes responsible for the metabolism of dopamine) and adolescent cannabis use were at increased risk for schizophreniform disorder.⁸

In a case control study, the odds ratio of being diagnosed with a psychotic disorder was 5.4 (95% CI 2.80–11.30, $p=0.002$) for those patients that used high potency “skunk” cannabis every day.⁹ This OR represents 103 patients (25%) who used skunk cannabis every day out of 410 total patients with first episode psychosis.⁹ In a longitudinal study looking at adolescent boys, investigators found a cumulative effect of weekly cannabis use on subclinical psychotic symptoms.¹⁰ This effect remained after adjusting for covariates. For each additional year adolescent boys engaged in weekly cannabis use, their expected number of subsequent psychotic symptoms rose by 21%.¹⁰ For each additional year adolescent boys engaged in weekly cannabis use, the predicted odds of experiencing subsequent paranoia rose by 133% and the odds of experiencing future hallucinations rose by 92%.¹⁰

The authors point out that by showing a positive association between individual cannabis use and subclinical psychotic symptoms over time, all pre-existing covariates that are time-stable are eliminated, thus dismantling the argument that psychosis in individuals who use cannabis is due to individual pre-existing differences. In other words, the longer the individuals in this study engaged in weekly cannabis use, the higher the likelihood that these individuals would develop psychotic symptoms.

In human laboratory studies, cannabis extracts including $\Delta 9$ -tetrahydrocannabinol (THC) produce a host of transient positive symptoms including paranoid delusions, grandiose delusions, suspiciousness, conceptual disorganization, and fragmented thinking.¹¹ THC has also been shown in human laboratory studies to produce negative symptoms, such as blunted affect, emotional withdrawal, psychomotor retardation, lack of spontaneity, and reduced rapport.¹¹ Without proving a causal link, it has been noted that cannabis use is associated with more time in affective episodes and higher rates of rapid cycling in bipolar disorder.¹² Cannabidiol (CBD), on the other hand, lowers some of the THC-induced psychotic symptoms such as paranoia, THC-induced anxiety, and THC-induced verbal memory impairment.¹¹ CBD is the second most prominent cannabinoid in the cannabis plant and has drawn attention because of its potential antipsychotic effects.¹¹

3. Inhaled Cannabis use is a risk factor for respiratory infections.

Cannabis smoke can lead to loss of ciliated cells and hyperplasia of mucus-secreting goblet cells in the lung epithelium.¹³ These cellular changes cause reduced clearance of the respiratory tract and subsequent mucus accumulation with bacterial colonization.¹³ THC can affect the bactericidal and fungicidal activity of the alveolar macrophages as well, thus increasing the risk of respiratory infection.¹³

Marijuana contaminated with *Aspergillus fumigatus* and Gram-negative bacteria, has also been found.¹³

4. Cannabis use increases the rate of vascular disease.

Cannabis is the third most often identified drug of abuse involved in ischemic stroke, after tobacco and cocaine.¹⁴ An analysis of stroke in cannabis users was performed in Australia using survey data from a longitudinal cohort study.¹⁵ This analysis demonstrated that persons who used cannabis in the past year had 2.3 times the risk of stroke/transient ischemic attack (TIA) compared to persons who had not used cannabis in the past year (after adjusting for demographics, tobacco smoking, hypertension, heart problems, and diabetes).¹⁵ This study also found that using cannabis less than weekly during the past year was not associated with a significant increased risk of stroke/TIA, while using cannabis weekly or more frequently was associated with a adjusted IRR of 4.7 (95% CI 2.1–10.7, $p<0.001$) increase in the risk of stroke/TIA.¹⁵

Another study that looked at aneurysmal subarachnoid hemorrhages (aSAH) amongst cannabis users versus non-users in northern Manhattan found that the incidence of aneurysmal subarachnoid hemorrhages in the cannabis use cohort ages 25-34 was greater than two times that of the non-cannabis use cohort.¹⁶ This includes an incidence of hospitalizations for aSAH of 65.61 per 100,000 in cannabis users (ICD-9-CM codes 304.30 (cannabis dependence, unspecified), 304.31 (cannabis dependence, continuous), 304.32 (cannabis dependence, episodic), 305.20 (nondependent cannabis use, unspecified), 305.21 (nondependent cannabis use, continuous), and 305.22 (nondependent cannabis abuse, episodic) vs. an incidence of 30.78 of aSAH per 100,000 in non-cannabis users.¹⁶

The authors of another study that looked at hospitalized patients concluded that recreational cannabis use was associated with an odds ratio of 1.17 (95% CI: 1.15–1.20) of being hospitalized for an acute ischemic stroke.¹⁷ In contrast, there was an associated odds ratio of 1.76 (95% CI: 1.74–1.77) of being hospitalized for an acute ischemic stroke for tobacco users.¹⁷ The authors report that the mechanism behind cannabis-induced acute ischemic stroke is not fully understood. For example, there is evidence that cannabis has both vasodilatory and vasoconstrictive cerebrovascular effects.¹⁷

5. Cannabis use during pregnancy has been associated with increased risk of adverse birth outcomes.

THC crosses the placenta from mother to fetus, however, at much lower levels than the mother's serum levels.¹⁸ One Australian study that based its finding on the self report of birthing mothers found that women who use cannabis during their pregnancy have an increased rate of preterm labor (aOR 1.5, 95%CI 1.1–1.9; $P < .01$), delivering babies with low birth weight (aOR 1.7, 95% CI 1.3–2.2; $P < .001$) and with higher admissions to the neonatal intensive care unit (aOR 2.0, 95%CI 1.7–2.4; $P < .001$).¹⁹

Another study found that cannabis use (without concurrent tobacco use) was not associated with a significant difference in head circumference <25th percentile (aOR, 1.093; 95% CI, 0.613-1.949; $P = .763$) or birthweight <25th percentile (aOR, 1.442; 95% CI, 0.821-2.531; $P = .202$).¹⁸ Note the large P values with these associations.

6. Legalization of cannabis has been shown to increase cannabis exposure in the pediatric population.

In states that have decriminalized cannabis, the rate of calls to the poison control center involving cannabis exposure to young children increased by 30.3% calls per year from 2005 to 2011.²⁰ Comparatively, there was no increase in the call rate in states in which cannabis is not legal during the same time period.²⁰

In Colorado, the annual number of cannabis exposure cases for children younger than ten-years-old reported to the regional poison center (RPC) increased more than five-fold, from 9 in 2009 to 47 in 2015.²¹ During this period, Colorado had a 34% mean increase in RPC cannabis exposure cases per year (95% CI, 22%-47%; $P < .001$), while the remainder of the United States had an average increase in the annual case incidence of 19% (95% CI, 12%-27%, $P < .001$).²¹ This difference in Colorado annual case incidence versus the remainder of the United States from 2009 to 2015 had a P value of 0.04. 52% of the exposures in this pediatric population were due to edible products (51 of the 99 exposure cases).²¹ Known marijuana products involved in the exposure included infused edible products (48%): seventeen baked goods (cookies, brownies, and cake), ten candies, and two popcorn products.²¹

In January of 2014 recreational marijuana became legal in Colorado.²² The number of cannabis exposure calls for children nine-years-old and younger made to the Colorado Regional Poison Center per 100,000 population increased 135.6% (95% CI, 60.4-246.1, $P < .001$) from the two years prior to legalization (2012-2013) to the two years after legalization (2014-2015).²¹

7. Heavy cannabis use is associated with diminished lifetime achievements.

The percent of THC in cannabis has increased steadily, from 3% in the 1980s to 12% in 2012.²³ The CBD content has decreased on average from approximately 0.28% in 2001 to < 0.15% in 2014, resulting in a change in the ratio of THC to CBD from fourteen times in 1995 to ~80 times in 2014.²⁴ In Colorado, the percentage of THC in marijuana available for sale ranges between 19% and 30%, compared with the 3% to 6% of THC in marijuana available for research by the National Institutes of Health.²¹

Heavy cannabis use is associated with impairments in memory and attention that persist and worsen with increasing years of regular use, impaired school performance, increased risk of dropping out of school, lower income, and

greater need for socioeconomic assistance, unemployment, criminal behavior, and lower satisfaction with life.²³ Not surprisingly, adolescents who perceive a low risk to using cannabis have a higher rate of using cannabis.²³

According to 2014 statistics, the prevalence of students who used cannabis daily in the United States was 1% among eighth graders, 3.4% among tenth graders, and 5.8% among twelfth graders.²⁵ In comparison, when the study that monitored these statistics commenced in 1991, the prevalence rates of daily users were 0.2% among eighth graders, 0.8% among tenth graders, and 2% among twelfth graders.²⁵

CONCLUSION

Doctors must educate the public about the potential harm cannabis causes with heavy, and possibly moderate, widespread use just as they do about the dangers of tobacco use. Tobacco use has declined in the United States in large part because of the knowledge the public now holds about its adverse effects, as opposed to legislative action.

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