

## **INFORMATIONAL TESTIMONY**

**Bill No.:** HB0032

**Bill Title:** Cannabis - Legalization and Regulation (Inclusion, Restoration, and Rehabilitation Act of 2021)

**Bill Sponsor:** Delegate Lewis, J.

**Christopher J. Hammond MD PhD**  
Director of Co-occurring Disorders in Adolescents and Young Adults (CODA) Clinical and Research Programs and Assistant Professor of Psychiatry & Child Psychiatry at Johns Hopkins University School of Medicine

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Dear Chair and Members of the House Judiciary Committee,

My name is Christopher Hammond. I am an MD PhD physician scientist with training in child & adolescent psychiatry and addiction medicine with over 10 years of clinical and research experience working with children and families impacted by substance use and mental health disorders. At Johns Hopkins, I direct clinical and research programs and an educational initiative focused on prevention and early-intervention for substance use and co-occurring mental health disorders in young people. Much of my research focuses on adolescent cannabis use and on the impact of cannabis use during adolescence on brain development and health outcomes. In my clinic, I work directly with youth and families that have been impacted by changing marijuana legislation.

I am here today to provide unbiased scientific background and answer questions about the risks related to cannabis use and effects of cannabis legislation on health outcomes in young people and people with mental health problems as part of an informational testimony related to HB 0032, a bill supporting Cannabis Legalization in the State of Maryland. I feel strongly that this and future cannabis legislation should be evidence-informed and that our state legislators should rely on sound empirical data to guide their legislative decisions. Relating this to HB0032, I feel that it is important for the state legislators to know the current state of the data on risks for harm related to cannabis use among young people and people with mental illnesses and the data on changing perceptions and patterns of cannabis use in relation to marijuana legislation.

### Current scientific evidence shows that:

- Over the past 20 years, in context of expansive state-level marijuana legislation, perceptions about cannabis and cannabis use patterns among adolescents and adults throughout the U.S. have changed.<sup>1,2</sup>
- Cannabis remains the most commonly used drug by U.S. adolescents and is the main drug for which U.S. youth present for substance use treatment.<sup>3,4</sup>
- Adolescent cannabis use is associated with immediate and possibly long-term impairments in cognition, worse academic and vocational outcomes, and increased prevalence of psychotic, mood, and addictive disorders and suicidal thoughts and behaviors.<sup>1,5-9</sup>
- Odds of having adverse developmental outcomes (across many outcome types) are increased in youth who start using cannabis at an earlier age and who engage in

persistent/chronic use, high frequency use, and high potency  $\Delta$ -9-tetrahydrocannabinol (THC) cannabis use.<sup>1,10-12</sup> These findings suggest dose-dependent effects.

- Legalization of cannabis for recreational purposes has been shown to increase rates of cannabis use among young people.<sup>13-15</sup>
- Legalization of cannabis has been shown to increase availability and access to high THC potency cannabis products by American youth.<sup>16-18</sup>
- Legalization of cannabis has been shown to increase use of different cannabis products (e.g. smoking plant, vaping, dabbing/concentrates, edibles) by American youth.<sup>16-18</sup>
- Legalization of cannabis has been associated with higher rates of motor vehicle crashes secondary to cannabis in young people, more accidental overdoses of cannabis by young children and pets, and increased emergency department visits and hospitalizations as a result of high potency cannabis use leading to psychosis and severe mood/anxiety reactions.<sup>19-21</sup>
- Young people and individuals with mental health problems are vulnerable populations that are at elevated risk for having adverse health and functional outcomes related to their use of cannabis.<sup>1,22</sup>
- Not all cannabis legislation is the same. In addition to the decision about whether or not to vote for cannabis legislation, specific provisions in cannabis legislation may increase or decrease the risk for negative population health outcomes.<sup>23</sup>

This and other scientific evidence should be considered by Maryland legislators when deciding how to amend and vote on HB0032. I very much appreciate the Chair and Committee for giving me the opportunity to educate you about the current state of the scientific evidence in this field and would be happy to provide additional information and guidance as it relates to HB0032 and other cannabis-related legislation at your request.

Thank you.



**Christopher Hammond, M.D., Ph.D.**

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## Background research and publications from my lab related to cannabis use among young people


INTERNATIONAL REVIEW OF PSYCHIATRY  
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REVIEW ARTICLE



### Cannabis use among U.S. adolescents in the era of marijuana legalization: a review of changing use patterns, comorbidity, and health correlates

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#### ABSTRACT

Decriminalization, medicalization, and legalization of cannabis use by a majority of U.S. states over the past 25 years have dramatically shifted societal perceptions and use patterns among Americans. How marijuana policy changes have affected population-wide health of U.S. youth and what the downstream public health implications of marijuana legalization are topics of significant debate. Cannabis remains the most commonly used federally illicit psychoactive drug by U.S. adolescents and is the main drug for which U.S. youth present for substance use treatment. Converging evidence indicates that adolescent-onset cannabis exposure is associated with short- and possibly long-term impairments in cognition, worse academic/vocational outcomes, and increased prevalence of psychotic, mood, and addictive disorders. Odds of negative developmental outcomes are increased in youth with early-onset, persistent, high frequency, and high-potency  $\Delta$ -9-THC cannabis use, suggesting dose-dependent relationships. Cannabis use disorders are treatable conditions with clear childhood antecedents that respond to targeted prevention and early intervention strategies. This review indicates that marijuana policy changes have had mixed effects on U.S. adolescent health including potential benefits from decriminalization and negative health outcomes evidenced by increases in cannabis-related motor vehicle accidents, emergency department visits, and hospitalizations. Federal and state legislatures should apply a *public health framework* and consider the possible downstream effects of marijuana policy change on paediatric health.

#### ARTICLE HISTORY

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#### KEYWORDS

Adolescents; cannabis; marijuana; legalization; psychiatric comorbidity; health correlates

# Psychiatric Times

# Adolescent Marijuana Use and Vulnerability for Neuropsychiatric Disorders

December 4, 2014

Christopher J. Hammond, MD

Christopher J. Hammond, MD

Conferences | **AAAP**

*An overview of some of the recent scientific data examining the relationship between adolescent marijuana use and later onset of neuropsychiatric disorders.*

## **CONFERENCE COVERAGE**

In context of the evolving legal regulations on the medical and recreational use of marijuana, there has been an increase in marijuana use and marijuana-related disorders in the US, especially among adolescents, where daily use is at a 30-year high among US high school seniors.<sup>1</sup> Because adolescence represents a period of significant neurodevelopment, the effects of marijuana use during adolescence and possible short- and long-term consequences are a growing concern. Here we discuss some of the recent scientific data examining the relationship between adolescent marijuana use and later onset of neuropsychiatric disorders.

Converging scientific evidence from preclinical studies, human neuroimaging, and large longitudinal studies suggests that adolescent-onset marijuana use, particularly heavy marijuana use, is associated with a number of neuropsychiatric sequelae including neurocognitive deficits and reductions in IQ, increased risk for psychosis, affective disorders, marijuana and non-marijuana drug addiction, and lower academic attainment.<sup>2</sup> Is a relationship between adolescent marijuana use and neuropsychiatric disorders biologically plausible?

In the human brain, cannabinoid 1 receptors, the receptors which marijuana's biochemical components act on to cause its psychoactive effect, are expressed widely with the highest density of receptors found in the striatum, amygdala, hippocampus, hypothalamus, and cerebellum—all brain regions that are implicated in marijuana addiction and other neuropsychiatric disorders. Neuroimaging studies of adolescent marijuana users have found structural and functional differences in some of these brain regions when compared to matched controls.<sup>3</sup>

Preclinical studies have shown that when rodents are exposed to cannabinoid compounds during adolescence, brain and behavioral changes are observed.<sup>4</sup> The animals show signs of being more anxious and depressed in animal behavioral stress tests compared to non-exposed

rodents, and their brains show altered maturation of the prefrontal cortex and subcortical structures, as well as altered connections between those structures. The brains of adolescent cannabis-exposed rodents also show changes in a number of different neurotransmitters (eg, dopamine, glutamate, GABA) and the stress-response system (ie, hypothalamic-pituitary-adrenal gland [HPA] axis). Interestingly, many of these brain and behavior changes do not develop when chronic cannabinoids are administered to older (adult) animals, suggesting an age-dependent vulnerability to adverse effects of marijuana which may be specific to childhood and adolescence.

Perhaps the strongest evidence that links adolescent marijuana use to neuropsychiatric disorders comes from a series of large longitudinal studies, many of which were done in Australia and New Zealand.<sup>5,6</sup> These studies have followed children from birth through young adulthood (some for up to 30 years) and many have attempted to control for a number of confounding variables, allowing for the isolation of the effects of marijuana on specific neuropsychiatric outcomes.

While these studies have consistently shown a dose-response relationship between adolescent marijuana use and increased vulnerability to developing neuropsychiatric disorders, the results are less consistent after controlling for confounding variables, such as childhood adversity and shared risk genes, suggesting that at least some of the risk may be related to common factors.

To better answer questions about the impact of marijuana on neurodevelopment, data from these large cohort studies have recently been pooled for systematic reviews and integrative analyses.<sup>5,6</sup> Moore and colleagues<sup>5</sup> completed a systematic review that includes 35 studies to examine if marijuana use was associated with psychotic or affective outcomes (both symptoms and disorders), beyond transient intoxication.<sup>5</sup>

The researchers found that there was an increased risk for psychotic outcomes in individuals who had ever smoked marijuana (1.5 times more likely to develop psychosis) (adjusted odds ratio [OR] = 1.41, 95%CI = 1.54-2.84) with a dose-response such that heavy marijuana use and earlier age of onset were associated with increased risk. While the data was less consistent for affective disorders, there was also association between heavy marijuana use and an increased risk for depression (adjusted OR = 1.49, 95%CI = 1.15-1.94).

An integrative participant-level analysis was recently completed using pooled data from three large longitudinal studies which included 3765 subjects.<sup>6</sup> Silins and colleagues<sup>6</sup> looked at the maximum frequency of teenage marijuana use (age < 17) and a number of developmental outcomes in young adulthood. They found a dose-response relationship between adolescent marijuana use and a number of adverse outcomes in young adulthood with the heaviest marijuana users (daily use) experiencing the most neuropsychiatric sequelae as young adults.

After controlling for covariates, adolescent daily marijuana users were 18 times more likely to develop a marijuana use disorder (adjusted OR = 17.95, 95%CI = 9.44-34.12); 8 times more

likely to use other illicit drugs (adjusted OR = 7.80, 95%CI=4.46-14.63); and 7 times more likely to attempt suicide (adjusted OR = 6.83, 95%CI = 2.04-22.90) in young adulthood. They were also significantly less likely to graduate high school and achieved lower academic attainment.

These findings linking adolescent-onset marijuana use to neuropsychiatric outcomes in young adulthood, and bridging preclinical, clinical translational, and prospective longitudinal methodologies, underscore the need for increased research in this area and the importance of psychiatrists to help patients with the following:

1. educate youths and their parents about the harms of marijuana
2. screen and provide early treatment to high-risk adolescents
3. increase advocacy
4. involve the scientific community in marijuana-related policy decisions

*Dr Hammond will present evidence examining links between cannabis use and mood disorders and anxiety disorders at the 25th Annual Meeting and Symposium of the American Academy of Addiction Psychiatry, in a symposium titled "What is the Evidence of Harm to Adolescents Using Cannabis?"*

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## Journal of Substance Abuse Treatment

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# Temporal dynamics of the relationship between change in depressive symptoms and cannabis use in adolescents receiving psychosocial treatment for cannabis use disorder



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### ARTICLE INFO

#### Keywords:

Cannabis use disorder

Adolescent

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Psychosocial treatment

### ABSTRACT

**Aims:** Cannabis use disorder (CUD) and depression frequently co-occur in youth. How depressive symptoms change over the course of CUD treatment and how they impact substance use treatment outcomes is unknown. In the current study, we examine the temporal relationships between cannabis use and depression in adolescents receiving evidence-based treatments for CUD as part of a multisite clinical trial.

**Design:** Six hundred adolescents (age 12–18) with a CUD were randomly assigned to substance use treatment from one of five evidence-based psychosocial interventions. We assessed self-reported cannabis use frequency and depressive symptoms at baseline (BL) and again at 3-, 6-, 9, and 12-months. A bivariate latent change model assessed bidirectional effects of baseline levels and time-lagged changes in depressive symptoms and cannabis use on depression and cannabis use outcomes.

**Findings:** Depressive symptoms (72%) and major depressive disorder (MDD) (18%) were common at BL. Both depression and cannabis use decreased over time and change in cannabis use was significantly associated with change in depressive symptoms ( $b = 1.22$ ,  $p = .003$ ). Time-lag analyses showed that within-subject change in depression (from one time point to the next) was predicted by previous depression ( $b = -0.71$ ,  $p < .001$ ) but not cannabis use ( $p = .068$ ), and change (decrease) in cannabis use was predicted by previous (greater) depressive symptoms ( $b = -1.47$ ,  $p < .001$ ) but not cannabis use ( $p = .158$ ), respectively.

**Conclusion:** These findings indicate an enduring relationship between decreasing cannabis use and decreasing depression among adolescents lasting for 9-months after receiving psychosocial interventions for CUD. The presence of depressive symptoms did not appear to interfere with substance use treatment or attenuate improvements in cannabis use frequency. A decrease in cannabis use was not contingent upon a reduction in depressive symptoms. These findings are limited by the possibility of regression to the mean for both cannabis use and depressive symptoms, and the lack of a nonintervention control group.



## An exploratory examination of marijuana use, problem-gambling severity, and health correlates among adolescents

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**Background and aims:** Gambling is common in adolescents and at-risk and problem/pathological gambling (ARPG) is associated with adverse measures of health and functioning in this population. Although ARPG commonly co-occurs with marijuana use, little is known how marijuana use influences the relationship between problem-gambling severity and health- and gambling-related measures. **Methods:** Survey data from 2,252 Connecticut high school students were analyzed using chi-square and logistic regression analyses. **Results:** ARPG was found more frequently in adolescents with lifetime marijuana use than in adolescents denying marijuana use. Marijuana use was associated with more severe and a higher frequency of gambling-related behaviors and different motivations for gambling. Multiple health/functioning impairments were differentially associated with problem-gambling severity amongst adolescents with and without marijuana use. Significant marijuana-use-by-problem-gambling-severity-group interactions were observed for low-average grades (OR = 0.39, 95% CI = [0.20, 0.77]), cigarette smoking (OR = 0.38, 95% CI = [0.17, 0.83]), current alcohol use (OR = 0.36, 95% CI = [0.14, 0.91]), and gambling with friends (OR = 0.47, 95% CI = [0.28, 0.77]). In all cases, weaker associations between problem-gambling severity and health/functioning correlates were observed in the marijuana-use group as compared to the marijuana-non-use group. **Conclusions:** Some academic, substance use, and social factors related to problem-gambling severity may be partially accounted for by a relationship with marijuana use. Identifying specific factors that underlie the relationships between specific attitudes and behaviors with gambling problems and marijuana use may help improve intervention strategies.

**Keywords:** marijuana, gambling, at-risk/problem gambling, adolescence, risk behaviors

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# Treatment



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**Pharmacotherapy for Substance Use Disorders in Youths**  
Christopher J. Hammond, M.D.\* and Kevin M. Gray, M.D.



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**Temporal dynamics of the relationship between change in depressive symptoms and cannabis use in adolescents receiving psychosocial treatment for cannabis use disorder**

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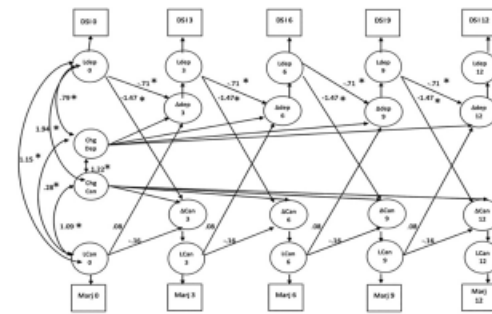
# Psychiatric Times

**8 Core Principles When Treating Addiction in Adolescents**  
Jul 07, 2017

Christopher J. Hammond, MD, PhD

Pravesh Sharma, MD

<http://www.psychiatrictimes.com/child-adolescent-psychiatry/8-core-principles-when-treating-addiction-adolescents>



# Neurobiology



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**Structural and Functional Neural Targets of Addiction Treatment in Adolescents and Young Adults: A Systematic Review and Meta-Analysis**

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**Neurobiology of Adolescent Substance Use and Addictive Behaviors: Prevention and Treatment Implications**

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PMCID: PMC4446977; PMID: [25022184](https://pubmed.ncbi.nlm.nih.gov/25022184/)

