INFORMATIONAL TESTIMONY
Bill No.: Senate Bill 708 (SB0708)
Bill Title: Cannabis - Legalization and Regulation
Bill Sponsor: Senators Feldman, Ferguson, Guzzone, King, Smith, Waldstreicher, & Washington

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

Dear Chair and Members of the Maryland Senate Finance 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, research, and educational programs 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 cannabis 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 Senate Bill 708 (SB0708), a bill supporting Cannabis Legalization in the State of Maryland. I feel strongly that this and future cannabis legislation in Maryland should be evidence-informed, apply a public health framework, and that our state legislators should rely on sound empirical data to guide their policy choices. Of relevance to SB0708, current scientific evidence supports the following four points:

- **Cannabis use is common among American youth**
    - Cannabis is the most commonly used drug by American youth, and cannabis use disorder is the main drug problem that teens receive substance use treatment for in the U.S.[1-3]
- **Cannabis use by young people is associated with adverse health outcomes**
    - 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.[4-8]
    - Odds of having adverse health outcomes (across outcome types) are increased in youth who start using cannabis at an earlier age and who engage in regular heavy use, and high potency Δ-9-tetrahydrocannabinol (THC) cannabis use. [9-11]
    - Depressive, anxiety, and psychotic symptoms, cognitive and memory impairments, legal problems, and rates of school-related absences and failure all DECREASE following cessation or reduction of cannabis use by young people.[12-16]
- **Legalization of cannabis increases the risk for adverse health outcomes in American youth**

- Cannabis legalization for recreational purposes is associated with increase rates of cannabis use by American adolescents and young adults.[17-20]

- Cannabis legalization is associated with increased availability of, access to, and use of high THC potency cannabis products (e.g. dabbing/concentrates) by American youth.[21-23]

- Cannabis legalization is associated with increased rates of cannabis-related motor vehicle crashes and *costly* emergency department visits and hospitalizations as a result of high potency cannabis use by young people.[24-27]

- Societal perceptions that cannabis use is harmful have decreased dramatically among American youth and their parents increasing the likelihood of future youth cannabis use.[1]

- **More research is needed to understand the risks of legalization and how to mitigate them**

  - Not all cannabis policies are the same.[26,27]

  - Specific policy strategies may increase or decrease the likelihood of youth cannabis use and risk for adverse health outcomes in young people.[27-31]

    - Capping the THC potency of cannabis products
    - Pricing/taxation policies that promote public health
    - Use of warning labels, clear labeling, and childproof packaging
    - Restricting marketing/advertising and minimizing youth advertisement exposure
    - Reduced purchase quantity limits
    - Location restrictions prohibiting sale near places frequented by youth
    - Enhanced regulatory monitoring and enforcement practices

  - These policies could mitigate some of the risks for negative health outcomes for youth, but more research is needed before they are considered evidence-based risk mitigation policies.

  - Research is being conducted *right now* that will answer important questions about the downstream health effects of cannabis legalization and how to mitigate risks.

When deciding how to amend and vote on Senate Bill 708, please take into consideration the scientific evidence, the gaps in our current scientific evidence, and the fact that cannabis legalization outcome research that is highly relevant to public health outcomes for Maryland youth is being conducted right now but has not yet shown us which policies are safest and most effective at mitigating risk. 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 SB0708 and other cannabis-related legislation at your request.

Thank you.

Christopher Hammond, M.D., Ph.D.
Director, Co-occurring disorders in Adolescents and Young Adults (CODA),
Clinical and Research Programs at Johns Hopkins Bayview Medical Center
Johns Hopkins University School of Medicine
5500 Lombard Street. Baltimore, MD 21224 / chammo20@jhmi.edu

REFERENCES

1. **Hammond CJ**, Chaney A, Hendrickson B, Sharma S. Cannabis use among U.S. adolescents in the Era of Marijuana Legalization: a review of changing use patterns, comorbidity, and health correlates. International Rev of Psychiatry. 2020; DOI: 10.1080/09540261.2020.1713056
2. SAMHSA. (2018). Key substance use and mental health indicators in the United States: Results from the 2016 National Survey on Drug Use and Health (HHS Publication No. SMA 17-5044, NSDUH Series H-52). . Retrieved from Rockville, MD.
3. SAMHSA. (2019). Treatment Episode Data Set (TEDS): 2017. Admissions to and Discharges from Publicly-Funded Substance Use Treatment. Retrieved from Rockville, MD.
4. Moore, T. H., Zammit, S., Lingford-Hughes, A., Barnes, T. R., Jones, P. B., Burke, M., & Lewis, G. (2007). Cannabis use and risk of psychotic or affective mental health outcomes: a systematic review. Lancet, 370(9584), 319-328. doi:10.1016/S0140-6736(07)61162-3
5. Olfson, M., Wall, M. M., Liu, S. M., & Blanco, C. (2018). Cannabis Use and Risk of Prescription Opioid Use Disorder in the United States. Am J Psychiatry, 175(1), 47-53.
6. Hall, W., & Degenhardt, L. (2008). Cannabis use and the risk of developing a psychotic disorder. World psychiatry : official journal of the World Psychiatric Association (WPA), 7(2), 68-71.
7. Gobbi, G., Atkin, T., Zytynski, T., Wang, S., Askari, S., Boruff, J., . . . Mayo, N. (2019). Association of Cannabis Use in Adolescence and Risk of Depression, Anxiety, and Suicidality in Young Adulthood: A Systematic Review and Meta-analysis. JAMA Psychiatry, 76(4), 426-434. doi:10.1001/jamapsychiatry.2018.4500
8. Fergusson, D. M., Boden, J. M., & Horwood, L. J. (2015). Psychosocial sequelae of cannabis use and implications for policy: findings from the Christchurch Health and Development Study. Soc Psychiatry Psychiatr Epidemiol, 50(9), 1317-1326. doi:10.1007/s00127-015-1070-x
9. Fergusson, D. M., & Horwood, L. J. (1997). Early onset cannabis use and psychosocial adjustment in young adults. Addiction, 92(3), 279-296.
10. Gruber, S. A., Sagar, K. A., Dahlgren, M. K., Racine, M., & Lukas, S. E. (2012). Age of onset of marijuana use and executive function. Psychol Addict Behav, 26(3), 496-506. doi:10.1037/a0026269
11. Hall, W., & Degenhardt, L. (2015). High potency cannabis. BMJ : British Medical Journal, 350, h1205. doi:10.1136/bmj.h1205
12. Arias AJ, **Hammond CJ**, Burleson JA, Feinn R, Kaminer Y, Curry JF, Dennis ML. Temporal relationships between the change in depressive symptoms and cannabis use in youth treated for cannabis use disorder. J Substance Abuse Treatment 117:108087. July 2020. DOI: 10.1016/j.jsat.2020.108087
13. Jacobus J, Squeglia LM, Escobar S, McKenna BM, Hernandez MM, Bagot KS, Taylor CT, Huestis MA. Changes in marijuana use symptoms and emotional functioning over 28-days of monitored abstinence in adolescent marijuana users. Psychopharmacology (Berl). 2017 Dec;234(23-24):3431-3442. doi: 10.1007/s00213-017-4725-3. Epub 2017 Sep 12. PMID: 28900686; PMCID: PMC5693666.
14. van der Meer FJ, Velthorst E; Genetic Risk and Outcome of Psychosis (GROUP) Investigators. Course of cannabis use and clinical outcome in patients with non-affective psychosis: a 3-year follow-up study. Psychol Med. 2015 Jul;45(9):1977-88. doi: 10.1017/S0033291714003092. Epub 2015 Feb 5. PMID: 25654244.
15. Farabee, David, Shen, Haikang, Hser, Yih-Ing, Grella, Christine E., Anglin, M. Douglas The effect of drug treatment on criminal behavior among adolescents in DATOS-A. Journal of Adolescent Research. 16, (6), 679-696.
16. Engberg, J. and Morral, A.R. (2006), Reducing substance use improves adolescents' school attendance. Addiction, 101: 1741-1751. https://doi.org/10.1111/j.1360-0443.2006.01544.x
17. Ammerman, S., Ryan, S., Adelman, W. P., & Abuse, C. o. S. (2015). The impact of marijuana policies on youth: clinical, research, and legal update. Pediatrics, 135(3), e769-e785

18. Cerdá M, Wall M, Feng T, et al. Association of State Recreational Marijuana Laws With Adolescent Marijuana Use. JAMA Pediatr. 2017;171(2):142–149. doi:10.1001/jamapediatrics.2016.3624
19. Miller AM, Rosenman R, Cowan BW. Recreational marijuana legalization and college student use: Early evidence. SSM Popul Health. 2017 Aug 3;3:649-657. doi: 10.1016/j.ssmph.2017.08.001. PMID: 29349253; PMCID: PMC5769109.
20. Kerr DCR, Bae H, Koval AL. Oregon recreational marijuana legalization: Changes in undergraduates' marijuana use rates from 2008 to 2016. Psychol Addict Behav. 2018 Sep;32(6):670-678. doi: 10.1037/adb0000385. Epub 2018 Jul 16. PMID: 30010351.
21. ElSohly, M. A., Mehmedic, Z., Foster, S., Gon, C., Chandra, S., & Church, J. C. (2016). Changes in Cannabis Potency Over the Last 2 Decades (1995-2014): Analysis of Current Data in the United States. Biol Psychiatry, 79(7), 613-619. doi:10.1016/j.biopsych.2016.01.004
22. Borodovsky, J. T., Lee, D. C., Crosier, B. S., Gabrielli, J. L., Sargent, J. D., & Budney, A. J. (2017). U.S. cannabis legalization and use of vaping and edible products among youth. Drug Alcohol Depend, 177, 299-306. doi:10.1016/j.drugalcdep.2017.02.017
23. Boyd, C. J., Veliz, P. T., & McCabe, S. E. (2015). Adolescents' Use of Medical Marijuana: A Secondary Analysis of Monitoring the Future Data. J Adolesc Health, 57(2), 241-244. doi:10.1016/j.jadohealth.2015.04.008
24. Li, L., et al. (2020). "Analysis of US Teen Driving After Using Marijuana, 2017." JAMA Network Open 3(12): e2030473-e2030473.
25. Hall, K. E., Monte, A. A., Chang, T., Fox, J., Brevik, C., Vigil, D. I., . . . James, K. A. (2018). Mental Health-related Emergency Department Visits Associated With Cannabis in Colorado. Acad Emerg Med, 25(5), 526-537. doi:10.1111/acem.13393
26. Hopfer, C. (2014). Implications of marijuana legalization for adolescent substance use. Subst Abus, 35(4), 331-335. doi:10.1080/08897077.2014.943386
27. Pacula, R. L., Powell, D., Heaton, P., & Sevigny, E. L. (2015). Assessing the effects of medical marijuana laws on marijuana use: the devil is in the details. Journal of policy analysis and management : [the journal of the Association for Public Policy Analysis and Management], 34(1), 7–31. https://doi.org/10.1002/pam.21804
28. Saloner B, McGinty EE, Barry CL. Policy strategies to reduce youth recreational marijuana use. Pediatrics. 2015 Jun;135(6):955-7. doi: 10.1542/peds.2015-0436. Epub 2015 May 4. PMID: 25941304.
29. Chelsea L. Shover & Keith Humphreys (2019) Six policy lessons relevant to cannabis legalization, The American Journal of Drug and Alcohol Abuse, 45:6, 698-706, DOI: 10.1080/00952990.2019.1569669
30. Ghosh T, Van Dyke M, Maffey A, Whitley E, et al. 2016: The Public Health Framework of Legalized Marijuana in Colorado American Journal of Public Health 106, 21_27, https://doi.org/10.2105/AJPH.2015.302875
31. Parnes JE, Bravo AJ, Conner BT & Pearson MR (2018) A burning problem: cannabis lessons learned from Colorado, Addiction Research & Theory, 26:1, 3-10, DOI: 10.1080/16066359.2017.1315410

Background research and publications showing effects cannabis use on health outcomes among young people from my lab

INTERNATIONAL REVIEW OF PSYCHIATRY
https://doi.org/10.1080/09540261.2020.1713056

REVIEW ARTICLE

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

Christopher J. Hammond[a,b,c], Aldorian Chaney[a,c], Brian Hendrickson[a,c] and Pravesh Sharma[d]

[a]Division of Child & Adolescent Psychiatry, Johns Hopkins University School of Medicine, Baltimore, MD, USA; [b]Behavioral Pharmacology Research Unit, Johns Hopkins University School of Medicine, Baltimore, MD, USA; [c]Department of Psychiatry and Behavioral Sciences, Johns Hopkins University School of Medicine, Baltimore, MD, USA; [d]Department of Psychiatry, Mayo Clinic Health System and University of Wisconsin-Eau Claire, Eau Claire, WI, USA

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 Δ-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
Received 15 September 2019
Accepted 6 January 2020

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

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.[1] 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.[2] 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.[3]

Preclinical studies have shown that when rodents are exposed to cannabinoid compounds during adolescence, brain and behavioral changes are observed.[4] 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.[5,6] 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 cofounding 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.[5,6]Moore and colleagues[5]

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.[5]

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.[6]Silins and colleagues[6] 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

Journal of Substance Abuse Treatment 117 (2020) 108087

Contents lists available at ScienceDirect

Journal of Substance Abuse Treatment

journal homepage: www.elsevier.com/locate/jsat

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

Albert J. Arias[a,*], Christopher J. Hammond[b], Joseph A. Burleson[c], Yifrah Kaminer[c], Richard Feinn[d], John F. Curry[e], Michael L. Dennis[f]

[a] Virginia Commonwealth University, United States of America
[b] Johns Hopkins University School of Medicine, United States of America
[c] University of Connecticut School of Medicine, United States of America
[d] Quinnipiac University School of Medicine, United States of America
[e] Duke University School of Medicine, United States of America
[f] Chestnut Health Systems, United States of America

ARTICLE INFO

Keywords:
Cannabis use disorder
Adolescent
Depression
Treatment outcome
Marijuana
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.

FULL-LENGTH REPORT

Journal of Behavioral Addictions 3(2), pp. 90–101 (2014)
DOI: 10.1556/JBA.3.2014.009
First published online April 5, 2014

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

CHRISTOPHER J. HAMMOND[1,2], COREY E. PILVER[3], LOREEN RUGLE[4], MARVIN A. STEINBERG[5], LINDA C. MAYES[1], ROBERT T. MALISON[2], SUCHITRA KRISHNAN-SARIN[2], RANI A. HOFF[2,6] and MARC N. POTENZA[1,2,7]*

[1]Child Study Center, Yale University School of Medicine, New Haven, CT, USA
[2]Department of Psychiatry, Yale University School of Medicine, Connecticut Mental Health Center, New Haven, CT, USA
[3]Department of Biostatistics, Yale University School of Public Health, New Haven, CT, USA
[4]Problem Gambling Services, Middletown, CT, USA
[5]Connecticut Council on Problem Gambling, Clinton, CT, USA
[6]Department of Epidemiology, Yale University School of Medicine, New Haven, CT, USA
[7]Department of Neurobiology, Yale University School of Medicine, New Haven, CT, USA

(Received: October 1, 2013; revised manuscript received: January 14, 2014; accepted: January 15, 2014)

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

The adverse consequences of cannabis use among North American college students.*

Carol Vidal, MD MPH; Christopher J. Hammond, MD PhD; Flavius R.W. Lilly, PhD MPH

*=This report on cannabis-related outcomes in North American college students using the Healthy Minds Dataset will be presented at the Society for Behavioral Medicine 2021 Scientific Meeting April 2021.

ABSTRACT

Background: Cannabis is the most widely used drug among college students in the United States with rising prevalence year-to-year. Existing evidence indicates that cannabis use may have negative mental health and wellness consequences in young adults. However, research on outcomes of cannabis use among college students has been limited. The current study extends knowledge by examining extensive health, wellness, and social consequences of cannabis use. **Methods:** A survey was administered to college students (N = 40,250) between the ages of 18 and 25 years in universities across the United States (n =53) and Canada (n=1). Multiple logistic and ordinal regression analyses, adjusted by sociodemographic, academic, and other drug use covariates, was conducted to examine the relationship between past 30-day cannabis use with multiple outcomes. **Results:** Cannabis use was significantly ($p < .0001$) associated with greater risk for suicide ideation (*AOR* = 1.54), suicide planning (*AOR* = 1.39), suicide attempts (*AOR* = 1.66), depression (*AOR* = 1.32), anxiety disorder (*AOR* = 1.19), eating disorders (*AOR* = 1.20), binge drinking (*AOR* = 4.96), tobacco use (*AOR* = 3.57), cocaine use (*AOR* = 7.13), ecstasy use (*AOR* = 10.14), methamphetamine use (*AOR* = 6.91), stimulant use (*AOR* = 6.68), financial stress (*AOR* = 1.22), poorer grade point average (*AOR* = 1.20), violence victimization (*AOR* = 1.36), and poorer quality social relationships (*AOR* = 1.10). Cannabis use was significantly ($p < .0001$) associated with less risk of insomnia (AOR = .67). Cannabis use was not associated with greater heroin use. **Conclusions:** Cannabis use has significant negative health, wellness, and social consequences for college students. These findings point to the importance of identification and treatment of cannabis users in a college setting and for robust prevention interventions.

Different clinical characteristics and hospital course of adolescents diagnosed with substance-induced psychosis and primary psychotic disorders in a United States Nationwide inpatient sample*

Rikkin Patel, MD, MPH; Ankit Chalia, MD; Pravesh Sharma, MD; Christopher J Hammond MD PhD

*=This report has been submitted as a oral/poster presentation abstract to the College on Problems of Drug Dependence (CPDD) 2021 Scientific Meeting to be presented in June 2021.

ABSTRACT

Background/Objective: Over the past decade, scientific evidence has increasingly blurred the diagnostic boundaries and etiologies of substance-induced psychotic disorders (SIPD) and 'independent' primary psychotic disorders (PPD) (e.g. schizophrenia) among youth, creating a conundrum for clinicians. Evidence-based data to guide diagnostic differentiation and treatment selection for SIPD and PPD in youth is lacking. Given this, we compared clinical characteristics, hospital courses, and relationships with substance use disorder (SUD) diagnoses among youth hospitalized for SIPD and PPD using data on national hospital admissions in the U.S.

Methods: Data from the present analysis were drawn from healthcare cost and utilization project's (HCUP) nationwide inpatient sample (NIS) data from 2010-14. Analyses focused on HCUP-NIS data from pediatric inpatient psychiatric hospitalizations and examined clinical and non-clinical patient-level data elements including demographics, diagnoses (ICD-9-codes), procedural codes, length of stay, and cost. Specifically, we conducted case-control study using the NIS sample comparing psychiatric inpatients between the ages of 12 and 17 years with primary diagnoses of SIPD (N=345) versus PPD (N=2412). Binomial logistic regression model was used to evaluate odds ratio (OR) of association between SIP and SUDs. Pearson's correlation (r) test was used to analyze the relationship between SIP and cannabis use.

Results: SIP inpatients had comorbid mood disorders (47.8%), ADHD/conduct disorder (24.6%), and anxiety (18.8%). Among SUDs, cannabis was prevalent (49.3%) followed by amphetamine (10.1%), cocaine (4.3%) and opioid (2.9%) use. Cannabis use was associated with five times higher odds (OR 95%CI 3.54–7.59) for SIP, and after adjusting for psychiatric comorbidities and other SUDs the association was statistically significant (OR 3.5, 95%CI 2.29–5.38). No other SUDs had a significant association with SIP. Among SIP inpatients, comorbid cannabis use was prevalent in adolescents (mean age: 16.4y), male (82.4%) and whites (44.8%). There existed a significant positive correlation between cannabis use and SIP (r = 0.35, 95%CI 0.28–0.42).

Conclusion: Cannabis use increases the odds of SIP-related hospitalization by 250% in pediatric population.

Cannabis cravings at treatment initiation moderate the relationship between ethnicity and abstinence in Hispanic and Non-Hispanic adults treated for cannabis use disorder

Christopher J Hammond MD PhD[1,2*]; Ariel Pollack[1]; Jun Tarashi[1]; Grace Park MPH[1]; Carol Vidal MD MPH[1]; Rheanna Platt MD MPH[1]

*=This report on will be presented at the American Society for Addiction Medicine (ASAM) 2021 Scientific Meeting in April 2021.

ABSTRACT

Background: Recent epidemiological data indicate that racial/ethnicity differences in cannabis use and cannabis-related problems as a function of Hispanic/Latinx identity are present and may impact treatment outcomes. The mechanisms and factors that contribute to these racial/ethnicity differences are poorly understood. In the present study, we sought to characterize moderators of the relationship between Hispanic ethnic group membership and during-treatment cannabis abstinence in adults receiving combination pharmacotherapy plus behavioral treatment for Cannabis Use Disorders (CUD).

Methods: This post-hoc analysis used data from the Achieving Cannabis Cessation-Evaluating N-Acetylcysteine Treatment study (ACCENT, NIDA-CTN-0053), a double-blind randomized placebo-controlled 12-week trial of N-acetylcysteine (NAC) pharmacotherapy in combination with contingency management for CUD treatment. Participants included 302 adults diagnosed with CUD including N=65 (22%) Hispanic participants and N=237 (78%) Non-Hispanic participants. Baseline sociodemographic and clinical profiles were compared across participants stratified by Hispanic ethnicity. Moderation models were run to determine if clinical features differentiating Hispanic and Non-Hispanic participants at baseline moderated the association between Hispanic ethnicity and during-treatment cannabis abstinence measured via negative urine cannabis tests (UCT).

Results: Compared to Non-Hispanic participants, Hispanic participants had higher cannabis cravings (MCQ scores: 55.3 vs. 48.4, *p=0.005*) and lower nicotine dependence scores (FNDS scores: 0.7 vs. 1.3, *p=0.03*) at baseline. Hispanic and Non-Hispanic participants showed no differences in sociodemographic characteristics or on baseline measures of cannabis use, cannabis withdrawal, and anxiety/depressive symptoms. During treatment, Hispanic participants were half as likely to test negative for urine cannabinoids (adjusted OR= 0.46; 95%CI: 0.24-0.92). A cannabis craving-by-ethnicity interaction effect was observed (F= 6.8, *p=0.03*). Post-hoc analyses showed that baseline cannabis craving severity and tobacco smoking status partially moderated the association between Hispanic ethnic group membership and cannabis abstinence.

Conclusions: These findings provide preliminary evidence that compared to Non-Hispanic adults, Hispanic adults seeking treatment for CUD show important differences in key clinical features including cravings and tobacco smoking status and that these differences may, in part, contribute to poorer treatment outcomes in this population. Of clinical relevance - we found that Hispanic adults had greater cannabis cravings at treatment initiation and the severity of these cravings accounted for some of the variance in the likelihood of achieving cannabis abstinence during treatment. As such, cravings may represent a prognostically-relevant modifiable treatment target in Hispanic adults.

Do the transmissible liability index (TLI) and adolescent cannabis use predict paranoid and schizotypal symptoms at young adulthood?*

Sharma P, Rabinowitz J, Myerburg L, Tarter RE, Reynolds MD, Horner MS, **Hammond CJ**.

*=This report is currently under review for publication and has been presented at the American Academy of Child & Adolescent Psychiatry (AACAP) 2018 Annual Scientific Meeting.

ABSTRACT

Background*:* Adolescent cannabis use is an established risk factor for the development of psychosis, but the premorbid vulnerability factors and specificity versus generality of the psychotic symptom domains affected in cannabis-psychosis relationships remain incompletely understood. To improve our understanding of these relationships, we used longitudinal data to examine the individual and interactive effects of preadolescent transmissible liability to substance use disorders (SUD), measured via the transmissible liability index (TLI), and adolescent cannabis use on the development of two distinct psychotic symptom domains, paranoid and schizotypal personality traits in young adulthood. ***Methods:*** We performed secondary analysis of data from the Center for Education and Drug Abuse (CEDAR) study, which longitudinally assessed offspring of men with (N=211) and without (N=237) lifetime history of SUD at ages 10-12, and across adolescence as they transitioned to young adulthood. TLI scores were calculated at age 10-12, self-reported cannabis use was assessed at age 16, and paranoid and schizotypal symptoms were assessed at age 19. ***Results:*** Cannabis use at age 16 and family history of SUD were significantly associated with paranoid and schizotypal symptoms at age 19, but TLI scores were not. The interactive effect of TLI x cannabis use was also not significant. Paranoid and schizotypal symptoms showed different dose-dependent sensitivities to cannabis exposure at age 16. ***Conclusions:*** These findings indicate that adolescent cannabis use and family history of SUD differentially contribute to the development of paranoid and schizotypal personality traits through mechanisms that do not include behavioral disinhibition.

This poster presented at the 12th Annual National Network for Depression Centers (NNDC) Scientific Meeting shows preliminary data from a large study that we are conducting on attitudes and perceptions about marijuana and cannabidiol use from Maryland youth receiving treatment for mood disorders and their parents

Marijuana and cannabidiol attitudes, perceptions, and behaviors among youth receiving mood disorder treatment and their parents: Preliminary results from the MABS study

Christopher J. Hammond MD PhD[1]; Mary Fristad PhD[2]; Annabel Kady[1]; Christopher D Schneck MD[3]; Neera Ghaziuddin MD MRCPsych[4]; Jarrod Leffler PhD[5]; Manpreet K Singh MD MS[6]; Sally Weinstein PhD[7]; Leslie Hulvershorn MD[8]; Leslie Miller MD[1]

1 Johns Hopkins School of Medicine; 2 Ohio State University Wexner Med Center; 3 University of Colorado Anschutz Med. Campus; 4 University of Michigan; 5 Mayo Clinic; 6 Stanford University; 7 University of Illinois at Chicago; 8 Indiana University School of Medicine

Introduction

Decriminalization, medicalization, and legalization of marijuana use across the U.S. over the past 25 years has dramatically shifted societal perceptions and use patterns among Americans. Recent hemp deregulation by the federal government has enabled cannabidiol (CBD) products to be sold as health supplements nationwide. These legislative shifts and the accompanying widespread promotion of non-evidence-based health claims about cannabinoids have unknown implications for American youth.[1-3]

Objectives

In the present study, we examine attitudes, perceptions, and behaviors related to marijuana and CBD product use among youth receiving treatment for mood disorders and their parents.

Methods

Overview. This analysis used preliminary data from an ongoing NNDC-funded study - the Marijuana and Cannabidiol Attitudes, Beliefs, and Behaviors Survey [MABS] study.

Measures. The survey was administered electronically, and branching logic was used. The *MABS Survey instrument* included 130 items querying marijuana- and CBD related attitudes, perceptions, and behaviors, including acceptability, perception of harmfulness and medical benefit, beliefs and expectancies about marijuana's and CBD's effects on mood, anxiety, and cognition, along with parent-youth communication, parenting practices, and participant demographics and clinical/practice characteristics. Respondents also completed the *Marijuana Effect Expectancy Questionnaire-Brief (MEEQ-B)* and youth respondents completed the *Patient Health Questionnaire-2 (PHQ-2)* and *Generalized Anxiety Disorder 2-item (GAD-2)* .

Methods, cont.

Participants and procedures. Participants included adolescent (ages 12-17) and young adults (ages 18-25) patients in treatment for mood disorders, parents of patients, and mental health providers recruited from NNDC-affiliated Child Mood Disorder Clinics throughout the U.S. All participants were informed that the survey was anonymous, and that their participation was optional. The MABS study has a target accrual goal of 50 participants from each group respectively (N=150 total sample). Preliminary single-site data presented here are from 23 participants (15 youth and 8 parents) recruited from the Johns Hopkins NNDC site.

Results

Results from youth respondents (n=15) showed that most youth (93% and 87%) agreed/strongly agreed that medical marijuana and CBD products are safe and effective treatments for certain mental health conditions

Table 1. Sample Characteristics

	Youth (n = 15)
Age (Years)	18.4 (2.8)
Sex (% Female)	80 %
Mental Health Conditions (%)	
Depressive disorder	87 %
Anxiety disorder	100 %
Bipolar disorder	7 %
ADHD	40 %
Substance use disorder	0 %
Suicidal ideations	67 %
Mental Health Treatment (%)	
Individual Psychotherapy	100 %
Psychotropic medication	100 %
Medical marijuana is being used in the home (%)	27 %
CBD products are being used n the home (%)	21 %
MEEQ-B positive expectancy score	4.1 (0.6)
MEEQ-B negative expectancy score	3.4 (0.7)
PHQ-2 Depression Total Score	2.0 (1.5)
GAD-2 Anxiety Total Score	2.6 (1.7)
Probably/definitely plan to use in the next 6 months (%)	
Marijuana	20 %
Medical marijuana	7 %
CBD	7 %

Funding: Support for this study came from a Seed to a Network of Depression Centers (NNDC) Task Group Mechanism Grant. Disclosures: The authors have no conflicts of interest relevant to the information presented in this poster.

Results, cont.

Fifty-three percent and 57% of youth agreed/strongly agreed that mental health providers should be recommending or prescribing medical marijuana and/or CBD for treatment of mental health conditions. Results from parents (n=8) were also largely positive towards medical marijuana and CBD with 63% and 56% agreed/strongly agreed that medical marijuana and CBD products are safe and effective treatments for certain mental health conditions. Fewer parents as compared to youth believed that mental health providers should be recommending or prescribing medical marijuana and/or CBD for treatment of mental health conditions, with 25% and 33% agreeing/strongly agreeing. Generally, both youth and parents believed that regular use of marijuana and CBD products improves depression in the typical user (**Fig. 1**)

Fig. 1. Beliefs about antidepressant effects of MJ + CBD

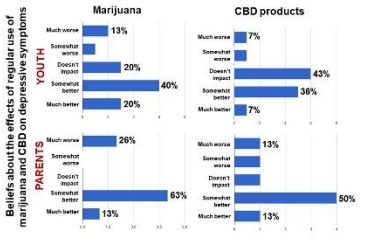
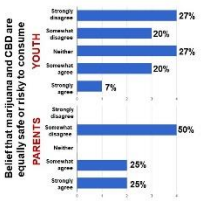


Fig. 2. Belief that marijuana + CBD are equally safe/risky to consume



Conclusion

While requiring cautious interpretation due to their preliminary nature, our results suggest that youth receiving treatment for mood disorders and their parents perceive marijuana and CBD products to be safe and effective treatments for mental health problems, including depression. These early findings from the MABS study suggest a mismatch between youth/parent perception[1-3] and the current evidence related to safety and efficacy of cannabinoid products for mood disorders.[4,5] Mental health clinicians and public health campaigns should provide targeted, evidence-based education to youth and parents and encourage fact-driven discussions between parents, youth, and providers about cannabinoids and mood disorders.

References

1. Hammond CJ, Chaney A, Hendrickson B, Sharma S. Cannabis use among U.S. adolescents in the Era of Marijuana Legalization: a review of changing use patterns, comorbidity, and health correlates. International Rev of Psychiatry. 2020; DOI: 10.1080/09540261.2020.1713356
2. Ghuprie JI, et al. Parental Cannabis Use Is Associated with Cannabis Initiation and Use in Offspring. J Pediatr. 2019; 206:142-147.e1. doi: 10.1016/j.jpeds.2018.10.057
3. Mason WA, Hanson K, Fleming CB, Ringle JL, Haggerty KP, Washington State Recreational Marijuana Legalization, Parent and Adolescent Perceptions, Knowledge, and Discussions in a Sample of Low Income Families. Sub Use Misuse. 2015;50(5):541-45.
4. Arias AJ, Hammond CJ, Gutierrez JA, Ferro R, Kantrowitz Y, Curry JF, Dennis ML. Temporal relationships between the change in depressive symptoms and cannabis use in youth treated for cannabis use disorder. J Substance Abuse Treatment. 2020; 111:92-98. https://doi.org/10.1016/j.jsat.2020.02.007
5. Lucatch AM, Lowe DJE, Clark RE, George TP. Cannabis and Mood Disorders. Curr Addict Rep. 2018;5(3):336-345. doi: 10.1007/s40429-018-0214-y. Epub 2018 May 10. PMID: 30643728; PMCID: PMC6329404