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Impacts of Marijuana on Academic Performance and Achievement

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Recent electoral and legislative efforts to legalize recreational marijuana have prompted policymakers to ask whether legalization leads to increased use of marijuana among adolescents and young adults, and whether the drug damages academic performance and cognitive functioning. Through the use of national and state level data, this report explores trends in usage before and after legalization. It also evaluates the academic literature on the impacts of marijuana on cognition and academic achievement, including an analysis of research done in Vermont.

Cognitive and Academic Effects of Marijuana on Adolescents

General Cognitive Effects

Researchers typically focus on two risk factors associated with marijuana use and cognitive functioning: frequency of use, and age of onset of use. Though uniform designations of “frequent use” and “early-onset use” do not exist in the literature, common definitions of the two risk factors include: daily or near-daily use as “frequent” and use prior to or during ages 15-17 as “early-onset.”¹

The cognitive effects of marijuana use on IQ, attention, memory, and learning have been extensively studied in both experimental studies (conducted in a laboratory setting over a short period of time) and longitudinal studies (repeated observations of the same subjects over

¹ Madeline H. Meier et al., “Persistent Cannabis Users Show Neuropsychological Decline from Childhood to Midlife,” *Proceedings of the National Academy of Sciences of the United States of America* 109 (2012): E2657–E2664, accessed March 23, 2017, <http://www.pnas.org/content/109/40/E2657>; Lambros Messinis et al., “Neuropsychological Deficits in Longterm Frequent Cannabis Users,” *Neurology* 66 (2006): 737, accessed May 2, 2017, <http://www.neurology.org/content/66/5/737.long>; Harrison G. Pope Jr. et al., “Early-onset Cannabis Use and Cognitive Deficits: What is the Nature of the Association,” *Drug and Alcohol Dependence* 69 (2003): 304, accessed May 2, 2017, <http://www.sciencedirect.com/science/article/pii/S0376871602003344>; Stacey A. Gruber et al., “Age of Onset of Marijuana Use and Executive Function,” *Psychology of Addictive Behaviors* 26 (2012): 496, accessed May 2, 2017, <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3345171/>.

time).² Active adolescent users of marijuana perform worse than their peers on tests of memory, attention, learning, and planning.³ Early onset of use and heavy use are both associated with inferior cognitive functioning.⁴ It is, however, unclear whether the association between marijuana use and lower IQ is a causal one; studies differ on this core question, as well as on the relationship between IQ scores, dose amount, and frequency.⁵ Meanwhile, prolonged abstinence from marijuana has been shown to ameliorate the negative cognitive effects of use.⁶

Effect on Academic Performance

The literature on the effects of marijuana use on academic performance also focuses on frequency of use and age of onset of use as two key risk factors. Recent studies that have explored the relationship between these risk factors and postsecondary degree attainment have found statistically significant differences in degree attainment between frequent marijuana users and abstainers.⁷ Differences between infrequent users and abstainers were less noticeable.⁸ Significant differences in degree attainment have also been found between early-onset and late-onset users.⁹ In a longitudinal study published in 2010, students who

² Krista M. Lisdahl et al., "Considering Cannabis: The Effects of Regular Cannabis Use on Neurocognition in Adolescents and Young Adults," *Current Addiction Reports* 1 (2014): 144–156, accessed March 23, 2017, <https://link.springer.com/article/10.1007%2Fs40429-014-0019-6>; Natania A. Crane et al., "Effects of Cannabis on Neurocognitive Functioning: Recent Advances, Neurodevelopmental Influences, and Sex Differences," *Neuropsychology Review* 23 (2013): 117–137, accessed March 23, 2017, <https://link.springer.com/article/10.1007%2Fs11065-012-9222-1>.

³ Maria Alice Fontes et al., "Cannabis Use Before Age 15 and Subsequent Executive Functioning," *The British Journal of Psychiatry*, 198 (2011): 442–447, accessed March 23, 2017, <http://bjp.rcpsych.org/content/198/6/442>; Mary P. Becker, Paul F. Collins, and Monica Luciana, "Neurocognition in College-Aged Daily Marijuana Users," *Journal of Clinical and Experimental Neuropsychology*, 36 (2014): 379–398, accessed March 23, 2017, <https://www.cambridge.org/core/journals/psychological-medicine/article/cannabis-schizophrenia-and-other-non-affective-psychoses-35-years-of-followup-of-a-populationbased-cohort/D4A7F9409437E308002E1EA85F4EF319>.

⁴ Fontes et al., "Cannabis Use Before Age 15 and Subsequent Executive Functioning," 442–447; Meier et al., "Persistent Cannabis Users," E2657–E2664.

⁵ Meier et al., "Persistent Cannabis Users," E2657–E2664; Claire Mokrysz et al., "Are IQ and Educational Outcomes in Teenagers Related to Their Cannabis Use? A Prospective Cohort Study," *Journal of Psychopharmacology* 30 (2016): 159–168, accessed March 23, 2017, <http://journals.sagepub.com/doi/10.1177/0269881115622241>.

⁶ Karen L. Hanson, et al., "Longitudinal Study of Cognition among Adolescent Marijuana Users over Three Weeks of Abstinence," *Addictive Behaviors* 35 (2010): 970–976, accessed March 23, 2017, <http://www.sciencedirect.com/science/article/pii/S0306460310001747>.

⁷ L. John Horwood et al., "Cannabis Use and Educational Achievement: Findings from Three Australian Cohort Studies," *Drug and Alcohol Dependence* 110 (2010): 247–253, accessed March 23, 2017, <http://www.sciencedirect.com/science/article/pii/S0376871610001092>; Jennifer L. Maggs et al., "Predicting Young Adult Degree Attainment by Late Adolescent Marijuana Use," *Journal of Adolescent Health* 57 (2015): 205–215, accessed March 23, 2017, <http://www.sciencedirect.com/science/article/pii/S1054139X15002189>.

⁸ Ibid.

⁹ Horwood, "Predicting Young Adult Degree Attainment by Late Adolescent Marijuana Use," 247–253; David M. Fergusson and Joseph M. Boden, "Cannabis Use and Later Life Outcomes," *Addiction* 103 (2008): 969–976, accessed March 23, 2017, <http://onlinelibrary.wiley.com/doi/10.1111/j.1360-0443.2008.02221.x/abstract;jsessionid=B8E1B619C91BF61699FB69B8FBF7ADC8.f03t02>.

began using marijuana after age 18 or abstained altogether were 2.5 times more likely to attain university degrees than students who began prior to age 15.¹⁰

Studies have shown an association between marijuana use and lower Grade Point Average (GPA) and class attendance.¹¹ The frequency with which an individual consumes marijuana can predict how often that individual skips class. Class attendance, subsequently, can also predict GPA and degree attainment.¹² Marijuana use during college is associated with lower rates of degree completion, lower GPAs, lower exam and project grades, less time spent studying, decreased attendance, and a lower frequency of graduating or graduating on time.¹³ Another study found a relationship between when students begin to use marijuana and their usage patterns: students who begin using marijuana before the age of 16 are more likely to continue using throughout college and are also more likely to use on a more regular basis.¹⁴ Students who reported using marijuana in college also reported lower GPAs than their classmates who abstained.¹⁵ A student who develops a substance use disorder may lose interest in completing his or her degree.¹⁶ When individuals begin marijuana use in early adolescence, they experience higher levels of academic unpreparedness, as well as higher rates of mental health issues in the future.¹⁷

Mental illness and substance abuse are associated with academic performance problems in adolescents.¹⁸ Marijuana use is consistently, though modestly, associated with psychosis, specifically schizophrenia.¹⁹ It has also been positively associated with anxiety, though no

¹⁰ Horwood, "Predicting Young Adult Degree Attainment by Late Adolescent Marijuana Use," 247-253.

¹¹ Amelia M. Arria et al., "The Academic Consequences of Marijuana Use During College," *Psychology of Addictive Behaviors*, 29 (2015): 564-575, accessed April 5, 2017, <http://psycnet.apa.org/index.cfm?fa=search.displayrecord&uid=2015-34685-001>.

¹² Ibid.

¹³ Ibid.

¹⁴ Cynthia K. Suerken et al., "Marijuana Use Trajectories and Academic Outcomes Among College Students," *Drug and Alcohol Dependence* 162 (2016): 137-145, accessed April 5, 2017, <http://www.sciencedirect.com/science/article/pii/S037687161600140X>.

¹⁵ Ibid.

¹⁶ Amelia M. Arria et al., "Drug Use Patterns and Continuous Enrollment in College: Results from a Longitudinal Study," *Journal of Studies on Alcohol and Drugs* 74 (2013): 71-83, accessed March 23, 2017, <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3517265/>. The noted study uses the American Psychiatric Association's *Diagnostic and Statistical Manual of Mental Disorders, Fourth Edition's* definition of substance use disorders.

¹⁷ Elizabeth J. D'Amico et al., "Alcohol and Marijuana Use Trajectories in a Diverse Longitudinal Sample of Adolescents: Examining Use Patterns from Age 11 to 17 Years," *Addiction*, 111 (2016): 1825-1835, accessed April 5, 2017, <http://onlinelibrary.wiley.com/doi/10.1111/add.13442/abstract>.

¹⁸ Ibid.

¹⁹ Charles Ksir and Carl L. Hart, "Cannabis and Psychosis: A Critical Overview of the Relationship," *Current Psychiatry Reports* 18 (2016): accessed March 23, 2017, <https://link.springer.com/article/10.1007%2Fs11920-015-0657-y>; E. Manrique-Garcia et al., "Cannabis, Schizophrenia and Other Non-affective Psychoses: 35 Years of Follow-up of a Population-based Cohort," *Psychological Medicine* 42 (2012): 1321-1338, accessed March 23, 2017, <https://www.cambridge.org/core/journals/psychological-medicine/article/cannabis-schizophrenia-and-other-non-affective-psychoses-35-years-of-followup-of-a-populationbased-cohort/D4A7F9409437E308002E1EA85F4EF319>; Samuel T. Wilkinson, Rajiv Radhakrishnan, and Deepak Cyril

relationship exists between marijuana use after diagnosis and worsening of anxiety disorders.²⁰ These associations are further complicated by the prevalence of medical marijuana as a prescribed treatment for posttraumatic stress disorder and other anxiety disorders.²¹ Additionally, there is a relationship between marijuana consumption and other substance use disorders; higher and more frequent doses are correlated with an increased likelihood of substance use disorders in the future.²²

Though each study controls for a variety of confounding factors (such as childhood mental health and behavior issues, use of alcohol or tobacco, or other drug use), the literature has not developed a uniform methodology to control for such factors. This means that while each study may identify correlation, it is difficult to generalize these findings.²³ These studies can suggest associations between variables, but rely on experimental research to identify cause-and-effect relationships between the variables in question.²⁴

The Vermont Department of Health’s “Health Impact Assessment: Marijuana Regulation in Vermont” Report

In January 2016, the Vermont Department of Health released a report on the potential public health impacts of marijuana legalization in Vermont.²⁵ The Department periodically releases “Health Impact Assessments” in response to local or statewide policy proposals.²⁶

In its section on the effects of marijuana use on academic outcomes, the report concludes that the research on the negative academic impacts of marijuana use among high school and college students is “almost sufficient to show a cause-and-effect link between the two” and that the effects of marijuana use are especially apparent in youth with behavioral or mental health

D’Souza, “Impact of Cannabis Use on the Development of Psychotic Disorders,” *Current Addiction Reports* 1 (2014): 115-128, accessed March 23, 2017, <https://link.springer.com/article/10.1007%2Fs40429-014-0018-7>.

²⁰ Karina Karolina Kedzior, and Lisa Tabata Laeber, “A Positive Association between Anxiety Disorders and Cannabis Use or Cannabis Use Disorders in the General Population: A Meta-Analysis of 31 Studies,” *BMC Psychiatry* 14 (2014): accessed March 23, 2017, <https://bmcp psychiatry.biomedcentral.com/articles/10.1186/1471-244X-14-136>.

²¹ Kevin P. Hill, “Medical Marijuana for Treatment of Chronic Pain and other Medical and Psychiatric Problems: A Clinical Review,” *Journal of the American Medical Association (JAMA)* 313 (2015): 2475, accessed May 3, 2017, <http://jamanetwork.com/journals/jama/fullarticle/2338266>.

²² Arria et al., “Drug Use Patterns and Continuous Enrollment in College,” 71–83.

²³ Elizabeth C. Temple, Rhonda F. Brown, and Donald W. Hine, “The ‘Grass Ceiling’: Limitations in the Literature Hinder our Understanding of Cannabis Use and its Consequences,” *Addiction* 106 (2011): 238-244, accessed March 23, 2017, <https://www.ncbi.nlm.nih.gov/pubmed/21208311>; H. Valerie Curran et al., “Keep Off the Grass? Cannabis, Cognition and Addiction,” *Nature Reviews Neuroscience* 17 (2016): 293–306, accessed April 27, 2017, <https://www.nature.com/nrn/journal/v17/n5/full/nrn.2016.28.html>.

²⁴ Maggs et al., “Predicting Young Adult Degree Attainment by Late Adolescent Marijuana Use,” 210.

²⁵ Vermont Department of Health, *Health Impact Assessment: Marijuana Regulation in Vermont*, Montpelier, VT, January 2016, accessed April 5, 2017, http://www.healthvermont.gov/sites/default/files/documents/pdf/hsvr_collegehealth_2016.pdf.

²⁶ “Health Impact Assessments,” Vermont Department of Health, accessed April 10, 2017, <http://www.healthvermont.gov/about/reports/health-impact-assessments>.

issues.²⁷ As explained above, while there is indeed a growing body of scientific literature on the negative effects of marijuana use on academic performance, identifying causality in observational research remains extremely difficult.²⁸ Meanwhile, the report implies that a spike in Colorado school suspensions might have been related to marijuana legalization during the 2013-2014 school year.²⁹ More recent data, however, shows a decline in drug related suspensions from 2014 to 2016 and an overall decrease in suspensions of 25 percent over the past 10 years.³⁰

The Department of Health report drew on conversations with educators throughout the state, including teachers, administrators, nurses, and counselors, to acquire “a sense from those working with youth in schools about their perceptions and thoughts on marijuana regulation in Vermont.”³¹ These voices are a valuable source of information for legislators, but as the report’s authors acknowledged, the study did not employ scientific sampling in selecting interview subjects, and its results were not weighted to fit the state’s population.³²

Usage Rates and Academic Performance in Colorado, Washington, and Vermont

Given this evidence suggesting that marijuana may have negative academic and cognitive effects, it is particularly relevant to explore the prevalence of marijuana use among the adolescents who may be most at risk of experiencing these effects.

Methodology

The Substance Abuse and Mental Health Services Administration (SAMHSA) administers the National Survey on Drug Use and Health (NSDUH) each year to gain information regarding usage, attitudes, and consequences of alcohol, tobacco, and illegal drug use among adolescents and young adults.³³ SAMHSA reports usage at national, state, and sub-state levels. We analyzed national data and data from three states: Colorado, Washington, and Vermont. Recreational use of marijuana is now legal in seven states and the District of Columbia, but Colorado and Washington provide the most instructive examples because they have the longest records of

²⁷ Vermont Department of Health, *Health Impact Assessment*, 46.

²⁸ Temple et al., “The ‘Grass Ceiling,’” 238-244; C Mokrysz et al., “Are IQ and Educational Outcomes in Teenagers Related to Their Cannabis Use?” 159-168.

²⁹ Vermont Department of Health, *Health Impact Assessment*, 46.

³⁰ “Suspension/Expulsion Statistics,” Colorado Department of Education, last modified January 10, 2017, <http://www.cde.state.co.us/cdereval/suspend-expelcurrent>.

³¹ Vermont Department of Health, *Health Impact Assessment*, 45.

³² *Ibid.* The report’s results may have also been inadvertently influenced by question wording. For example, one question asked: “Research has shown that regular marijuana use may negatively impact academic performance. In your experience, do you find this to be true?”

³³ “Population Data/NSDUH,” Substance Abuse and Mental Health Services Administration, last modified August 30, 2016, <https://www.samhsa.gov/data/population-data-nsduh>.

the use and sale of recreational marijuana.³⁴ We extracted and compiled state-level data from SAMHSA’s “Reports by Geography” database, which contains state-level NSDUH data from 2010-2015.³⁵ The database also includes reports comparing usage rates from 2010-2015 with rates from earlier years, which allowed us to represent usage rates from 2008-2015 in Figures 1-4.

Figures 1 and 2 represent the percentage of individuals who have used marijuana in the past year. These figures reflect responses from a SAMHSA survey question that asked: “On how many days in the past 12 months did you use marijuana or hashish?”³⁶ Figures 3 and 4 represent the percentage of individuals who have used marijuana in the past month. These figures reflect responses from a SAMHSA survey question that asked: “During the past 30 days, on how many days did you use marijuana or hashish?”³⁷

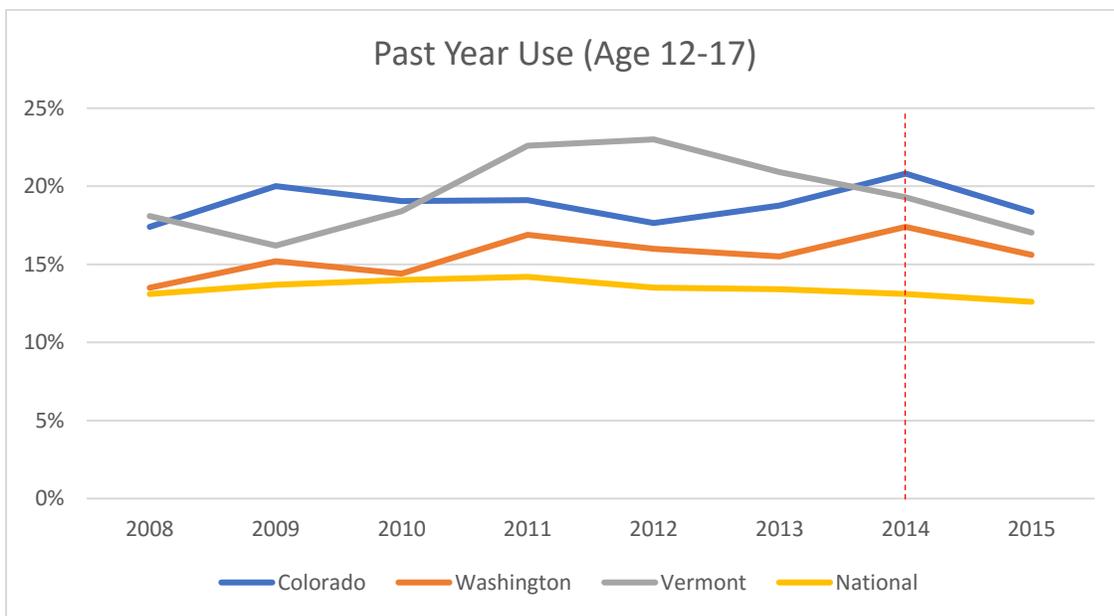


Figure 1: Marijuana usage rates per year among youth (12-17) in Colorado, Washington, Vermont, and the national average between 2008 and 2015. The red line indicates when retail sale of marijuana began in Washington and Colorado (2014).

Source: “2017 National Survey on Drug Use and Health (NSDUH): Specifications for Programming,” SAMHSA, last modified October 28, 2016, 77, <https://www.samhsa.gov/data/sites/default/files/NSDUHmrbcAISpecs2017.pdf>.

³⁴ Thomas Fuller, “Californians Legalize Marijuana in Vote That Could Echo Nationally,” *The New York Times*, November 9, 2016, accessed April 11, 2017, https://www.nytimes.com/2016/11/09/us/politics/marijuana-legalization.html?_r=1.

³⁵ “Reports by Geography,” Substance Abuse and Mental Health Services Administration, last modified September 12, 2016, <https://www.samhsa.gov/data/reports-by-geography?tid=650&map=1>.

³⁶ “2017 National Survey on Drug Use and Health (NSDUH): Specifications for Programming,” SAMHSA, last modified October 28, 2016, 77, <https://www.samhsa.gov/data/sites/default/files/NSDUHmrbcAISpecs2017.pdf>.

³⁷ “2017 National Survey on Drug Use and Health,” 77.

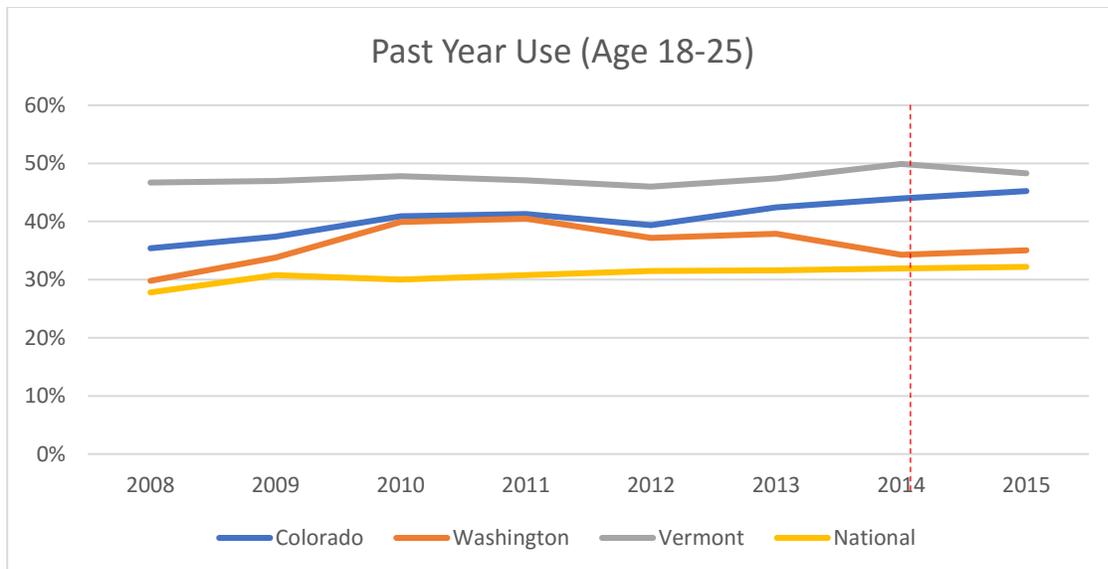


Figure 2: Marijuana usage rates per year among college-aged adults (18-25) in Colorado, Washington, Vermont, and the national average between 2008 and 2015. The red line indicates when retail sale of marijuana began in Washington and Colorado (2014).

Source: “2017 National Survey on Drug Use and Health (NSDUH): Specifications for Programming,” SAMHSA, last modified October 28, 2016, 77, <https://www.samhsa.gov/data/sites/default/files/NSDUHmrbcAISpecs2017.pdf>.

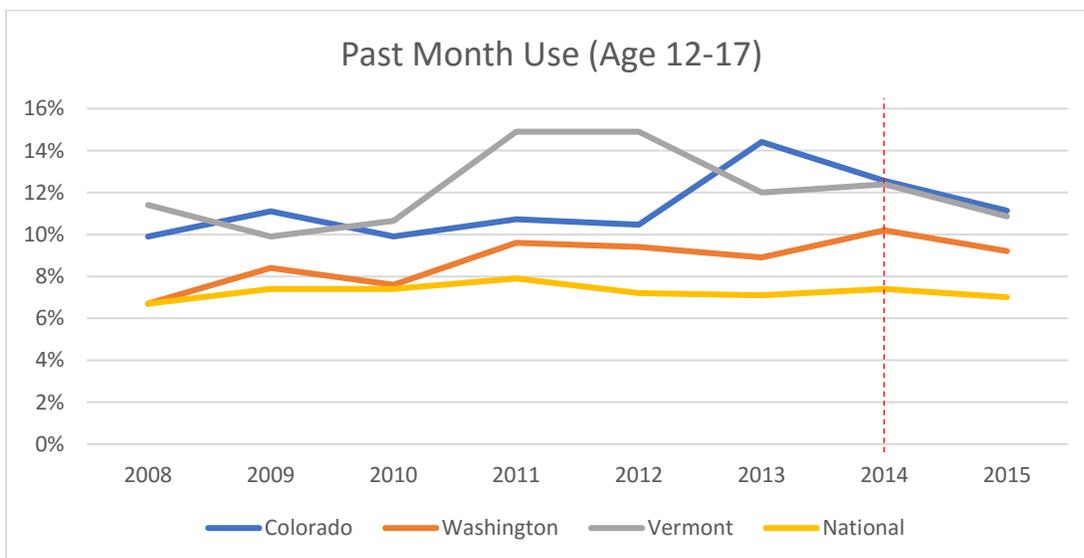


Figure 3: Marijuana usage rates per month among youth (12-17) in Colorado, Washington, Vermont, and the national average between 2008 and 2015. The red line indicates when retail sale of marijuana began in Washington and Colorado (2014).

Source: “2017 National Survey on Drug Use and Health (NSDUH): Specifications for Programming,” SAMHSA, last modified October 28, 2016, 77, <https://www.samhsa.gov/data/sites/default/files/NSDUHmrbcAISpecs2017.pdf>.

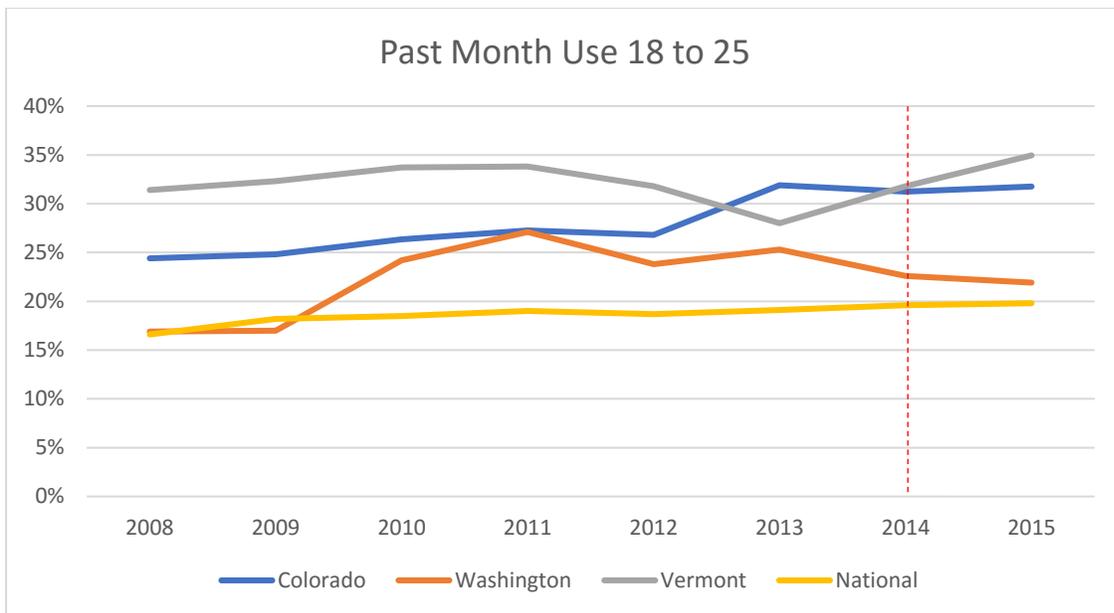


Figure 4: Marijuana usage rates per month among college aged adults (18-25) in Colorado, Washington, Vermont, and the national average between 2008 and 2015. The red line indicates when retail sale of marijuana began in Washington and Colorado (2014).

Source: “2017 National Survey on Drug Use and Health (NSDUH): Specifications for Programming,” SAMHSA, last modified October 28, 2016, 77, <https://www.samhsa.gov/data/sites/default/files/NSDUHmrbcAISpecs2017.pdf>.

Colorado

In 2012, Colorado voters legalized recreational marijuana for adults over the age of 21, and in 2014 the first retail marijuana store opened.³⁸ As the above figures demonstrate, there has not been a significant or consistent increase in marijuana usage in either age range since legalization. Instead, marijuana usage rates among teens and college-aged adults have continued to follow previous trends (Figures 1-4). Usage rates among youth (12-17) have increased slightly, though not at a statistically significant level. Rates among college-aged adults (18-25) increased by approximately 10 percent between 2003 and 2015, from 21.67 percent to 31.75 percent.³⁹

School disciplinary actions provide a second way of observing the potential academic effects of marijuana legalization. When examining disciplinary-action data, it is important to note that Colorado introduced a law before the 2012-2013 school year that aimed to reduce expulsions and suspensions imposed due to zero-tolerance disciplinary policies. This policy change likely

³⁸ Dills, Gofford, and Miron, “Dose of Reality.”

³⁹ “Reports by Geography.”

led to the overall decreases seen in Figures 5 and 6.⁴⁰ Since the 2013-2014 school year, the number of drug-related suspensions has fallen, while overall suspensions remain steady.⁴¹ Expulsions both overall and due to drugs have fallen since the 2012 bill was instituted, but drug-related expulsions now make up a higher percentage of total expulsions, indicating a slower decline (Figure 5).⁴² Meanwhile, in the 2015-2016 school year, marijuana violations accounted for 63 percent of all Colorado school drug violations.⁴³

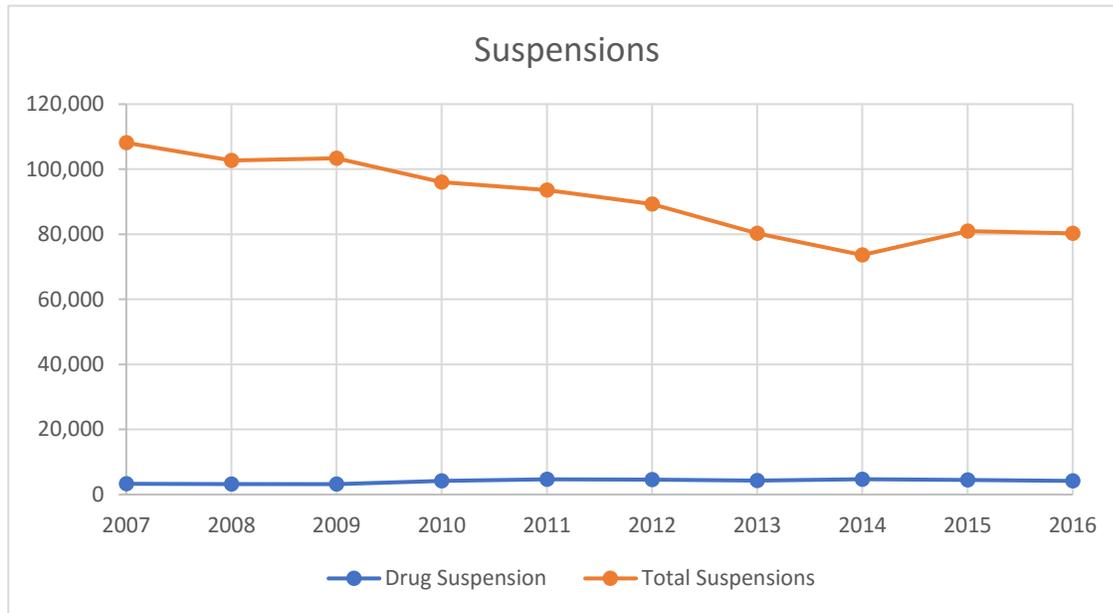


Figure 5: Drug-related suspensions and total suspensions in Colorado high schools from the 2006-2007 school year to the 2015-2016 school year.⁴⁴

Source: “Suspension/Expulsion Statistics,” Colorado Department of Education, last modified January 10, 2017, <http://www.cde.state.co.us/cdereval/suspend-expelcurrent>.

⁴⁰ An Act Concerning the Financing of Public Schools, Co. Rev. Stat. §21 (West 2012); “Marijuana Legalization in Colorado: Early Findings, A Report Pursuant to Senate Bill 13-283,” Colorado Department of Public Safety, March 2016, accessed April 22, 2017, <http://cdpsdocs.state.co.us/ors/docs/reports/2016-SB13-283-Rpt.pdf>.

⁴¹ “Suspension/Expulsion Statistics.”

⁴² Ibid.

⁴³ Ibid.

⁴⁴ Ibid.

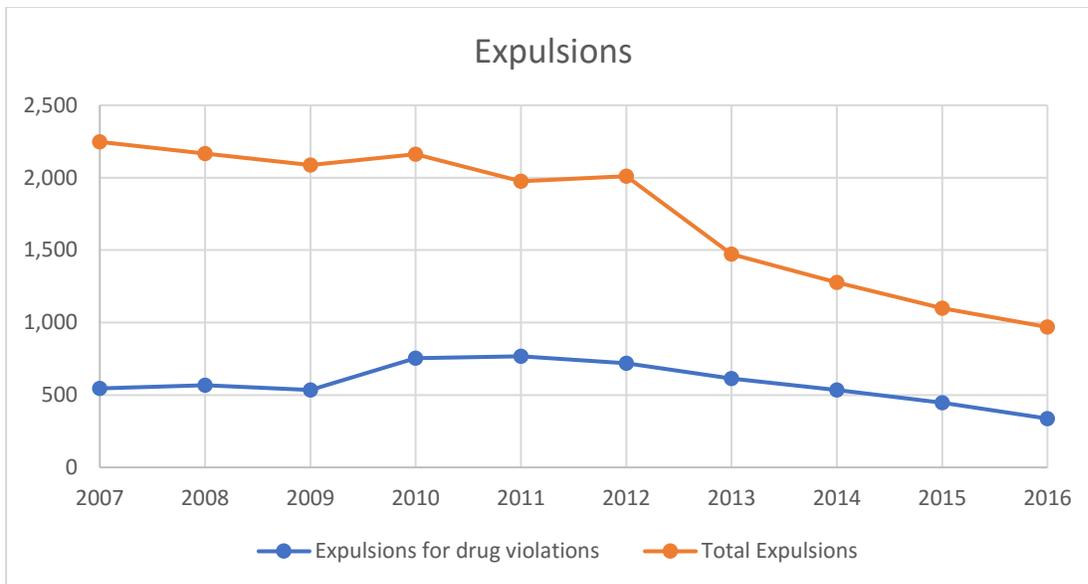


Figure 6: Drug-related expulsions and total expulsions in Colorado high schools from the 2006-2007 school year to the 2015-2016 school year.

Source: "Suspension/Expulsion Statistics," Colorado Department of Education, last modified January 10, 2017, <http://www.cde.state.co.us/cdereval/suspend-expelcurrent>.

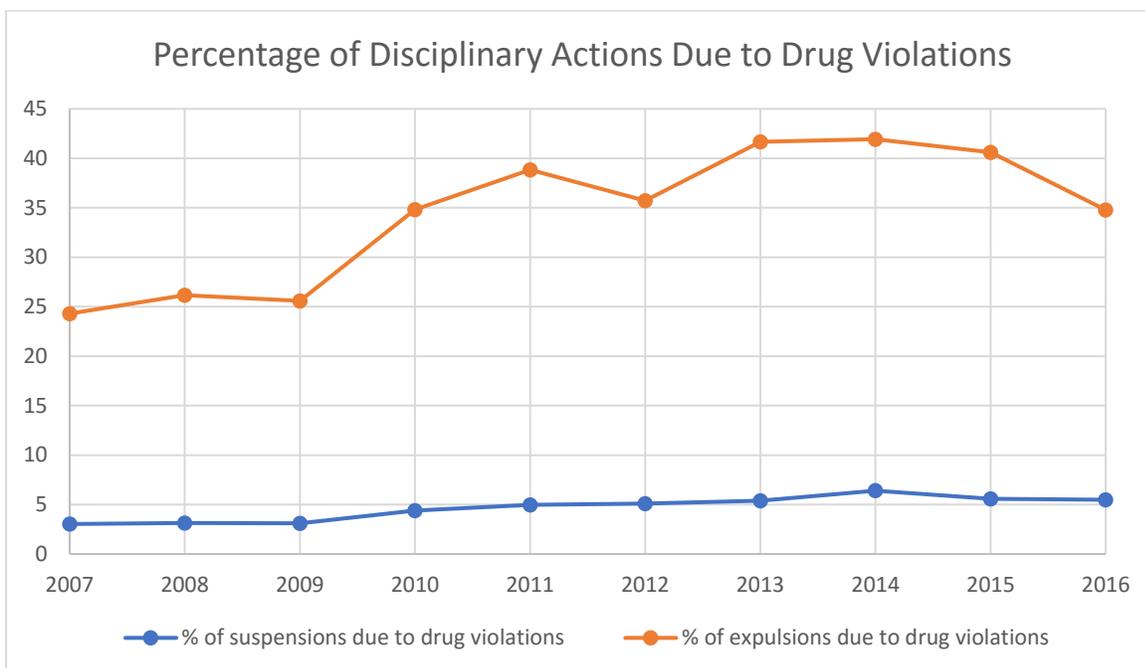


Figure 7: Percentage of total suspensions and expulsions related to drugs from the 2006-2007 school year to the 2015-2016 school year.

Source: "Suspension/Expulsion Statistics," Colorado Department of Education, last modified January 10, 2017, <http://www.cde.state.co.us/cdereval/suspend-expelcurrent>.

Survey data from Colorado, meanwhile, suggests that public perceptions of harm from marijuana use among youth aged 12-17 have also fallen over the past 10 years. From 2006 to 2014 the percentage of respondents in a SAMHSA survey who associate “great harm” with monthly marijuana use has fallen from 19 percent to 8 percent.⁴⁵ Trends in both usage and in public perception of marijuana’s possible harms have followed pre-legalization trajectories.⁴⁶ Along with decreasing suspensions and expulsions, this suggests that legalization has not had a detrimental academic effect on students in Colorado. The Cato Institute’s report on Colorado’s legalization of marijuana suggests that rather than legalization causing an increase in marijuana use, legalization may, instead, be a consequence of increased use and of changing attitudes in favor of legalization.⁴⁷

Washington

Voters in the state of Washington passed Ballot Initiative Measure No. 502 (I-502) in November 2012, which legalized recreational marijuana use and authorized the State Liquor and Cannabis Board to tax and regulate the sale of marijuana.⁴⁸ Later, in July 2014, retail outlets began selling marijuana.⁴⁹ There has not been a significant or consistent increase in marijuana usage in either age range since legalization (please see Figures 1-4, above). Instead, marijuana usage rates among teens and college-aged adults have continued to follow previous trends (Figures 1-4).

Vermont

According to self-reported data from the Vermont Department of Health’s “2016 Vermont College Health Survey,” the percentage of Vermont college students who have ever used marijuana increased from 53 percent in 2014 to 57 percent in 2016, while the percentage of students who have used in the past 30 days has decreased from 32 percent in 2014 to 30 percent in 2016 (Figure 8). Of those students who reported using in the last 30 days, 28 percent reported using in the last 1-2 days in 2014, compared to 26 percent in 2016 (Figure 9). In 2014, 28 percent of users reported using marijuana in the last 3-9 days, while 22 percent reported that in 2016 (Figure 9). The number of students who reported using marijuana in the past 10 or more days increased from 43 percent in 2014 to 51 percent in 2016 (Figure 9). In 2016, the majority (71 percent) of Vermont college students who said they had used marijuana reported that their usage had not changed. As Figure 11 shows, survey respondents indicated that the most common perceived academic impacts of their marijuana use included an inability to think

⁴⁵ Dills, Goffard, and Miron, “Dose of Reality”; “Marijuana Legalization in Colorado”; “2017 National Survey on Drug Use and Health,” 77. The survey asked: “How much do people risk harming themselves physically and in other ways when they smoke marijuana once a month?”

⁴⁶ SAMHSA; “Marijuana Legalization in Colorado.”

⁴⁷ Dills, Goffard, and Miron, “Dose of Reality.”

⁴⁸ Jonathan Martin, “Voters Approve I-501 Legalizing Marijuana,” *The Seattle Times*, last modified November 6, 2012, <http://www.seattletimes.com/seattle-news/voters-approve-i-502-legalizing-marijuana/>.

⁴⁹ “FAQs on Marijuana,” Washington State Liquor and Cannabis Board, accessed April 10, 2017, http://lcb.wa.gov/mj2015/faqs_i-502#Licenses.

clearly (15 percent of respondents), skipping class (11 percent), and not completing work on time (7 percent).

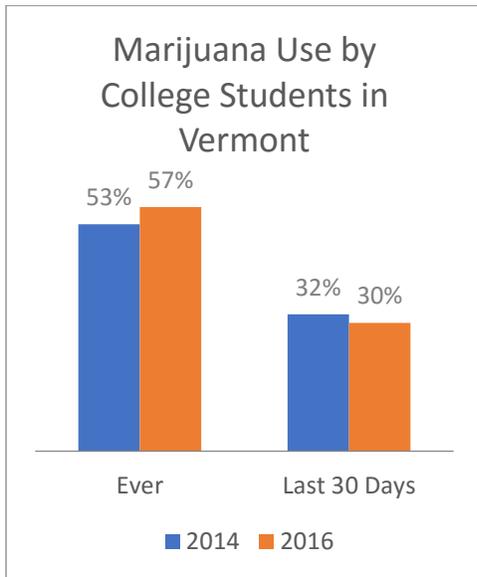


Figure 8: Percentage of Vermont college students who have used marijuana ever, and in the last 30 days, in 2014 and 2016.

Source: Vermont Department of Health, *2016 Vermont College Health Survey*, Montpelier, VT, March 2017, accessed April 5, 2017, http://www.healthvermont.gov/sites/default/files/documents/pdf/hsvr_collegehealth_2016.pdf.

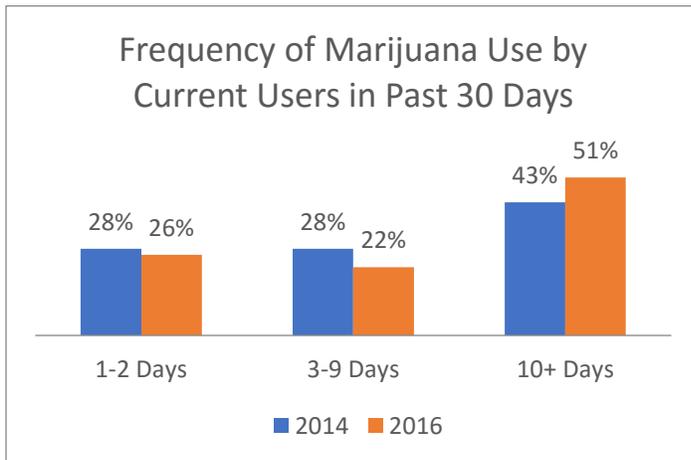


Figure 9: Frequency of marijuana use among Vermont college students who are current users, in the past 1-2 days, 3-9 days, and 10+ days, in 2014 and 2016.

Source: Vermont Department of Health, *2016 Vermont College Health Survey*, Montpelier, VT, March 2017, accessed April 5, 2017, http://www.healthvermont.gov/sites/default/files/documents/pdf/hsvr_collegehealth_2016.pdf.

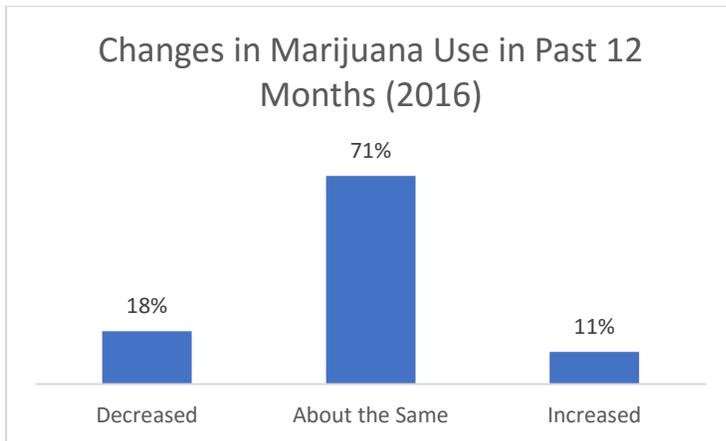


Figure 10: Changes of marijuana use in the past 12 months of 2016 by Vermont college students.

Source: Vermont Department of Health, *2016 Vermont College Health Survey*, Montpelier, VT, March 2017, accessed April 5, 2017, http://www.healthvermont.gov/sites/default/files/documents/pdf/hsvr_collegehealth_2016.pdf.

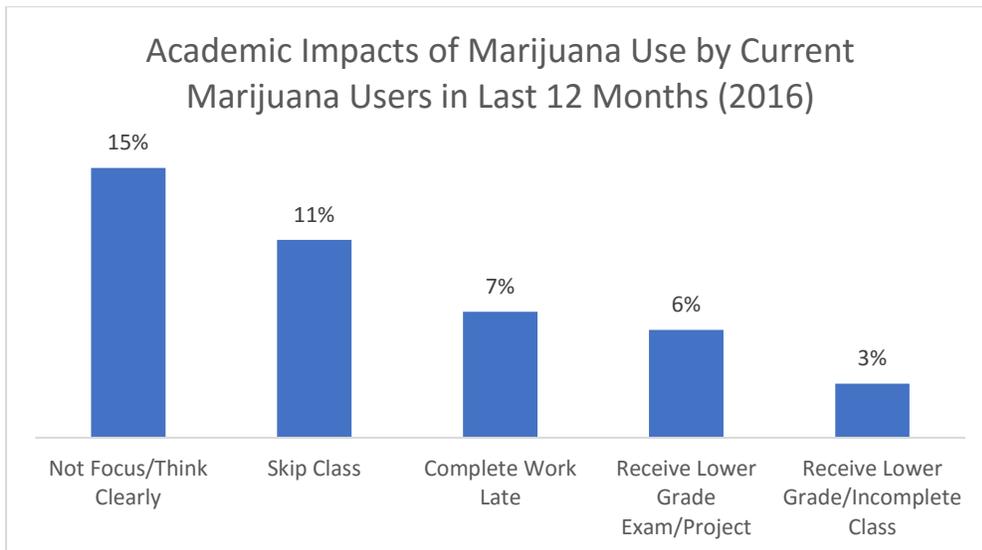


Figure 11: Impacts of marijuana use on Vermont college students who used marijuana in the last 12 months.

Source: Vermont Department of Health, *2016 Vermont College Health Survey*, Montpelier, VT, March 2017, accessed April 5, 2017, http://www.healthvermont.gov/sites/default/files/documents/pdf/hsvr_collegehealth_2016.pdf.

Conclusion

Research on the effects of marijuana has consistently found associations between use, especially early-onset and frequent use, and decreased cognitive functioning and poorer academic performance. Determining whether these correlations reflect causal links, as well as whether reduction or cessation of marijuana use mitigates any adverse effects, will require further research. In states that have legalized the sale and purchase of recreational marijuana, usage rates among adolescents and young adults have followed pre-legalization trends. If usage rates in Vermont were to follow the post-legalization trends observed in Colorado and Washington, it is unlikely that legalization would cause a significant change in use among adolescents and young adults. Considering Vermont's already high usage rates, however, it remains important for researchers and policymakers to continue examining the academic effects associated with marijuana use.

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Disclaimer: This report has been compiled by undergraduate students at the University of Vermont under the supervision of Professor Jack Gierzynski, Professor Alec Ewald and Professor Eileen Burgin. The material contained in the report does not reflect the official policy of the University of Vermont.