

Health Impact Assessment

Marijuana Regulation in Vermont

Released January 2016



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Executive Summary

The Vermont Department of Health and key stakeholders conducted this Health Impact Assessment of the possible effects that could result from regulating and taxing adult marijuana use on the health of Vermonters.

Literature Review

The assessment began with an extensive review of the existing literature to identify the strength of evidence associated with the potential health impacts. Indicators (impacts) were rated as not well researched, a fair amount of evidence, strong evidence, or very strong evidence. A full description of the methodology used to determine these ratings is provided on page 17.

Health Indicators associated with Marijuana Use

NOTE: This section of the literature review is related to use, but not specifically legalized use – it does not include research related to medical marijuana use.

Impact of non-medical marijuana use on health indicator	Does indicator get better, worse, or stay the same with non-medical marijuana use?	Strength of evidence on the indicator
Mental health		
Psychosis/Psychotic symptoms	Worse	Very strong evidence
Depression	Worse	Fair evidence
Schizophrenia	Worse	Fair evidence
Anxiety	Worse	Fair evidence
Brain function	Worse	Fair evidence
Psychosocial functioning	Worse	Strong evidence
Injury		
Motor vehicle accidents	Worse	Very strong evidence
Child poisoning	Worse	Not well researched
Skiing safety (snowboarding)	No studies	No research
Respiratory		
Short-term air flow	Better	Strong evidence
Long-term air flow	Worse	Fair evidence
Cancer	Unclear	Fair evidence
Chronic bronchitis	Worse	Strong evidence
Physical health		
Cancer (non-lung)	Unclear	Not well researched
Stroke/heart attack	Worse	Fair evidence
Reproductive health		
Pregnancy	Worse	Strong evidence
Youth		
Future dependence	Worse	Very strong evidence

Academic performance	Worse	Strong evidence
Substance abuse		
Dual use	Worse	Fair evidence
Treatment	Unclear	Not well researched
Future use	Unclear	Not well researched
Dependence on marijuana	Worse	Strong evidence

Health Indicators associated with Non-Medical Marijuana Regulation on Youth

Impact of regulation of non-medical marijuana use on youth	Does indicator get better, worse, or stay the same under marijuana regulation?	Strength of evidence on the indicator
Access	Increases	Fair evidence
Use	Unclear	Not well researched

Medical Marijuana Uses *Note: This summary is based on three clinical review articles.*

Symptom the patient is seeking to relieve	Legal in Vermont?	Alleviates symptoms?	Strength of evidence on the indicator
Physical health			
Symptoms of cancer	Yes	Yes	Strong evidence
Symptoms of cancer treatment	Yes	Yes	Strong evidence
Symptoms of HIV/AIDS or treatment	Yes	Yes	Strong evidence
Multiple-sclerosis or treatment	Yes	Yes	Strong evidence
Wasting syndrome (excluding related to cancer, HIV & MS)	Yes	Yes	Fair evidence
Severe pain (excluding related to cancer, HIV & MS)	Yes	Yes	Fair evidence
Chronic pain (non-severe)	No	Yes	Fair evidence
Nausea (excluding related to cancer, HIV & MS)	Yes	Yes	Fair evidence
Seizures	Yes	Research in progress	Not well researched
Glaucoma	No	Unclear	Not well researched
Other			
Sleep	No	Not helpful	Not well researched
Social anxiety	No	Unclear	Not well researched
PTSD	No	Unclear	Not well researched

The reviews note that with the use of cannabinoids for treatment of these disorders, individuals can also experience increased risk of short-term adverse events including dizziness, dry mouth, nausea, fatigue, somnolence, vomiting, disorientation, confusion, loss of balance, and hallucinations.

References: Hill, 2015; Koppel et al., 2014; Whiting et al., 2015

Questions and Findings

Following are the questions the stakeholder group sought to answer with this health impact assessment, and the findings.

What would happen to the prevalence of marijuana use if Vermont taxed and regulated marijuana?

- Perception of harm and perception of use are both predictors of marijuana use among youth and adults. The percentage of Vermonters who perceive marijuana use as harmful is decreasing; at the same time, they overestimate the prevalence of marijuana use.
- Some populations are more likely to use marijuana, and health impacts differ depending on who uses marijuana. Children, pregnant women, people with pre-existing physical health or mental health conditions, users of alcohol or other drugs, etc. are at greater risk of negative health outcomes from using marijuana.
- Among high school students who use marijuana, about one-third use it almost daily.
- The concentration of THC in marijuana being sold now in Vermont is not known, but it has likely increased greatly since 1990. The average THC concentration now being sold in Colorado is 17 percent, which is much higher than any concentrations used in peer-reviewed health effect studies. It is not known how this higher concentration of THC affects prevalence of use.

Would traffic safety change if Vermont taxed and regulated marijuana?

- Research shows increased odds of crashing, crash culpability, and fatality with increasing blood THC levels. A blood THC concentration of 5 ng/mL increased the odds of crash responsibility from 2.7 to 6.6 – odds similar to that of a blood alcohol content of 0.15 percent. The exact blood level of THC associated with impairment is not known, and it is not entirely clear if blood level alone is a sufficient indicator of impairment for all users.
- Data from Washington and Colorado show more fatalities with THC in the blood toxicology, but the data are too new to establish causality.
- Using marijuana and alcohol together increases crash risk, but it is not clear whether regulation will increase or decrease driving under the influence of alcohol alone. It is possible that fewer people will drive drunk if they substitute marijuana for alcohol.
- Education campaigns alone will not deter drivers from using and driving.

**What would be the impact on mental health be if Vermont regulated and taxed marijuana?
What would change in psychosocial outcomes (e.g. life satisfaction, interpersonal relationships) if Vermont regulated and taxed marijuana?**

- Early and persistent use of marijuana can lead to the development of anxiety disorders later in life. It may lead to development of depressive disorders. Among individuals at risk for the development of some psychotic disorders, marijuana use may increase the risk or mean that onset of those disorders begins earlier in life.
- Marijuana use may impact the physical structure of the brain. The exact effect, whether it is reversible, and what the potential health implications are, remains unknown.
- Early and continuous use of marijuana significantly increases risk of not completing high school, not enrolling or completing college, low educational achievement, lower income, unemployment and welfare dependence as an adult, premature work force retirement due to disability, and reduction in IQ in middle adulthood.

What might change in other substance use disorders and treatment if Vermont regulated and taxed marijuana?

- The number of Vermonters in treatment for marijuana as the primary substance of abuse is going down overall. Still, about 40 percent of those treated for a substance use disorder in the state substance abuse treatment system also misuse marijuana.
- If marijuana use increases, the number of people with a marijuana use disorder will also increase.
- If use increases among youth, individuals with a substance use disorder for more than one substance will also increase.

What might change in academic outcomes if Vermont regulated and taxed marijuana?

- Marijuana use among high school and college students negatively impacts academic outcomes. The association has a dose-response relationship, which means the more a student uses, the worse the outcomes.
- The research on the relationship between marijuana use and academic outcomes is almost sufficient to show a cause-and-effect link between the two.
- Youth in more vulnerable situations (e.g. already experiencing behavior or mental health problems) are more likely to experience a negative academic outcome due to marijuana use.
- In Colorado, there has been a sharp increase in suspensions from 2013 to 2014. The state cannot confirm whether this is due to marijuana use, or due to the state's legalization in 2014. In Vermont, marijuana is the number one substance for which students are suspended from school.

- In a convenience sample of 130 Vermont educators, half reported they had not noticed an increase in marijuana use from the 2013 school year to the 2015 school year, but two-thirds expected to see an increase in use under a regulated system.

Would emergency department admissions change if Vermont regulated and taxed marijuana?

- In Vermont, there was a drop in the number of emergency department visits with any mention of cannabis abuse or dependence in the diagnosis codes from 2008 to 2011. Since 2011, the numbers have gone back up.
- Based on Colorado's estimates within the first year of legalization, should Vermont see a similar trend after regulation, the increase would be from 581 visits in 2013 to approximately 750 visits in 2014. This assumes Vermont includes infused products in the legislation.

Lessons from Tobacco and Alcohol that Could Apply to Marijuana Regulation

The stakeholder group also explored what is known from tobacco and alcohol policy and lessons that may be applied to protect and improve health under a regulated marijuana market. Here are some of the key lessons:

- **Smoke-free policies** reduce secondhand smoke, increase the number of people who quit smoking, reduce tobacco initiation rates, and reduce tobacco-related morbidity and mortality. Vermont law currently allows for tobacco substitutes (i.e. vaporizers) in many places where smoking is banned. Vermont smoke-free laws do not cover the use of marijuana.
- **Limiting access** to alcohol and tobacco has been proven to reduce use. This includes:
 - Limiting outlet density – controlling the number of stores that can sell the substance within a certain area. This is true for alcohol or tobacco.
 - Limiting the type of outlet that can sell tobacco can decrease initiation and youth use. If youth have access to tobacco or exposure to tobacco advertising in the retail outlets they frequent, they are more likely to begin smoking cigarettes.
 - Limiting the times of day that alcohol can be sold.
 - Limiting the age at which a person can purchase alcohol or tobacco.
- **Increasing taxes** and establishing minimum price laws reduce the amount of alcohol or tobacco people use. In addition, prohibiting price discounting is an effective strategy to reduce use.
- **Allowing local control** over outlet density and advertising contributes to a culture of health in the community, despite the fact that people can easily travel from one town to another.

- **Limiting the age** of legal alcohol purchase to 21 years old or older decreases the number of motor vehicle accidents, reduces initiation of use, and use of alcohol.
- **Child-resistant packaging** saves lives.
- **Limiting tobacco and alcohol advertising** can reduce youth initiation and use. Prohibiting self-service displays, Internet sales, free samples, mass media advertising and flavored products are all established means of limiting youth tobacco use.
- **Enforcing laws** that restrict sale to those of legal age is an effective way to keep alcohol and tobacco out of the hands of youth. This requires a strong enforcement effort.

Recommendations

Stakeholders identified the following recommendations should Vermont decide to regulate and tax marijuana for non-medical use.

Infrastructure

- **Put infrastructure in place before sales begin.** Ensure that all critical staff are hired, all regulations and rules are in place, and all testing infrastructure is built and functioning before allowing for the licensing of production, distribution or retail of marijuana products. Authorize a governing body or administrative unit responsible for overseeing the implementation of the regulation and taxation of marijuana.
- **Expand Existing Tobacco Laws.** Expand and enhance *all* current tobacco smoking laws and regulations to include the use of tobacco *or* marijuana and include any potential type of delivery system or tobacco substitute (electronic cigarettes, vape pens, etc.).
- **Do not allow use of marijuana in public places.** Ensure children and youth are not exposed to marijuana use or second hand smoke.
- **Fully fund enforcement and oversight.** Follow best practice in protecting youth and young-adults, as well as adult users, by ensuring licensing fees are set at a level, and will continue to grow with inflation and industry growth, that fully funds the necessary enforcement and oversight efforts now and in the future. Note: Current tobacco and alcohol licensing fees are not sufficient to support best practice enforcement efforts.
- **Standardize and test packaging and potency.** Ensure that all THC concentration regulations, particularly those relating to packaging, labeling and testing, are in place before implementation. Marijuana and marijuana products should be batch-tested and labeled for potency. Procedures must be in place to regulate and test final products for contaminants.

Protect Youth and Young Adults

- **Restrict Age of Access.** Implement prevention, regulation and enforcement strategies that greatly reduce access to marijuana for those age 25 and younger. This is to protect children, youth and young adults during the time in life of rapid brain development and academic involvement.
- **Fund Prevention.** Set up a fund, similar in mechanics to the Clean Water Fund, from taxes on marijuana production, distribution and sales directed to a designated fund in the Treasurer's Office, and used only for substance use prevention and education efforts. Use this funding to:
 - Expand substance misuse prevention, education and screening in schools (including post-secondary institutions) and pediatric offices.
 - Launch a statewide education campaign directed at specific populations such as youth, young adults and pregnant women, about the potential health risks of non-medical marijuana use.
- **Restrict Advertising.** Put in place advertising restrictions to ensure that youth and young adults are not targeted by, or exposed to, marijuana advertising. Restrict advertising from any area where youth could potentially be exposed.

Infused Products (Edibles)

- **Do not allow infused products on the regulated market.** Do not include retail sales of products infused with marijuana for non-medical purposes.
- **Never allow infused products that could appeal to children.** Mandate that should future legislation ever allow for infused/edible products, they are never allowed in a format that could be attractive to youth (e.g. gummy bears, cookies, brownies, etc.). Before any future regulation regarding edibles is implemented, ensure that full testing and regulatory bodies are in place. This includes development, implementation and full funding for comprehensive food inspection.

Prevent Motor Vehicle Crashes

- **Set a blood level operating limit for THC.** Set a per se active-THC blood level limit for operating a motor vehicle based on the best available evidence. Designate a non-Legislative body with rulemaking authority made up of law enforcement and health officials to review data and determine the exact per se limit. Allow this body to amend that limit in the future based on scientific evidence, surveillance data, and emerging information from other states.

- **Build driver testing infrastructure.** Build the infrastructure and procedures necessary to conduct appropriate and consistent testing for THC before marijuana is regulated.
- **Implement a public education strategy about the dangers of driving under the influence of THC.** Do this before marijuana is regulated and ensure that the education includes information on what the legal limits mean in terms of use.

Protect Adults

- **Expand screening in primary care practices.** Expand screening for substance use disorders and mental health problems and trauma in primary care.
- **Get providers the information they need.** Ensure medical providers receive the most recent information and training related to screening for risk factors for substance misuse disorders (e.g. non-adaptive stress response) as well as Screening, Brief Intervention and Referral to Treatment (SBIRT). Work with local teaching institutions to ensure that medical students, nursing students (and other allied health professionals) receive the most recent information and training on the health impacts of marijuana.

Reduce Access and Protect Local Control

- **Limit sales to adult-only outlets statewide.** Do not allow sales in locations that minors can enter. Ensure a statewide standard, but:

Allow local governments to further restrict sale, outlet density/location and advertising through municipal zoning and ordinance mechanisms – including banning the sale of marijuana, similar to Vermont’s laws concerning medical marijuana dispensaries.
- **Consider statewide “buffer zones”.** Consider implementing statewide buffer zones for the sale of marijuana around areas such as playgrounds, schools and colleges.

Monitor the Future

- **Fund surveillance and research.** Fund surveillance efforts to monitor more closely the type of use, frequency of use, and potency of marijuana used among Vermonters of all ages. Encourage and fund the scientific study of health effects among Vermonters who use marijuana.

Background

In 2004, the Vermont Legislature legalized the use of marijuana to treat a small number of medical disorders: multiple sclerosis, cancer and HIV/AIDS. Severe pain, wasting syndrome, nausea and seizures were added in 2007. In 2011, the Legislature legalized permits under the jurisdiction of the Department of Public Safety for four dispensaries to grow and sell marijuana to patients registered with the medical marijuana registry. The first dispensaries opened in 2013. In 2013, the Legislature decriminalized the possession and use of small amounts of marijuana. Effective July 1, 2013, possession of an ounce or less of marijuana can result in a fine, but not in a criminal charge.

Advocates have been promoting legislation to regulate marijuana for adult (age 21+) use. In May 2014, Governor Peter Shumlin signed Act 155, which required the secretary of administration to provide a report about the benefits and consequences of legalizing marijuana in Vermont. The state hired the RAND Corporation to assess the financial implications and policy options should Vermont choose to regulate marijuana, and the report was presented in January at the start of the 2015 legislative session. During the session, legislators introduced a bill to regulate and tax marijuana, and the Senate Committee on Government Operations met weekly to study the issue.

The RAND report was designed to look at a number of economic and marketplace factors, and provided only limited information on the potential health impacts of regulating marijuana in Vermont. While this health impact assessment will discuss the basic premise of regulation and taxation in relation to health, it will not duplicate the RAND analysis.

What is a Health Impact Assessment?

According to the Centers for Disease Control and Prevention, a Health Impact Assessment (HIA) is a “process that helps evaluate the potential health effects of a plan, project or policy before it is built or implemented.”¹ A health impact assessment is an objective process involving stakeholders from all sectors – from transportation to agriculture to education to housing, etc. – to consider health consequences broadly, and to recommend strategies that can be implemented to protect or improve health.

The HIA process consists of six steps:

1. *Screening* determines the need for and value of a health impact assessment.
2. *Scoping* determines which health impacts to evaluate, analysis methods, a work plan, and generates a pathway diagram.
3. *Assessment* profiles existing health conditions and evaluates potential health impacts.
4. *Recommendations* to identify strategies to address health impacts.
5. *Reporting* includes the development of the health impact assessment report
6. *Monitoring* tracks how the health impact assessment influences decision-making processes and decisions, as well as the effects on health.

Source: Human Impact Partners – www.humanimpact.org/new-to-hia/tools-a-resources/#hiaquidesandsteps

What is the proposed marijuana legislation?

S.95 was introduced in the 2015 Legislative Session to regulate marijuana for adult use. This health impact assessment, however, focuses on the broad outline of policy recommendations as described by the Senate Government Operations Committee:

<http://legislature.vermont.gov/committee/detail/2016/26>

In brief –

Policymakers recognize legitimate federal concerns about marijuana reform and seek through this legislation to provide better control of access and distribution of marijuana in a manner that prevents:

- (A) distribution of marijuana to persons less than 21 years of age;
- (B) revenue from the sale of marijuana going to criminal enterprises;
- (C) diversion of marijuana to states that do not permit possession of marijuana;
- (D) State-authorized marijuana activity from being used as a cover or pretext for trafficking of other illegal drugs or activity;
- (E) violence and the use of firearms in the cultivation and distribution of marijuana;
- (F) drugged driving and the exacerbation of any other adverse public health consequences of marijuana use;
- (G) growing of marijuana on public lands and the attendant public safety and environmental dangers posed by marijuana production on public lands; and
- (H) possession or use of marijuana on federal property.”

Why conduct a health impact assessment on marijuana legislation in Vermont?

The Health Department is pursuing a Health in All Policies approach. In following this approach, health impact assessments are a strong tool in investigating the effects of policy and planning decisions on health outcomes, and making recommendations to optimize potential positive health impacts and mitigate potential negative health impacts.

On October 6, 2015, Governor Peter Shumlin signed a Health in All Policies Executive Order (No. 07-15) establishing a Health in All Policies Task Force. The executive order, while not directed at this topic specifically, asks the task force to report on “potential opportunities to include health criteria in regulatory, programmatic and budgetary decisions” and to identify evidence-based actions and policies.

Health Department leadership also identified a health impact assessment of marijuana regulation as a priority through its Public Health Stat process. Facilitated by the department’s performance improvement manager, Public Health Stat is an internal cross-divisional management process that promotes data-driven decision making, relentless follow through and a focus on accountability. Every month, key department decision-makers and stakeholders come together to plan and allocate resources to support one of six high priority, department-wide goals. The meetings engage managers at all levels in developing and owning solutions that are data-driven, with an eye toward achieving efficiencies that will positively impact health outcomes.

Health Department leadership identified staff from the Division of Health Surveillance and the Division of Alcohol and Drug Abuse Programs to lead the health impact assessment. They in turn invited a group of stakeholders from a range of sectors to participate in the assessment process, using peer-reviewed research and federal and state government reports to analyze what is currently known about the potential health impacts of marijuana regulation. Because only a few states have very recently legalized marijuana and the data are still very limited, the group also drew from research and knowledge of regulation, taxation and use of the two other legal adult-only substances: alcohol and tobacco.

See Appendix A for a list of the stakeholders and participants.

Goals of the Health Impact Assessment

The overarching goal of this health impact assessment is to determine the potential impacts of legislation to regulate marijuana on the health of Vermonters – and to recommend ways to mitigate any adverse health impacts of such legislation.

The group also chose to focus on the impact to youth (age 12 to 21), children (under age 12), pregnant women, and individuals of lower socioeconomic status.

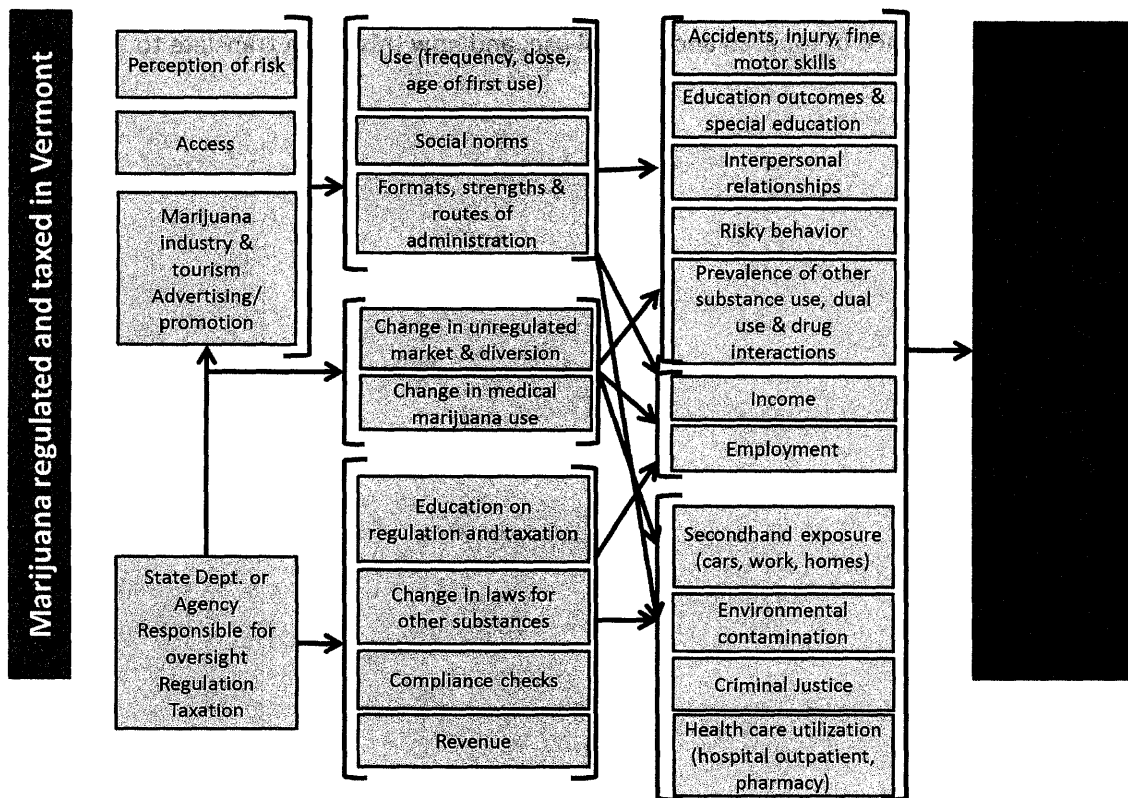
Scoping

Health Impact Assessment Scoping Process

To develop the health impact assessment scope, the Health Department convened the group of stakeholders and consultants from multiple sectors. (See Appendix A for a full list.) The group met every month from June 2015 until January 2016. Before the first meeting, all members received background information on health impact assessment, marijuana legislation, and the purpose of the project. At the first meeting, stakeholders brainstormed the many potential pathways by which marijuana legalization could affect health. Meetings were held via WebEx and in person so that all those who were able could attend without undue hardship.

Stakeholders were given a survey and asked to prioritize the pathways identified in the first meeting for discussion at the July meeting. Members finalized the pathway diagram in October 2015 and agreed on a set of questions upon which to build the health impact assessment analysis. A pathway diagram is a visual representation of how the policy could potentially impact health. It does not specify if or how the policy will impact health. Such questions are answered during the assessment process.

Scope and Pathway Diagrams



Pathway Diagram: Marijuana Regulation and Taxation

The health impact assessment is divided into sections based on questions derived from the pathway diagram:

- What would happen to the prevalence of marijuana use if Vermont taxed and regulated marijuana?
- Would traffic safety change if Vermont regulated marijuana?
- What would be the impact on mental health if Vermont regulated marijuana?
- What would be the change in psychosocial outcomes (e.g. life satisfaction, interpersonal relationships) if Vermont regulated marijuana?
- What might change in other substance use disorders and treatment if Vermont regulated and taxed marijuana?
- What might change in academic outcomes if Vermont regulated and taxed marijuana?
- Would emergency department admissions change if Vermont regulated and taxed marijuana?

Stakeholders also wanted to learn from our experience with tobacco and alcohol, the other legal adult-only substances. They asked how regulation and taxation affect youth substance use initiation, and prevalence of tobacco and alcohol use, and how this might translate to marijuana.

Assessment

Literature Review Methodology

Health Department staff, supported by other stakeholders, completed a systematic literature review. We specified search terms that would return citations with any positive, negative and neutral health effects of cannabis use. While ideally the literature review could have focused on the health effects of regulated marijuana, these data are not yet available and such studies are very scarce. (Data from Colorado have yet to accumulate enough to make any direct assessments.) It is therefore important to remember that this literature review was based on illicit marijuana use.

In addition, we did not focus on marijuana delivered from a medical marijuana dispensary for medical purposes, as that is already legal in Vermont and outside the scope of this health impact assessment. We have included a brief summary table with evidence for medical marijuana uses from a limited number of thorough research reviews. We did this to ensure that we had examined all potential health benefits that could be derived from individuals who are not seeking medical treatment, but who might use marijuana under legalization.

Search Criteria for Health Impact Assessment on the Legalization of Marijuana

1. PubMed and PsychINFO:
 - a. Title/Abstract: Marijuana OR Cannabis AND Health
 - b. Title/Abstract: Marijuana OR Cannabis AND Mental Health
 - c. Title/Abstract: Marijuana OR Cannabis AND Psychosis OR Schizophrenia
 - d. Title/Abstract: Marijuana OR Cannabis AND Fatal Crashes
 - e. Title/Abstract: Alcohol OR Drugs AND Fatal Car Crashes
 - f. Title/Abstract: Marijuana OR Cannabis AND Driving
 - g. Title/Abstract: Marijuana OR Cannabis AND Adolescent(s) OR Young Adults
2. *Addiction* 2009-2015: Searched each issue for Marijuana OR Cannabis AND Health-related Outcomes.
3. Relevant references from articles obtained from 1 and 2 above.
4. State government reports on marijuana legalization
 - a. Searched State websites where marijuana has been legalized for health impact or effect reports

Strength-of-Evidence Criteria for Literature Review of the Health Effects of Marijuana

We used an objective set of criteria, adapted from the Washington State Board of Health's *Draft Health Impact Review Strength-of-Evidence Criteria*, to accurately assess the relevance and weight the results each study should be given in making conclusions about health impacts.

We note that while meta-analyses – studies that look at the findings from many studies all at once – are commonly accepted as the most complete and impartial assessments of particular research questions, they too have been subject to significant criticism, including study search

strategy, selection criteria, basic definitions, misspecification, coding and computational errors, and inappropriate metrics.

Strength-of-Evidence Criteria Used in the Literature Review:

- **Not well researched:** the literature review yielded few if any studies, or only yielded studies that were poorly designed or executed or had high risk of bias.
- **A fair amount of evidence:** the literature review yielded several studies supporting the association, but a large body of evidence was not established; or the review yielded a large body of evidence but findings were inconsistent with only a slightly larger percent of the studies supporting the association; or the research did not incorporate the most robust study designs or execution or had a higher than average risk of bias.
- **Strong evidence:** the literature review yielded a large body of evidence on the relationship (a vast majority of which supported the association) but the body of evidence did contain some contradictory findings or studies that did not incorporate the most robust study designs or execution or had a higher than average risk of bias; or there were too few studies to reach the rigor of 'very strong evidence'; or some combination of these.
- **Very strong evidence:** the literature review yielded a very large body of robust evidence supporting the association with few if any contradictory findings. The evidence indicates that the scientific community largely accepts the existence of the association.

Calculations

Whenever available, analysts at the Health Department used data from Colorado and Washington to extrapolate potential changes in health in Vermont. When not available, analysts used estimates from studies and the literature to approximate potential changes in outcomes under legalization. Changes in impact due to regulation and taxation were considered based on tobacco and alcohol policies analyzed in the past. Note that these are all estimates based on multiple assumptions and should be considered as such; changes in these assumptions would alter any estimates. In most cases, calculations were not made because too many assumptions would have been necessary.

Analysis

The stakeholder group charged Health Department analysts with reviewing the literature and assessing the potential impact on Vermont based on data and the science currently available. Stakeholders reviewed and commented on this analysis.

In addition, stakeholders went back to their constituencies and collected questions and ideas relevant to their areas of interest. This information is also included; this is not a quantitative scientific approach, but provides context as well as a local perspective to the issue.

Prevalence

What would happen to the prevalence of marijuana use if Vermont taxed and regulated marijuana?

Estimating the change in use of marijuana should it be taxed and regulated in Vermont is difficult due to the lack of comparison data. The laws in Colorado, Washington, Washington D.C. and Oregon are all too new to produce reliable estimates for any potential changes due to legalization.

Prevalence of use involves the number of individuals using marijuana, the age at which they begin use, the age at which they stop using, the frequency with which they use, and the amount (or concentration) they use on each occasion. All of these prevalence factors could change under legalization, and it is not certain in which direction each factor may change.

Studies have now shown that medical marijuana laws do not appear to increase youth use of marijuana in states where medical marijuana is available (Hasin, 2015; Anderson, 2015). This includes Vermont, based on Youth Risk Behavior Survey data. This evidence does not, however, address whether regulation of marijuana for non-medical adult use will change youth use.

A recent study released in 2015 using *Monitoring the Future* data shows that among California 12th grade students, decriminalization might have impacted rates of use. However, the study is not able to estimate whether that change will persist through other cohorts of students, or whether the impact may have resulted from media coverage of decriminalization rather than decriminalization itself. From the study:

In 2012 and afterwards California 12th graders as compared to their peers in other states became (a) 25% more likely to have used marijuana in the past 30 days, (b) 20% less likely to perceive regular marijuana use as a great health risk, (c) 20% less likely to strongly disapprove of regular marijuana use, and (d) about 60% more likely to expect to be using marijuana five years in the future. Analysis of 10th graders raises the possibility that the findings among 12th graders may reflect a cohort effect that was set into place two years earlier.” (Miech et al., 2015)

The data included in this *Health Impact Assessment of Marijuana Legislation in Vermont* are an overview of current and past population-level surveillance data on marijuana use among various populations. These data sources are used to monitor marijuana prevalence among the general Vermont population. Based on studies and other state findings once they are available, some of these data sources could be used to predict potential changes in Vermont or measure the health impact if marijuana regulation were to pass.

The Health Department runs three key population-level surveys funded by the Centers for Disease Control and Prevention. All three of these surveys are weighted to represent the Vermont population. The *Youth Risk Behavior Survey* is administered to all middle and high school students in Vermont every odd-numbered year. This is a pencil-and-paper survey.

The *Behavioral Risk Factor Surveillance System* is a phone survey conducted every year on a random sample of Vermont adults age 18 and older. The *Pregnancy Risk Assessment Monitoring System* is conducted every year. This is a paper-and-pencil survey sent to a representative sample of mothers within the first year of their child's life.

In addition, the *Vermont College Health Survey* was initiated by the Health Department in 2014 to monitor the health of Vermont college students. The survey will be conducted every even-numbered year. It is distributed to students via email, and statewide results are weighted to represent the Vermont college student population.

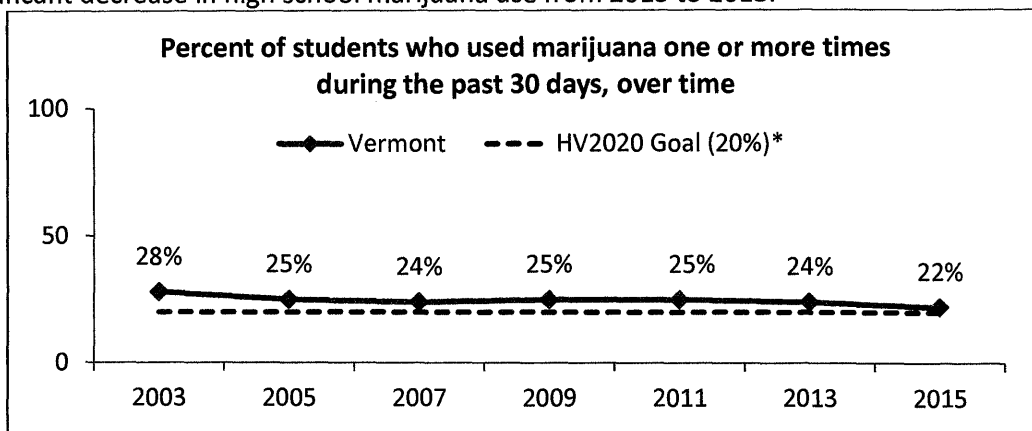
The *National Survey on Drug Use and Health* is managed by the Substance Abuse and Mental Health Administration and is conducted through a combination of in-person interviews and questionnaires. Data are collected every year, but reported at the state level in two-year aggregate in order to achieve representative weighted samples.

Findings from these five surveillance tools are presented on the following pages. They do not demonstrate or illustrate what will happen if Vermont moves to regulate marijuana. However, they can be used to monitor any changes, and can be used as a baseline to estimate potential changes in prevalence given the changes seen in states such as Colorado and Washington that have already gone through the legalization process.

High School Prevalence and Perceptions

Prevalence of Use

Based on the Vermont Youth Risk Behavior Survey, youth prevalence of marijuana use among high school students (grades 9-12) changed very little from 2005 to 2013, and there was a significant decrease in high school marijuana use from 2013 to 2015.

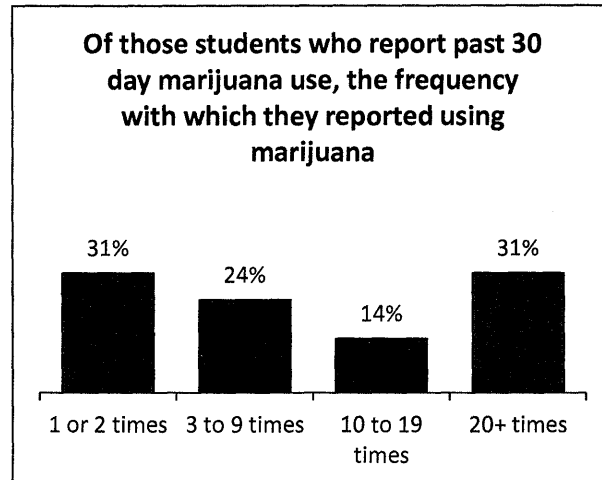


Source: Vermont Youth Risk Behavior Survey

*Note: the HV2020 Goal stands for Healthy Vermonters 2020 Goal. These are a set of goals chosen from among hundreds of Healthy People 2020 goals for the State Health Assessment. For more information: <http://healthvermont.gov/hv2020/index.aspx>

Frequency of Use

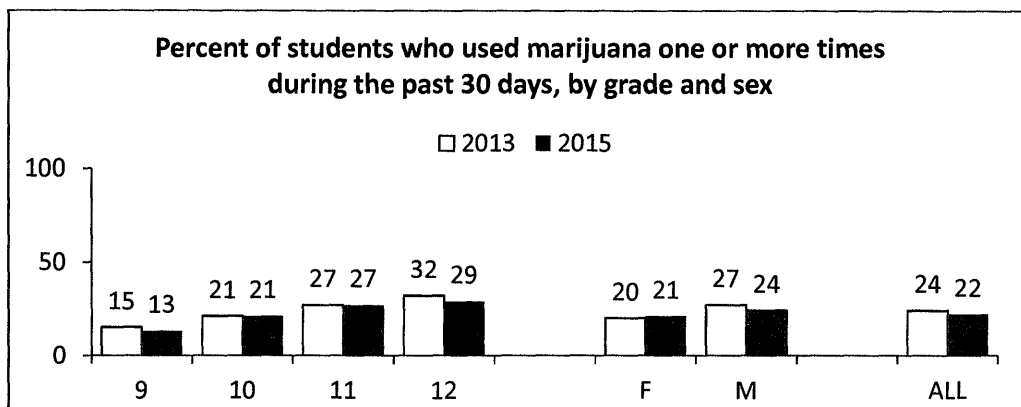
Of those students who used marijuana in the past 30 days in 2013, 31 percent used it 20 or more times in the past month.



Source: Vermont Youth Risk Behavior Survey, 2013

Regular Use and Age

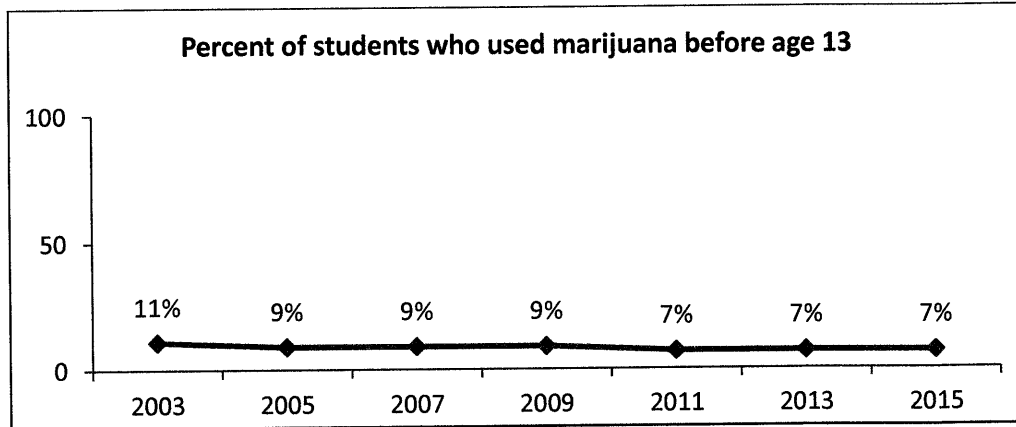
Older students continue to use more marijuana than younger students. Twenty-nine percent of high school seniors reported past month marijuana use, compared to only 13 percent of freshman. There are also differences by gender, with more boys reporting use than girls.



Source: Vermont Youth Risk Behavior Survey, 2013 & 2015

Age at First Use

Initiation of marijuana use is also of importance. Among high school students, 7 percent reported using marijuana before they were 13 years old. This has not changed in recent years.

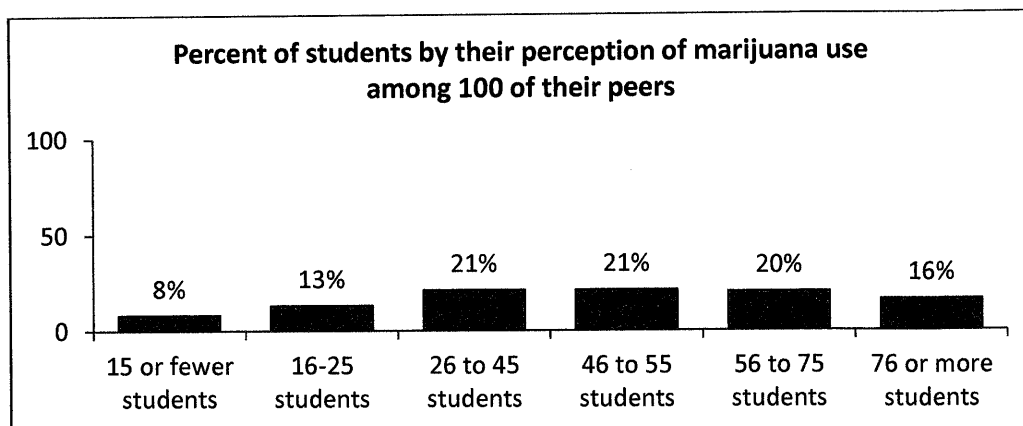


Source: Vermont Youth Risk Behavior Survey

Perceptions of Use

Seventy-nine percent of high school students believe that more than 25 percent of their peers use marijuana. The following graph depicts the perceived amount of use among high school students. Students appear to believe more of their peers use marijuana than actually do.

This is important because perception of use and perception of harm of marijuana use are both predictors of marijuana use among youth as well as adults.



Source: Vermont Youth Risk Behavior Survey, 2015

In addition to asking students about prevalence of use among their peers, the Youth Risk Behavior Survey asks students about their perceptions of substance use as it relates to their parents, their peers, risk to health, and ease of access.

Question	Percent of students who think their parents would think it is <i>wrong</i> or <i>very wrong</i> for them to:			Percent of students who think it would be <i>wrong</i> or <i>very wrong</i> for someone their age to:			Percent of students who report that it would be <i>sort of easy</i> or <i>very easy</i> to get:		
	2011	2013	2015	2011	2013	2015	2011	2013	2015
Smoke cigarettes	89%	90%	92%	72%	75%	78%	69%	66%	61%
Drink alcohol	73%	74%	72%	47%	49%	53%	73%	72%	70%
Smoke marijuana	83%	82%	80%	59%	57%	56%	63%	63%	62%

Source: Vermont Youth Risk Behavior Survey

Percent of students who think <i>people their age</i> greatly risk harming themselves (physically or in other ways) if they:			
	2011	2013	2015
Smoke one or more packs of cigarettes per day	59%	63%	65%
Have five or more drinks of alcohol once or twice each weekend	36%	38%	38%
Use marijuana regularly	34%	31%	27%

Source: Vermont Youth Risk Behavior Survey

Students who used marijuana in the past 30 days were more likely to also report other risky behaviors. This was increasingly true the more frequent the reported marijuana use. For example, among students who reported using marijuana zero times in the past month, 3 percent reported attempting suicide in the past year, while among students who reported using marijuana 20+ times in the past month, 15 percent reported attempting suicide in the past year.

The Youth Risk Behavior Survey can only show *associations* and it is important to note that this table does not in any way imply *causation*.

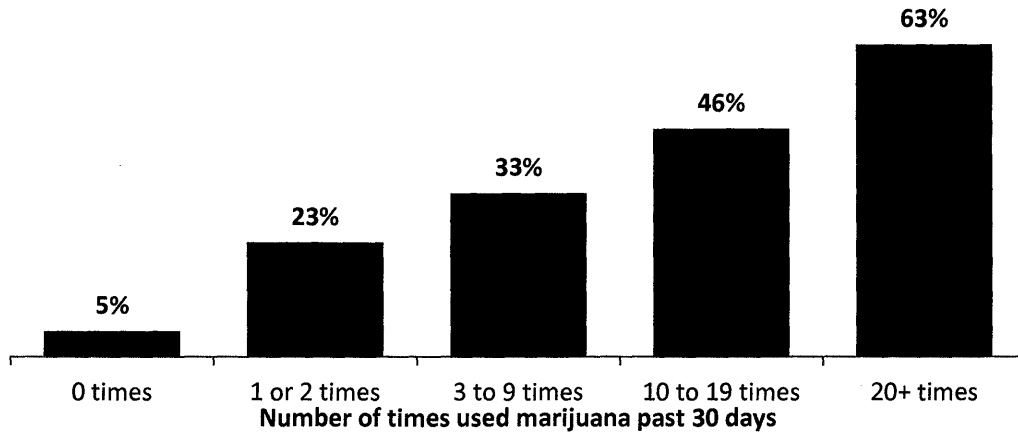
Percent of high school students reporting certain risk behaviors or assets, by frequency of marijuana use, Vermont 2013					
	0 times	1-5 times	6-19 times	20-29 times	30+ times
Violence					
Attempted suicide in the past 12 months	3%	7%	9%	11%	15%
Bullied someone else in the past 30 days	10%	20%	22%	22%	30%
Fought in the past 12 months	15%	26%	30%	37%	48%
Hurt self in the past 12 months	13%	22%	27%	32%	30%
Mental Health Indicators					
Made suicide plan past 12 months	9%	14%	17%	19%	21%
Sad 2 weeks past 12 months	18%	28%	32%	35%	35%
Substance Use					
Of those who had sex in the past 3 months, used drugs or alcohol the last time	8%	21%	28%	37%	57%
Misused a prescription drug, ever	6%	19%	29%	40%	59%
Five+ drinks in the past 30 days	8%	42%	57%	60%	69%
Student Assets					
Agree teachers really care	63%	51%	47%	46%	43%
Agree you matter to community	52%	50%	45%	40%	35%
Got mostly As and Bs	83%	76%	75%	65%	57%

Source: Vermont Youth Risk Behavior Survey, 2013

The more frequently students report using marijuana, the more likely they are to report smoking cigarettes. Among students in grades 9-12 who used marijuana on one or two of the

past 30 days, 23 percent reported smoking cigarettes. Among those who used marijuana on 20 or more of the past 30 days, 63 percent reported smoking cigarettes at least once in the past 30 days.

Percent of high school students who smoked 1+ cigarette in the past 30 days by reported intensity of marijuana use in the past 30 days

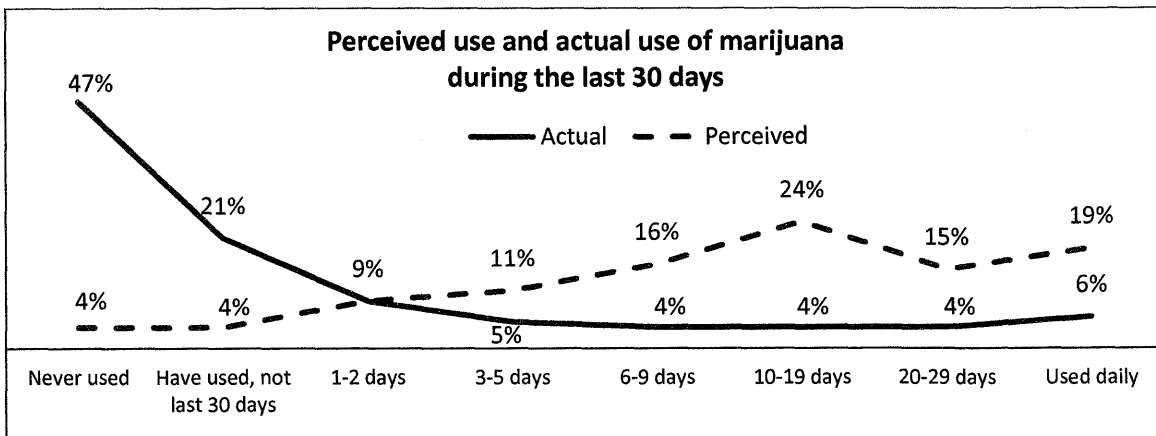


Source: Vermont Youth Risk Behavior Survey, 2013

College Age Prevalence and Perceptions

One-third of all college students have used marijuana in the last 30 days, with 50 percent of those using it on at least 20 of the previous 30 days. Male college students were more likely to use marijuana daily (8%), or to use it on at least 20 days (5%), compared to female college students who used marijuana daily (4%) or on 20 or more days (3%).

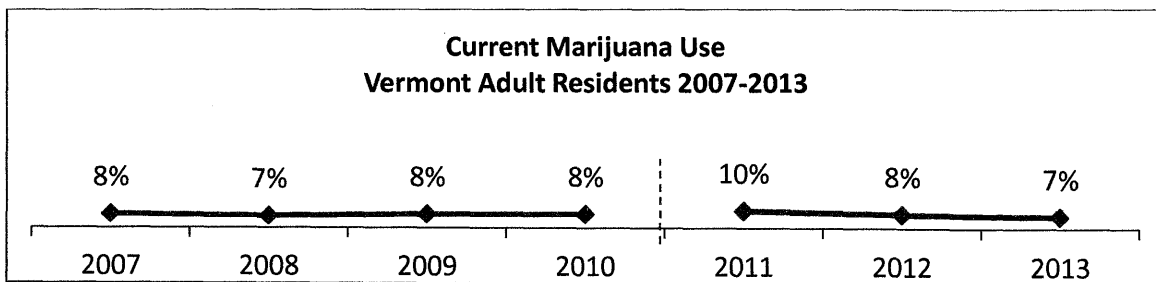
Compared to reported marijuana use, college students' perceived use among peers is much higher. College students reported thinking that 92 percent of college students have used marijuana during the past 30 days compared to 32 percent who reported actually using it. Notably, college students believe that six times as many of their peers use marijuana on 10 to 19 days per month, and about three times as many used it daily. Likewise, nearly 12 times as many college students reported never using marijuana compared to their beliefs about how many college students have never used marijuana.



Source: Vermont College Health Survey, 2014

Adult Prevalence and Perception

Rates of current marijuana use among Vermont adults are similar in 2012 and 2013. However, reported current use decreased significantly when comparing 2011 and 2013 (10% vs. 7%). In 2013, 16 percent of current adult marijuana users said they also drove after using at least once during the previous month.



Source: Vermont Behavioral Risk Factor Surveillance System

The Behavioral Risk Factor Surveillance System asks about the number of days of poor mental and physical health the participant experiences. If the participant responds that they have had one or more poor health days in the past month, the interviewer asks how many days their poor health has kept them from doing what they would normally do.

Participants who reported past 30-day marijuana use had a 2.3 increased odds (95% CI 1.6, 3.1) of also reporting one or more poor health days in the past month that kept them from their normal activities. Out of all adults reporting that they used marijuana in the past 30 days, 37 percent reported at least one poor health day that kept them from their normal activities, compared to 20 percent of those who did not use marijuana in the past 30 days.

The survey does not make a distinction between people who use marijuana for medical purposes and those who use it for non-medical reasons. (As of Nov. 5, 2015, there were 2,346 people in Vermont on the medical marijuana registry. These numbers are not likely to influence the statewide surveillance numbers dramatically.)

In addition, 78 percent of those who used marijuana in the past 30 days also used alcohol in the past 30 days. Among those who did not use marijuana in the past 30 days, 61 percent reported using alcohol during that time. This illustrates that if someone uses marijuana they are more likely to use alcohol as well, compared to those who do not use marijuana. This is a correlation, not a cause-and-effect relationship.

A similar pattern emerges with tobacco: 40 percent of those who used marijuana in the past 30 days also reported being a current smoker, while among those who did not use marijuana in the past 30 days, 14 percent reported being a current smoker.

According to the Pregnancy Risk Assessment Survey in 2011, 20 percent of Vermont women who have given birth reported using marijuana in the 12 months before their pregnancy. A total of 6 percent reported using marijuana during their most recent pregnancy, and 7 percent reported using marijuana since their child was born.

Probation officers in Colorado offer additional data on prevalence in another higher-risk population. In 2014, when retail sales of marijuana began, there was a 16 percent increase in positive THC urinalyses among people on probation between the ages of 18 and 25. Among those age 26+, there was a 35 percent increase in positive THC urinalyses from 2013 to 2014 (Rocky Mountain High Intensity Drug Trafficking Area, 2015).

Prevalence and Perception Among Vermonters Age 12 and Older

The 2014 National Survey on Drug Use and Health (NSDUH) data recently released by the Substance Abuse and Mental Health Administration showed increases in prevalence of marijuana use. In the northeastern region of the U.S., which includes New England and the mid-Atlantic states, past month marijuana use for people age 12 and older rose from 7.6 percent of the population in 2012/2013 to 9.5 percent in 2013/2014. This is a statistically significant increase of 25 percent. Past year use in the northeast region rose from 13.0 percent to 14.8 percent, a statistically significant increase of 13.8 percent.

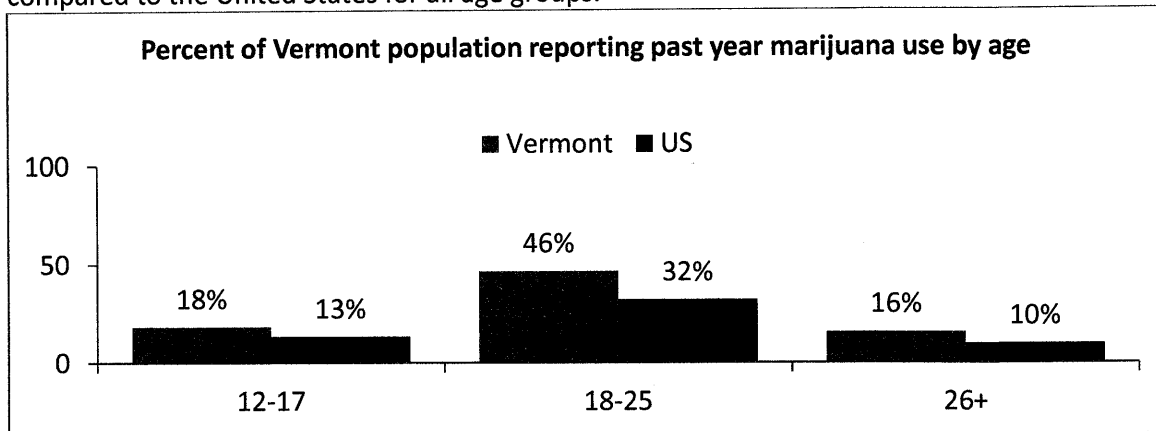
NSDUH breaks out the population by age group differently than the Behavioral Risk Factor Surveillance System or the Youth Risk Behavior Survey, and asks about past year and past month use rates for Vermont. Past 30-day marijuana use for 18 to 25-year-olds, age 18+, and age 26+ showed a significant increase from 2012/2013 to 2013/2014. Overall, 18 to 25-year-olds have a statistically higher prevalence of past year and past 30-day marijuana use compared to those age 12 to 17 years and those age 26+.

Vermont marijuana use in the past month, by age group and year

Age in years	2012/2013	2013/2014
12+	12%	13%
18+	12%	13%
26+	9%	10%

Source: National Survey on Drug Use and Health, 2012-2014

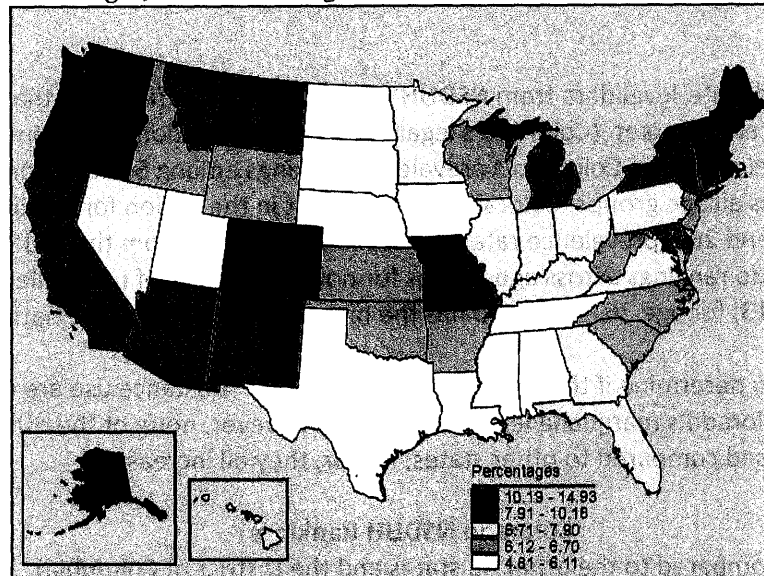
Vermont has a statistically higher percentage of past year and past 30-day marijuana use compared to the United States for all age groups.



Source: National Survey on Drug Use and Health, 2013/2014

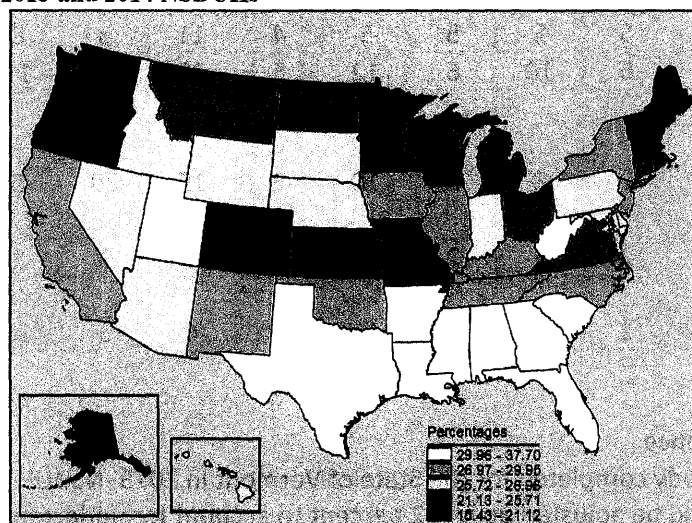
Maps illustrating NSDUH data (following page) show states in five groups. States shown in dark red are in the top fifth (worst) of all the states. Vermont is in the top fifth for past month and past year marijuana use, and for perception of risk, with a statistically lower percentage of people who do not see great risk from smoking marijuana once a month compared to the U.S.

Figure 3a *Marijuana Use in the Past Month among Individuals Aged 12 or Older, by State: Percentages, Annual Averages Based on 2013 and 2014 NSDUHs*



Source: SAMHSA, Center for Behavioral Health Statistics and Quality, NSDUH, 2013 and 2014.

Figure 4a *Perceptions of Great Risk from Smoking Marijuana Once a Month among Individuals Aged 12 or Older, by State: Percentages, Annual Averages Based on 2013 and 2014 NSDUHs*



Source: SAMHSA, Center for Behavioral Health Statistics and Quality, NSDUH, 2013 and 2014.

According to NSDUH, the prevalence of marijuana use in Colorado changed for adults, but did not change significantly for youth. However, Colorado leads the nation in terms of youth marijuana use.

The newly released state-level data from NSDUH includes 2014, the first year that marijuana was available in a retail market. (Colorado’s legalization and regulation began on January 1, 2014.) The table below shows Colorado’s prevalence rankings among 50 states and the District of Columbia. Across all age groups, Colorado ranks highest in the nation for marijuana use. For ages 12+, 18+ and 26+, prevalence rates increased significantly from the 2013 survey. In addition, Colorado rankings across age groups for nonmedical use of pain relievers (opioids) increased from 2013; for age 26+ Colorado has the highest prevalence in the nation.

It is still too early to determine if the parallel changes in other substance use are directly associated with Colorado’s marijuana legalization laws. However, none of the other major substances decreased compared to other states; rather, they all increased.

Colorado NSDUH Rankings
(compared to the other 49 states and the District of Columbia)

Year	Overall 12 & older		All adults 18 & older		Adults 26 & older		Youth 12-17		Young adults 18-25	
	2013	2014	2013	2014	2013	2014	2013	2014	2013	2014
Past 30 days										
Marijuana use	2	1	2	1	5	1	3	1	2	1
Alcohol use	5	5	5	5	5	4	11	3	8	8
Binge drinking	10	6	10	6	12	5	20	10	15	20
Illicit Drug Use Other than Marijuana	8	2	8	2	10	2	15	20	5	6
Past year										
Cocaine use	2	2	2	2	2	2	3	3	1	3
Nonmedical Use of Pain Relievers	12	2	13	2	16	1	4	3	10	7

Estimating Future Prevalence

According to the RAND study completed for the State of Vermont in 2015, NSDUH numbers related to marijuana should be adjusted up by 22 percent to account for underreporting due to sampling error as well as participant underreporting of use (Caulkins et al, 2015). In addition, the RAND report suggests that, on average, legalization could increase adult use between 25 percent and 100 percent, and uses 50 percent in many of its estimates. These estimates are highly uncertain, and the increases will vary based on the way in which marijuana is regulated and taxed in Vermont.

The RAND study did not predict a decrease in marijuana use, or a decrease in marijuana use frequency among users. Of note, the estimated 50 percent increase in use is a combination of an increase in the number of users as well as an increase in the amount used by each. Studies have not estimated the increase in the number of adult users alone.

Monitoring the Future is an annual study of approximately 130 public and private high schools throughout 48 states. Palamar et al. examined responses from seniors in the years 2007 to 2011 regarding whether or not they would use marijuana should it be legalized. Seniors were broken out into those who have used marijuana already, and those who have not. The study found that if marijuana were legalized, there would be a 5.6 percent absolute increase in lifetime prevalence of marijuana use among seniors, from 45.6 percent (44.6, 46.6) to 51.2 percent (50.2, 52.2). (Palamar et al., 2015) Of students who reported already using marijuana, 18 percent responded that were marijuana legalized, they would use it more frequently. Peer approval or disapproval affected the odds of a student reporting intention to use marijuana.

Based on these data, and using the Vermont Youth Risk Behavior Survey, we can calculate an estimated potential increase in prevalence if marijuana were to be regulated here. Among 12th grade students in 2013, 52 percent reported ever using marijuana. Using the estimated increase from Palamar et al., should marijuana be legalized in Vermont, almost 58 percent of 12th grade students might use marijuana. This does not take into account differences in culture or use patterns, which may be critically important factors in determining the original estimate from Palamar et al.

It is important to note that the ability to access marijuana, and the type of marijuana products available, could affect youth initiation and use of marijuana should it be regulated. In addition, intention to use and actual use are not the same, and this study was based on a hypothetical question posed to students. Marijuana will continue to be illegal for underage youth, and that was made explicitly clear in the survey. Youth who are considering changing their actions are not basing the decision on what is legal for them, but on what is legal for adults.

From research on alcohol and tobacco we know that greater access and lower prices lead to more use (Shih, in press; Wagenaar et al., 2010), even for products associated with high perception of harm. Given the uncertainty concerning the potential increases in adult marijuana use (25% to 100% increase) and youth marijuana use (mostly unknown, but potentially over 5%) – as well as use among special populations such as pregnant women – it is difficult to estimate the potential change in impact on health in Vermont. It is, however, safe to hypothesize that use will increase for adults, and will likely increase for youth, and therefore any positive or negative health effects will increase as well.

THC Potency

Potency has important implications for assessing the health impact of using marijuana. The RAND report states:

Potency in terms of THC content varies enormously from perhaps 4 to 8 percent for some commercial-grade imports. (Caulkins et al, 2015)

In Colorado, the mean THC content is now 17 percent (Marijuana Policy Group, 2015). Very little, if any, of the available research is based on marijuana with a THC content of 17 percent. This means that our current understanding of health effects is not accurate based on the potential THC potency under a regulated marijuana market, and makes calculating health effects more complicated. The health effects in Vermont would vary greatly from what has happened in Colorado and Washington if Vermont put a potency limit on regulated marijuana products.

Again, the RAND report confirms this finding:

Indeed, evidence suggests that the average potency of seized marijuana has been increasing in states that provide explicit legal protection for marijuana dispensaries. If this trend continues with legalization, insights from the previous health literature could understate future health impacts. (Caulkins et al., 2015, p, 31)

Summary of findings:

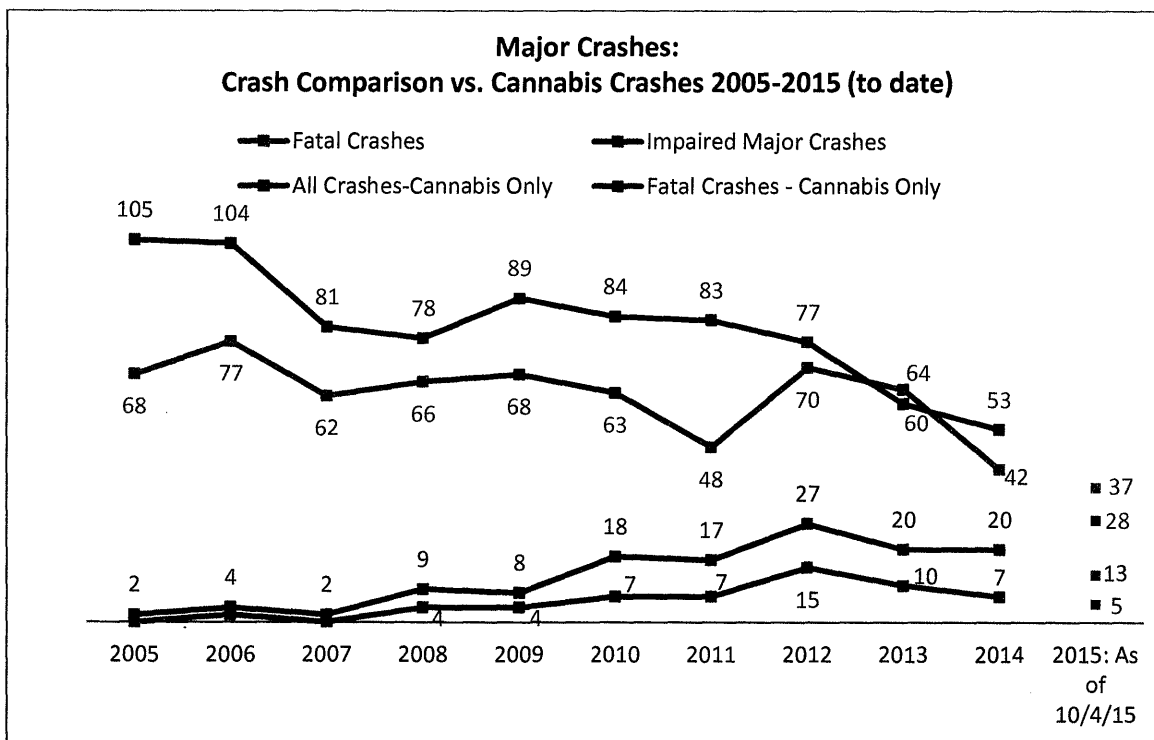
- Perception of harm and perception of use are both predictors of marijuana use among youth and adults. The percentage of Vermonters who perceive marijuana use as harmful is decreasing; at the same time, they overestimate the prevalence of marijuana use.
- Some populations are more likely to use marijuana, and health impacts differ depending on who uses marijuana. Children, pregnant women, people with pre-existing physical health or mental health conditions, users of alcohol or other drugs, etc. are at greater risk of negative health outcomes from using marijuana.
- Among high school students who use marijuana, about one-third use it almost daily.
- The concentration of THC in marijuana being sold now in Vermont is not known, but it has likely increased greatly since 1990. The average THC concentration now being sold in Colorado is 17 percent, which is much higher than any concentrations used in peer-reviewed health effect studies. It is not known how this higher concentration of THC affects prevalence of use.

Traffic Safety

Would traffic safety change if Vermont taxed and regulated marijuana?

Research on the effect of marijuana on traffic safety is well documented. Studies conflict on the strength of the effect blood THC levels have on the likelihood of a motor vehicle accident, but multiple systematic reviews have concluded that acute cannabis blood THC levels increase the risk of motor vehicle crashes. (Asbridge, 2012; Hartman, 2013) Studies show that acute cannabis consumption is associated especially with fatal collisions (Asbridge, 2012), and is particularly risky for occasional marijuana smokers (Hartman, 2013). Culpability also increases with increasing blood THC concentrations. A blood THC concentration of 5 ng/mL increased the odds of crash responsibility from 2.7 to 6.6, odds similar to that of a blood alcohol content of 0.15 percent. (Hartman, 2013). Brady and Li, 2013 reported that the number of cannabis-related fatal motor vehicle accidents in the United States tripled from 1999 to 2010.

In Vermont, according to the Chief Medical Examiner's Office from 2011 to 2014 there were 141 motor vehicle crashes where the driver/operator died that included a complete toxicology report. Of those, 50 had no potentially impairing substances detected, 47 had a blood alcohol content greater than 0.08, and 14 had blood Delta-9 THC content greater than 10 ng/ml. According to the Agency of Transportation Highway Research Section, crashes involving only cannabis have gone up since 2009, while overall impaired major crashes have gone down.



Data Source: VTrans VCSG dbase and FARS. Data as submitted by law enforcement.

*ALCOHOL &/OR DRUGS - **INDICATED**: For data years 2004-2013 this filter is used: Major Crashes where ContribCircum1 or 2 is "Under the influence" or AppOperCond 1 or 2 was "Under the Influence" or "Had Been Drinking" or Operator BAC = 0.01+ or Drug Test Results indicate positive findings.

ALCOHOL &/OR DRUGS - **IMPAIRMENT**: For data years 2014 + this filter is used: Operator BAC => 0.08 OR AppOperCond 1 or 2 = "Under the Influence" AND Drug Test Results = Positive OR ContribCircum 1 or 2 = "Under the Influence" AND Drug Test Results = Positive.

**Drug Test - Positive Results = 8-14

***Major Crash involves Fatality and/or Incapacitating injury.

Version: mw 10/5/15

In the time since laws legalizing the use of marijuana were implemented for adults in Washington and Colorado, both states have seen increases in motor vehicle fatalities involving cannabis.

In Washington State, a report released in August 2015 by the Washington Traffic Safety Commission on fatal crashes reports that:

The number of drivers testing positive for active THC increased, from 65 percent (38 of 60 drivers) in 2013 to an alarming 85 percent (75 of 89 drivers) in 2014. Approximately half of these THC-positive drivers exceeded the 5 ng/ml THC per se limit (A "per se" limit is the amount of a substance in a person's blood that according to Washington law makes the person DUI notwithstanding other evidence.)

A report released in October of 2015 from the Washington Traffic Safety Commission, titled *Driver Toxicology Testing and the Involvement of Marijuana in Fatal Crashes, 2010-2014*, found:

- In 2014, 84.3 percent of drivers positive for cannabinoids were positive for THC, compared to only 44.4 percent of cannabinoid-positive drivers in 2010. In 2014, among the 75 drivers involved in fatal crashes positive for THC, approximately half (38) exceeded the 5 ng/ml THC per se limit.
- The frequency of drivers in fatal crashes that tested positive for THC, alone or in combination with alcohol or other drugs, was highest in 2014 (75 drivers) compared to the previous four-year average (36 drivers). The frequency of drivers with alcohol greater than/equal to BAC .08 and no other drugs was lowest in 2014 (51 drivers) compared to the previous four-year average (98 drivers).
- The Washington report clearly states that the information presented cannot be used to determine a link between THC and crash risk. However, the Commission now differentiates between Carboxy-THC (the metabolite of delta-9-THC that can be detected up to 30 days after consumption of marijuana) and delta-9-THC itself.

In Colorado, a report from the Rocky Mountain High Intensity Drug Trafficking Area released in September 2015 reported:

- In 2014, when retail marijuana businesses began operating, there was a 32 percent increase in marijuana-related traffic deaths in one year.
- Colorado marijuana-related traffic deaths increased 92 percent from 2010 to 2014. During the same time period, all traffic deaths increased 8 percent.
- Marijuana-related traffic deaths made up approximately 20 percent of all traffic deaths in 2014, compared to half that (10%) five years ago.
- In 2014, when retail marijuana businesses began operating, toxicology reports with positive marijuana results of active THC for primarily driving under the influence increased 45 percent in one year.

While these data are preliminary and must be validated and studied in order to show any potential causal or strong trend information, this all that is currently available from the two states.

Of note, few studies are able to determine how to reduce the prevalence of driving while under the influence of marijuana. Hartman & Huestis review two smaller studies of attitudes and perceptions of driving while under the influence of marijuana, and from those conclude that education campaigns alone will not deter marijuana users from driving while under the influence (Hartman, 2013).

Summary of findings:

- Research shows increased odds of crashing, crash culpability, and fatality with increasing blood THC levels. A blood THC concentration of 5 ng/mL increased the odds of crash responsibility from 2.7 to 6.6 – odds similar to that of a blood alcohol content of 0.15 percent. The exact blood level of THC associated with impairment is not known, and it is not entirely clear if blood level alone is a sufficient indicator of impairment for all users.
- Data from Washington and Colorado show more fatalities with THC in the blood toxicology, but the data are too new to establish causality.
- Using marijuana and alcohol together increases crash risk, but it is not clear whether regulation will increase or decrease driving under the influence of alcohol alone. It is possible that fewer people will drive drunk if they substitute marijuana for alcohol.
- Education campaigns alone will not deter drivers from using and driving.

Mental Health & Psychosocial Outcomes

What would be the impact on mental health if Vermont regulated and taxed marijuana?

What would change in psychosocial outcomes (e.g. life satisfaction, interpersonal relationships) if Vermont regulated and taxed marijuana?

There are three interrelated aspects of examining the impact of marijuana regulation on mental health:

- 1) structural changes in brain morphology
- 2) development, exacerbation, or acceleration of serious mental illness (e.g. psychosis)
- 3) psychosocial changes

A substantial body of recent research suggests that early (before age 18), frequent, and continuous use of marijuana may have a significantly antagonistic impact on both structures and functions of the brain, which in turn can lead to negative psychosocial outcomes. These reports are typically from prospective, longitudinal cohort studies over a time period spanning 15 to 45 years, from all over the world. Several of these long-term studies have been conducted in countries where there are carefully maintained registries on health care utilization for both physical and mental health, as well as demographic and socio-economic indicators, making the results highly reliable: Cobb-Clark, 2013; Elickson et al., 2004; Ferguson et al., 2015; Griffith-Lendering et al., 2013; Kuepper et al., 2015; Manrique-Garcis et al., 2015; Meier et al., 2012; Silins et al., 2014; Washburn & Capaldi, 2015¹.

The results of these studies are supported by contemporary experimental research employing MRI and fMRI scans of current marijuana users compared to age-matched non-users (e.g. Gilman et al., 2014). While many questions remain about the course and long-term effects of continuous marijuana use on adult outcomes, it seems very clear that adolescent use may be harmful for health in a number of ways.

Mental Health

Early adolescent marijuana use has been linked to the development of anxiety disorders later in life. Degenhardt et al. (2012) found that among adolescents, regular marijuana use or a diagnosis of marijuana dependence was significantly associated with increased risk of anxiety disorders in adolescence and late young adulthood (age 29), even if individuals had stopped using marijuana. This prospective longitudinal study also determined that marijuana use was not associated with developing depression disorders². However, a meta-analysis of 14

¹ One longitudinal study did not find differences in adult physical or mental health outcomes for adolescent marijuana users compared to nonusers (Bechthold et al., 2015). However, the sample studied was not representative of the general population, or the population of Vermont in particular. In addition, serious methodological issues in the design of the study and analysis of the data mitigate their findings. Further information about this study is available in the appendix (Madras, 2015).

² Unless otherwise indicated all results presented herein have been adjusted for relevant potential confounders such as concurrent alcohol and other illicit substance use, socio-demographic factors, baseline use, etc.

longitudinal studies (Lev-Ran et al., 2013) found a modest but significant effect associating the development of depression with heavy early marijuana use.

There is also evidence showing an increased risk of developing short-term, transient acute psychotic symptoms and, in some cases, chronic psychotic illness such as schizophrenia among early (adolescent) and persistent users of marijuana. There appears to be consensus regarding the finding that individuals at risk to develop schizophrenia through genetic factors (i.e. family history, high-risk genotype) and environmental factors (i.e. early onset child maltreatment/abuse) significantly increase that risk by using marijuana starting in adolescence (Radhakrishnan et al. 2014). Furthermore, it appears that early marijuana use accelerates the progression from symptoms to diagnosis such that at-risk marijuana users are diagnosed with schizophrenia several years earlier than at-risk nonusers (Myles et al., 2012; Large et al., 2011). However, there is some disagreement as to whether heavy marijuana use may facilitate or accelerate psychotic symptoms and diagnoses in individuals without an identified risk profile (Crean et al., 2011). Schizophrenia is a rare disorder, whether marijuana is an exacerbating risk factor or not.

Drug abuse and addiction can be predicted based upon early childhood experiences and other social determinants, rather than the inherent qualities of any drug (Felitti, 2003).³ Multiple large-scale peer-reviewed studies indicate that Adverse Childhood Experiences (ACEs), which include abuse and neglect as well as household exposure to substance abuse, domestic violence, incarceration and mental illness, are common. In Vermont, 57 percent of adults experienced at least one childhood adversity (witnessing or experiencing physical or sexual abuse, emotional abuse or neglect, having a family member incarcerated, having divorced or separated parents, seeing the mother battered, living with someone with mental illness or alcoholism); 13 percent experienced four or more of these kinds of adversities.⁴ Adults with four or more ACEs experience higher rates of chronic disease and risky behaviors than those with no ACEs. In Vermont, adults with four or more ACEs are significantly more likely to smoke, have recently used marijuana (past 30 days), be obese, experience depression or have another chronic disease.⁵

In a screening and referral pilot in Barre, Vermont, practitioners are using the four-question post-traumatic stress disorder (PTSD) screen to identify adults with a non-adaptive stress response, and referring those who screen positive to treatment. While called a “PTSD” (post traumatic stress disorder) screen, a positive screen (answering yes to any three of the four questions) does not result in a PTSD diagnosis. Instead, a positive response demonstrates a non-adaptive stress response.

Brain Morphology

While there is as yet no unequivocal evidence of changes in brain structure from cannabis use, several studies have suggested a very close association between marijuana use and structural

³ <http://www.drcarlhart.com/deal-with-the-pain-that-leads-to-the-problem/>

⁴ http://healthvermont.gov/research/brfss/documents/2010_data_brief_ace.pdf

changes in the developing brain (Churchwell et al., 2010; Filbey et al., 2014; Jacobus & Tapert, 2014; Zalesky et al., 2012). Smith et al. (2015) have shown significant differences in the shape of the hippocampal (area associated with long term memory), in subjects who had past but not current cannabis use disorder compared to control subjects with no history of any substance use disorder. These differences were associated with deficits in episodic memory. Gilman et al. (2014) have shown abnormalities in both the nucleus accumbens (central to the brain's reward/satiety system) and amygdala (central to emotional regulation and memory formation) of young adult recreational marijuana users compared to non-using controls (mean age of 21.3 years).

Another recent study, however, did not find brain morphometric differences in either adults (mean age of 27) or adolescents (mean age of 17) among daily marijuana users compared to nonusers (Weiland, et al., 2015).

Clearly more research is needed. Questions remaining for all studies that show structural changes in brain morphology:

- Are changes in the brain reversible if usage stops?
- Do brain structures fully or only partially return to pre-usage integrity?
- How long does it take for these processes to occur, if they do?

Weiland et al. (2015) also suggest that future studies more adequately control for differences in alcohol consumption between marijuana using groups and control groups.

Psychosocial Effects

There is strong evidence that early and continuous use of marijuana has long term negative effects on psychosocial outcomes. Several longitudinal prospective studies have converged on the same results for using marijuana prior to age 18 (Arria et al., 2013; Danielson et al., 2014; Degenhardt et al., 2010; Ferguson et al., 2015; Meier et al., 2012; Silins et al., 2014;).

These studies all found significantly increased risk of:

- not completing high school
- not enrolling or completing college
- low educational achievement level
- lower income
- unemployment and welfare dependence as an adult
- premature work force retirement due to disability
- reduction in IQ in middle adulthood

Silins et al. (2014) has demonstrated a strong linear, dose-dependent association between several of these adult outcomes and adolescent marijuana use – the heavier the use in terms of frequency, the worse the outcome. Furthermore, significant risks attach to frequencies as low as monthly use. The Silins et al. (2014) study is notable for its lengthy follow-up period of 25 years, and the large number of subjects available for analysis (more than 2,500 cases).

Unanswered Questions

Because the changes in prevalence and frequency of use under marijuana regulation in Vermont remain largely unknown, we can only describe in general terms what is likely to happen given specific circumstances. If prevalence decreases, the adverse consequences associated with mental health and psychosocial outcomes will likely decrease in the population; if prevalence among adolescents and young adults increases, so will the long-term adverse consequences. However, these consequences are not uniquely a function of prevalence; they also depend on the frequency and intensity of use, as well as the potency of the available product.

Potency can have an impact in a number of ways, all of which are unclear at the present time. For example, it is unclear how potency affects frequency and intensity of use or how these variables affect adverse consequences. Studies of potent marijuana have suggested that these strains add significant additional risk for first episode psychosis; those who used high potency marijuana on a daily basis were five times more likely to experience a first episode psychosis than nonusers (DiForti et al., 2015).

Summary of findings:

If prevalence of marijuana use increases – especially among youth – or if frequency of use or dose increases, then negative mental health and psychosocial outcomes can also be expected to increase.

- Early and persistent use of marijuana can lead to the development of anxiety disorders later in life. It may lead to development of depressive disorders. Among individuals at risk for the development of some psychotic disorders, marijuana use may increase the risk or mean that onset of those disorders begins earlier in life.
- Marijuana use may impact the physical structure of the brain. The exact effect, whether it is reversible, and what the potential health implications are, remains unknown.
- Early and continuous use of marijuana significantly increases risk of not completing high school, not enrolling or completing college, low educational achievement, lower income, unemployment and welfare dependence as an adult, premature work force retirement due to disability, and reduction in IQ in middle adulthood.

Other Drugs and Alcohol Use

What might change in other substance use disorders and treatment if Vermont regulated and taxed marijuana?

Using marijuana can lead to dependence on marijuana. This has been well documented in the literature. The lifetime risk of developing dependence on marijuana among users is about one in 10 adults or 9 percent, and one in six if the person began using as a teenager (Hall & Degenhardt, 2013; Stinson et al., 2006). Young people are particularly at risk for marijuana dependence, with one study noting "the odds of cannabis abuse did not decrease linearly with age, while the odds of dependence did." (Stinson et al., 2006)

Data from the National Survey on Drug Use and Health indicate that people who start using marijuana before age 14 are 57 times more likely to have an illicit drug dependence diagnosis by age 34 compared to those who never used marijuana. In addition, people who start using marijuana between 15 and 17 years of age are 17 times more likely to obtain an illicit drug dependence diagnosis by age 34 than their non-using peers (National Survey on Drug Use and Health, 2014).

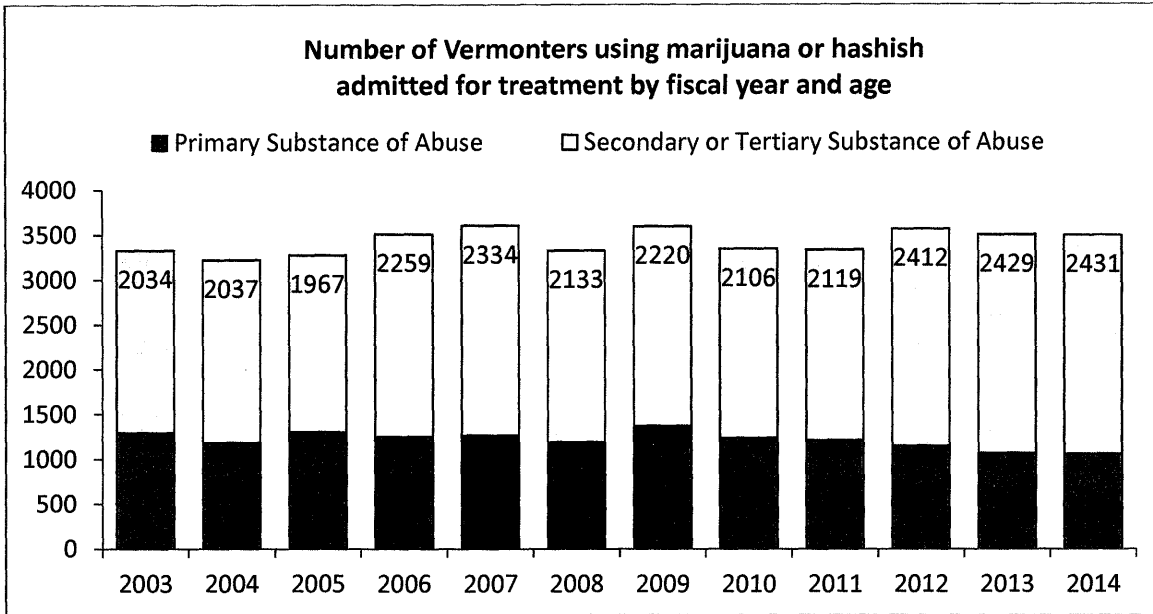
Other Illicit Drug Use

Early and persistent use of marijuana is significantly related to both later cannabis dependence diagnosis and an increased risk of using other illicit drugs, including opioids (Ferguson et al., 2015, Silins et al., 2014). Use of other illicit drugs in combination with marijuana is likely to exacerbate adverse mental health and psychosocial outcomes (Volkow et al., 2014). Silins et al. (2014) reported that compared to nonusers, those who used marijuana monthly as adolescents more than doubled their risk for cannabis dependence as adults in their late 20s; those who used marijuana weekly or more as adolescents were eight times more likely to develop cannabis dependence. Those who used marijuana monthly as adolescents were nearly three times more likely to use other illicit drugs by age 29; those who used weekly as adolescents were five times more likely to use other illicit drugs.

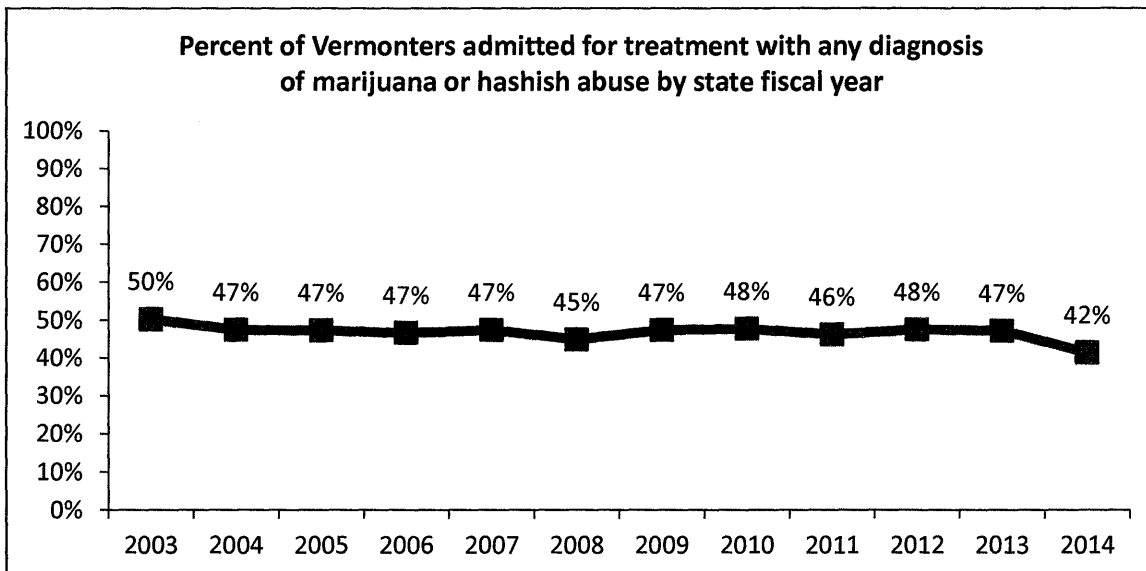
People at highest risk of dependence are also those who are already suffering other risks in their life:

Those at highest risk of cannabis dependence have a history of poor academic achievement, deviant behaviour in childhood and adolescence, rebelliousness, poor parental relationships, and a parental history of drug and alcohol problems.
(Hall & Degenhardt, 2013)

The majority of those who are treated for marijuana use disorders in Vermont report marijuana as a secondary or tertiary substance of abuse/dependence. In addition, while 42 percent of those treated for substance use disorder included marijuana in the list of substances they misuse in 2014, that percentage has decreased significantly since 2013.

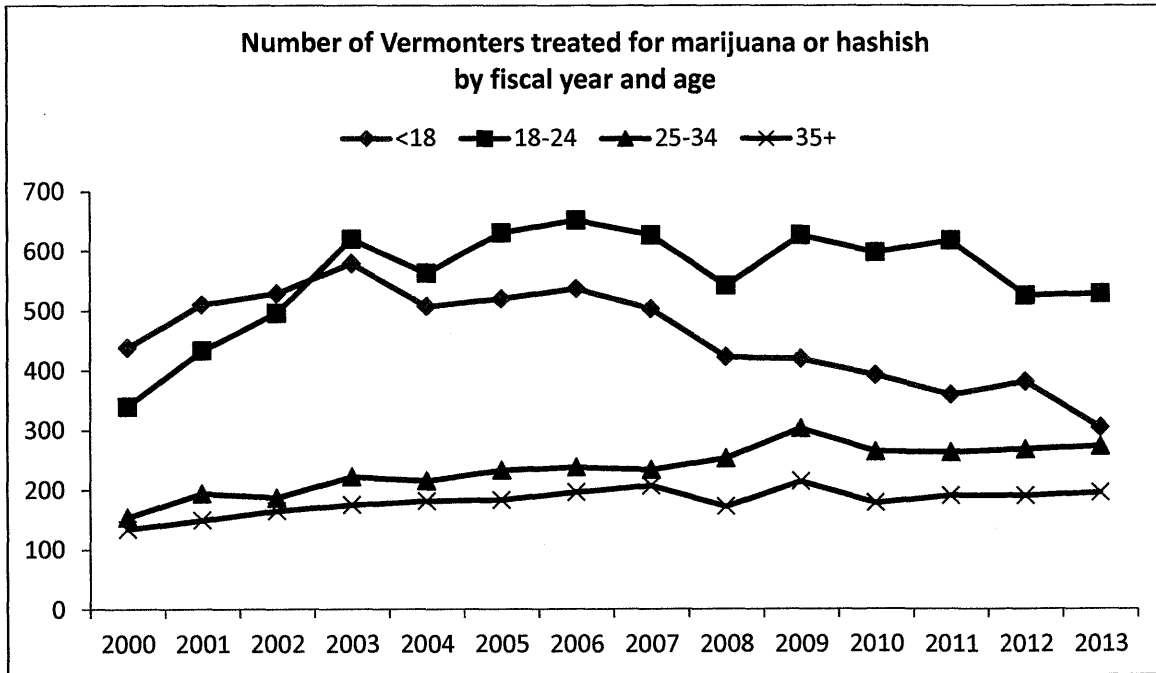


Source: Vermont Alcohol and Drug Abuse Programs Treatment Data



Source: Vermont Alcohol and Drug Abuse Programs Treatment Data

Vermont has seen a decline in the number of teenagers being treated for marijuana abuse or dependence over the past decade. It is unclear how regulation would affect the number of teenagers referred to treatment.



Source: Vermont Alcohol and Drug Abuse Programs Treatment Data

Nationally, past year marijuana use disorders among youth and young adults is decreasing. National Survey on Drug Use and Health data show:

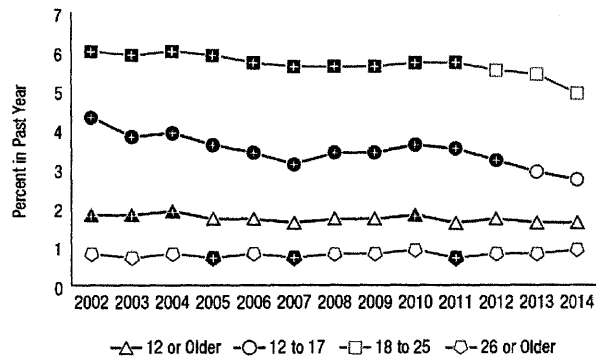
- Age 12 to 17

In 2014, 2.7 percent of adolescents age 12 to 17 – about 667,000 adolescents – had a marijuana use disorder in the past year. The percentage of adolescents with a marijuana use disorder in 2014 was lower than the percentages in 2002 to 2012.
- Age 18 to 25

In 2014, 4.9 percent of young adults age 18 to 25 – about 1.7 million young adults – had a marijuana use disorder in the past year. The percentage of young adults with a marijuana use disorder in 2014 was lower than the percentages in 2002 through 2011, but was similar to the percentages in 2012 and 2013.
- Age 26 or Older

In 2014, 0.0 percent of adults age 25 and older – about 1.8 million adults – had a marijuana use disorder in the past year. The 2014 percentage of adults aged 26 or older with a marijuana use disorder was similar to the percentages for most years between 2002 and 2013.

Figure 35. Marijuana Use Disorder in the Past Year among People Aged 12 or Older, by Age Group: Percentages, 2002-2014



+ Difference between this estimate and the 2014 estimate is statistically significant at the .05 level.

Figure 35 Table. Marijuana Use Disorder in the Past Year among People Aged 12 or Older, by Age Group: Percentages, 2002-2014

	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
12 or Older	1.8 ⁺	1.8 ⁺	1.9 ⁺	1.7	1.7	1.6	1.7	1.7	1.8 ⁺	1.6	1.7	1.6	1.6
12 to 17	4.3 ⁺	3.8 ⁺	3.9 ⁺	3.6 ⁺	3.4 ⁻	3.1 ⁺	3.4 ⁺	3.4 ⁺	3.6 ⁺	3.5 ⁺	3.2 ⁺	2.9	2.7
18 to 25	6.0 ⁺	5.9 ⁺	6.0 ⁺	5.9 ⁺	5.7 ⁺	5.6 ⁺	5.6 ⁺	5.6 ⁺	5.7 ⁺	5.7 ⁺	5.5	5.4	4.9
26 or Older	0.8	0.7	0.8	0.7 ⁺	0.8	0.7 ⁺	0.8	0.8	0.9	0.7 ⁺	0.8	0.8	0.9

+ Difference between this estimate and the 2014 estimate is statistically significant at the .05 level.

Source: National Survey on Drug Use and Health, 2014 National Report

It is not possible to predict what regulation of marijuana could mean for the Vermont substance abuse treatment system. However, if adults use marijuana 50 percent more under a regulated system as predicted by RAND, there will be an increase in marijuana use disorders.

Summary of findings:

- The number of Vermonters in treatment for marijuana as the primary substance of abuse is going down overall. Still, about 40 percent of those treated for a substance use disorder in the state substance abuse treatment system also misuse marijuana.
- If marijuana use increases, the number of people with a marijuana use disorder will also increase.
- If use increases among youth, individuals with a substance use disorder for more than one substance will also increase.

Education

What might change in academic outcomes if Vermont regulated marijuana?

Academic outcomes

Education is one of the primary social determinants of health. The level of education a person achieves is a predictor of many types of health outcomes, including how long a person will live. Marijuana use among youth is associated with negative academic outcomes (Cobb-Clark, 2013; Zölitz, 2015; Ehrenreich et al. 2015). Longitudinal studies that follow students over many years have shown both associations between marijuana use and negative academic outcomes, as well as a cause-and-effect relationship between marijuana use and poor academic outcomes. One recent longitudinal study found that “marijuana was not an isolated or benign event in the life of adolescents but part of an overall problem behavior syndrome” (Zölitz, 2015).

A recent study took advantage of a natural experiment in the Netherlands. The authors looked at student demographics and academic information based on actual records, as opposed to self-report. A law allowing students access to marijuana “coffee shops” was changed, banning students from countries other than the Netherlands from legally accessing marijuana through these shops. The authors found a strong positive effect on course grades:

Our main finding is that the temporary restriction of legal cannabis access had a strong positive effect on course grades of the affected students. These individuals performed, on average, 9 percent of a standard deviation better and were 5.4 percent more likely to pass courses when they were banned from entering cannabis-shops (“coffeeshops”). Importantly, we do not detect a change in dropout probability, which could have created complex composition effects. Sub-group analysis reveals that these effects are somewhat stronger for women than men and that they are driven by younger and lower performing students. This can be explained by baseline differences in consumption rates or differences in marginal compliance with the prohibition. (Zölitz, 2015)

A study released in 2004 used a longitudinal panel of middle school students followed from age 13 to age 23. The study found that the group of “abstainers” who never used marijuana “consistently had the most favorable outcomes, whereas early high users consistently had the least favorable outcomes” (Ellickson et al., 2004).

Suspensions and marijuana use

The Rocky Mountain High Intensity Drug Trafficking Area Summary of *The Legalization of Marijuana in Colorado: The Impact, Vol. 3, September, 2015* reported that “drug-related suspensions/expulsions increased 40 percent from school years 2008/2009 to 2013/2014. The vast majority were for marijuana violations.” These data are not causal.

The following table presents baseline data for Vermont suspensions, by main cause for the suspension. The vast majority of suspensions in Vermont are for non-drug related reasons. The drug related to the most suspensions is marijuana.

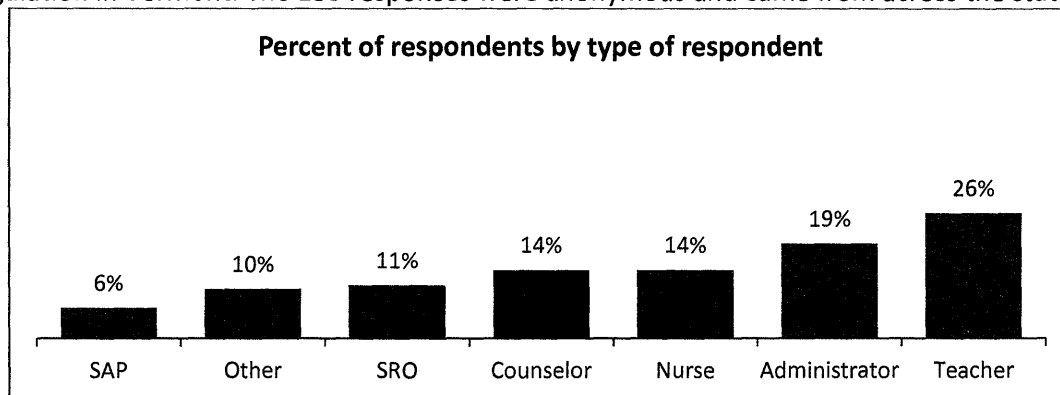
Vermont Agency of Education: Suspension Data by School Year

Suspension	2013	2014	2015
Non-drug related	7342	7395	5440
Alcohol	78	69	67
Marijuana	266	391	272
Other drugs	41	29	29
Tobacco	182	178	119
Total	7909	8062	5927

Suspension data are important to monitor, particularly given which groups of students are most likely to be suspended. A report released by Vermont Legal Aid in January 2015 found: “During 2011 - 2012, 5-10% of Vermont’s public school students were suspended, losing at least 8,000 days of school. In addition, Vermont’s students with disabilities and students of color were two to three times more likely to be excluded from school through suspension and expulsion. These disparities persisted for restraint, seclusion, and referral to law enforcement.” www.vtlegalaid.org/sites/default/files/Kicked%20Out_School%20Discipline%20Report.pdf

Educator Survey

Education professionals in the stakeholder group distributed a survey via listservs to school administrators, counselors, superintendents, resource officers, student assistance program counselors, and nurses. The survey is not scientific, meaning it is not a random sample and is not weighted to represent the education community as a whole, but was meant to get a sense from those working with youth in schools about their perceptions and thoughts on marijuana regulation in Vermont. The 130 responses were anonymous and came from across the state.



Source: 2015 Educator Survey on marijuana regulation
 SAP = Student Assistance Professional SRO = Student Resource Officer

Respondents were asked to compare the 2012 school year with the 2015 school year and report their perception of the change in:

- number of students you work with who arrive at school under the influence of marijuana?
- number of students who were caught in possession of marijuana?
- number of students suspended for problems directly related to marijuana use or possession?

Approximately half of all respondents reported no change in the number of students arriving at school under the influence of marijuana, 30 percent reported a slight increase or increase, and 19 percent reported a slight decrease or decrease. When asked who or what has the largest effect on the average student’s decision whether or not to use marijuana, respondents ranked, in order of importance: peers, parents, teachers, school policy and statewide policy.

Respondents were asked: The Vermont Legislature may consider the regulation and taxation of marijuana for adult use (age 21 and older) this winter. Based on your work with students, what, if any, effect do you think this could have on:

	Slight to great decrease	No change	Slight to great increase
the number of students who use marijuana?	7%	26%	67%
the amount of marijuana used by students who already use marijuana?	3%	36%	61%

Respondents were also asked: “Research has shown that regular marijuana use may negatively impact academic performance. In your experience, do you find this to be true?” Sixty-seven percent responded yes, 11 percent responded no, 10 percent were not sure or did not know, and 11 percent had not worked with students that they were aware used marijuana. The respondents were given an open-ended question to add their thoughts about marijuana regulation.

Example from affirmative answer:

“Regular marijuana use does negatively impact academic performance in my experience. That said, regular use of marijuana is often coupled with other social family problems which also negatively impact academic performance.”

Example from a negative answer:

“No, there are other preceding factors impacting academic performance that outweigh regular Marijuana use.”

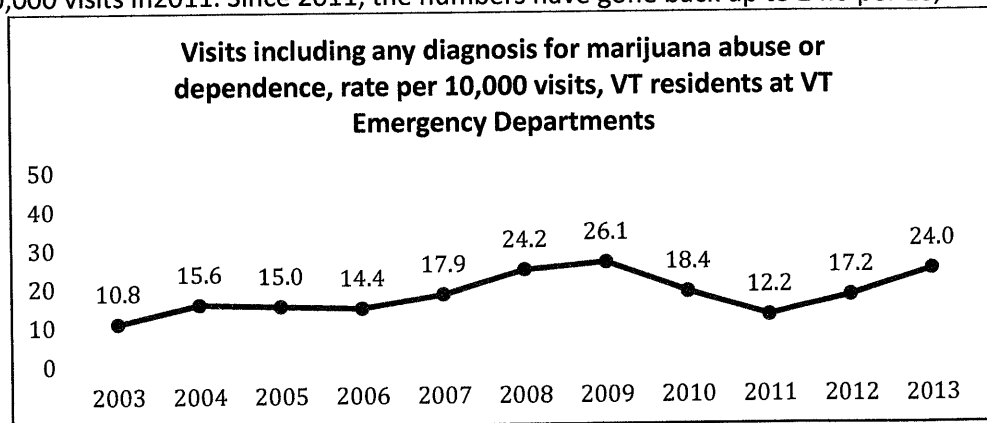
Summary of findings:

- Marijuana use among high school and college students negatively impacts academic outcomes. The association has a dose-response relationship, which means the more a student uses, the worse the outcomes.
- The research on the relationship between marijuana use and academic outcomes is almost sufficient to show a cause-and-effect link between the two.
- Youth in more vulnerable situations (e.g. already experiencing behavior or mental health problems) are more likely to experience a negative academic outcome due to marijuana use.
- In Colorado, there has been a sharp increase in suspensions from 2013 to 2014. The state cannot confirm whether this is due to marijuana use, or due to the state's legalization in 2014. In Vermont, marijuana is the number one substance for which students are suspended from school.
- In a convenience sample of 130 Vermont educators, half reported they had not noticed an increase in marijuana use from the 2013 school year to the 2015 school year, but two-thirds expected to see an increase in use under a regulated system.

Medical Emergencies

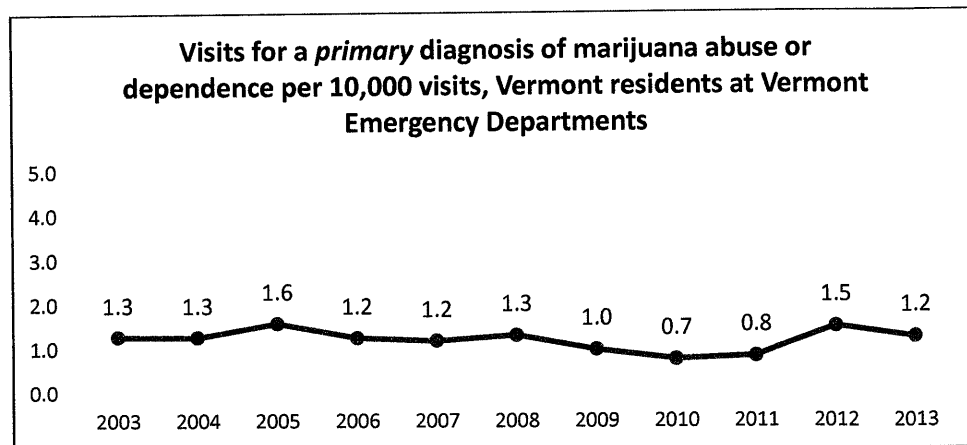
Would emergency department admissions change if Vermont regulated and taxed marijuana?

Vermont emergency department visits that include a diagnosis of either cannabis abuse or dependence have fluctuated over the past decade. There was a drop in the number of visits with any mention of cannabis abuse or dependence from 24.2 per 10,000 visits in 2008 to 12.2 per 10,000 visits in 2011. Since 2011, the numbers have gone back up to 24.0 per 10,000 visits.⁵



Source: Vermont Uniform Hospital Discharge Dataset

The number of emergency department visits with a primary diagnosis code of cannabis abuse or dependence has remained very low over the past decade.



Source: Vermont Uniform Hospital Discharge Dataset

⁵ Note that historical hospital discharge data in Vermont is based on the Diagnostic and Statistical Manual of Mental Health Disorders IV (DSM-IV) and the International Classification of Diseases Ninth Revision (ICD-9). The current version of these two coding manuals are the DSM-V and the ICD-10. The DSM-V lists substance use disorders as a spectrum and does not have the "abuse" and "dependence" definitions.

According to the Rocky Mountain High Intensity Drug Trafficking Area Summary of *The Legalization of Marijuana in Colorado: The Impact, Vol. 3, September, 2015*, marijuana-related emergency department visits increased from 14,148 in 2013 to 18,255 in 2014. Based on Colorado's estimates, should Vermont see a similar trend after legalization, the increase would be from 581 visits in 2013 to approximately 750 visits in 2014. This estimate is based on the assumption that Vermont regulates marijuana with the same rules and restrictions that were implemented in Colorado. A large number of the admissions in Colorado were reported due to over-consumption of infused products.

Summary of findings:

- In Vermont, there was a drop in the number of emergency department visits with any mention of cannabis abuse or dependence in the diagnosis codes from 2008 to 2011. Since 2011, the numbers have gone back up.
- Based on Colorado's estimates within the first year of legalization, should Vermont see a similar trend after regulation, the increase would be from 581 visits in 2013 to approximately 750 visits in 2014. This assumes Vermont includes infused products in the legislation.

Lessons from Tobacco and Alcohol

In the U.S., marijuana legalization has occurred in too few locations and too recently to provide a broad evidence base on regulatory structures that minimize marijuana abuse, dependence, and youth initiation. However, research findings from the tobacco control and alcohol literature are extensive and hold important lessons for how marijuana regulations could influence marijuana-related morbidity and mortality. Lessons from both tobacco and alcohol are especially germane as marijuana is most frequently consumed by smoking/inhalation but also has intoxication effects that can impair driving and other functions.

Smoke-free Policies

Very strong evidence supports the association between comprehensive smoke-free policies and a variety of health benefits. Smoke-free policies may be governmental regulations (e.g. the Vermont Clean Indoor Air laws) or private-sector rules (e.g. a smoke-free lease agreement for an apartment).

A comprehensive review by the Community Preventive Services Task Force of 82 studies found very strong evidence for the following health benefits from smoke-free policies. Nearly all studies used in their review pertained to public place and work place bans:

- Reducing exposure to secondhand smoke – Smoke-free policies reduce self-reported exposure to secondhand tobacco smoke by a median of 50 percent. The reduction in self-reported exposure is corroborated by a 50 percent reduction in secondhand smoke biomarkers and a measured reduction in indoor air pollution of 88 percent.
- Reducing the prevalence of tobacco use – Smoke-free policies reduce tobacco prevalence by a median of 2.7 percentage points.
- Increasing the number of tobacco users who quit – Smoke-free policies increase tobacco cessation by 3.8 percentage points. Per capita cigarette consumption also declines by 1.2 cigarettes per day.
- Reducing youth tobacco initiation – Youth exposed to smoke-free policies are significantly less likely to smoke (OR 0.85, IQI 0.68-0.93).
- Reducing tobacco-related morbidity and mortality – Smoke-free policies reduce hospital admissions for cardiovascular events by a median of 5.1 percent and asthma hospital admissions by 20.1 percent.

There is also evidence that smoke-free housing and car policies have health benefits, but the body of research is smaller.

Vermont statute currently bans lit tobacco products in all enclosed public places and work places and bans indoor smoking rooms. Vermont also bans smoking on the outdoor grounds of public schools, registered child care centers and homes (while children are in care), within 25 feet of state-owned buildings, and on the grounds of state-owned and operated hospitals. In addition, it is illegal to smoke in a car with a child in a car seat or booster seat.

Significantly for this health impact assessment, Vermont's smoke-free laws are not broad enough to prohibit public or work place use of marijuana. Vermont law also allows the use of tobacco substitutes⁶ (i.e. e-cigarettes and other vapor devices) indoors, except on school grounds or child care facilities. Tobacco substitutes can be used for other drugs, including marijuana.

In addition to state laws, a growing number of local Vermont laws restrict tobacco use in outdoor public places and housing. Sixteen communities have smoke-free ordinances covering parks or recreation areas. Of Vermont's eight public housing authorities that oversee 33 public housing buildings, 23 of these buildings are smoke-free.

Few, if any, of these policies specifically ban marijuana use. Federally-subsidized housing is a grey area with regard to marijuana use since it remains banned at the federal level and on federal property. However, the U.S. Department of Housing and Urban Development has proposed a rule that, if adopted, will require all public housing agencies to adopt smoke-free policies.

As public awareness of the dangers of secondhand smoke has risen, the vast majority of Vermonters do not smoke in their homes or cars. In 2014, 69 percent of smokers reported banning smoking in their own home (80 percent of smokers with children), and 93 percent of nonsmokers banned smoking at home (97 percent of nonsmokers with children). Eight-nine percent of smokers and 96 percent of nonsmokers banned smoking in their cars. Despite the prevalence of smoke-free indoor and outdoor air laws, 82 percent of Vermont smokers and 46 percent of nonsmokers reported exposure to secondhand smoke in the last week. Voluntary marijuana-free policies at home and in cars would be highly dependent on perceptions of harm.

Alcohol Policies

For alcohol use, a similar body of evidence exists that demonstrates comprehensive policy restrictions can have a variety of health benefits. However, unlike tobacco use, where any amount of tobacco use can have negative effects, moderate use of alcohol does not necessarily have negative health impacts. Excessive alcohol consumption has been estimated to have economic costs in the U.S. in 2010 on the order of \$249 billion (Sacks et al., 2010).

⁶ Tobacco substitute is how Vermont statute defines e-cigarette: <http://legislature.vermont.gov/statutes/fullchapter/07/040>. Their use is not currently banned in indoor public places or work places in Vermont (though they are banned on school grounds and in licensed childcare facilities/homes), and they are often used to inhale substances other than liquid nicotine or other "e-juice". In the context of marijuana regulation, this means that anyone could use a marijuana product indoors or in a public place by using a tobacco substitute to vaporize.

Excessive alcohol consumption, defined as heavy drinking, binge drinking, or any drinking by pregnant women or underage youth is the third leading cause of preventable death in the U.S.⁷ This necessarily makes the policy environment more complicated and nuanced for alcohol control efforts, with more focus on reducing excessive consumption and subsequent reductions of episodes of alcohol poisoning, impaired driving, injuries, and fatalities.

The U.S. Community Preventative Services Task Force has conducted several systematic reviews to assess the efficacy of multiple policy interventions aimed at reducing excessive alcohol consumption. Because these systematic reviews provide enough evidence of the positive health impacts, the Comprehensive Preventative Services Task Force recommends the following policy interventions to reduce excessive consumption of alcohol:

- Enforce Dram Shop Liability
- Increase Alcohol Taxes
- Limit Days of Sale
- Limit Hours of Sale
- Limit Alcohol Outlet Density
- Enhance Enforcement of Laws Prohibiting Sales to Minors
- Maintain Government Control Over Alcohol Sales (versus Privatization Of Sales)

These systematic reviews demonstrated the following benefits from implementing recommended strategies:

- Dram shop liability laws were associated with a 6.4 percent decrease in alcohol-related motor vehicle fatalities.
- Higher alcohol prices or taxes were associated with fewer motor vehicle accidents, less alcohol-impaired driving, and less mortality from liver cirrhosis: A 10 percent increase in the price of alcohol s associated with a 7 percent decrease in alcohol consumption.
- Limiting the number of days of sale of alcohol in off-premise settings is associated with decreased alcohol consumption, alcohol-impaired driving, motor vehicle fatalities, and rates of domestic violence.
- Limiting the number of days of sale of alcohol in on-premise settings is associated with decreases in alcohol-impaired driving, and both fatal and non-fatal motor vehicle accidents.
- Decreases in alcohol outlet density are associated with reductions of excessive alcohol consumption.

Vermont statutes currently incorporate a number of these policy recommendations.

⁷ Heavy Drinking is defined as more than 14 drinks per week for men or more than eight drinks per week for women. Binge drinking is defined as five or more drinks during a single occasion for men or four or more drinks during a single occasion for women. (<http://www.cdc.gov/alcohol/fact-sheets/prevention.htm>)

- **7 VSA §501-507: Sale to Intoxicated Persons and Public Charges**

Allows civil action for damages for persons harmed by the furnishing of alcohol by a licensee to minors, to a person obviously intoxicated, to a person after legal hours, or to person whom it would be reasonable to expect would be intoxicated as a result of the amount of liquor previously served.

Social hosts may be held liable if furnishing alcohol to a minor.

- **7 VSA §62: Hours of Sale**

First and Third Class Licensees may sell alcohol from 8 a.m. to 2 a.m. of the following morning.

Second Class Licensees may sell alcohol from 6 a.m. to 12. a.m. of the following morning.

- **7 VSA §104: Department of Liquor Control**

The Department of Liquor Control supervises and manages the sales of spirits and fortified wines (effective January 1, 2016) within the state.

In addition, through the provisions of 7 VSA §161-168, municipalities have powers to limit and place restrictions on liquor licensees, includes limitations on hours/days of operation and limitations to alcohol outlet density.

Youth Access

Minimum Legal Sale Age

A well-established body of evidence shows that a purchase age of 21 years for both tobacco and alcohol has positive implications for public health. Nearly 90 percent of smokers initiate tobacco use before age 18 (US Surgeon General 2012 Report), and more than half of Vermont high school smokers report getting cigarettes from social connections, which could include high school friends who are of legal purchase age (2013 YRBS). In 2013, 45 percent of Vermont 12th grade smokers reported purchasing cigarettes from a store or gas station compared to 12 percent of 11th graders, indicating that many teens pass the age of purchase while still in high school. This compares to fewer than 6 percent of Vermont 12th graders who reported purchasing alcohol.

A 2015 report from the Institute of Medicine found that raising the minimum age of purchase for tobacco from 18 to 21 years would decrease the prevalence of tobacco use by 12 percent by the time today's teenagers were adults. In addition, associated health harms such as preterm births, low birth weight, sudden infant death, and secondhand smoke exposure would also likely decrease significantly. Nationally, a rising the minimum legal age for tobacco to 21 would result in "approximately 223,000 fewer premature deaths, 50,000 fewer deaths from lung cancer, and 4.2 million fewer years of life lost for those born between 2000 and 2019."

Since the Institute of Medicine report was released, additional evidence from Needham, Massachusetts, which raised the minimum purchase age for tobacco to 21 in 2005, suggested that the declines in tobacco use could be even steeper. From 2006 through 2010, 30-day smoking among high school youth declined from 13 percent to 7 percent, compared with 15 percent to 12 percent in 16 comparison communities (Schneider 2015). In Vermont localities do not have the authority to raise the minimum legal sale age for tobacco, though some decision makers in Montpelier have expressed interest in doing so.

These findings have two important implications for minimum purchase ages in Vermont. First, even regulatory changes at the town level can have a significant positive impact on rates of substance use. Strong regulatory measures such as high taxes and/or strict license limits would have significant positive effects on the state as a whole, or for individual towns, regardless of the policies of bordering states or localities. Second, towns may want to preserve local control of marijuana regulations so they can enact stricter regulatory strategies if they are in their residents' interest.

Each year, excessive alcohol consumption contributes to more than 4,300 deaths among underage youth (younger than 21 years) in the U.S. Underage drinking is strongly associated with alcohol-impaired driving, physical fighting, poor school performance, sexual activity, and smoking. Two in three high school students who drink do so to the point of intoxication, and binge drink on multiple occasions. Underage drinking is a significant public health concern. As such, the Community Preventive Services Task Force recommends maintaining an age 21 minimum legal drinking age (MLDA), as it has a strong based of evidence⁸:

- Age 21 MLDA is associated with a 16 percent decline in motor vehicle accidents among youth.
- Age 21 MLDA is associated with lower consumption in both young adults aged 21 and older as well as youth and young adults under 21.
- States with more stringent alcohol control policies (including 21 MLDA) have lower levels of adult and college binge drinking.

In 2008, John McCardell, president emeritus of Middlebury College, helped found the Amethyst Initiative to push for open debate on changing the MLDA from 21 to 18. Currently 136 college presidents have signed on to this initiative, sparking more research on the MLDA. Several published papers have discredited the hypotheses of the Amethyst Initiative and demonstrated that age 21 MLDA is good public policy.^{9,10,11}

Due to the intoxicating effects of marijuana and the potential for marijuana-related motor vehicle accidents, experiences with the alcohol age 21 MLDA suggests a similar MLDA for marijuana would be warranted.

⁸ <http://www.cdc.gov/alcohol/fact-sheets/minimum-legal-drinking-age.htm>

⁹ <http://www.ncbi.nlm.nih.gov/pmc/articles/PMC2866588/>

¹⁰ <http://www.ncbi.nlm.nih.gov/pubmed/24565317>

¹¹ <http://www.ncbi.nlm.nih.gov/pmc/articles/PMC2866588/>

Child-Resistant Packaging

The rapid expansion of the Electronic Nicotine Delivery System (ENDS, also known as e-cigarettes and vape products) industry provides a strong example of how a lack of early regulation can endanger public health. The American Association of Poison Control Centers reports human exposure to e-cigarettes and liquid nicotine cases reported to poison centers was 271 in 2011. From January through October 2015 the total number of exposures reported was 2,689. In December 2014, a toddler in New York State died from ingesting liquid nicotine.

Vermont was one of the first states to enact packaging restrictions for liquid nicotine in July 2014. However, the legislation exempts specific types of ENDS and does not specify enforcement authority. As a result, it is unknown how many Vermont ENDS sellers comply with the child-resistant packaging requirements or restrictions on sales to minors. Marijuana legalization presents an opportunity to revisit ENDS packaging regulations, including whether they should include all products, and detail enforcement mechanisms.

Graphic Health Warnings

Graphic health warning labels on tobacco packaging are effective in encouraging and maintaining tobacco cessation and deterring youth from initiating tobacco use. While over 60 countries require pictures or images on cigarette packs, graphic labels proposed several years ago by the U.S. Food and Drug Administration have been delayed by industry court challenges, and it is unclear when they will be implemented:

<http://www.tobaccofreekids.org/research/factsheets/pdf/0325.pdf>

Experience from tobacco control suggests that graphic warnings could be effective for marijuana if done in a manner to withstand legal challenge.

Retailer Licensing

Minimum Legal Sale Age Compliance

Age restrictions for the purchase of alcohol and tobacco are only effective at preventing initiation if they successfully keep these products out of the hands of minors. The Federal Synar program requires that states receiving a Substance Abuse Block Grant from the Substance Abuse and Mental Health Services Administration conduct compliance checks to ensure that retailers are not selling tobacco to youth under age 18. States that miss the compliance check target risk losing 40 percent of their block grant funding. From 1997, when the Synar program began, to 2012, the national weighted average for retailer tobacco sales to underage youth has dropped from 40.1 percent to 9.6 percent. The Vermont 2013 violation rate was 10.2 percent. In addition to the Synar amendment, Vermont follows two additional levels of regulation for tobacco sales to minors. Vermont state law requires that no more than 10 percent of the state's tobacco retailers violate the minimum legal sale age, and the Department of Liquor Control is required to inspect every tobacco licensee once per year and submit a report to the Legislature. At the federal level, the 2009 Family Smoking Prevention and Tobacco Control Act

initiated compliance checks in each state through the U.S. Food and Drug Administration. In Vermont, the Department of Liquor Control conducts compliance checks at each tobacco retailer that count toward all three requirements – Vermont state law, the Synar program, and the Food and Drug Administration.

Vermont's experience in tobacco control sales restrictions has shown that enforcing the minimum legal sale age is a necessary component of comprehensive substance control and is especially effective when paired with more than one inspection annually and a meaningful fine schedule for violations. However, enforcing minimum age laws is not enough to keep tobacco out of the hands of minors, and it is unlikely that even a 100 percent compliance rate with a marijuana minimum legal sales age would eliminate underage access if youth have access to social sources. This is why strong social norms and high product prices through excise, minimum price standards, and restrictions of price promotion are also identified as necessary components to reduce youth initiation and use.

The Community Preventive Services Task Force also suggests that enhancing enforcement of laws prohibiting sale to minors will help reduce alcohol access to minors. Enhanced enforcement programs, particularly when conducted as part of a comprehensive approach to alcohol control, have been shown to reduce retail sales of alcohol to minors, have modest decreases in underage alcohol consumption, and were effective in a variety of contexts: on- and off-premise establishments and in rural and urban communities.¹²

Restricting the Number and Density of Outlets

Licensing retailers is a critical strategy for regulators at the state and local levels to reduce the impact of adult-only substances. At a basic level, licensing is a mechanism to track producers, distributors, and retailers to ensure accountability at each level of the supply chain. In addition, licensing provides a critical framework to overlay additional protections, such as the number and density of licenses. Tobacco control research has found that increased tobacco retailer density results in higher youth smoking rates and incidence of tobacco-related disease – higher density often occurs in lower income neighborhoods and areas.

Unlike many states, Vermont licenses tobacco and alcohol retailers at the state level through the Department of Liquor Control, which allows for centralized data collection and easy public access to records. The Department of Liquor Control and Liquor Control Board have no written rules to govern the approval of tobacco licenses, and communities can only control the location and density of tobacco licenses through a lengthy zoning process. Licensing fees are also not sufficient to finance enhanced enforcement; a tobacco license costs \$100 but is free with the purchase of an alcohol license. More than 90 percent of Vermont's tobacco retailers also have an alcohol license.

There are nearly 1,000 tobacco licensees in Vermont. In 2014, the Vermont Tobacco Control program worked to map the location of Vermont's tobacco licensees, along with demographic

¹² <http://www.thecommunityguide.org/alcohol/lawsprohibitingsales.html>

data and the location of youth-serving venues such as schools and parks. The project found that 12 percent of Vermont tobacco licensees are located within 1,000 feet of a school or park, and 17 percent of retailers in the state's lowest-income neighborhoods are within 1,000 feet of a school or park. Nationally, both small towns and large cities (e.g. San Francisco) have adopted regulations that cap the number of licenses near schools in an effort to reduce the appeal of tobacco for youth. Once licensees are established, it is less politically feasible to revise the number of licenses downward in the interest of public health, although grandfathering existing license holders is one strategy. A robust, randomized schedule of youth enforcement checks, which in some states occurs more than once a year, helps reduce youth sales and violations.

Retailer licensing can also include measures to reduce tobacco marketing and retailer density, and use retailer license fees to support a robust enforcement program. The evidence from tobacco control suggests that setting a cap on the number of marijuana licenses, the density of licenses (either per 1,000 population or by location), and creating buffer zones around youth-oriented venues (e.g. schools, parks, and child care facilities) could mitigate increased youth exposure to marijuana product and marketing, as well as ease of access.

These strategies have also been conducted with alcohol licensees and shown to be effective and are now promoted as evidence-based strategies¹³. In addition, there is evidence that reducing alcohol outlet density near college campuses can have a significant impact on reducing campus binge drinking rates.

Restricting the number and density of marijuana retail outlets should be considered – especially near schools, parks, child care centers, and other places where youth congregate. Restricting density near college campuses should also be considered. As these interventions usually occur at the local level, thought should be given as to how to best empower municipalities to implement these types of policy interventions.

Prohibiting the Sale of Adult-Only Substances at Certain Retailer Types

Another strategy to reduce youth exposure to tobacco and tobacco advertising and initiation is to eliminate sales at certain types of retailers or licensing only for adult-only establishments. More than 100 municipalities nationwide have tobacco-free pharmacy laws, including more than 80 municipalities in Massachusetts. Vermont municipalities do not have the authority to enact similar licensing restrictions on the type of retailer selling tobacco.

In Vermont, three-quarters of tobacco retailers are convenience or grocery stores, but chain pharmacies commonly sell both tobacco and alcohol. A recent review of the Vermont tobacco licensee list found that the most common tobacco retailer name was Rite Aid; Kinney Drugs was also one of the 10 most common retailer names. Many supermarkets with pharmacy licenses also sell tobacco. For chain stores, decisions about tobacco sales come from the corporate level; only one of Vermont's independent pharmacies sells tobacco. A strong licensing strategy for marijuana would be stringent in the number of licenses and types of retailers that sell, since

¹³ <http://www.camy.org/docs/research-to-practice/place/alcohol-outlet-density/outlet-density-strategizer-nov-2011.pdf>

it is difficult to reduce licensees once they are granted. Vermont's experience with tobacco licenses also illustrates the importance of local control, since municipalities do not have the authority to restrict local tobacco sales.

Limiting Times of Sale

This is a recognized strategy in national tobacco point-of-sale policy but is also a well-established practice in alcohol sales. Limiting both the day of sales as well as the times of sales is an effective alcohol control strategy. Currently both are permissible at the local level, primarily through using zoning ordinances or by the powers of the local liquor commissioners. There is also a state-wide restriction on the hours of sale: First/Third Class Licensees may sell alcohol from 8 a.m. to 2 a.m. of the following morning, and Second Class Licensees may sell alcohol from 6 a.m. to 12 a.m. of the following morning. There is much evidence that restrictions on days and hours of sales will reduce excessive alcohol consumption.

Pricing

Tobacco use is strongly correlated with tobacco prices. According to the Centers for Disease Control and Prevention, tobacco taxes that keep the price of tobacco high are one of the most effective interventions to reduce tobacco use. To counter the effect of tobacco taxes, the tobacco industry employs targeted marketing strategies to keep prices as low as possible. Since tobacco consumers are extremely price-sensitive, especially youth, low-income smokers, and pregnant smokers, per capita consumption and use declines when prices rise significantly.

Comprehensive reviews of tobacco taxation literature have found that with every 10 percent increase in price, overall cigarette consumption decreases by 3 to 5 percent, the number of young adult smokers decreases by 3.5 percent, and the number of youth smokers decreases by 6 to 7 percent.

Every year the tobacco industry spends more than \$9.6 billion nationally and more than \$19 million in Vermont to market its products. The vast majority of these expenditures are designed to keep tobacco prices low. Common marketing practices include discount coupons; off-invoice discounts, where retailers may receive a price reduction if they sell a certain volume of product within a time limit; buy-down programs, where retailers receive a rebate from the manufacturer for sales of a specific brand; wholesale pricing agreements, where the retailer receives a similar rebate from the wholesaler; and retail value-added promotions such as buy-one-get-one-free or a free unit of one product with the purchase of another.

For rebates that go to the retailer, retailers pass these savings on to the consumer. Tobacco manufacturers and wholesalers can offer specific discounts to specific retailers, thus manipulating which products or brands are discounted down to the neighborhood or store level.

There are a variety of countermeasures nationwide employed by state or local jurisdictions to keep tobacco prices high.

- Minimum price laws: Nationwide, 24 states have enacted minimum price laws to try and establish a floor price for tobacco products. The effectiveness of these laws is variable as the tobacco industry has developed strategies to work around different minimum price mechanisms. However, when paired with other strategies, minimum price laws are recognized as part of effective point-of-sale strategy to keep prices high.
- Prohibiting price discounting, including coupons: New York City and Providence, Rhode Island enacted bans on the discounting strategies described above. Both have withstood court challenges.

Marketing and Advertising

The U.S. Surgeon General has identified tobacco marketing and advertising as a primary cause of youth tobacco use. Decades of litigation and regulation, most notably the Master Settlement Agreement of 1998 and the Family Tobacco Prevention and Control Act of 2009, have resulted in limitations on tobacco advertising and marketing to limit tobacco's appeal to youth. Vermont benefits from additional regulations at the state level. The following strategies are best-practice in tobacco control and prevention that could be applied to marijuana:

- **Prohibit self-service displays:** Vermont requires most tobacco products to be contained in displays that are only accessible by the store clerk. This reduces the probability of youth shoplifting tobacco.
- **Restrict displays to adult-only venues:** Several Massachusetts towns have considered restricting tobacco sales to adult-only venues. This accomplishes two prevention goals. First, youth are less likely to be exposed to tobacco marketing and advertising that encourages the use and social acceptability of tobacco. Second, requiring ID checks at the door could reduce the likelihood that underage youth attempt a tobacco purchase.
- **Prohibit Internet sales:** Vermont prohibited internet sales of tobacco in 2008, and the federal government followed suit in 2010. Studies have shown that underage youth can still easily access tobacco when Internet sales are legal. A recent study showed the nearly 94 percent of youth e-cigarette Internet purchase attempts were successful. Prohibiting Internet sales of marijuana and THC delivery devices could reduce youth access and help ensure that marijuana legal in Vermont did not leave the state.
- **Prohibit free samples of products:** Similar to self-service displays and adult-only venues, prohibiting free samples reduces an easy avenue for youth to try products they can't legally buy. In addition, the Food and Drug Administration prohibits free tobacco-branded giveaways, such as lighters or hats, to reduce another means of increasing brand awareness and recruiting youth smokers.
- **Prohibit mass media advertising (e.g. television and radio):** A series of national policies has banned tobacco advertising on television and radio, limited print advertising to publications with significant youth readership, banned most outdoor advertising, and

limited the size of advertising at the point of sale. Colorado followed a similar model for restricting mass marketing of marijuana, though some restrictions only apply if less than 30 percent of the audience is over 21 years of age.

- **Prohibit flavored products (including menthol and nicotine):** Flavored tobacco products are designed to appeal to youth. In 2009, the Food and Drug Administration banned flavored cigarettes, with the exception of menthol, but continued to allow the sale of flavored smokeless tobacco and cigars and cigarillos. Since e-cigarettes are not regulated, there are more than 7,000 flavors available. Nationally and in Vermont, flavored products remain popular with youth. In Vermont in 2015, 24 percent of high school students reported ever trying a flavored tobacco product (Vermont Youth Risk Behavior Survey). Menthol products are also popular with youth. Some studies have shown that menthol cigarettes are more popular among youth or new tobacco users, and others demonstrate that menthol products are more addictive, and harder to quit. The tobacco industry also targets specific demographic groups, such as African Americans, with menthol marketing, and menthol use is higher among these groups. Chicago, Illinois recently banned the sale of all flavored products, including menthol, within 500 feet of schools, and New York City bans the sale of any flavored product except menthol. These initiatives are too recent to determine whether they will deter youth initiation of tobacco use, but preliminary results from New York show significant decreases in flavored tobacco sales and the near elimination of flavored smokeless product sales. With the federal government's guidance to avoid any marijuana marketing to youth, and the emergence of edibles such as Gummi bears in states where marijuana is legal, a ban on the sale of certain flavored manufactured products could be considered.

Marijuana legalization in Colorado and Washington has illustrated key differences between the regulation of tobacco and marijuana marketing and advertising. In Vermont, 52 percent of high school students recall seeing tobacco advertising when they visit retailers likely to sell tobacco (Vermont Youth Risk Behavior Survey, 2015). Despite existing restrictions, tobacco industry promotions still easily reach youth. In a recent audit of Vermont's tobacco retailers, the Health Department found that 38 percent of retailers advertised tobacco within three feet of the floor or within one foot of products such as candy or gum.

However, marijuana is still illegal at the federal level, and the Cole Memorandum requires states that legalize marijuana to prevent its distribution to minors. Accordingly, local jurisdictions in Colorado have taken measures to reduce marijuana's appeal to youth, such as restricting signage that advertises marijuana, without legal challenge. A thorough review of marijuana marketing regulations should be performed to determine if best-practice tobacco prevention strategies from other countries, such as display bans and plain packaging, would be legally feasible.

Dedicated Funding for Prevention and Comprehensive Programming

The CDC evidence base shows that the strategies outlined here are only effective in conjunction with a comprehensive program that facilitates a multi-faceted and inter-agency effort regarding prevention, regulation, enforcement and treatment. CDC research demonstrates that well-funded state-level infrastructure provides the oversight, community engagement, education, prevention and enforcement measures necessary for performing key functions, identifying gaps and solutions, and responding to emerging trends.

An additional best-practice strategy to limit harmful effects from tobacco is to earmark taxation revenue for cessation and prevention, public health, or similar services. Thus the externalities, such as increased costs to public health, enforcement, treatment, or health care systems, are offset by tax revenue. An added advantage of this approach is that funding keeps pace with use and the resulting need for services.

Preventing initiation of an addiction to legal drugs is resource-intensive. Based on nearly 20 years of evidence from state tobacco control programs, the Centers for Disease Control and Prevention recommends a minimum of \$13.41 per capita in Vermont for tobacco control programming for a total funding level of \$8.4 million. This amounts to 7 percent of the total state revenue from tobacco sales taxes and the Master Settlement Agreement (\$114.6 million in FY2012).

Current funding for tobacco control in Vermont is \$3,558,269, from a combination of state and federal sources, which represents a significant decrease in recent years. Without sustained funding levels, decreases in tobacco use prevalence have attenuated. Earmarking revenue for marijuana prevention and control, preferably from revenue generated by marijuana, would be critical to not increasing current prevalence, and treating dependence.

Additional Stakeholder Input

The Medical Community on Pregnancy

The American College of Obstetricians and Gynecologists put out a statement on marijuana use during pregnancy and lactation in July of 2015:

Because of concerns regarding impaired neurodevelopment, as well as maternal and fetal exposure to the adverse effects of smoking, women who are pregnant or contemplating pregnancy should be encouraged to discontinue marijuana use. Obstetrician–gynecologists should be discouraged from prescribing or suggesting the use of marijuana for medicinal purposes during preconception, pregnancy, and lactation. Pregnant women or women contemplating pregnancy should be encouraged to discontinue use of marijuana for medicinal purposes in favor of an alternative therapy for which there are better pregnancy-specific safety data. There are insufficient data to evaluate the effects of marijuana use on infants during lactation and breastfeeding, and in the absence of such data, marijuana use is discouraged.

The American College of Obstetricians and Gynecologists recommends the following:

- Before pregnancy and in early pregnancy, all women should be asked about their use of tobacco, alcohol, and other drugs, including marijuana and other medications used for nonmedical reasons.
- Women reporting marijuana use should be counseled about concerns regarding potential adverse health consequences of continued use during pregnancy.
- Women who are pregnant or contemplating pregnancy should be encouraged to discontinue marijuana use.
- Pregnant women or women contemplating pregnancy should be encouraged to discontinue use of marijuana for medicinal purposes in favor of an alternative therapy for which there are better pregnancy-specific safety data.
- There are insufficient data to evaluate the effects of marijuana use on infants during lactation and breastfeeding, and in the absence of such data, marijuana use is discouraged.

The Effect of Package and Portion Size on Consumption

Many studies have shown that people eat more of a food when it is served in a large portion, even when the eater intends to limit consumption. A meta-analysis of 88 studies concluded that consumption increased by approximately 35 percent when the portion size was doubled (Zlatevska, Dubelaar & Holden, 2014). An additional study found that moviegoers given stale popcorn in large containers still ate more than those given medium-sized containers, indicating that people will increase their consumption of larger portions of food even if that food is not palatable (Wansink & Kim, 2005). These findings can be extrapolated to the case of edible marijuana products designed to be eaten in small sections of a larger portion.

The effect of portion size can be moderated by providing visual cues to stop eating. For example, college students consumed 50 percent fewer potato chips from a tube-shaped container when a red chip was inserted every few chips (Geier, Wansink & Rozkin, 2012). In a similar manner, packaging foods in individual serving sizes so that the consumer can easily identify one portion can reduce the likelihood of over consumption.

The Agency of Education on Experiences from Colorado

Stakeholders from the Agency of Education wished to share an experience from a school in Colorado. A two-page letter to the Colorado Department of Education was sent by the Sierra Grande School District Board of Directors to the Vermont Agency of Education Secretary Rebecca Holcombe. The letter expressed concern about having adequate resources available to address a large influx of new students “behind academically, having individualized plans (IEP), and having additional health needs that require an abundance of support” following the implementation of Amendment 64, which legalized the growth, cultivation, and retail sale of marijuana.

The Sierra Grande School District Board express their concerns about a rapid change in their student body, which they attributed to families moving to their district due to "easy access to cheap land". Many questions remain regarding this concern; however the experience in Colorado is a reminder that we cannot predict all potential outcomes of a regulated marijuana market, and that the impact on schools requires detailed attention.

Recommendations

Stakeholders developed recommendations in the final meeting and month of the health impact assessment. Stakeholders considered the analysis section of the health impact assessment when making the recommendations, and made these recommendations based on the possibility that Vermont would regulate marijuana. Some stakeholders do not agree that the State should regulate marijuana, while others are actively promoting regulation. This diverse group was able to agree on the following in order to protect and improve the health of Vermonters should the Legislature regulate marijuana.

Infrastructure

Findings

The Colorado State Government had very little time between marijuana legalization and when the necessary regulatory and tax structures needed to be in place. This led to negative outcomes such as spikes in emergency department admissions and large inconsistencies in listed potency and dosage or "portion size" of products. Research from tobacco and alcohol has shown that strong, clear and consistent regulation is critical in controlling negative health outcomes from the sale of adult-only substances. There are many different types of tobacco and marijuana delivery systems (e.g. electronic vaporizers), as well as many tobacco substitutes. These delivery systems, tobacco substitutes and commercial products are not covered under current tobacco law and regulation in Vermont. Ensuring that current regulations are expanded to include marijuana as well as the many different types of delivery systems will be critical in preventing or limiting the possible negative health outcomes.

Recommendations

- **Put infrastructure in place before sales begin.** Ensure that all critical staff are hired, all regulations and rules are in place, and all testing infrastructure is built and functioning before allowing for the licensing of production, distribution or retail of marijuana products. Authorize a governing body or administrative unit responsible for overseeing the implementation of the regulation and taxation of marijuana.
- **Expand Existing Tobacco Laws.** Expand and enhance *all* current tobacco smoking laws and regulations to include the use of tobacco *or* marijuana and include any potential type of delivery system or tobacco substitute (electronic cigarettes, vape pens, etc.).
- **Do not allow use of marijuana in public places.** Ensure children and youth are not exposed to marijuana use or second hand smoke.

- **Fully fund enforcement and oversight.** Follow best practice in protecting youth and young-adults, as well as adult users, by ensuring licensing fees are set at a level, and will continue to grow with inflation and industry growth, that fully funds the necessary enforcement and oversight efforts now and in the future. Note: Current tobacco and alcohol licensing fees are not sufficient to support best practice enforcement efforts.
- **Standardize and test packaging and potency.** Ensure that all THC concentration regulations, particularly those relating to packaging, labeling and testing, are in place before implementation. Marijuana and marijuana products should be batch-tested and labeled for potency. Procedures must be in place to regulate and test final products for contaminants.

Protect Youth and Young Adults

Findings

Frequent and persistent marijuana use has clear scientifically delineated negative consequences on brain development, substance use disorders and academic achievement for youth. The brain continues to undergo rapid development until age 25, and the majority of college students are under the age of 25. The American Society of Addiction Medicine recommends to “prohibit the legal sale of marijuana to anyone under the age of 25.” (ASAM, 2015).

Recommendations

- **Restrict Age of Access.** Implement prevention, regulation and enforcement strategies that greatly reduce access to marijuana for those age 25 and younger. This is to protect children, youth and young adults during the time in life of rapid brain development and academic involvement.
- **Fund Prevention.** Set up a fund, similar in mechanics to the Clean Water Fund, from taxes on marijuana production, distribution and sales directed to a designated fund in the Treasurer’s Office, and used only for substance use prevention and education efforts. Use this funding to:
 - Expand substance misuse prevention, education and screening in schools (including post-secondary institutions) and pediatric offices.
 - Launch a statewide education campaign directed at specific populations such as youth, young adults and pregnant women, about the potential health risks of non-medical marijuana use.
- **Restrict Advertising.** Put in place advertising restrictions to ensure that youth and young adults are not targeted by, or exposed to, marijuana advertising. Restrict advertising from any area where youth could potentially be exposed.

Infused Products (Edibles)

Findings

There is little to no research on the health effects of non-medical use of infused/edible marijuana products. Infused/edible products can be more attractive to individuals who have not previously used marijuana, particularly youth.

Recommendations

- **Do not allow infused products on the regulated market.** Do not include retail sales of products infused with marijuana for non-medical purposes.
- **Never allow infused products that could appeal to children.** Mandate that should future legislation ever allow for infused/edible products, they are never allowed in a format that could be attractive to youth (e.g. gummy bears, cookies, brownies, etc.). Before any future regulation regarding edibles is implemented, ensure that full testing and regulatory bodies are in place. This includes development, implementation and full funding for comprehensive food inspection.

Prevent Motor Vehicle Crashes

Findings

Operating a motor vehicle – of any type, including an ATV or snowmobile – and using marijuana increases risk of motor vehicle crashes and fatal crashes in particular. The precise minimum active-THC blood level associated with crash risk has not yet been determined.

Recommendations

- **Set a blood level operating limit for THC.** Set a per se active-THC blood level limit for operating a motor vehicle based on the best available evidence. Designate a non-Legislative body with rulemaking authority made up of law enforcement and health officials to review data and determine the exact per se limit. Allow this body to amend that limit in the future based on scientific evidence, surveillance data, and emerging information from other states.
- **Build driver testing infrastructure.** Build the infrastructure and procedures necessary to conduct appropriate and consistent testing for THC before marijuana is regulated.
- **Implement a public education strategy about the dangers of driving under the influence of THC.** Do this before marijuana is regulated and ensure that the education includes information on what the legal limits mean in terms of use.

Protect Adults

Findings

Regular marijuana use has negative mental health consequences for adults. Adults with any pre-existing mental health or psychosocial problems, are at higher risk of experiencing additional negative mental health consequences from marijuana use.

Recommendations

- **Expand screening in primary care practices.** Expand screening for substance use disorders and mental health problems and trauma in primary care.
- **Get providers the information they need.** Ensure medical providers receive the most recent information and training related to screening for risk factors for substance misuse disorders (e.g. non-adaptive stress response) as well as Screening, Brief Intervention and Referral to Treatment (SBIRT). Work with local teaching institutions to ensure that medical students, nursing students (and other allied health professionals) receive the most recent information and training on the health impacts of marijuana.

Reduce Access and Protect Local Control

Findings

The location and density of retail outlets and advertising has an effect on prevalence of tobacco and alcohol use among adults and youth. Currently, localities in Vermont cannot go beyond the licensing restrictions established by the State for tobacco retail licenses. This has greatly limited community participation in deciding on tobacco retail density, and has limited local input in protecting youth and disadvantaged populations.

Recommendations

- **Limit sales to adult-only outlets statewide.** Do not allow sales in locations that minors can enter. Ensure a statewide standard, but:

Allow local governments to further restrict sale, outlet density/location and advertising through municipal zoning and ordinance mechanisms – including banning the sale of marijuana, similar to Vermont’s laws concerning medical marijuana dispensaries.
- **Consider statewide “buffer zones”.** Consider implementing statewide buffer zones for the sale of marijuana around areas such as playgrounds, schools and colleges.

Monitor the Future

Findings

Current surveillance systems do not collect data on dose (potency) and method of use (e.g. vaporizing, edibles, etc.). This makes it difficult to estimate both current and long-term health effects. There are many areas that need future research.

A monitoring plan will be developed in the Spring of 2016. This will involve expanding current surveillance mechanisms and reports on marijuana use in Vermont. In addition, the stakeholder group will be asked to consider development of an evaluation of this health impact assessment.

Recommendation

- **Fund surveillance and research.** Fund surveillance efforts to monitor more closely the type of use, frequency of use, and potency of marijuana used among Vermonters of all ages. Encourage and fund the scientific study of health effects among Vermonters who use marijuana.

APPENDIX A: Stakeholders & Participants

Facilitator: Shayla Livingston, Department of Health, Division of Health Surveillance

Stakeholders: The following individuals drove this Health Impact Assessment. While they do not all agree with every part of this document, their input was critical to developing the HIA.

Name	Organization
John Searles, PhD	Department of Health Alcohol and Drug Abuse Programs
Jaskanwar Batra, MD	Department of Mental Health
Robert C. Uerz, MEd	Agency of Education Student Health and Learning Team
Rob Williams, PhD	Vermont Cannabis Collaborative Steering Committee Member
Lori Tatsapaugh Uerz, MPH	Department of Health Alcohol and Drug Abuse Programs
Eoana Sturges, MPH	Department of Health Health Promotion and Disease Prevention
Melanie Sheehan	Mount Ascutney Prevention Partnership
Ilisa Stalberg, MSS, MLSP	Department of Health Maternal and Child Health
Mark Depman, MD	SBIRT Vermont; Central Vermont Medical Center Department of Emergency Medicine
Amy Malinowski, RD	Department of Health Burlington District Office
Hilary Fannin, MPH	SAMHSA/CSAP Prevention Fellow, Vermont
Kim Hubbard, LADC	The Howard Center
Timothy Trevithick	Chittenden South Supervisory Union
Margo Austin, MEd, LADC	Burlington High School Student Assistance Program Counselor
Lori Augustyniak	Prevention Works! VT
Judy MacIsaac Robertson	Vermont Cannabis Collaborative (VTCC) Steering Committee / Co-lead Industry
Kayla Tatro, LICSW LADC	Northwestern Counseling & Support Services Master Clinician, Adolescent Services
Virginia Lyons	Vermont Senate

Jill Rinehart, MD, FAAP	American Academy of Pediatrics Vermont Chapter
Cindy Thomas	Department of Health Alcohol and Drug Abuse Programs
Tin Barton Caplin	Department of Health Alcohol and Drug Abuse Programs
Chris Bell	Department of Health Emergency Medical Services
Heidi Klein	Department of Health Health Surveillance
Mark Ames	Recovery Network
Kathy Hentcy	Department of Mental Health

Participants: These individuals took part in the process at one point or another. They may have come to some meetings, contributed data, or otherwise helped in developing the HIA.

Name	Organization
Adam Frowine	Department for Children and Families
Jen Fisher	Department of Liquor Control
Genevieve Paul	Department of Motor Vehicles Enforcement and Safety Division
Jeannette White	Vermont Senate
Shayne Lynn	Medical Marijuana Dispensary Representative
Ann Pugh	Vermont House
Sarah Wylie	Department of Health Tobacco Control Program
Willa Ferrell	Court Diversion/Reclaiming Futures
Mary Gratton	Addiction Treatment Specialist
Joe Flynn	Department of Public Safety
Chauncey Liese	Department of Motor Vehicles Chief of Driver Improvement

APPENDIX B: Definitions

THC – Tetrahydrocannabinols. For the purposes of this report, THC refers to delta-9-THC, the psychoactive chemical that enters the blood and brain immediately after smoking or consuming marijuana.

Carboxy-THC – The metabolite of delta-9-THC, which can be detected up to 30 days after consumption of marijuana.

Cannabinoid – Chemicals that are unique to the cannabis sativa plant. There are five major subclasses of cannabinoids:

1. Cannabigerols (CBG)
2. Cannabichromenes (CBC)
3. Cannabinoids (CBD)
4. Tetrahydrocannabinols (THC)
5. Cannabinol (CBN) and Cannabinodiol (CNDL)

Marijuana – Another term for cannabis. Marijuana is the term most people use.

Dependence – In the DSM-4 (under which many of the studies and data presented in this report were conducted), substance dependence was defined as a maladaptive pattern of substance use leading to clinically significant impairment or distress, as manifested by three or more of the following, occurring within a 12-month period:

1. Tolerance, as defined by either of the following:
 - a need for markedly increased amounts of the substance to achieve intoxication or desired effect
 - markedly diminished effect with continued use of the same amount of the substance
2. Withdrawal, as manifested by either of the following:
 - the characteristic withdrawal syndrome for the substance
 - the same or a closely related substance is taken to relieve or avoid withdrawal symptoms
3. The substance is often taken in larger amounts or over a longer period than was intended.
4. There is a persistent desire or unsuccessful efforts to cut down or control substance use.
5. A great deal of time is spent in activities necessary to obtain the substance, use the substance, or recover from its effects.
6. Important social, occupational, or recreational activities are given up or reduced because of substance use.
7. The substance use is continued despite knowledge of having a persistent or recurrent physical or psychological problem that is likely to have been caused or exacerbated by the substance.

Abuse – In the DSM-4 (under which many of the studies and data presented in this report were conducted), substance abuse was defined as:

- A) A maladaptive pattern of substance use leading to clinically significant impairment or distress, as manifested by one or more of the following, occurring in a 12 month period:
 - a. recurrent substance use resulting in a failure to fulfill major role obligations at work, school, or home
 - b. recurrent substance use in situations in which it is physically hazardous
 - c. recurrent substance-related legal problems
 - d. continued substance use despite having persistent or recurrent social or interpersonal problems caused by or exacerbated by the effects of the substance
- B) The symptoms have never met the criteria for substance dependence for this class of substance.

Substance Use Disorder – The DSM-5 states that for a person to be diagnosed with a disorder due to a substance, they must display two of the following 11 symptoms within 12 months:

- A) Consuming more of the substance or other substance than originally planned
- B) Worrying about stopping or consistently failed efforts to control one's use
- C) spending a large amount of time using drugs/alcohol, or doing whatever is needed to obtain them
- D) Use of the substance results in failure to "fulfill major role obligations" such as at home, work, or school.
- E) "Craving" the substance (alcohol or drug)
- F) Continuing the use of a substance despite health problems caused or worsened by it
This can be in the domain of mental health (psychological problems may include depressed mood, sleep disturbance, anxiety, or "blackouts") or physical health.
- G) Continuing the use of a substance despite its having negative effects in relationships with others (for example, using even though it leads to fights or despite people's objecting to it)
- H) Repeated use of the substance in a dangerous situation (for example, when having to operate heavy machinery, when driving a car)
- I) Giving up or reducing activities in a person's life because of the drug/alcohol use
- J) Building up a tolerance to the alcohol or drug. Tolerance is defined by the DSM-5 as "either needing to use noticeably larger amounts over time to get the desired effect or noticing less of an effect over time after repeated use of the same amount."
- K) Experiencing withdrawal symptoms after stopping use
- L) Levels of severity are defined as follows:
 - a. mild – two symptoms manifest within a 12 month period
 - b. moderate – four symptoms manifest within a 12 month period
- M) Severe – six or more symptoms manifest within a 12 month period

Synthetic cannabinoids – Designer drugs that mimic the effects of cannabis. They are typically applied to an herbal base; examples are K2 and Spice. These drugs have been made illegal in many states, including Vermont.

APPENDIX C: Frequently Asked Questions

The Health Impact Assessment stakeholder group determined that there is a need for a brief frequently asked questions section, based on the literature review.

I know people who used marijuana while they were in school, and they're fine. – OR – My parents smoked marijuana when they were young and they're fine. What's the big deal?

Frequent and persistent marijuana use appears to have a physical impact on the developing brain, and the brain develops rapidly until age 25. Research has now shown that frequent and persistent marijuana use during youth has negative cognitive and academic outcomes.

Research over several years (prospective longitudinal studies) has shown that marijuana has negative health outcomes:

- decrease in cognitive function and memory loss
- increased risk of becoming addicted to marijuana and other illicit drugs
- decrease in educational/occupational attainment
- increased risk of serious mental health problems.

Not all people have the same risk for health outcomes. Some of us know people who smoke a pack of cigarettes a day and live until they are 100, but we know that cigarette use is bad for health and reduces overall life expectancy. In the same way, some people might use marijuana and not have an outwardly noticeable change, but this does not mean that marijuana use is safe. Effects of marijuana are cumulative over time, and are dose dependent. This means that the earlier age someone begins using marijuana, the longer someone uses marijuana, and the more often marijuana is used (e.g. weekly, daily, etc.) the higher the risk of adverse consequences.

Also, the risk of health consequences is not distributed evenly throughout the population. Individuals have unique genetic and environmental risk and protective factors that will affect their responses to any substance, not just marijuana. Unfortunately, those people who often suffer the most from substance use and abuse are those who have fewer positive factors in their lives.

Another important factor is potency, the amount of the active ingredient (i.e. THC) in the marijuana. The concentration of THC in marijuana is very different depending on when and where it is obtained. The potency of marijuana has also changed over time. While the average THC content in decades past hovered between 3 and 6 percent, average THC concentration in marijuana currently sold in Colorado is 17 percent.

It's safe to drive if I just smoke a little bit, right? I just drive slower.

No. It is not safe to drive while under the influence of marijuana. Research has now clearly shown that motor vehicle crash risks – both fatal and nonfatal – increase significantly if the driver is under the influence of marijuana. We do not yet know the minimum blood level of THC that will result in an increased risk. This means that there is no currently identified safe blood level of THC for operating a motor vehicle.

People can get loud and aggressive drinking alcohol. This doesn't happen with marijuana, right?

It's true that aggression is not a normal reaction to marijuana use. However, this is not the only measurable consequence of any substance use/misuse. When assessing health risks of a substance it is important to compare use of the substance to no substance use, instead of use to another substance. While marijuana use does not normally lead to aggressive behavior, it is associated with higher levels of anxiety and depression for some people, and serious mental health symptoms for others. It can lead to a marijuana substance use disorder for one out of 10 users, and one out of six adolescent and young adult users. Use of marijuana is also associated with use of and dependence on other illicit drugs. Marijuana use poses significant health risks compared to not using marijuana.

People use marijuana medically, so it can't be that dangerous, right?

Medical marijuana can be used for a very limited number of debilitating medical conditions in Vermont: cancer, AIDS, HIV, and multiple sclerosis. Marijuana can also be used to relieve symptoms associated with treating these conditions such as wasting syndrome, nausea, seizures, and severe pain.

Many drugs available by prescription can be misused. For example, prescription opioid pain relievers such as hydrocodone or oxycodone when used properly are very beneficial to those suffering acute or chronic pain. However, we have also seen that misusing these medications can lead to extremely adverse outcomes, including dependence and death. Using a substance in a medical context to treat a specific symptom with oversight and assistance from professionals is very different from using a substance outside of that context. Ensuring that people are not self-medicating and that the individuals know the potential risks of use are critically important to the continued safety of the medical marijuana work being done in Vermont.

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