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Health considerations in regulating marijuana in Vermont

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ABSTRACT

This article delineates the current efforts of the Vermont Department of Health (VDH) to address the potential health impact of legalization and regulation of recreational marijuana for use by adults at least 21 years of age. To this end, VDH and key stakeholders developed and published a Health Impact Assessment with specific recommendations should legislation that legalized and regulated marijuana be passed into law. Although the legalization legislation failed in 2016 and was vetoed by the Governor in 2017, it is unclear what will happen in the future.

In 2014, the Vermont legislature passed and Governor signed Act 155, which among other things directed the Secretary of Administration to "report to the General Assembly regarding the taxation and regulation of marijuana in Vermont" (Vermont General Assembly, 2014). The Governor's office contracted with the Rand Corporation to assess the potential economic, social, mental and physical health consequences of legalizing adult use of marijuana in Vermont as well as several options for supply and distribution architecture. This report did not make specific recommendations for or against legalization but rather detailed short and long term potential costs and benefits of such a policy (Caulkins et al., 2015).

The context surrounding the legalization of marijuana in Vermont is important. Fig. 1 shows the prevalence of marijuana use across age groups compared to the US National average. In addition, past 30-day use of marijuana as measured by the Vermont Behavioral Risk Factors Survey System (BRFSS) show dramatic increases from 2013 to 2015: 80% increase among those 18–24; 40% increase among those 25–44; and 50% increase among those 45–64.

To offer more clarity on the issue of possibly legalizing and regulating marijuana for recreational use the Vermont Department of Health and key stakeholders conducted and published a Health Impact Assessment (HIA) of the possible health effects that could result from the legalization of marijuana for adults in January 2016 (Vermont Department of Health, 2016). The stakeholder group proposed a series of questions to guide the analysis. Findings were based on a comprehensive literature review and Vermont-specific data to the extent it could be ascertained. The questions addressed by this HIA were:

1. What are the potential health impacts (both positive and negative) of regulating marijuana use?
2. What lessons can be learned from tobacco and alcohol policy?
3. What are the ways we can mitigate any potential negative health effects and enhance any health benefits?
4. If Vermont regulated marijuana what would happen to:
   a. Prevalence of marijuana use
   b. Traffic safety (e.g., marijuana involved fatal car crashes)
   c. Mental health
   d. Long-term psychosocial outcomes (e.g., educational attainment, life satisfaction, etc.)
   e. Substance use disorders including disorders co-morbid with cannabis use disorder

Several critical unknowns were identified that would likely influence any health impacts of regulating marijuana. These include, but are not limited to:

1. Age at which consumers first use and age at which consumers begin regular use
2. The actual number of marijuana users in Vermont
3. The number of days each consumer users (e.g. days/week; days/month)
4. Frequency of use in each day of use
5. Potency of each dose

One of the major concerns expressed in the HIA was the potential for legalization to expand youth access to marijuana. Although rates of use

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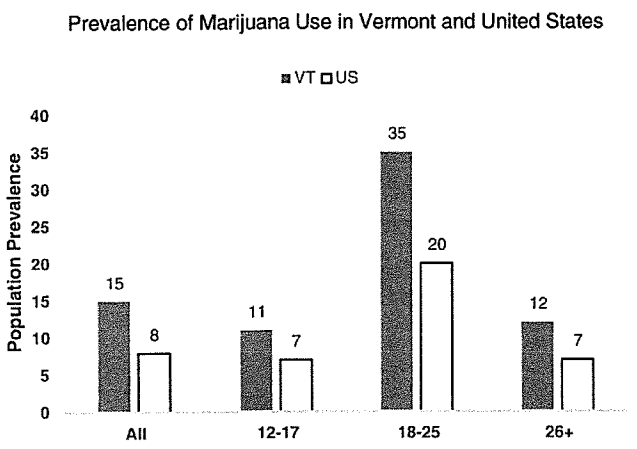

Fig. 1. Percentage of individuals reporting the past 30 days of marijuana use by age; Vermont compared to United States average (National Survey on Drug Use and Health 2014/2015).

in Colorado were high prior to legalization, following legalization of marijuana that state now has the highest past 30-day use in the country across all age groups, including 12–17-year-olds (Substance Abuse and Mental Health Services Administration, 2014; Substance Abuse and Mental Health Services Administration, 2015). This is troubling because several methodologically sound longitudinal studies suggested serious long-term negative mental health and psychosocial impacts for individuals who start using as adolescents and continue use into adulthood including lower educational and career attainment, lower life satisfaction, declining IQ, and increased risk for other substance use disorders (e.g., Fergusson et al., 2015; Meier et al., 2012; Silins et al., 2014). Research is unclear that early marijuana use may adversely affect morphological or functional alterations in brain development (Filbey et al., 2014; Gilman et al., 2014; Smith et al., 2015; Weiland et al., 2015). Whether any structural changes that may occur are reversible with discontinued use is currently unclear.

The HIA also considered the increasing levels of potency of both illicit and retail marijuana. The University of Mississippi tests federally seized cannabis for potency of THC, the psychoactive component in marijuana. In 1986, the average potency was 2.8%; in 2013, the average potency rose to 12.6% - a 450% increase (ElSohly et al., 2000; ElSohly et al., 2016). In Seattle, WA at one marijuana retailer potency of one strain of cannabis was determined to range from 13% to 28.3% with an average of 21% (Northwest High Intensity Drug Trafficking Area, 2016, p.34). In Denver, CO a State licensed testing facility reported THC potencies as high as 32% (CNN, 2016).

The combination of early initiation (i.e., adolescence), more frequent use, and higher potency may have profound adverse implications for public health in the long-term. There is very little research on the relationship between frequency and potency of marijuana use. It could be that higher potency marijuana may reduce frequency of use, but this is currently an open question. However, one study suggested that high frequency use of high potency marijuana increased the risk of a first-time episode of psychosis by a factor of five compared to nonusers (Diforti et al., 2015). To be clear, the time lags required to investigate these relationships are substantial. While nearly all the currently available longitudinal research suggests negative outcomes for early and persistent marijuana use (e.g., Fergusson et al., 2015; Meier et al., 2012; Silins et al., 2014) the overall impact on the general population will not be known for perhaps decades if marijuana use becomes widespread. For example, the HIA reported on data suggesting early initiation and continued use of marijuana may have a significant impact on the development of both the earlier emergence of symptoms of psychosis as well as full blown schizophrenia for those at risk for this disorder (Radhakrishnan et al., 2014). Continued research into the identified adverse psychological and psychosocial outcomes as well as any potential benefits associated with long-term marijuana use is essential.

Another concern addressed in the HIA is the effect of marijuana on automobile crashes particularly those that result in a fatality. As of November 29, 2016, of the 62 traffic fatalities recorded on Vermont roads, 13 involved marijuana (15 involved alcohol). Early data from the State of Washington indicate that car crash fatalities involving measurable levels of THC increased 122% from 2010 to 2014. Of even more concern, car crash fatalities involving THC and alcohol in combination increased 44% over the same time frame; those involving THC, alcohol, and other drugs rose 200% (Northwest High Intensity Drug Trafficking Area, 2016). The degree to which this is real or partly a function of increased surveillance is unclear. The increasing marijuana potency discussed earlier may also intensify this trend. Currently we do not have either national or Vermont-specific data on the role of marijuana in non-fatal car crashes.

An additional concern has been raised by the latest State-level NSDUH data, which is especially relevant in Vermont. In 2013, Colorado prevalence for past year nonmedical use of prescription pain relievers for ages 26+ was 16th in the Nation. In 2014 the year that marijuana was legalized, the state was the highest in the nation among this age group which suggests that marijuana is a complement to and not a substitute for illicit opioids. The same report shows prevalence of nonmedical use of prescription pain relievers among 18–25 year olds went from 10th in the nation to 2nd from 2013 to 2014. Given Vermont's documented problems with opioid misuse, this is troubling.

The impact on the treatment system is another unknown but potentially disquieting factor. Currently it is estimated that 1 in 3 marijuana users will eventually meet criteria for cannabis use disorder (CUD) (Hasin et al., 2015). Increased prevalence (especially among adolescents), more frequent use, and higher potency marijuana are all factors that independently as well as in combination could potentially increase both the number and severity of CUD thereby additionally burdening the treatment system. Given the previously cited data on marijuana being a complement to rather than a supplement for opioids this could further complicate the treatment burden in Vermont.

The HIA stakeholders suggested that lessons learned from previous policy efforts in tobacco and alcohol access be utilized. These include:

1. Smoke-free policies/open container restrictions
2. Limiting access (where, how, when, age)
3. Increasing taxes
4. Allowing local control
5. Child-resistant packaging
6. Limiting tobacco and alcohol advertising
7. Enforcing laws
8. Strong prevention efforts (messaging and education)

Each of these eight factors can be applied to marijuana regulation. In addition, the stakeholders made a series of recommendations that should be considered prior to any legalization initiatives being introduced;

1. Put infrastructure in place before sales begin.
2. Expand existing tobacco laws.
3. Do not allow use of marijuana in public places.
4. Fully fund enforcement and oversight.
5. Standardize testing, packaging and potency.
6. Restrict age of access.
7. Fund prevention.
8. Restrict advertising.
9. Do not allow infused products on the regulated market.
10. Never allow infused products that could appeal to children.
11. Set a blood level operating limit for THC.
12. Build driver testing infrastructure.

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13. Implement a public education strategy about the dangers of driving under the influence of THC.
14. Limit sales to adult-only outlets statewide.
15. Allow local governments to further restrict sale, outlet density/location and advertising.
16. Consider statewide "buffer zones" (e.g. around areas frequented by young people).
17. Expand screening in primary care practices.
18. Get providers the information they need.
19. Fund surveillance and research.

On February 25, 2016, the Vermont Senate voted 17–12 in favor of a bill that would legalize, regulate, and tax marijuana for recreational use. On May 3, 2016, the Vermont house voted 121–28 against the bill. Since then, the landscape of marijuana legalization has shifted dramatically. There are now 8 states that have passed referendums to allow for sales of marijuana to adults. The most directly influential to Vermont are Massachusetts and Maine. The legal status of recreational use of marijuana in Vermont is uncertain at this time. On May 24, 2017, the Governor vetoed a bill that would have legalized the possession of 1 oz. of marijuana for adults 21 and older. The Vermont Department of Health will continue to provide information on the potential benefits and adverse health consequences of marijuana use through updates of the HIA.

Disclosures

The authors have nothing to declare.

References

Caulkins, J.P., Kilmer, B., Kleiman, M.A.R., MacCoun, R.J., Midgette, G., Oglesby, P., Pacula, R.L., Reuter, 2015. Considering Marijuana Legalization: Insights for Vermont and Other Jurisdictions. Rand Corporation, Santa Monica, CA http://www.rand.org/pubs/research_reports/RR864.html (Accessed April 6, 2017).

CNN (October 21, 2016). Colorado Marijuana's Potency Getting 'Higher'. http://www.cnn.com/2016/10/21/health/colorado-marijuana-potency-above-national-average/. (Accessed April 6, 2017).

Diforti, M., Marconi, A., Fraietta, S., Trotta, A., Bonomo, M., et al., 2015. Proportion of patients in South London with first episode psychosis attributed to use of high potency cannabis: a case-control study. The Lancet Psychiatry 2, 233–238.

ElSohly, M.A., Ross, S.A., Mehmedic, Z., Arafat, R., Yi, B., Banahan, B.F., 2000. Delta-9-THC and other cannabinoids in confiscated marijuana from 1980–1997. J. Forensic Sci. 45, 24–30.

ElSohly, M.A., Zlatko, M., Foster, S., Gon, C., Chandra, S., Church, J.C., 2016. Changes in cannabis potency over the last two decades (1996–2014): analysis of current data in the United States. Biol. Psychiatry 79, 613–619.

Fergusson, D.M., Boden, J.M., Horwood, L.J., 2015. Psychological sequelae of cannabis use and implications for policy: findings from the Christchurch health and development study. Soc. Psychiatry Psychiatr. Epidemiol. 50, 1317–1326.

Filbey, F.M., Aslan, S., Calhoun, V.D., Spence, J.S., Demaraju, E., Caprihan, A., Segall, J., 2014. Long-term effects of marijuana on the brain. Proc. Natl. Acad. Sci. 111, 16913–16918.

Gilman, J.M., Kuster, J.K., Lee, M.J., Makris, N., van der Kouwe, A., Blood, A.J., Breiter, H.C., 2014. J. Neurosci. 34, 5529–5538.

Hasin, D., Saha, T.D., Kerridge, B.T., Goldstein, R.B., Chou, S.P., et al., 2015. Prevalence of marijuana use disorders in the United States between 2001–2002 and 2012–2013. JAMA Psychiatry 62, 1235–1242.

Meier, M.H., Caspi, A., Ambler, A., Harrington, H., Houts, R., et al., 2012. Persistent cannabis users show neuropsychological decline from childhood to midlife. Proc. Natl. Acad. Sci. 109, E2657–E2664.

Northwest High Intensity Drug Trafficking Area (NWHIDTA), 2016. Washington State Marijuana Impact Report. http://www.riag.ri.gov/documents/NWHIDTAMarijuanaImpactReportVolume1.pdf.

Radhakrishnan, R., Wikinson, S.T., D'Souza, D.C., 2014. Gone to pot: a review of the association between cannabis and psychosis. Front. Psych. http://dx.doi.org/10.3389/fpsyt.2014.00054/full.

Silins, E., Horwood, L.J., Patton, G.C., Fergusson, D.M., Olsson, C.A., et al., 2014. Young adult sequelae of adolescent cannabis use: an integrative analysis. The Lancet Psychiatry 1, 286–293.

Smith, M.J., Cobia, D.J., Reilly, D.J., Roberts, A.G., Alpert, K.L., Wang, L., Breiter, H.C., Csernansky, J.G., 2015. Cannabis-related episodic memory deficits and hippocampal morphological differences in healthy individuals and schizophrenia subjects. Hippocampus 25, 1042–1051.

Substance Abuse and Mental Health Services Administration, 2014. Results From the 2013 National Survey on Drug Use and Health: Summary of the National Findings. NSDUH Series H-48, HHS Publication No. (SMA) 14-4863. Substance Abuse and Mental Health Services Administration, Rockville, MD.

Substance Abuse and Mental Health Services Administration, 2015. Results From the 2014 National Survey on Drug Use and Health: Summary of the National Findings. NSDUH Series H-50, HHS Publication No. (SMA) 15-4927. Substance Abuse and Mental Health Services Administration, Rockville, MD.

Vermont Department of Health, 2016. Health Impact Assessment: Marijuana Regulation in Vermont. http://www.healthvermont.gov/sites/default/files/documents/2016/11/HIA_marijuana_regulation_in_VT_2016.pdf (Accessed April 6, 2017).

Vermont General Assembly, 2014. S.247 (Act 155) An Act Relating to the Regulation of Marijuana for Symptom Relief and Dispensaries. http://legislature.vermont.gov/bill/status/2014/S.247 (Accessed April 6, 2017).

Weiland, B.J., Thayer, R.E., Depue, B.E., Sabbineni, Bryan, A.D., Hutchison, K.E., 2015. Daily marijuana use is not associated with brain morphometric measures in adolescents. J. Neurosci. 35, 1505–1512.

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