The Implications of Cannabis Policy Changes in Washington on Adolescent Perception of Risk, Norms, Attitudes, and Substance Use

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ABSTRACT: There is increasing interest in the effect of legalization (particularly recreational legalization) of cannabis on prevalence of use and related problems. However, there is no consensus about the impact of policy change on cannabis use, particularly among adolescents. Legalization may increase adolescent use through mediating factors such as perceived risk and normative beliefs regarding the use of cannabis. Washington State enacted Initiative 502 on December 2012, which legalized and taxed recreational cannabis for adults aged ≥21 years. This paper used data from a randomized, controlled intervention trial for cannabis-using adolescents that was recruiting participants in Seattle before and after the policy change to evaluate the following goals: assess differences in substance use, problems, and symptomatology pre- and post-policy change; evaluate several proposed risk factors that may be associated with such differences; and describe participants' understanding of the law and how this understanding may relate to rates of use. Analyses revealed no significant differences pre- to post-policy in rate of substance use. However, there were significant post-policy increases in problems and use disorder symptoms. Despite these differences, there were no significant increases in norms, attitudes, or perceptions of risk. Participants were able to answer most questions regarding policy changes correctly, indicating a good understanding of the policy. Results provided no evidence that policy change influenced heavy-using adolescents' rates of use nor the proposed risk factors associated with problematic use patterns.

KEYWORDS: marijuana, cannabis, legalization, adolescents

Cannabis is the most popular among illicit substances in the United States.[1] Rates of cannabis use across the United States have nearly doubled since 2001.[2] Rates of use are particularly high among adolescents.[3] Prolonged heavy cannabis use is often associated with negative outcomes in school,[4] neurocognitive deficits,[5] negative mental health outcomes,[4,6] and problems with family and friends.[7] Despite potential problems associated with heavy and long-term use of cannabis, the proportion of high school students in the United States who see cannabis use as risky decreased over the course of the 2000s.[3]

Use rates and risk perceptions are likely influenced by macro-level factors, such as laws, as these laws may shape perceptions regarding normative use of cannabis. Beginning in 1996, cannabis use has been legalized for medical purposes in more than 30 states and the District of Columbia,[8] suggesting a trend toward a more normative view of cannabis.[9] In November 2012, Colorado and Washington became the first among the United States to legalize cannabis for recreational use by adults, a trend which has exponentially increased over the past several years. However, policy change may not be a causal factor for the changes in use and perception of risk over time (ie this may be a change that began before the widespread legalization of cannabis use).

Several large epidemiological findings have suggested that legalization for medical purposes is not associated with increased rates of adolescent cannabis use.[10] However, implications of legal recreational use, a policy change that is evident more often in states with legal medical use, are more uncertain and mixed.[11–15] In addition to rates of use, age of initiation may be impacted by policy change: however, recent findings suggest no differences in age of first cannabis use among states that have legalized cannabis use versus those that have not.[16] The impact of policy change on cannabis consumption becomes more nuanced when taking into account other methods of cannabis consumption, such as vaping or edibles.[16,17] The use of other substances may also be impacted by policy change, as use rates and perception of use may generalize across substances. However, findings surrounding use of other substances (alcohol and tobacco) in a state with legal cannabis show reductions after policy change.[18]

Within the theories of Planned Behavior and Reasoned Action, behavioral intentions—and consequently behaviors

such as cannabis use—are determined by both attitudes and subjective perceptions of norms.[19,20] Consistent with theory, attitudes regarding approval of substance use and perceived risk are associated with rates of use—with increased approval, cannabis use rates increase.[21] For example, along with rates of use, perception of risk has changed over time both in states with recreational cannabis laws and those without.[3,15] Some research finds that adolescent perceptions of cannabis riskiness is lower in states with legal medical cannabis.[11] For example, Khatapoush and Hallfors[22] found lower rates of risk perceptions and higher rates of approval among adolescents and young adults in California after medical cannabis legalization as compared to states that had not legalized, but, this difference was apparent pre-policy change (ie risk perception was lower and approval was higher than other states even before legalization). As such, findings do not necessarily imply that policy changes caused differences and may reflect that states with higher use rates and less perceived risk are more likely to enact medical cannabis legislation,[23] suggesting a different temporal relationship between these factors.

Furthermore, perceptions concerning normative use of peers and perceived approval of peers are associated with rates of cannabis use among adolescents.[24–26] Indeed, perception of approval and normative use especially among close friends and peers are associated with cannabis-related outcomes.[27] Macro-level norms may be similarly influential to behavior as individual-level norms. Keyes et al[28] found that individuals born in birth cohorts with greater approval of cannabis are more likely to use cannabis, independent of personal attitudes toward cannabis. Cannabis laws partially determine macro-level norms[12]—as such, policy changes may impact attitudes regarding risk and acceptability, as well as use rates. In addition, there is some evidence to suggest that policy changes influence cannabis use perceptions; however, evidence regarding effects of policy on use is mixed.

This paper used a sample of adolescents from a randomized clinical trial, the Teen Marijuana Check-Up (TMCU), to investigate whether recreational cannabis legalization impacted perceived norms, perceived risk, attitudes, and frequency of cannabis and other substance use among cannabis users immediately following the legalization of recreational cannabis use for adults in Washington State. The sample were heavy-using adolescents, thus the current study evaluates frequency of use rather than measuring use in a dichotomous way, as is often typical in epidemiological studies. Initiative 502 (I-502) was passed on November 6, 2012 and went into effect on December 6, 2012. I-502 legalized the personal possession of up to an ounce of cannabis for individuals aged ⩾21 years.[29] Legal sales were put under the control of the state's liquor control board. It is unclear how well specific provisions of the law were understood, particularly by adolescents, for whom the passage of I-502 did not apply (ie cannabis remains illegal for those under the age of 21). The law also does not allow for public consumption of cannabis and a per se driving under the influence was set (although DUI laws

remained unchanged, including the zero tolerance policy for minors). Recruitment of trial participants began in 2011, before policy change, and ended in 2013. Analyses will (a) assess differences in substance use, problems, and symptomatology pre- and post-policy change; (b) evaluate several proposed risk factors that may be associated with such differences, including norms and attitudes, and (c) describe participants' understanding of the law and its relationship with use.

Method

The TMCU 4 is a randomized, controlled trial that tests the effectiveness of Motivational Enhancement Therapy (MET) and brief "check-in" interventions for heavy cannabis using adolescents.[30] All procedures were approved by the University of Washington and Virginia Tech institutional review boards. Participants were randomly assigned to either receive two MET sessions (ACI condition; N = 124) or to receive two sessions of MET plus three additional MET-based "check-ins" at 4, 7, and 10 months after baseline assessment (MCI condition; N = 128). Check-in sessions involved MET and completing several self-report questionnaires in the MCI condition, while those in the ACI condition only completed questionnaires. Both conditions had the opportunity to participate in optional cognitive behavioral therapy (CBT) sessions as desired. Participants completed follow-up assessments at 6, 9, 12, and 15 months post-baseline. Data from this study come from assessments administered at the baseline session.

Participants

To be eligible, teens must have used cannabis on at least 9 of the past 30 days, plan to remain in the region through the entirety of the 15-month study, not currently be involved in substance abuse treatment, and have no serious current psychiatric concerns. Of the 668 adolescents who expressed interest, 460 individuals attended screening. A total of 15 participants (3%) opted not to participate. Among those who opted to participate, 178 were ineligible due to using cannabis fewer than 9 days of the past 30 (n = 154; 35%), not available to participate for the next year (n = 27; 6%), and having a serious medical or psychiatric condition (n = 3; 0.7%). Since they would not be able to participate in parts of the study after graduation, students in their senior year (n = 19; 4%) were excluded. A total of 252 individuals were eligible and interested in participation and comprised the enrolled sample. To account for seasonal changes in cannabis use and control for media attention surrounding the policy vote, we only compared individuals who completed baseline measures from January to June of 2012 (pre-policy; n = 92) and January to June of 2013 (post-policy; n = 78). Participants were primarily male (65.9%) and Caucasian (59.4%), with a mean age of 16.03, standard deviation (SD) = .89. This heavy-using sample reported using an average of 36.4 of the past 60 days (SD = 15.37).

Procedure

Participants interested in receiving feedback on their cannabis use were voluntarily recruited at six Seattle high schools. Recruitment occurred following classroom presentations or lunchroom information tables. Classroom presentations by research staff included education about cannabis and its effects in addition to describing the research project. After presentations and at the information tables, students were given the opportunity to sign up for participation. Students who were interested in participating were called out of class and individually screened for eligibility in private offices in the schools. Eligible and interested participants completed a computerized baseline assessment and then were randomly assigned to condition. See parent main outcome paper for intervention description.[30]

Measures

Substance use. Frequency of cannabis, alcohol, and other drug use was assessed by asking participants to report how many days of the past 60 days that they used each substance. These questions were adapted from the Global Appraisal of Individual Needs (GAIN).[31] The GAIN has been found to have good reliability and validity as compared with other validated measures of frequency of use.[32]

Cannabis use disorder symptomatology. Participants were asked a series of questions from the GAIN[31] that assessed for the presence of Diagnostic and Statistical Manual of Mental Disorders, 4th Edition (*DSM*-IV) cannabis abuse and dependence symptoms. Previous research has supported the use of the GAIN as a reliable and valid measure of symptomatology.[33] The number of symptoms endorsed was totaled to create an index of cannabis use disorder symptomatology.

Cannabis problems. Problems associated with cannabis use were assessed via the Marijuana Problems Index (MPI). The MPI is a 23-item adaptation of the Rutgers Alcohol Problem Index (RAPI)[34] that asks participants to rate on a scale of 0 (never) to 4 (more than 10 times) the extent to which they experienced problems as a result of marijuana use. A total MPI score was computed by adding item scores (alpha = .84).

Attitudes toward approval and risk perception. Attitudes toward use were assessed in two ways: personal approval of their own cannabis use (*personal approval*) and attitudes toward use if the law changed and cannabis was legalized (*legal approval*). Participants rated on a scale of 1 (strongly disapprove) to 7 (strongly approve) how much they would approve of using "once or twice," "occasionally," and "regularly." Responses were averaged to create separate measures of personal approval (3 items; alpha = .73) and legal approval (3 items; alpha = .84). In addition, participants rated on a scale of 0 (no risk) to 3 (great risk) the amount of risk that cannabis use posed if the substance was used once or twice, occasionally, and regularly. Items were averaged to create a scale score (alpha = .61).

Perceived norms. Participants completed questions regarding their perceptions of rates of use and approval of use for two referent groups: average teens their age and their close friends. For each referent group, they indicated the percentage they believed used cannabis "ever" and "regularly" to assess descriptive norms. Responses were averaged across the four items (2 referent groups × 2 levels of use; alpha = .58). Similarly, injunctive norms were assessed for the same groups and rates of use "once or twice," "occasionally," and "regularly" on a scale of 1 (strongly disapprove) to 7 (strongly approve) across six items (2 referent groups × 3 levels of use; alpha = .76).

Policy understanding. After the legalization initiative was adopted by the voters, five items were added to the baseline measure to assess for participants' understanding of the law change. Specifically, participants were asked about legal age of possession, legal age of purchase, consequences of driving under the influence, use in public, and the difference between laws and consequences of driving under the influence for teens and adults.

Results

Preliminary analyses examined recruitment by school in the pre-policy and post-policy change groups. Chi-square analyses revealed differences in recruitment patterns by school such that the proportion of participants recruited pre- and post-policy was not equal among several schools. To determine if recruitment differences corresponded with differences in variables of interest, analyses of variance (ANOVA) were performed on substance use (rates of use and consequences) and sociodemographic (age and gender) variables by school. No significant differences were revealed between schools.

Changes in use, problems, and symptoms

In order to assess for differences in substance use, problems, and symptoms among those recruited pre- and post-policy change, ANOVAs were used. Rates of cannabis, alcohol, and other drug use did not significantly vary between participant groups (see Table 1). However, cannabis-related problems and symptoms were significantly different such that those recruited post-policy had significantly higher rates of problems and symptoms.

Proposed risk factors

To evaluate the proposed risk factors, ANOVA were again used to compare participants who were recruited pre- and post-policy change (see Table 1). There were no significant differences between pre- and post-policy groups on any variable of interest, including personal attitudes toward their own

Table 1. Means and standard deviations for pre- and post-policy variables.

	PRE-POLICY MEAN (SD)	POST-POLICY MEAN (SD)
Marijuana use (60 days)	36.71 (15.89)	36.05 (14.83)
Alcohol use (60 days)	8.05 (9.40)	9.09 (10.00)
Drug use (60 days)	2.40 (7.03)	2.26 (4.11)
Marijuana problems	1.50 (.37)	1.70 (.47)**
Marijuana symptoms	3.08 (2.47)	4.42 (2.64)**
Personal approval	5.26 (1.18)	5.30 (1,21)
Legal approval	5.05 (1.46)	5.31 (1.27)
Risk perception	.51 (.41)	.63 (.50)
Injunctive norms	4.91 (.95)	5.11 (.97)
Descriptive norms (%)	68.73 (12.66)	65.83 (14.16)

**$P < .01$ (significance values come from ANOVA analyses).

use (personal approval), attitudes toward cannabis if the law were to change (legal approval), risk perception, and injunctive and descriptive norms.

Understanding of the law

Participants were asked five questions regarding aspects of the law. On average, participants answered 74.8% of questions regarding stipulations of I-502 correctly (SD = 0.24). The most commonly missed question was regarding how the policy change affected cannabis-driving laws for teens as compared to adults, which 45% of participants answered incorrectly. To determine the relationship between policy understanding and rates of use and consequences, we performed bivariate correlations comparing overall policy understanding score and use variables. Policy understanding was not significantly related to use or consequences (P = .36-.96).

Discussion

There were no significant differences in frequency of cannabis use, alcohol use, or other drug use before and after legalized recreational use of cannabis in our sample of adolescents in Washington State. Similarly, there were no differences in attitudes, perceived risks, or norms for samples recruited before and after policy change. Overall, adolescents had a good understanding of specific provisions included in I-502. Unexpectedly, participants endorsed significantly more cannabis-related problems and use disorder symptoms post-policy change.

The lack of difference in rates of use pre- to post-policy change is similar to the results from the Seattle Youth Risk Behavior Surveillance System data, which indicate no significant increase of cannabis use from 2011 to 2013, pre- and post-policy change.[35,36] They are also consistent with studies from medical cannabis literature that also did not find significant increases in use post-policy change.[10,13,14,22]

Despite literature that has demonstrated changes in attitudes following medical cannabis legalization, there is no evidence in this sample to suggest that norms, attitudes toward approval, or risk perceptions—all proposed risk factors for increased use and problems—significantly varied as a result of policy change. These results are inconsistent with studies reporting decreases in risk perception following policy change.[22] Given the importance in normative views and attitudes in relation to rates of use, this finding is notable. Indeed, previous research has established that targeting norms regarding use—particularly norms regarding close friends and peers—are associated with a reduction in use-related negative outcomes.[27] It may be that the heavy-using sample in this study may have a lower perception of risk before policy change, which may have contributed to a floor effect. In addition, it is possible that legalization occurred in Washington because of the normative views toward cannabis pre-policy change—thus, the causal mechanism between use, attitudes, and legalization is unknown.

Although frequency of use in this heavy-using sample did not appear to change following legalization, the reported consequences of cannabis use were significantly different in that participants endorsed more *DSM*-IV symptomatology and higher frequency of use-related problems after legalization. This finding was unexpected, as negative consequences typically follow increased use rates. Previous studies of adolescents and young adults do not include similar indicators of psychopathology, so it is uncertain how our results compare with an epidemiological sample. However, previous research has shown that, among those who consume cannabis, rates of cannabis use disorder have reduced over time, suggesting that individuals are using a more normative (or less harmful) pattern of use.[2] Given that the study had been active in the school for over a year before policy changed, it is possible that some participants waited to become involved

in the intervention until their use reached a more problematic threshhold.

Given the various methods in which cannabis can be consumed and their increased availability (eg vaping and edibles), it is possible that this study did not adequately measure the full extent of cannabis uses. Consequences associated with these forms of cannabis use may be different than typical negative outcomes of smoking: future research should evaluate this possibility.

Media coverage of I-502 was expansive throughout the months surrounding the campaign. Results indicate that teens had been exposed to details of the law and had a basic understanding of specific provisions. Teens appeared to be well-versed in the age restrictions for possession and purchasing stipulated in I-502 but less aware of how the laws and consequences for teens compare to those for adults. Future education efforts may focus on such differences. We found no significant differences between knowledge of the law and use and consequences, suggesting a lack of a relationship between policy understanding and problematic use patterns. However, if media coverage began years before policy change, it may have impacted views toward cannabis and/or use rates in a variety of ways beyond education, such as by normalizing use or by stigmatizing use. Future research should evaluate these possibilities.

The TMCU provided a unique sample in which to evaluate the effect of policy change on rates of use and consequences. TMCU recruited heavy-using adolescents, a population that may not be adequately represented in epidemiological studies. Thus, the failure to find differences on measures of use and risk factors may relate to this population's already heavy marijuana involvement. Nonusers and lighter users may be more affected by legalization and consequent inferences of greater acceptability and lower risk. In addition, since recruitment for the TMCU was completed before the opening of cannabis retail stores in Washington in the summer of 2014, we could not assess the effects of commercialization. Other studies have found a relationship between cannabis retail density and use of vaping and edibles.[17] It is possible that legalized sale to adults will yet have trickle-down effects on availability that impacts younger adolescents.

Several limitations of this analysis should be noted. The TMCU was not an epidemiological study and did not sample representatively from the population. It is possible that differences, and the lack thereof, between groups recruited before and after policy change were due to reaching somewhat different populations. However, comparisons on sociodemographic and use measures showed no differences on measured variables. The sole differences on measures of negative consequences are inconsistent with this pattern and remain to be explained. Furthermore, to avoid confounding the effects of the intervention with policy change, we used a between-subjects design focused solely on baseline data. It would have been preferable and more powerful to have been able to examine actual changes within individuals pre- and post-policy change. In addition, as policy change was not imminent during study design, we did not assess for other variables that may have been affected by the policy change (eg cannabis availability, vaping, and edible use changes[16,17]). Nevertheless, we believe these data contribute to emerging knowledge about the effects of legalizing cannabis on teen attitudes and rates of use.

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Author Contributions
RS, DW, and RR conceived and designed the parent trial. RS, DW, RR, CB, and KB implemented the parent trial. CB conceived the aims of this paper, wrote the initial draft, and performed statistical analyses. EM contributed substantially to the writing and editing of the manuscript. All authors discussed the results and contributed to and have approved the final manuscript.

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