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Legalization of medical marijuana and marijuana use among youths

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Abstract

Aims—This study examined the relationship of youth marijuana use and perceived ease of access with the number of medical marijuana cards at the county-level, and marijuana norms as indicated by percent of voters approving legalization of medical marijuana in 2004.

Methods—Survey data from 17,482 youths (ages 13 – 19) in Montana and county-level archival data, including votes for the legalization of medical marijuana and the number of medical marijuana cards were analyzed using hierarchical linear modeling.

Findings—Living in a county with more medical marijuana cards was not related to lifetime or 30 day marijuana use. However, voter approval of medical marijuana was positively related to lifetime and 30 day use. Perceived ease of access to marijuana was positively related to medical marijuana cards, but this relation became non-significant when voter approval was controlled. Among marijuana users, marijuana cards and voter approval were positively related to perceived ease of access.

Conclusions—The relation between medical marijuana cards and youth use may be related to an overall normative environment that is more tolerant of marijuana use. Interventions to prevent youth marijuana use should focus on adult norms regarding use by and provision of marijuana to youths.

Keywords

marijuana use; medical marijuana; adolescents

Introduction

Marijuana use has been on the rise in the U.S. and daily marijuana use is at a 30 year high among high school seniors (Johnston, O'Malley, Bachman, & Schulenberg, 2012). National youth survey data indicate that marijuana is the most commonly used illicit drug among U.S. teens with 13% of 8th graders, 29% of 10th graders, and 36% of 12th graders having used it in the past year (Johnston et al., 2012). Marijuana is easily accessible to youths with 38% of 8th graders, 68% of 10th graders, and 82% of 12th graders reporting that it is fairly easy or very easy to get marijuana (Johnston et al., 2012). In addition, perceived risk of using marijuana has been declining with 43% of 8th graders, 30% of 10th graders and 40% of 12th graders reporting that occasional marijuana use poses a great risk (Johnston et al., 2012).

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conflict of interest

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Marijuana use by adolescents may have significant negative short- and long-term consequences. A recent meta-analysis found that marijuana use is related to significant increases in automobile crash risk, especially for fatal crashes (Asbridge, Hayden, & Cartwright, 2012). Another review concluded that marijuana use is associated with increased likelihood of a range of negative health outcomes, including accidental injury, chronic bronchitis and respiratory infections, and psychotic disorders (Hall, 2009). Initiation of marijuana use in adolescence has been associated with negative outcomes in adulthood, including poorer educational attainment, greater risk of intimate partner violence, lower work commitment, greater risk of drug dependence, and greater involvement in crime (Chen, Storr, & Anthony, 2009; Green, Doherty, Stuart, & Ensminger, 2010; Hall, 2009; Hall & Degenhardt, 2009; Hyggen, in press; Reingle et al., 2011).

Although the debate over the medical benefits of marijuana remains contentious, to date, 16 U.S. states and the District of Columbia have legalized medical marijuana (Procon.org, 2011a). Montana is one of these states, having passed the Medical Marijuana Act (MMA) in 2004. The MMA allows a patient to use marijuana for specified medical conditions and for a patient or caregiver to possess up to 1 ounce of marijuana and six mature marijuana plants (Procon.org, 2011b).¹ Medical marijuana laws are controversial and one of the arguments against legalization of medical marijuana is that it is a pretext for recreational marijuana use and could negatively impact youths (New York Times, 2011). It is possible, for example, that increased availability of medical marijuana may increase access to marijuana for youths, which, in turn, may increase the likelihood or frequency of use. Legalizing medical marijuana may also send a message that marijuana is safe to use or that its use is normative, which may increase its use. Only a few studies have investigated the possible impact of legalization of medical marijuana on adolescents' use. In a small study of youths in treatment, nearly half (49%) reported ever obtaining marijuana from someone with a medical marijuana license (Thurstone, Lieberman, & Schmiede, 2011). Compared with other youths in the study, those obtaining marijuana from a licensee reported easier access to marijuana and less perceived peer disapproval of marijuana use. They were also more likely to use marijuana 20 or more times per month and were more likely to report drug use problems. Another study using data from the National Survey on Drug Use and Health (NSDUH) found that prevalence of marijuana use among 12–17 year olds was 8.7% higher in states allowing medical marijuana compared to those not allowing medical marijuana (Wall et al., 2011). This same study found that youths from states with medical marijuana laws perceived marijuana use to be less risky. Another study found that states that legalized medical marijuana use have significantly higher rates of marijuana use and of marijuana abuse and dependence (Cerdá et al., 2012). Interpreting the findings from these studies is difficult, however. On one hand, availability of medical marijuana may provide youths with easier access and thus encourage use or heavy use. On the other hand, legalization of medical marijuana may reflect more liberal community norms regarding marijuana use in general, which, in turn, may increase the likelihood of youth use. That is, both legalization and youth use may result from broader normative processes. Consistent with this latter interpretation, a replication study using the same NSDUH data set found no effect of legalization of medical marijuana on marijuana use once unmeasured state characteristics were controlled statistically (Harper, Strumpf, & Kaufman, 2012).

Additional support for the importance of such normative processes can be found in the literature. In one study, a strong correlation was found between intention to vote for

¹The MMA was amended in July 2011. The new medical marijuana law (SB0423) reduced the number of marijuana plants allowed from six to four plants, tightened regulations for physicians prescribing medical marijuana, and specified allowable medical conditions which qualify for a medical marijuana card, among other restrictions (Montana Department of Public Health and Human Services, 2011a).

marijuana legalization and attitudes toward marijuana use more generally (Albrecht & Carpenter, 1976). A study that examined whether the legalization of medical marijuana changed attitudes and marijuana use in California concluded that policy changes were a result of attitudes rather than attitudes being a reflection of policy change (Khatapoush & Hallfors, 2004).

The present study investigates the relation between number of medical marijuana licenses at the county-level in Montana and youth marijuana use and perceived ease of access. The percentage of voters approving legalization of medical marijuana in each county was included as an indicator of overall community norms toward marijuana. We also investigated other individual- and county-level factors that could potentially confound this relation. We hypothesized that the number of medical marijuana licenses would be positively related to youths' marijuana use, but that this relation would be attenuated when voter approval of medical marijuana was controlled.

Methods

Survey data

Survey procedures—The survey data were from the 2010 Prevention Needs Assessment Community Student Survey (PNA), which is conducted by the Montana Department of Public Health and Human Services. This voluntary and anonymous survey is administered every other year to students in grades 8, 10 and 12. The survey is designed to measure adolescent substance use, anti-social behavior, and risk and protective factors. In 2010, data were collected using self-administered surveys given by teachers and other school staff in 186 out of 253 eligible schools (73.5%). All schools with grades 8, 10 or 12 in Montana are eligible for participation. Of all students enrolled in grades 8, 10 and 12 across eligible schools, 53% participated in the 2010 PNA. There are a total of 56 counties in Montana, but only 51 participated in data collection. The missing counties are small, rural counties that elected not to participate. The number of participating schools per county ranged from 1 to 14, and the number participating students per county ranged from 22 to 2,909. School boards were responsible for deciding whether to require active or passive consent from parents.

Youth data outcome variables

Marijuana use—Lifetime frequency of marijuana use was ascertained by asking respondents on how many occasions they had used marijuana in their lifetime (0, 1–2, 3–5, 6–9, 10–19, 20–39, and 40 or more). This variable was recoded into a dichotomous variable representing lifetime use of marijuana (0 = never used marijuana, 1 = used marijuana). Marijuana use in the previous month was measured by asking on how many occasions they used marijuana during the past 30 days (0, 1–2, 3–5, 6–9, 10–19, 20–39, and 40 or more). This variable was re-coded to response category midpoints representing number of occasions on which marijuana was used (0, 1.5, 4, 7.5, 14.5, 29.5, and 40). Age at first marijuana use was ascertained by asking respondents how old they were when they first smoked marijuana (8 or younger, 9 or 10, 11, 12, 13, 14, 15, 16, 17 or older). A value of 8 was assigned to the 8 and under category, a value of 9.5 to the 9 or 10 category, and 17 to the 17 or older category.

Perceived access to marijuana—Perceived ease of access to marijuana was measured by asking respondents how hard or easy would it be for them to get marijuana if they wanted to do so (1 = very hard, 2 = sort of hard, 3 = sort of easy, 4 = very easy).

Youth data background variables—Background variables included race/ethnicity (African American, Asian, Native American, Hispanic or Latino, Native Hawaiian/Pacific

Islander, and White). Youths were allowed to check more than one race/ethnicity. These variables were coded as a series of dummy variables (1 = yes). The survey also asked gender (1 = male), and age (10 = 10 or younger, 11, 12, 13, 14, 15, 16, 17, 18, 19 = 19 or older). Parents' educational attainment was ascertained by asking youths about the highest level of schooling completed by the adults with whom they lived (1 = completed grade school or less, 2 = some high school, 3 = completed high school, 4 = some college, 5 = completed college, 6 = graduate or professional school after college).

County-level data

Marijuana licenses—The number of registered medical marijuana users in each county was obtained from the Montana Department of Public Health and Human Services (2011b). Medical marijuana cards issued to patients and caregivers were summed and the number of cards per 1,000 population was calculated based on 2010 U.S. Census population estimates.

Marijuana norms—The percent of voters in each county who voted yes on Measure 148 in 2004, supporting the legalization of medical marijuana, was included as a measure of marijuana norms. These data were obtained from the Montana Secretary of State's Office (2004). Voter participation in the general election in 2004 was 71.4% (Montana Secretary of State, 2010).

Findings

The sample consisted of 17,482 respondents. The majority of them identified as White (86.8%), followed by Native American (10.1%), Hispanic/Latino (4.8%), African American (2.5%), Asian (2.2%), and Native Hawaiian/Pacific Islander (1.4%). A small number of youths (5.3%) identified themselves as multi-racial. The sample consisted of about half males and females (50.5% vs. 49.5%). Age ranged from 13–19, with an average age of 15.6 ($SD = 1.7$). More than half (56.3%) of the youths reported that the adults with whom they lived had completed at least college.

Marijuana use

A third (33.6%) of youths reported that they had used marijuana in their lifetime. Rates of lifetime marijuana use were 36.2% for males and 30.9% for females ($\chi^2(1) = 55.0, p < .001$). On average, those who had used marijuana reported having done so on 19.5 occasions ($SD = 16.4$), and 33.1% of lifetime users reported having used it on 40 or more occasions. More than half of lifetime users (54.3%) reported having used marijuana in the past 30 days, with an average of 8.0 occasions ($SD = 13.4$). On average, lifetime users of marijuana were 13.8 years old ($SD = 2.3$) the first time they smoked marijuana. On average, perceived access to marijuana was rated as somewhat easy by all respondents ($M = 2.6, SD = 1.3$), and easy ($M = 3.5, SD = 0.8$) by lifetime marijuana users.

County-level variables

In June 2011, there were a total of 30,036 patients enrolled in the medical marijuana program throughout Montana, and a total of 4,438 caregivers associated with enrolled patients. The number of medical marijuana cards per 1,000 population ranged from 2.6 to 67.3 cards per county with a mean of 25.1 ($SD = 15.1$). Fewer than .2% of medical marijuana card holders were under 18 years of age, and 3.8% were 18–21 years of age. The average age of enrolled patients was 41 years (Montana Department of Public Health and Human Services, 2011b). Percent of yes votes for Measure 148 (legalization of medical marijuana) in the general election in 2004 ranged from 36.5% to 73.2% across counties with a mean of 55.9% ($SD = 7.0$). Marijuana cards and votes for the legalization of medical marijuana were highly correlated, $r(54) = .59, p < .001$.

Multi-Level Regression Analyses

Multi-level linear regression analyses were conducted to examine the relationships between individual and county-level factors, frequency of marijuana use and perceived ease of access. The analyses were conducted with HLM Version 7.0 to account for clustering of observations within counties (Raudenbush et al., 2010). Linear regression was used for continuous outcomes. A logit link function was used for dichotomous outcomes. In order to investigate the role of marijuana norms, two models were examined. Model 1 included participants' race/ethnicity, gender, age, and parents' education. The county-level data included number of medical marijuana cards per 1,000 population. Model 2 included all of Model 1 variables, plus the percent yes votes for Measure 148. Initially we included median household income, percent single parent households, percent of persons living below the poverty level, and percent of Whites living in each county in the models. However, these variables were not statistically significant for any of the dependent variables and were not included in the final models.

Lifetime prevalence of marijuana use

The number of medical marijuana cards was not significantly related to prevalence of lifetime marijuana use in Model 1 (Table 1). When votes for Measure 148 were included in the model (Model 2), this variable was significantly and positively related to lifetime marijuana use. At the individual-level, lifetime marijuana use was positively related to being male, older, and African American, Native American, Native Hawaiian/Pacific Islander or Hispanic. Lifetime use was negatively related to parents' educational attainment and being White or Asian. The relations between these background factors and marijuana use were unchanged by the addition of votes for Measure 148. Because age may be an important consideration, we ran separate analyses for 8th, 10th and 12th graders. The only significant effect for medical marijuana cards was among 12th graders, $b = .009$ (.004), $p = .04$, but this effect became non-significant when votes were added to the model. In the final models votes were significantly and positively related to lifetime use of marijuana for all grades.

Age of initiation

Neither the number of medical marijuana cards nor the number of votes for Measure 148 was significantly related to age at first use. At the individual-level, age of initiation was positively related to current age, parents' educational attainment, and being White. It was negatively related to being male, African American or Native American. The relations between these background factors and age of initiation were unchanged by the addition of votes for Measure 148.

30 day frequency of marijuana use

Medical marijuana cards were not related to 30 day frequency of marijuana use among lifetime users in Model 1 (Table 1). When votes for Measure 148 were added to the model (Model 2), they were positively related to 30 day use and, moreover, the number of medical marijuana cards was negatively related to 30 day use. Males were more likely than females to have smoked marijuana in the past 30 days. Age was positively related to 30 day use, and parents' educational attainment was negatively related to 30 day use. Being African American was positively related to 30 day use, and being White was negatively related to 30 day marijuana use.

Perceived ease of access to marijuana

The number of medical marijuana cards was positively related to perceived ease of access in Model 1 for all respondents (Table 2). When votes for medical marijuana were added, the number of medical marijuana cards was no longer related to perceived ease of access. When

all respondents (users and non-users) were considered, being older was positively related to perceived ease of access. Parents' educational attainment was negatively related to perceived ease of access. Being African American, Hispanic and Native American were positively and being White was negatively related to perceived ease of access. Considering marijuana users only, we found that the number of medical marijuana cards was related to perceived ease of access in Model 1 and Model 2. In Model 2, the number of votes for medical marijuana was also positively related to perceived ease of access. Parents' educational attainment was negatively related to perceived ease of access. Being male was negatively related to perceived access, and being older, Asian and Hispanic were positively related to perceived access. These findings were consistent for Models 1 and 2.

Conclusions

The findings of this study suggest that it may be the normative environment more than the number of medical marijuana cards *per se* in a community that is related to marijuana use among youths. The percentage of votes in favor of Measure 148 may represent not only greater acceptance of medical marijuana, but more tolerant attitudes toward marijuana use more generally. These findings highlight the importance of the normative environment in which youths live and suggest that this environment may account for the relation between availability of medical marijuana and youths' marijuana use. A significant strength of this study is that we have independent data on the number of medical marijuana cards, youth marijuana use, and community norms (votes in favor of legalization of medical marijuana). We did find a relationship between perceived ease of access to marijuana and medical marijuana cards. This suggests that the number of marijuana cards in a community may increase youths' access to marijuana, even though not directly related to use. The fact that votes for medical marijuana were also positively related to perceived ease of access suggests that the number of medical marijuana cards and the normative environment may be closely related.

Although strongly suggestive, the findings of this study should not be considered definitive. A limitation is that the measures of medical marijuana cards were at the county-level. The county may be too large a unit to thoroughly investigate influences on youth marijuana use. Using data for smaller geographic units such as census blocks may be more sensitive. Directions for future research should include a closer examination of the relationship between medical marijuana cards in a community and community norms. In addition, the effects of medical marijuana dispensaries on a community should be examined. It may be that even though there is no effect of medical marijuana cards at the county level, the immediate area and residents living near medical marijuana dispensaries may be affected.

We used voter approval of Measure 148 as a proxy for community norms. Although legalization of medical marijuana has been used in other studies as a surrogate for community marijuana norms, support for medical marijuana may not be an endorsement of recreational marijuana use. Voters may vote for medical marijuana on compassionate grounds. In addition, votes for medical marijuana may be a reflection of voters' views about other issues or for other concerns such as tax revenue or prison overcrowding. In this regard, it is important to note that legalization of medical marijuana is strongly correlated with public opinion (Khatapoush & Hallfors, 2004). Other limitations of the study include a low youth survey participation rate. Out of all eligible students in grades 8, 10, and 12 across all schools in Montana, 53% participated. It was not possible to ascertain the extent to which selection biases may have affected the sample. There are other short-comings to school-based surveys. For example, teacher administered surveys may introduce bias in the responses, and student absenteeism on the day of the survey may lead to an underestimation of the true prevalence of drug use. A comparison of youth lifetime marijuana use data

collected by Monitoring the Future, a large national survey, shows that use rates are similar to those in Montana. According to Monitoring the Future, 31% of youths in grades 8th, 10th and 12th have used marijuana in their lifetime (Johnston et al., 2012). By comparison, 34% of 8th, 10th and 12 graders in the Montana PNA report lifetime use of marijuana. In addition, findings based on Montana may not generalize to other parts of the U.S. or to other countries. In particular, our analyses cannot not take into consideration differences in medical marijuana regulations, such as the amount of medical marijuana that can be possessed. For example, Montana's MMA prior to being modified in July 2011 allowed 1oz of marijuana and six mature plants, compared to 8 ounces and six mature plants which are allowable in California (Legislative Counsel, 2003). Such differences may be important and should be investigated in future research. Another limitation is that we only have measures of perceived availability. Such perceptions may be influenced by both actual availability and by a youth's marijuana use or other predisposing factors.

In spite of its limitations, the study is important because it represents one of the first attempts to explore the relationship between legal medical marijuana, the normative environment, perceived access and marijuana use among youths. The study suggests that reducing marijuana use among youths will require comprehensive prevention efforts. These prevention efforts should focus on norms surrounding marijuana use in the community, family and among peers, availability of marijuana, and enforcement in order to reduce marijuana use among youths. The study further highlights the need to explore these questions in more detail.

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Table 1

Results of HLM regression analyses predicting adolescent marijuana use and perceived ease of access

Predictors	Adolescent Lifetime Use		Adolescent 30 Day Frequency ^a		Age of Initiation ^a	
	Model 1	Model 2	Model 1	Model 2	Model 1	Model 2
Individual Characteristics						
Male	.23 (.04)***	.24 (.04)***	3.81 (.46)***	3.80 (.46)***	-.59 (.06)***	-.59 (.06)***
Age	.39 (.02)***	.39 (.02)***	.40 (.09)***	.40 (.09)***	.60 (.02)***	.60 (.02)***
Parent Education	-.22 (.02)***	-.22 (.02)***	-.83 (.16)***	-.83 (.16)***	.23 (.04)***	.23 (.04)***
African American	.44 (.10)***	.44 (.10)***	3.50 (1.11)**	3.59 (1.11)**	-.65 (.24)**	-.65 (.24)**
Asian	-.27 (.11)*	-.27 (.11)*	.70 (1.78)	.65 (1.78)	.04 (.24)	.04 (.24)
Hispanic	.34 (.07)***	.35 (.07)***	.40 (1.05)	.48 (1.03)	-.14 (.12)	-.14 (.12)
Native American	.76 (.09)***	.76 (.09)***	.02 (.55)	-.14 (.53)	-.28 (.11)*	-.27 (.11)*
Native Hawaiian/Pacific Islander	.38 (.16)*	.38 (.16)*	1.82 (.98)	1.82 (.98)	-.12 (.19)	-.12 (.19)
White	-.29 (.07)***	-.29 (.07)***	-2.43 (.65)***	-2.34 (.65)***	.77 (.13)***	.77 (.12)***
County-level Characteristics						
Medical marijuana cards	.008 (.004)	.00003 (.005)	.003 (.02)	-.05 (.02)*	-.007 (.005)	-.0003 (.006)
% Votes for medical marijuana	--	.03 (.01)*	--	.22 (.05)***	--	-.03 (.02)

^aLifetime marijuana users only

* .05;

** *p* .01;

*** *p* .001

Note: Table entries are unstandardized regression coefficients. Standard errors are shown in parentheses.

Table 2

Results of HLM regression analyses predicting perceived ease of access among adolescent lifetime users

Predictors	Ease of Access (All Youths)		Ease of Access ^a (Adolescent Lifetime Users)	
	Model 1	Model 2	Model 1	Model 2
Individual Characteristics				
Male	.05 (.03)	.05 (.03)	-.06 (.03) [*]	-.06 (.03) [*]
Age	.26 (.008) ^{***}	.26 (.008) ^{***}	.03 (.006) ^{***}	.03 (.006) ^{***}
Parent Education	-.05 (.009) ^{***}	-.05 (.009) ^{***}	.009 (.007)	.009 (.007)
African American	.20 (.06) ^{***}	.20 (.06) ^{***}	.01 (.06)	.01 (.06)
Asian	-.09 (.05)	-.09 (.05)	.18 (.05) ^{***}	.18 (.05) ^{***}
Hispanic	.20 (.04) ^{***}	.20 (.04) ^{***}	.14 (.04) ^{***}	.15 (.04) ^{***}
Native American	.29 (.05) ^{***}	.29 (.05) ^{***}	.05 (.04)	.04 (.04)
Native Hawaiian/Pacific Islander	.08 (.07)	.08 (.07)	-.08 (.09)	-.08 (.09)
White	-.10 (.03) ^{***}	-.10 (.03) ^{***}	.002 (.03)	.006 (.03)
County-level Characteristics				
Medical marijuana cards	.008 (.002) ^{***}	.003 (.002)	.007 (.002) ^{***}	.004 (.002) [*]
% Votes for medical marijuana	--	.02 (.008) [*]	--	.01 (.005) [*]

^aLifetime marijuana users only^{*} .05;^{**} *p* .01;^{***} *p* .001

Note: Table entries are unstandardized regression coefficients. Standard errors are shown in parentheses.