SSM - Population Health 3 (2017) 649–657

Contents lists available at ScienceDirect

SSM - Population Health

journal homepage: www.elsevier.com/locate/ssmph

Article

Recreational marijuana legalization and college student use: Early evidence☆

Austin M. Miller*, Robert Rosenman, Benjamin W. Cowan

Washington State University, Pullman, WA 99164-6210, USA

ARTICLE INFO

Keywords:
Marijuana
Cannabis
Recreational
Legalization
Substance use
College students

ABSTRACT

We analyze marijuana use by college undergraduates before and after legalization of recreational marijuana. Using survey data from the National College Health Assessment, we show that students at Washington State University experienced a significant increase in marijuana use after legalization. This increase is larger than would be predicted by national trends. The change is strongest among females, Black students, and Hispanic students. The increase for underage students is as much as for legal-age students. We find no corresponding changes in the consumption of tobacco, alcohol, or other drugs.

1. Introduction

Recreational marijuana has been legalized for adults 21 years of age or older in several states beginning with Colorado and Washington in 2012. In 2014, Alaska, Oregon, and the District of Columbia voted to legalize recreational marijuana, followed by California, Massachusetts, Nevada, and Maine in 2016. We use data for students at Washington State University (WSU) to explore the role legalization plays in marijuana use among college students, a population generally thought to be predisposed towards risky behavior, including marijuana use. Our main hypothesis is that legalization of recreational marijuana induces more students to use marijuana by lowering one or more of the costs of using it. These costs may include the threat of punishment, the price and/or availability of marijuana, a lack of social acceptability, and an inherent desire to be law-abiding.

Throughout the U.S., marijuana access has been relaxed in three general ways: decriminalization, medical marijuana legalization (MML), and recreational marijuana legalization (RML). In the early 1970s, eleven states officially decriminalized the possession of small amounts of marijuana.[1] Though there is some evidence that use may increase with decriminalization (e.g., Damrongplasit et al., 2010), most research finds no evidence for such an increase (Thies and Register, 1993; Reinarman et al., 2004).

Since 1996, 28 states have legalized medical marijuana, which still prohibits recreational use. Most evidence shows that MML has not increased marijuana use among people younger than 21 (Khatapoush & Hallfors, 2004; Lynne-Landsman et al., 2013; Choo, Benz, Zaller, Warren, Rising & McConnell, 2014; Anderson, Hansen, & Rees, 2015), although Pacula, Powell, Heaton, and Sevigny (2015) find that MML increased use and abuse by those under and over the age of 21. Other studies find MML is associated with more non-medical use and abuse (Wen et al., 2014), more marijuana-related arrests and marijuana rehabilitation treatments (Chu, 2014), and a decrease in the price of illegal marijuana (Malivert & Hall, 2013).

There have been no direct assessments of the impact of RML on marijuana use of college students, though Cerdá et al. (2017) find some evidence that RML is associated with lower perceived risk and higher use for youth. Pacula (2010) predicts that use will increase. Hall and Lynskey (2016) predict that the price of marijuana will drop and heavy use will increase. Anderson, Hansen and Rees (2013) find evidence that RML has decreased the price of marijuana.

Our population of interest in this paper is students at WSU in Pullman, Washington. Many changes with respect to marijuana law and availability have occurred in Washington in the past two decades. In 1998, Washington decriminalized marijuana for adult medical use, with

Abbreviations: GPA, Grade point average; MML, Medical marijuana legalization; NCHA, National College Health Assessment; NSDUH, National Survey on Drug Use and Health; RML, Recreational marijuana legalization; WSU, Washington State University

☆ This research received no specific grant funding from agencies in the public, commercial, or not-for-profit sectors. All authors declare that there are no conflicts of interest with respect to this work.

* Corresponding author.
E-mail addresses: austin.m.miller@wsu.edu (A.M. Miller), yamaka@wsu.edu (R. Rosenman), ben.cowan@wsu.edu (B.W. Cowan).

[1] Decriminalization is the elimination of criminal punishments such as arrests and jail time associated with the possession of small amounts of marijuana, presumably intended for personal use rather than for sale or distribution. States differ with respect to how it is implemented (Pacula et al., 2003).

http://dx.doi.org/10.1016/j.ssmph.2017.08.001
Received 16 January 2017; Received in revised form 14 July 2017; Accepted 2 August 2017

qualifying conditions expanding in 2007, 2010, and 2011. In November 2012, Washington passed Initiative 502, which legalized the possession of marijuana for personal recreational use by people aged 21 and older and established a structure for licensing and taxing the production and distribution of recreational marijuana. Legal possession and use of marijuana took effect in December 2012. The first licensed retail stores opened in July 2014. In this paper, we investigate whether the 2012 legalization of recreational marijuana is associated with an increase in use above the long-term trend toward more use in Washington.

We hypothesize that marijuana use at WSU increased after RML because both the direct and social costs of using went down. RML increases the availability of marijuana for those 21 and older, and likely for those under 21 as well. It is expected that RML lowers the price of marijuana (e.g., Anderson et al., 2013), increasing demand. Legalization eliminates the threat of punishment to legal-age users, and sends a strong message about changing norms, lowering the social costs of marijuana use. Also, Moreno, Whitehill, Quach, Midamba, and Manskopf (2016) find that legalization may have caused some Washington college students to perceive marijuana as safer.

The first indication that marijuana use may have changed in Washington after Initiative 502 is observed in the trend of reported marijuana use. Fig. 1 shows the proportion of students who reported using marijuana in the past 30 days across years. For comparison, we also include the proportions over time of students who reported using tobacco, alcohol, or illegal drugs other than marijuana. To facilitate comparisons, proportions for use of each substance are presented as deviations from the 2012-use levels. We observe a substantial increase over a general upward trend in marijuana users after 2012. Use of the other substances does not show a similar increase.

More rigorously, we test for changes against a linear trend in the reported use of marijuana at WSU after RML at the end of 2012 and after legal sales began in Pullman in October 2014. We find that the probability of having used marijuana in the past 30 days increased after RML and remained high though did not increase significantly again after the first marijuana stores opened.

We also test for these same changes within specific subgroups of the population. First, we compare the change in use for legal-age students to those under 21, who are not directly affected by RML. We find that for those under 21, the probability of using marijuana increased both after RML and after legal sales began. For students age 21 and over we find no increase at either juncture that is statistically significant at conventional levels. Among other subgroups, we find consistent evidence of an especially large increase in the probability of use for females and for Black and Hispanic students (pooling both genders).

RML may also affect the use of tobacco, alcohol, or other drugs, either as a substitute or complement. Moreover, factors other than RML that affect marijuana use (e.g., changes in incomes or attitudes toward risk) likely also change the use of other substances. We find no evidence for any systematic changes in the use of other substances that correspond directly with the changes in marijuana use after RML.

We are also interested in the intensity of marijuana use, so we test whether the average frequency of marijuana use increased after RML or legal sales. These results show the intensity of marijuana increased after RML, but decreased again after legal sales commenced.

Data limitations prevent us from including a reliable control group in the regressions.[2] Thus, the estimated effect of RML from the above tests represents the actual treatment effect of RML only to the extent that the linear trend is a good proxy for what marijuana use would have been like without RML. We provide an alternative evaluation by comparing marijuana use at WSU to two national datasets. Although we are unable to include any covariate controls in the national data after 2011, we calculate simple difference-in-differences estimations of the impact of RML at WSU using two national samples as counterfactuals.

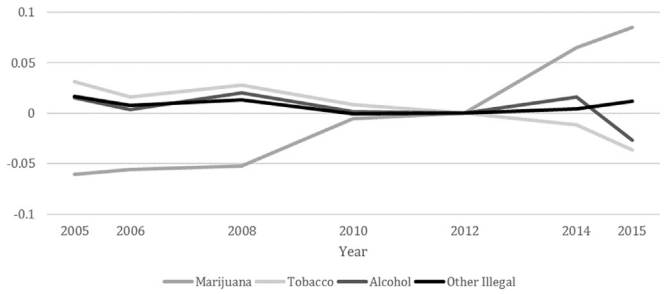

Fig. 1. Marijuana and other substance use trends: Probability of having used in the past 30 days (deviations from year 2012).

2. Data

We use repeated cross-sectional data of undergraduate students at Washington State University (WSU), collected for the National College Health Assessment (NCHA), a comprehensive health survey collected and made available by the American College Health Association.[3] WSU has participated in the NCHA in seven different survey years: 2005, 2006, 2008, 2010, 2012, 2014, and 2015. The total number of survey responses available is 14,485, with a mean of 2,069 students surveyed each year. Participants were randomly selected from the student population for all survey years except for 2012 and 2014; in those years, invitations were distributed to the entire student population. After eliminating observations for missing values, our sample contains 13,335 observations. The first column of Table 1 shows the number of students in each year of the WSU sample. The distribution of surveys across years for the excluded observations is nearly identical to the distribution for the whole sample.

The NCHA surveys contain questions about students' use of marijuana, tobacco, alcohol, and other drugs. Our main variable of interest is a count of how many times a student used marijuana in the past 30 days. For tests 1 and 2, this variable is modified into a binary indicator of whether a student used marijuana at all in the past 30 days. Variables included as controls in our regressions include age, sex, race, and year in school. In other specifications, we also include respondents' grade point average (GPA), type of residence, membership in a fraternity or sorority, and whether a student is international or if they have used tobacco, alcohol, or illegal drugs other than marijuana in the past 30 days. Table 2 provides summary statistics for these variables.[4] Also included in this table are mean values for all variables both before and after the passage of Initiative 502, and summary statistics for the same variables in the national sample of NCHA data and in the NSDUH sample as available.

The student population at WSU is about 53-percent male, 68-percent white, 3-percent Black, 5-percent Asian, 10-percent Hispanic, and 5-percent international. The distribution across years for undergraduates is about 23-percent first-year, 23-percent second-year, 24-percent third-year, and 31-percent fourth-year or more (Office of Institutional Research, 2017a). The average GPA for students is about 3.08 (Office of Institutional Research, 2017b). In 2014, the average age

[2] Although the NCHA has been administered to students at colleges and universities across the nation since 2000, we were unable to obtain data from any other university and the national sample does not contain school or state identifiers nor does it include enough observations post-RML to match the timing of the WSU data.

[3] The NCHA was also administered to graduate students, but we focus our analysis on undergraduate students.

[4] Apart from tobacco use, no significant difference for these variables was found between observations included in and excluded from analysis. For tobacco use, the excluded observations had a mean of 0.27 and standard deviation of 0.44 compared to included observations that have a mean of 0.19 and standard deviation of 0.39. We have no reason to believe that the estimates of our main results should be affected by this difference. We also observed no significant difference between the changes in marijuana use over time for included and excluded observations.