Long-term effects of minimum legal drinking age laws on marijuana and other illicit drug use in adulthood

Melissa J. Krauss [a,*], Patricia A. Cavazos-Rehg [a], Arpana Agrawal [b], Laura J. Bierut [a], Richard A. Grucza [a]

[a] Department of Psychiatry, Washington University School of Medicine, 660 South Euclid Avenue, St. Louis, MO 63110, USA
[b] Department of Psychology, Washington University School of Medicine, 660 South Euclid Avenue, St. Louis, MO 63110, USA

ARTICLE INFO

ABSTRACT

Background: Exposure to permissive minimum legal drinking age (MLDA) laws (ability to purchase alcohol <21 years) during adolescence can have long-term effects, including heavy alcohol use or alcohol use disorders as adults. We examined whether exposure to permissive MLDA laws during adolescence has long-term effects on illicit drug use and disorders in adulthood.
Methods: Participants from the 2004–2012 National Survey of Drug Use and Health (NSDUH) were linked with historical state MLDA laws. Participants born in 1949–1972 (age 31–63 years at observation, $n = 110,300$) were analyzed because they came of legal age for alcohol purchase when changes occurred in state MLDA laws. Logistic regression was used to model drug use measures as a function of exposure to permissive MLDA during adolescence, adjusting for state and birth-year fixed effects, demographics, and salient state characteristics.
Results: Rates of past month use, past year use, and abuse/dependence of marijuana were 4.7%, 7.8%, and 1.2%, respectively. Rates of past month use, past year use, and abuse/dependence of illicit drugs other than marijuana were 2.9%, 6.2%, and 0.7%, respectively. Among the full sample, exposure to permissive MLDA laws was not significantly associated with drug use or abuse/dependence in adulthood. Men exposed to permissive MLDA laws were at 20% increased odds of past year illicit drug use (aOR 1.20, 95% CI 1.09–1.32).
Conclusions: Restricting alcohol access during adolescence did not increase long-term drug use. Allowing the purchase of alcohol among those less than 21 years of age could increase the risk of drug use later in life.

1. Introduction

Prior to the 1970s, while a few states already had a minimum legal drinking age (MLDA) of less than 21 years (generally 18–20 years), most states had a MLDA of 21 years. In the 1970s many of these states lowered the MLDA to less than 21 as minimum age limits for voting were also being lowered (Wechsler and Sands, 1980). After evidence began to show that motor vehicle accidents were increasing among 18–20 year olds, states began raising the MLDA back to 21 in the late 1970s and early 1980s. This process was completed with passage of the 1984 National Minimum Legal Drinking Act stipulating that all states set the MLDA to 21 by 1986 or lose federal highway funds (Toomey et al., 2009). Research since then has confirmed that higher MLDA (age 21) is associated with reductions in alcohol consumption and alcohol-related motor vehicle crashes and fatalities (DeJong and Blanchette, 2014; Lovenheim and Slemrod, 2010; McCartt et al., 2010; Subbaraman and Kerr, 2013; Wagenaar and Toomey, 2002; Wechsler and Nelson, 2010). Furthermore, studies have found that exposure to permissive MLDA laws (ability to purchase alcohol <21 years of age) during adolescence can have long-term effects, including increasing the likelihood of heavy drinking (Kaestner and Yarnoff, 2011; Plunk et al., 2013) and alcohol use disorder (Norberg et al., 2009) in adulthood. In addition, women who were legally permitted to drink prior to age 21 were at elevated risk for death by suicide and homicide (Grucza et al., 2012), while similarly exposed men were at elevated risk for fatal accidents as adults (Kaestner and Yarnoff, 2011).

Our objective was to examine whether MLDA laws could also impact marijuana and other illicit drug use and abuse over the

* Corresponding author at: Department of Psychiatry, Washington University School of Medicine, 660 South Euclid Avenue, Box 8134, St. Louis, MO 63110, USA. Tel.: +1 314 362 9003; fax: +1 314 362 4247.
E-mail address: kraussm@psychiatry.wustl.edu (M.J. Krauss).

long term. If policies that discourage alcohol use tend to decrease drug use during adolescence, these habits may persist into adulthood, given the importance of this age in the development of substance use disorders (Chen and Jacobson, 2012; Sher et al., 2005; Stone et al., 2012). Some prior studies examining short-term effects of alcohol policies on drug use have suggested that alcohol use and illicit drug use are complementary behaviors, i.e., that policies discouraging alcohol use tend to also discourage drug use. For example, higher beer prices have been associated with reduced marijuana use (Farrelly et al., 1999; Pacula, 1998). Likewise, increasing costs of marijuana decreased both marijuana and alcohol use among college students and policies that reduced access to alcohol were associated with reductions in both alcohol and marijuana use (Williams et al., 2004).

On the other hand, restricting access to alcohol might increase the likelihood that young people would turn to marijuana and other drugs, i.e., other drugs are substitutes for alcohol. A study of 12th grader survey data from 1980 to 1989 found that higher MLDA laws were associated with increased marijuana use (DiNardo and Lemieux, 2001). A study of Australian survey data from 1988 to 1995 found that an increase in the price of alcohol increased the probability of marijuana use (Cameron and Williams, 2001). When examining the immediate effects of discontinuity of alcohol availability created by the current MLDA of 21 years on drug use among young adults, as alcohol consumption increased at age 21, there was a sharp decrease in consumption of hard drugs and marijuana (Crost and Guerrero, 2012; Deza, 2014) or no significant changes in marijuana use (Crost and Rees, 2013; Yörük and Yörük, 2013).

Only one study examined the long-term effects of exposure to permissive MLDA laws during adolescence on drug use later in adulthood. Norberg et al. (2009) examined respondents born between 1948 and 1970 from the 1991 National Longitudinal Alcohol Epidemiological Survey and the 2001 National Epidemiological Study of Alcohol and Related Conditions. Adults who had been legally allowed to purchase alcohol before age 21 were significantly more likely to have an illicit drug use disorder other than marijuana. Results also suggested that exposure to permissive MLDA increased the risk for marijuana use disorder, but this did not reach statistical significance.

Given the mixed findings regarding short-term effects of alcohol policies on drug use and the little attention given to long-term effects on drug use, additional research is needed to clarify the effects of MLDA laws during adolescence on illicit drug use in adulthood. Additional information on the effects of MLDA laws can help gain insight into how people engage or select their substances and inform debate about effects of lowering the current drinking age. In this study, we attempt to replicate findings of Norberg et al. (2009) in different survey data, and to extend them to an older cohort of adults to identify effects over a longer period of time. Like Norberg et al. (2009), we focus on a cohort of adults who were adolescents during the time period in which many changes in state MLDA laws occurred, but we use more recent national survey data (2004–2012, thus, the cohort is now older). Furthermore, we examine current drug use in addition to drug use disorders for both marijuana and other illicit drugs.

2. Material and methods

2.1. Subjects

The sample included participants in the 2004–2012 administrations of the National Survey of Drug Use and Health (NSDUH). The NSDUH is an annual nationwide cross-sectional survey of approximately 70,000 randomly sampled non-institutionalized civilians age 12 and older in the United States, with the primary intent of measuring the prevalence and correlates of drug use. Independent, multi-stage area probability samples are collected for each of the 50 states and the District of Columbia. The survey is administered by RTI International using a combination of computer-assisted personal interviewing (CAPI) conducted by trained interviewers

and audio computer-assisted self-interviewing (ACASI), which provides a more confidential way to respond to questions, thereby increasing honest reporting of illicit drug use (United States Department of Health and Human Services, 2012; Grucza et al., 2007; Tourangeau and Smith, 1996).

For our study, it was necessary to merge NSDUH participant data with state minimum legal drinking age (MLDA) policy, as well as other state level covariates. Access to NSDUH data containing geographic identifiers was obtained through the Center for Behavioral Health Statistics and Quality (CBHSQ) Data Portal maintained by the University of Michigan (http://www.icpsr.umich.edu/icpsrweb/content/SAMHDA/dataportal.html). The Data Portal is a secure virtual computing environment designed to allow for use of NSDUH data for research and policy analysis while also protecting identifiable data from disclosure.

From the 2004–2012 NSDUH data sets, we selected all participants born between 1949 and 1972 ($n = 111{,}600$) for inclusion in our study, as these participants came of legal age for alcohol purchase during the time period in which between-state and cross-year differences in minimum legal drinking age policies were present (participants were 18–20 years old in 1967–1992). Participants from the District of Columbia ($n = 1300$) were excluded due to missing data for some state covariates. This resulted in 110,300 total participants for analysis. All reports of unweighted sample sizes are rounded to the nearest 100 to help prevent disclosure.

2.2. Outcome measures

The main outcomes were use of marijuana and use of other illicit drugs. We used variables provided by the NSDUH which flagged whether the participant had used marijuana in the past month, used marijuana in the past year, and met the criteria for Diagnostic and Statistical Manual of Mental Disorders 4th edition (DSM-IV) marijuana abuse or dependence (American Psychiatric Association, 1994). Similarly, we used recoded variables that flagged whether the participant had used illicit drugs other than marijuana in the past month, used illicit drugs other than marijuana in the past year, and met the criteria for abuse or dependence for illicit drugs other than marijuana. Illicit drugs other than marijuana included cocaine, heroin, hallucinogens, inhalants, and the non-medical use of pain relievers, sedatives, stimulants, or tranquilizers.

2.3. Independent variable of interest: minimum legal drinking age (MLDA) exposure

We defined permissive MLDA exposure as the ability to legally purchase alcohol before the age of 21. MLDA policy data were coded as described in our previous studies (Grucza et al., 2012; Norberg et al., 2009). State of residence at the time of survey administration was used as a proxy for state of residence at the age of potential exposure, as this data was not available. To assess exposure precisely, we would need to know the state of residence of individuals when they were between the ages of 18 and 21. We used the Panel Study of Income Dynamics (PSID) to examine the expected level of cross-state migration between state of residence at age 20 and state of residence at survey administration in our cohort of interest as well as rates of potential misclassification. These analyses are detailed in Supplementary Material 1. In sum, we estimate that the proxy MLDA exposure (based on state of residence at survey administration) would match the true MLDA exposure at age 20 for 89% of respondents. Among the 11% that were misclassified, 47% were toward a permissive MLDA policy and 54% were toward a MLDA of 21. Thus, using state of residence at the time of survey administration is expected to have relatively low misclassification and to introduce only random error into our parameter estimates, biasing the estimates of the association (log-odds ratio) toward zero. Similarly, we have previously demonstrated that migration-induced error is unlikely to bias estimates toward a type I error (Grucza et al., 2012; Norberg et al., 2009).

2.4. Covariates

We accounted for participant demographic covariates, including sex, race/ethnicity, age (divided into quartiles), and education. We also controlled for selected time-varying state economic and demographic variables, including state annual average unemployment rate (from the Bureau of Labor Statistics), per capita income (adjusted for inflation to reflect 2012 dollars; from the Bureau of Economic Analysis), and a measure of citizen political ideology (Berry et al., 1998). Citizen political ideology was not available for 2011 and 2012; data from 2010 was used for these years. Other state covariates were considered (e.g., state alcohol taxes, percent of the state population that were affiliated with primarily Judeo-Christian denominations) but were collinear with state fixed effects, as determined by variance inflation factors, and thus were not included in the models.

2.5. Statistical analysis

To examine our hypothesis that exposure to permissive state MLDA policies during adolescence would be associated with increased likelihood of drug use as an adult, we used a regression extension of a classical "differences-in-differences" quasi-experimental method, expanding the canonical comparison of 2 groups at 2 different time points to multiple time points (Angrist and Pischke, 2008). We used